Murray–Darling Basin water reforms: Framework for evaluating progress
Acknowledgement of the Traditional Owners of the Murray–Darling Basin

The Murray–Darling Basin Authority acknowledges and pays its respect to the Traditional Owners and their Nations of the Murray–Darling Basin. The contributions of earlier generations, including the Elders, who have fought for their rights in natural resource management, are also valued and respected.

The MDBA recognises and acknowledges that the Traditional Owners and their Nations in the Murray–Darling Basin have a deep cultural, social, environmental, spiritual and economic connection to their lands and waters. The MDBA understands the need for recognition of Traditional Owner knowledge and cultural values in natural resource management associated with the Basin. Further research is required to assist in understanding and providing for cultural flows. The MDBA supports the belief of the Northern Murray–Darling Basin Aboriginal Nations and the Murray Lower Darling Rivers Indigenous Nations that cultural flows will provide beneficial outcomes for Traditional Owners.

The approach of Traditional Owners to caring for the natural landscape, including water, can be expressed in the words of Ngarindjeri elder Tom Trevorrow: ‘our traditional management plan was don’t be greedy, don’t take any more than you need and respect everything around you. That’s the management plan—it’s such a simple management plan, but so hard for people to carry out.’ ¹ This traditional philosophy is widely held by Traditional Owners and respected and supported by the Murray–Darling Basin Authority.

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<th>Description</th>
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<tr>
<td>BoM</td>
<td>Bureau of Meteorology</td>
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<tr>
<td>BP</td>
<td>Basin Plan – depending on the context, in this document the Basin Plan can mean the legislative instrument itself, or the instrument plus the wider set of associated reforms (involving the CEWH, the BoM, the ACCC), and the directly-associated Commonwealth programs intended to reduce the economic impacts of reduced water availability</td>
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<tr>
<td>CEWH</td>
<td>Commonwealth Environmental Water Holder</td>
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<tr>
<td>EWP</td>
<td>Environmental watering plan (see Chapter 8 of the Basin Plan)</td>
</tr>
<tr>
<td>Hydrograph</td>
<td>A graph of the rate of flow passing a particular point, at a certain time</td>
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<tr>
<td>MDBA</td>
<td>Murray–Darling Basin Authority</td>
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<tr>
<td>Plan</td>
<td>Basin Plan</td>
</tr>
<tr>
<td>SDL</td>
<td>Long-term average sustainable diversion limit (Chapter 6 of the Basin Plan)</td>
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<tr>
<td>WQSMP</td>
<td>Water quality and salinity management plan (Chapter 9 of the Basin Plan)</td>
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<td>WRP</td>
<td>Water resource plan prepared by a Basin state government for accreditation under the Basin Plan</td>
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Introduction

The Basin Plan is about placing the Murray–Darling Basin on a sustainable footing. The overarching aim is to ensure that there is a balance between the competing demands on the water resources of the Basin (economic, social and environmental). This balance should ensure that enough water is available to support productive industries, farmers and communities into the future, while leaving sufficient water in the Basin’s river system to ensure a healthy environment.

The central element of the Basin Plan is the introduction of a sustainable cap on surface and groundwater diversions. The Basin Plan sets limits on the quantity of water that may be taken from the Basin’s water resources as a whole (for surface water, an average of 10,873 gigalitres per year) and from particular water resource plan areas.

The Plan will be delivered through well-established state or valley-based water management arrangements: such as water resource plans, salinity management activities and water trading rules. However, for the first time in the Basin’s history we will now have planning decisions being made in the interests of the Basin as a whole. It is also the first time that environmental watering is being managed at a Basin scale and for Basin-wide outcomes. The Basin Plan also includes an environmental watering plan and a water quality and salinity management plan to coordinate the delivery of environmental outcomes across the Basin. To support the move to a more sustainable level of water use, water trading rules have also been introduced to reduce restrictions on trade and improve market transparency and confidence.

The Basin Plan itself is just one part of the broader Murray–Darling Basin water reform package. The Australian Government has invested heavily in irrigation modernisation, environmental works and measures (so water can be moved and held in places where it is needed), and water purchasing. Investment in better infrastructure and irrigation efficiency projects is helping industries and farmers adjust to less water availability. Getting these reforms right will mean a future for the Basin that includes strong communities with greater certainty and robust economies which are more resilient to change, underpinned by a healthy river system.

However, achieving the trans-boundary, wide-scale reform will take time and much coordinated effort. There are many review processes built into the Basin Plan—and these are crucial. The Murray–Darling Basin Authority (MDBA) is commissioned with tracking progress of the Plan’s implementation; and evaluating and reporting on the effects of the water reform on Basin communities and the environment. As the MDBA, Basin state governments and Basin communities work together to roll the Plan out (up until 2024) more flow-on effects will become apparent. An important focus will be on building knowledge and understanding whether the expected outcomes are being achieved. We want to be sure that we’re getting the right (balanced) results, understand whether there have been any unintended consequences, address problems as they are identified and adjust accordingly (adaptive management). The evaluation work guided by this framework will help us do this. As more elements of the Plan are in place and more effects can be tracked, the depth of this work will increase.

The MDBA recognises the importance of providing concrete evidence of what has been achieved. We also know that being able to measure the difference the Basin Plan has made is fundamental to gaining community confidence in the process and in the future.
Scope and context

Purpose

This Basin Plan evaluation framework outlines how the Murray–Darling Basin Authority will work with partner governments and the community to evaluate:

- the implementation of the Plan—how well it has been put in place by all those with obligations outlined in the legislation\(^2\); and how it is working administratively
- the effectiveness of this significant water reform package—whether the intended environmental, social and economic objectives and outcomes are being achieved.

The framework outlines the scope of the work, the questions that will be addressed, the evaluation methods, indicators that will be used to measure progress, the types of data that will be drawn upon and the roles and reporting by the people involved.

Approach

The work of evaluating the water reform is about:

- collecting data of various sorts (e.g. facts and figures, trends, reports, surveys, interviews etc.) through which to understand the effects that the Basin Plan is having (including any unintended consequences)
- comparing change against ‘baseline’ information about the current health of the Basin’s environment (before Basin-wide water reform)
- bringing this information together and making an assessment about whether a range of objectives and outcomes (the things we set out to do) are being achieved; and how well the Basin Plan is being implemented
- broadly tracking the effect of other influences and drivers on outcomes in the Basin (where data are available), so that the costs and benefits of reform are being attributed to the right place. Such factors affecting the Basin’s economy, social systems and ecosystems could include:
  - commodity prices, exchange rates, national social and economic trends (for example, moving for new work opportunities like mining)
  - climate variability (including fire, flood and long-term changes)
  - other government programs (noting that we will not be evaluating the effectiveness of these program activities themselves)
- reflecting on what we learn and reporting to governments to guide their decision-making.

\(^2\) See Schedule 12 of the Basin Plan
BASIN WATER REFORM

Figure 1 Conceptual model of influences on the Basin’s social, economic and environmental condition

What is the Basin Plan trying to achieve?

Our conceptual model of the Murray–Darling Basin water reform contextualised within the wider Basin social, economic and natural systems is shown above.

Overall the Basin Plan aims to achieve a ‘healthy, working Basin’. Under that, the desired outcomes can be described under three key themes:

- healthy and resilient rivers, wetlands and floodplains (environmental)
- productive and resilient industries, and confident communities (social and economic)
- better decisions made at the right level (governance).

Things we might expect to see if the reform is working well would include:

- for the community: greater certainty over the security of water supplies for the long-term; more water-efficient production; water that is fit-for-purpose; minimised transaction costs of water trade and economic activity
- **for the environment**: improved floodplain health; increased waterbird numbers; sustainable native fish populations; the Murray mouth open more often and maintenance of good water quality in the Coorong and Lower Lakes

- **for governance**: what we learn as we put the Basin Plan to work leading to better management; risks to the Basin’s water resources minimised; local solutions being put in place and confidence in a sustainable future.

Shown in [Figure 2](#), are the key mechanisms through which these outcomes are expected to be achieved:

<table>
<thead>
<tr>
<th>What outcomes is the Basin Plan trying to achieve?</th>
<th>Mechanisms</th>
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<tbody>
<tr>
<td>Healthy and resilient rivers, wetlands and floodplains</td>
<td>Managed environmental water</td>
</tr>
<tr>
<td>Restore and improve the resilience of water-dependent ecosystems</td>
<td>Environmental Watering Plan</td>
</tr>
<tr>
<td>Rivers connected to floodplains and the sea</td>
<td>Sustainable Diversion Limits - through state water resource plans</td>
</tr>
<tr>
<td>Healthier fish, birds and plant populations</td>
<td>Water Quality and Salinity Management Plan</td>
</tr>
<tr>
<td>Keep water fit for environmental uses</td>
<td>Constraints Management Strategy</td>
</tr>
<tr>
<td>Better decisions made at the right level</td>
<td>Basin-wide, integrated planning and management framework for water</td>
</tr>
<tr>
<td>Manage risks to Basin water resources</td>
<td>Involving the community</td>
</tr>
<tr>
<td>Local solutions and community confidence in a sustainable future</td>
<td>Monitoring, reporting and evaluation of the Plan’s implementation and effects</td>
</tr>
<tr>
<td>Adaptive management</td>
<td>Continued gathering of scientific and economic knowledge</td>
</tr>
<tr>
<td>Improved knowledge underpinning the Plan’s implementation</td>
<td></td>
</tr>
<tr>
<td>Productive and resilient industries, confident communities</td>
<td>Adjustment mechanism for SDL</td>
</tr>
<tr>
<td>Improved long-term water security</td>
<td>Investment in water recovery and efficiency infrastructure</td>
</tr>
<tr>
<td>Improved water trade (efficiency and minimised transaction costs)</td>
<td>Water trading rules</td>
</tr>
<tr>
<td>Keep water fit for industrial and community uses</td>
<td>Water market and charge rules</td>
</tr>
<tr>
<td>Greater certainty for all water users</td>
<td>Water Quality and Salinity Management Plan</td>
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<tr>
<td>Providing time to transition</td>
<td>Social and economic evaluation and reporting</td>
</tr>
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*Figure 2 Mechanisms to achieve Basin Plan outcomes*
Phasing of evaluation

Many of these outcomes will take a long time to be achieved (and thus able to be evaluated). We will be working with Basin state governments, the Commonwealth and local communities to roll out the Basin Plan up until 2019 (see Figure 6 in the Roles and reporting section of this framework for detail). Until such time as, for example, the sustainable diversion limits and the accreditation of state water resource plans are fully implemented, in-depth evaluation of their effectiveness cannot occur.

Also, once in place, the effects of these management activities on the Basin's social, economic and environmental systems will take varying amounts of time to become fully apparent. For example, achieving the high-level outcome of ‘healthier fish, birds and plant populations’ may depend upon successive environmental watering events, and possibly in the context of another drought. Thus the focus of monitoring and evaluation in any given year will change as implementation progresses and different components of the Plan come into place. The scope and depth of the evaluation work will also develop over time.

Figure 3 Simplified timeline of the first 10 years of evaluation reporting as Basin Plan rolls out
Evaluation questions

Evaluation is a systematic process in which the particular objectives and outcomes being sought guide the development of a series of evaluation questions to be asked. In this case, what will we need to know to assess if the Basin Plan is on track? The questions then frame the selection of a set of Indicators—what measures can be used to indicate an effect of the water reform? Then the indicators inform what needs to be measured, monitored and collected (to obtain Data sources). Information on the questions and indicators we have developed (including examples) can be found in the relevant sections of this document (see signpost diagram above).

The Basin Plan spells out the objectives against which the effectiveness of the Plan should be evaluated (see Chapters 5, 8 and 9 of the Plan). The Plan includes ‘key evaluation questions’ which we must answer when making an evaluation. These can be broadly categorised as relating to:

- how well the Plan is being implemented
- whether the desired outcomes are being achieved (the Plan’s effectiveness), and
- what has been learned.

This framework builds on these—setting out an expanded set of evaluation questions that give a clearer structure to help us do the evaluation. The type of question to be answered will inform the evaluation Methods we will use.

We developed our questions in consultation with technical experts, Basin communities, local councils and industry groups. Figure 4 sets out some examples of the types of evaluation questions and how they link to the intended outcomes of the Basin Plan.

Our evaluation questions may be revised periodically to reflect the stage of the roll-out and new information arising from the evaluation process.

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3 Section 13.06 of the Basin Plan
<table>
<thead>
<tr>
<th>Outcome</th>
<th>Sample evaluation questions</th>
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<tbody>
<tr>
<td>Healthy and resilient rivers, wetlands and floodplains</td>
<td>To what extent have the Basin Plan objectives, targets and outcomes for water-dependent ecosystems been achieved?</td>
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<tr>
<td></td>
<td>How has the Basin Plan contributed to the protection and restoration of water-dependent ecosystems?</td>
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<tr>
<td></td>
<td>How has the Basin Plan contributed to improved resilience of water-dependent ecosystems in the Murray-Darling to climate change and other risks and threats?</td>
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<td></td>
<td>In what way has the Environmental Watering Plan improved flow regimes and connectivity across the Basin?</td>
</tr>
<tr>
<td>Better decisions made at the right level</td>
<td>To what extent have the planned activities and outputs under the Environmental Watering Plan, the Water Quality and Salinity Management Plan and the Groundwater Planning programs been achieved?</td>
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<tr>
<td></td>
<td>How has the Basin Plan contributed to environmental watering in the Murray-Darling being coordinated between managers of planned environmental water, owners and managers of environmental assets, and holders of held environmental water?</td>
</tr>
<tr>
<td>‘A healthy, working Basin’</td>
<td>What have been the social and economic benefits and costs to water-dependent industries, from the implementation of the Basin Plan?</td>
</tr>
<tr>
<td></td>
<td>What have been the social and economic benefits and costs to Basin communities, and the nation more broadly, from the implementation of the Basin Plan?</td>
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<tr>
<td></td>
<td>Were there any unexpected or unintended social or economic consequences arising from the Basin Plan?</td>
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<td></td>
<td>To what extent have infrastructure investments and buybacks assisted communities and industry to transition to the Sustainable Diversion Limits?</td>
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<td></td>
<td>Has the Basin Plan provided greater certainty for industries and communities?</td>
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<tr>
<td></td>
<td>What are the major factors that have enabled or constrained the capacity of industries and communities to respond to the Basin Plan and to achieve intended Basin Plan outcomes?</td>
</tr>
<tr>
<td></td>
<td>What have been the social and economic benefits (including ecosystem service benefits) associated with improved environmental outcomes?</td>
</tr>
<tr>
<td></td>
<td>How have the different components of the Basin Plan interacted as a package to help water-dependent industries and communities to adapt to reduced water for consumption?</td>
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Figure 4 Sample evaluation questions
Methods

The choice of analysis method to be used depends on the nature of the question we are trying to answer and the type and depth of data that has been obtained. This may be quantitative (e.g. numerical, yes/no) or qualitative (e.g. interviews, expert opinion or a combination of the two, leading to an informed judgment). It also depends upon the ability to apply a method with sufficient rigour.

Other important elements of any such evaluation process include reporting and improvement (a feedback loop). This is discussed further in the Adaptive management section.

Types of methods

The main types of methods we will use to draw the various information we gather together to make an evaluation fall broadly into two categories—activity reporting and comparative assessments.

Activity reporting

This type of reporting typically helps to determine if an activity or a target has been met (the yes/no), rather than assessing outcomes. We will use it when evaluating whether the specified parties bound by the Basin Plan have complied with their obligations—for example, in assessing whether or not water resource plans are accredited, whether Basin states have prepared the required long-term watering plans and whether specific water quality targets have been met.

This method will tend to draw on information provided to the MDBA on ‘Matters for evaluation and reporting’ (Schedule 12 of the Basin Plan). This information may be supported by documentation explaining actions taken—for example, Statements of Assurance provided by Basin states.

Activity reporting will be phased in over time; so evaluation using this method will similarly evolve over time.

4 Chapter 9 of the Basin Plan
5 See also Part 4, Chapter 13 of the Basin Plan—Reporting requirements
Comparative assessment

Comparative assessments we will use include comparing observed results with a reference case—often called a baseline. Ideally, we will evaluate the Basin Plan outcomes by comparing what has happened with what would have happened if the Plan did not exist (with and without). Extensive computer modelling based on good quality quantitative data is required to undertake such analysis. This type of analysis will be possible, for example, when comparing gauged river data or area of floodplain inundation. It is more difficult where there are a range of influences affecting the outcome—for example, when considering areas of land irrigated by crop type (where climate or commodity prices might also come into play). In this latter case, the comparative method of assessing trends over time would be selected instead; until capacity is developed to increase the number of assessments that involve comparisons of ‘with’ and ‘without’ the Basin Plan.

Evaluating environmental outcomes

Comparative evaluation methods will underpin much of the assessment of the effect of the Basin Plan on ecological outcomes in the Basin. As the Basin Plan makes more water available for the environment, we would expect improved flows. These managed environmental flows should lead to increased frequency, and possibly duration, of inundation (low-level flooding) in wetland areas. Such inundation should, in turn, trigger a response from plants and animals. However, the relationship between flows and ecological response is also affected by other factors. In order to tease out the impact of the Basin Plan, the influence of factors other than flows on the plants and animals also needs to be considered. This will require a degree of interpretation based on an understanding of other contextual factors which affect the outcomes sought from the Basin Plan.

Figure 5 The focus of the Basin Plan environmental monitoring and evaluation program

An illustration of how hydrology, inundation and vegetation indicators will be related is presented in Figure 5. The pattern of river flows in the catchments of the Basin is monitored through a comprehensive network of gauges; and this information is coded within hydrology models. Using these hydrology models, a comparison can be made between the ‘with Basin Plan’ observations and the ‘without Basin Plan’ scenario. Flow regime and inundation indicators will be obtained from these modelled ‘with-’ and ‘without-Basin Plan’ scenarios. Satellite imagery will also
complement the inundation modelling—not only to validate the modelled results, but also to refine the modelling methodology over time.

By overlaying inundation maps with vegetation maps, we can calculate the area of particular vegetation inundated and compare this to the water requirements of that vegetation. For each targeted vegetation community, a suite of indicators will be calculated. This will include the area of the vegetation type that has been provided with optimal water requirements under the ‘with-Basin Plan’ scenario compared to the ‘without-Basin Plan’ scenario.

A key method in evaluating the effect of the Basin Plan on the animals of water-dependent ecosystems is to ask whether their water requirements have been met. The water requirements of some fauna are well documented in the literature and some are even codified in software tools. Confirming that these water requirements have been met more often due to the Basin Plan is the first stage of the ecological evaluation. This allows us to conclude that opportunities for growth, recruitment or movement of targeted animals have been changed by the Basin Plan.

On-ground monitoring provides the real-world confirmation that such opportunities led to the predicted response in the animal populations. Monitoring will be targeted to particular groups of animals at sites across the Basin (for example, aerial waterbird surveys at approximately 40 wetlands; and site-based surveys conducted by the states and Commonwealth Environmental Water Office). Where this type of monitoring has been undertaken in the past at the same locations, we can also use trend analysis to look at changes from before the Basin Plan to after Basin Plan.

A significant final step of the evaluation is to ask what other factors are influencing the outcomes and whether they were likely to be a strong or weak factor in that year. The relevant contextual information will be used to develop a commentary of the observed outcomes and the influence of the Basin Plan (recognising some of the non-water factors are well outside the scope of the Basin Plan). There are routine and readily available information sources for contextual factors such as fire, land-use, grazing and catchment disturbance that allow the commentary to be well informed.

Evaluating governance outcomes

Evaluating governance outcomes ensures all jurisdictions are meeting their Basin Plan responsibilities. These outcomes will be assessed using a judgement-based narrative—which will evaluate progress in implementation activities such as environmental water and water resource planning coordination. Some of these governance outcomes are about how the MDBA and individual jurisdictions implement our responsibilities at regional and local asset scales, and some are about how all jurisdictions work together at a Basin scale.

We will also assess how local knowledge enhances Basin outcomes through stakeholder engagement activities and processes. The Basin Plan has clear timelines for delivery of plans, strategies and Sustainable Diversion Limit (SDL) adjustment mechanisms. Each year we will measure progress in implementation activities against these timelines and develop a narrative on the quality of these outcomes.

Evaluating social and economic outcomes

There are a small number of direct indicators that we will use to measure changes in the Basin’s industries and communities over time as a result of the Basin Plan water reforms. The indicators
we will use are primarily based on those sectors more directly linked to the effects of the Basin Plan (for example, irrigated agriculture and floodplain grazing). It is also important to recognise that all indicators will be influenced by factors other than the Basin Plan—so a substantial component of the evaluation will be attempting to understand the extent to which the Plan is driving the changes. This will require a degree of interpretation based on an understanding of other contextual factors which also affect the outcomes sought from the Basin Plan.

The social and economic evaluation will build on previous work undertaken by the MDBA and others leading up to the Basin Plan coming into force. We will also draw on surveys conducted by the Australian Bureau of Statistics, Australian Bureau of Agricultural and Resource Economics and Sciences, universities, peak industry bodies, and work undertaken by local councils and other stakeholders. It will draw on both quantitative and qualitative methods and information. The specific analysis methods are described below.

**Trend analysis of indicators**

Comparing changes in indicators over time is one component of the analysis. Looking at a range of other factors such as commodity prices, water availability, exchange rates and input costs will also be required to develop our understanding of what has been driving change in irrigated agricultural production, including the level of importance of the Basin Plan among the drivers. This trend analysis can be undertaken at Basin and other spatial scales. For example, if there is data available, we could do this at irrigation district or local government scale.

**Developing a ‘with’ and ‘without’ Basin Plan comparison**

It is not currently possible for many social and economic indicators to develop the ‘without Basin Plan’ scenario. For example, we can’t currently compare ‘area irrigated by crop type’ with a ‘without Basin Plan’ modelled estimate. This is because of the large data requirements to reliably estimate what would have happened to ‘area irrigated by crop type’ if the Basin Plan did not come into force—driven, in particular, by the need to appropriately take account of all the other influences of change. We are building capacity in this area so that such modelling is possible in the future.

**Detailed studies**

Local studies will allow us to look in more detail at the drivers of social and economic change (including the role of the Basin Plan) in a particular region or industry.

We might also undertake specific studies into things like the effects of programs (e.g. Commonwealth investment in water infrastructure), certain themes (e.g. innovation and productivity, or the impact of the Basin Plan on Aboriginal people) and across a range of issues. For example:

- how people in irrigated agriculture in a particular region are adapting to reduced water for consumptive uses
- an assessment of the benefits to floodplain grazing from enhanced environmental flows
- a broad analysis of the contextual factors impacting industry, business and the wellbeing of communities within the Basin, with a focus on the Basin Plan
• how increased certainty is affecting investment
• the social and economic benefits derived from improved environmental outcomes driven by the Basin Plan
• how tourism activity has changed as a result of improved environmental outcomes.

It is expected that a small number of studies will be undertaken by late 2017. As more studies are completed, this will provide a broad representative range of narratives that will illustrate the different ways in which social and economic outcomes are affected by the Basin Plan and associated reform.

Note that across the range of social and economic outcomes, the degree of analysis may vary—with more detail required for assessing impacts of the Basin Plan in regions or industries where change is likely to be greatest.

Social science qualitative research

A range of social science research methods will also be used. This will include qualitative research, workshops and face-to-face interviews in communities; and will continue to review findings from research undertaken by industry, communities and governments.

These methods will be used to collect information about:
• how people in water-dependent industries are responding to the Basin Plan and the impacts for their farm enterprises
• constraints or barriers that limit the capacity of people to respond to the Basin Plan and achieve the intended outcomes
• other factors driving changes in water-dependent communities and industries (including those which have been significant in enabling adaptation to reductions in total water available for consumptive use).

Considering contextual information

A lot of the information we use will tell part of the story around the changes in rural communities and industries. We will also use additional contextual information to help explain changes in the indicators. For example, to interpret changes in the area of certain crops planted in the Basin, we would need to look at climate and commodity prices—as these affect farmers’ business decisions about what to grow and how much water to use, trade or carryover.

Contextual information (such as general changes in population structure inside and outside the Basin) will also be required to understand the broad context in which industries and communities are operating. As an example, if there are major technological changes occurring in a particular industry, it will be important to understand how this is impacting on associated businesses and the community. To help build this understanding, we will need to use a range of quantitative and qualitative data and consider existing reports and other information produced by industry groups, government agencies, and other stakeholders.

Climate is an important influence on ecosystem response and must be considered when, for example, interpreting extent or health of plants and animal communities.
An indicative list of possible contextual information that we may draw on includes:

- seasonal weather conditions, including rainfall
- commodity price changes
- input costs
- changes in productivity and technology
- employment (total and by industry)
- current land-use
- effect of invasive plants and animals
- profit and debt levels
- data on entry and exit from the irrigation sector
- population size and age structure
- measures of community or business confidence
- established indicators of community wellbeing (e.g. Socio-Economic Indexes for Areas, Community Indicators Victoria).

Drawing it all together

The Basin Plan is about ‘optimising social, economic and environmental outcomes’ as it is put into practice. All the information we collect will be synthesised to develop a holistic understanding of how, and to what extent, the Plan has affected the Basin’s environment, industries and communities. In the early years of evaluation (as the Plan is still being rolled out), our focus will be on how well that is going. However, over time greater emphasis will be placed on the effects on the Basin’s environment, industries and communities.

We are mindful that:

- both the shorter- and longer-term implications of the Basin Plan need to be properly reflected. That is, a range of social, economic and environmental benefits and costs are expected to occur throughout the life of the Basin Plan and well beyond the 2019 date when the SDLs are fully implemented
- the findings and recommendations that are produced by the evaluation are timely, relevant, accessible and useful for program management and budget assessment processes
- evaluation findings are translated into clear messages for decision-makers and other stakeholders
- the purpose and value of any local studies are clearly communicated. It is important that people understand that it is not feasible for local-scale studies to be done in all Basin communities; rather they will be directed at areas where changes are likely to be more closely associated with the implementation of the Basin Plan
- monitoring of the changes is reliant on many others’ capacity and resources to do so.
# Indicators

Indicators are the variables that we will track to help us measure changes in the Basin. This information is used to answer the evaluation questions.

No single indicator will tell the whole Basin Plan story. We will use these indicators in combination with a range of other information to understand the key drivers of social and economic change in the Basin—for example, population data, commodity prices, community views or local studies.

## Indicator development

Given that the Basin Plan is just one of many drivers for social, economic and environmental change in the Basin, a key issue in developing suitable indicators is ensuring that the changes being measured can be attributed (or attributed in part) to the Plan.

We consulted with farmers, irrigation operators, local business owners, local councils, local community groups, tourism operators, universities, consultants, scientists and Basin states to develop a range of suitable indicators that can be used in our evaluation. They are detailed below under the themes of environmental, water quality and social and economic indicators.

## Indicator applicability and refinement over time

Because the Basin Plan is being implemented in stages, many of the changes sought (and to be evaluated) will take time to occur, for example:

- while reporting on agricultural water use is done annually, some of the flow-on effects of changes to land management practices may take years to be observed
- the benefits that come from healthier environments will generally only be achieved in the longer term.

Therefore, the appropriate indicators to measure progress and effects will also need to change over time. Additional indicators will also be developed (in consultation with the Basin states and other relevant stakeholders) as more elements of the Plan are in place. For example:

- as the Basin-wide environmental watering strategy is published and Basin states establish objectives and targets for environmental assets in their long-term watering plans, indicators of environmental outcomes at asset scale (for example at key wetlands) will follow
- as state water resource plans are developed to align with the Sustainable Diversion Limits, indicators will be developed to test the efficiency and effectiveness of their operation.

Indicators may also be revised or discontinued as further research and community/industry consultation occurs.
The degree to which each indicator can be used across the whole Basin or to assess a particular issue will also be determined by its relevance to particular localities, the outcome in question and data availability. This will vary significantly across regions. Environmental studies may involve linking information between different spatial scales. For example, we could be:

- closely studying a particular site but looking for change across a larger area, or along whole reaches
- assessing bird health across the Basin using ‘whole basin’ bird surveys, but linking that to specific actions by environmental water managers at particular locations.

Environmental indicators

The selection of environmental indicators that will be used to assess the Basin Plan has been guided by the evaluation questions we are trying to answer; the complexities which arise because of the delays between actions taken and observing environmental responses; and the various spatial scales of interest.

In addition, there is a need to illustrate progress in implementing the overall environmental watering plan contained in the Basin Plan (which sets out objectives, principles and processes) and the Basin-wide environmental watering strategy in development by the MDBA, which provides detailed watering strategies and expected outcomes. These are critical because it is through these mechanisms that environmental watering actions are expected to produce the maximum environmental benefit.

The indicators that will help to answer the evaluation questions associated with the environmental objectives of the Basin Plan are described below.

Volumes of environmental water available

The annual water accounts of the Basin state governments, the Commonwealth Environmental Water Holder (CEWH) and the MDBA will provide a picture of the volume of held and planned environmental water available for each water resource plan area.

Environmental watering events

The quantity, timing and purpose of each release of environmental water will be reported for each regulated river system (and unregulated river systems where feasible). A summary of the purpose of environmental watering will be reported for each environmental asset (e.g. river or wetland). In some cases, environmental watering may have multiple purposes (e.g. to promote a specific ecological water regime and also waterbird breeding). Hydrographs and inundation maps will describe the influence of environmental watering on flow in the channel and on the floodplain respectively; which will allow us to evaluate whether an environmental water delivery met its intended purpose.

Flows connecting rivers and their floodplains

Over the long term, the computer modelling will allow mapping of areas inundated—which can be compared with ‘before Basin Plan’ scenarios to give a picture of improvement in connectivity.
Diversity, extent and condition of native water-dependent vegetation

The floodplain mapping described above will be overlaid with vegetation maps, which over the long term (and after considering the effects of other drivers like climate and land-use change) will allow assessment to be made of the improvement that accrues following environmental watering activities.

Condition of the Coorong and Lower Lakes ecosystems and Murray Mouth opening regime

With improved flows throughout the system, flow out of the Murray mouth is expected to increase by an average 30 to 40% annually. The mouth is expected to be open to the sea 90% of the time. This is expected to have flow-on benefits in terms of waterbird populations and vegetation condition, and reduced salinity—which can be measured.

Recruitment and populations of native water-dependent species including vegetation, birds, fish and macroinvertebrates

Indicators will be further developed for a range of native water-dependent species at Basin and asset scales to evaluate environmental outcomes of the Basin Plan. Analysis of these indicators will build on historic and current monitoring by the Commonwealth and Basin states. Government agencies are seeking further opportunities to integrate monitoring programs to optimise our ability to assess the environmental outcomes of Basin Plan implementation.

Comparisons and trend analysis can be made through ecological modelling of measured data ‘before Basin Plan’ and after.

Water quality indicators

The water quality and salinity management plan contained in the Basin Plan sets out water quality objectives for Basin water resources, including a salt export objective.

We will use a variety of indicators to inform the evaluation of the various activities undertaken to achieve the water quality objectives, such as:

- measures of water quality
- salinity levels at reporting sites
- estimates of the discharge of salt from the River Murray system
- reporting on whether water quality and salinity targets have been considered when managing water flows and in making decisions about the use of environmental water
- identification of measures to achieve end-of-valley targets in water resource plans
- the number and severity of blue-green algal and blackwater events.
Social and economic indicators

The indicators described below have been chosen based on their ability to answer the evaluation questions, technical suitability, data availability and local expertise; gained through consultation with people from Basin industries and communities. Some indicators may also only be used in a particular region or industry and not others.

Area irrigated and output by crop type

The reduction in water available for consumptive use may lead to a decrease in the average area irrigated and the volume of production. It may reduce the area farmed and/or the production volume. However, where farmers are able to transition to more water efficient methods or crops and/or benefit from improved infrastructure; we might expect this decline to be partially offset. Perennial crops are expected to be less responsive in the short term to the change in water availability, given their more consistent and ongoing water requirements.

Patterns of water trading

The Basin Plan is expected to result in more efficient and effective water markets. This may result in a greater number of trades across the Basin. Water is also expected to flow to its most productive use across regions and crops/commodities. This indicator will inform our understanding of how irrigators are running their businesses, and the impact of Basin Plan water trading rules on business behaviour.

Water used by irrigated agriculture

At the Basin level, a reduction in water available for consumptive use and investments in improving water use efficiency are expected to, on average, reduce water used by agriculture. Given increased water scarcity it is also expected that water will flow to regions or crops/commodities that have higher long-term expected returns.

Measures of productivity

The Basin Plan is expected to lead to improvements in productivity; meaning that the same or greater outputs can be produced with fewer inputs. Productivity improvements are expected to be driven by investment in more efficient water infrastructure and changes in behaviour in response to increased water scarcity.

Rate of return per unit of water used

A measure of the rate of return per megalitre (ML) of irrigation water will provide insights into changes in returns (or profits) to irrigators over time. In the long run the Basin Plan is expected to drive improvements in productivity and a move to more productive agricultural outputs—which are expected to lead to improvements in the rate of return per ML of water. The Basin Plan may also influence the price of water, which can be expected to have an impact on the rate of return. Rates of return will be significantly influenced by a range of other non-Basin Plan factors. For example, a change in commodity prices or in-season rainfall would likely have a much more significant impact on rates of return than the Basin Plan.
Value of production of floodplain agriculture

This indicator will provide a measure of some of the benefits that accrue from an improved environment for non-irrigated agricultural production on the floodplains of the Murray–Darling Basin. The Basin Plan is likely to result in improved floodplain condition. This is expected to lead to an increase in the productivity of native pasture, which will potentially lead to increased stocking rates by floodplain graziers in some areas.

Benefits from improved environmental outcomes

The environment provides benefits to people in a number of ways such as food and fibre provision, regulation of the climate and filtration of water and air. Where possible, we will undertake studies to highlight specific examples of how the Basin Plan is contributing to this; for example, whether increased environmental flows in a particular region are reducing water filtration costs for a community, or the costs of engineering works for reducing salinity.

Certainty and confidence

The Basin Plan sets out a clear framework for water policy which provides certainty on rules for all water users. Certainty around policy settings is expected to provide irrigated agricultural producers and related businesses with enhanced confidence to invest. Confidence and certainty can be measured directly through surveys or interviews which ask specifically about the level of business confidence. Insights into confidence and certainty can also be gained by looking at the level of investment in irrigated agriculture—through, for example, tracking the indicators outlined previously.

Indigenous values

The Basin Plan sets requirements for both the MDBA and Basin states to consult with Indigenous communities and to have regard to Indigenous values and uses in relation to both environmental watering and the development of water resource plans. We will collate information on when and how this has occurred and this will contribute to the evaluation across the objectives.
Data sources

Tracking changes in an indicator (to answer an evaluation question) may require data from one or more sources. The data may include measured, surveyed, computer-modelled or reported information.

Wherever possible, we will draw on data that is already being collected and reported, including that submitted by the MDBA, Basin states and the CEWH, as required by the Basin Plan. We will also draw on reporting that states provide to other Commonwealth agencies.

Examples of data sources that will be used specifically to evaluate how well the Basin Plan is being implemented include:

- reporting on the Basin Salinity Management Strategy
- reporting of water diversions
- MDBA review and register of water recovery
- Commonwealth Environmental Water Office’s Basin-scale assessment of monitoring at key environmental asset sites.

Examples of the sources of data for the environmental indicators include:

- Basin states, including Catchment Management Authorities and similar bodies
- the CEWH
- collaborative projects with Basin state agencies and other researchers
- the Australian Water Resources Information System, managed by the Bureau of Meteorology
- Geoscience Australia’s Landsat satellite imagery holdings.

Examples of the sources of data for social and economic indicators include:

- the Australian Bureau of Statistics and Australian Bureau of Agricultural and Resource Economics and Sciences
- local community groups
- irrigation operators
- local government
- industry bodies.
We will supplement this with additional local or regional information where needed, such as that collected by local government, industry associations and community groups, as well as ecological information collected through ‘citizen science’ (e.g. Birds Australia annual survey).

**Table 1** shows some examples of the link between objectives, data sources and indicators for the outcome ‘healthy and resilient rivers, wetlands and floodplains’.

**Table 2** presents the same information for the outcome ‘Better decisions made at the right level’.

**Table 3** presents the same information for the outcome ‘Productive and resilient industries, confident communities’.
### Table 1 Outcome ‘healthy and resilient rivers, wetlands and floodplains’ – example questions, indicators and data sources

<table>
<thead>
<tr>
<th>Evaluation questions</th>
<th>Theme</th>
<th>Example indicators</th>
<th>Data sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>To what extent have the Basin Plan objectives, targets and outcomes for water-dependent ecosystems been achieved?</td>
<td>Vegetation</td>
<td>• Red gum inundation&lt;br&gt;• Vegetation age classes (to see that germination and growth are occurring)&lt;br&gt;• Vegetation diversity (to assess no. of species)</td>
<td>• Flood inundation model scenarios ‘with-’ and ‘without-Basin Plan’&lt;br&gt;• Red gum location from MDB vegetation type map 2013</td>
</tr>
<tr>
<td>How has the Basin Plan contributed to the protection and restoration of ecosystem functions?</td>
<td>Birds</td>
<td>• Water bird nesting opportunities&lt;br&gt;• Water bird age classes</td>
<td>• Flood inundation model scenarios ‘with-’ and ‘without-Basin Plan’&lt;br&gt;• MDB aerial waterbird survey&lt;br&gt;• Other surveys especially those at assets as part of state reporting of the achievement of environmental outcomes at an asset scale</td>
</tr>
<tr>
<td>How has the Basin Plan contributed to the protection and restoration of water-dependent ecosystems?</td>
<td>Fish</td>
<td>• Spawning&lt;br&gt;• Distribution&lt;br&gt;• Age classes</td>
<td>• Gauge network flows that meet spawning requirements&lt;br&gt;• ‘With’ and ‘without-Basin Plan’ hydrology models&lt;br&gt;• A Basin wide fish monitoring program&lt;br&gt;• Other surveys especially at asset-scale as part of state reporting of the achievement of environmental outcomes</td>
</tr>
<tr>
<td>How has the Basin Plan contributed to improved resilience of water-dependent ecosystems in the Murray–Darling to climate change and other risks and threats?</td>
<td>Connectivity (lateral)</td>
<td>• Floodplain area inundated</td>
<td>• Flood inundation model scenarios ‘with-’ and ‘without-Basin Plan’</td>
</tr>
<tr>
<td>How did the water-dependent ecosystems respond to environmental watering?</td>
<td>Connectivity (vertical)</td>
<td>• Bankfull flows - a measure of how often / for how long rivers are full</td>
<td>• Hydrology models ‘with-’ and ‘without-Basin Plan’</td>
</tr>
<tr>
<td>In what way has the EWP improved flow regimes across the Basin?</td>
<td>Connectivity (longitudinal)</td>
<td>• Periods when flows stop or are low&lt;br&gt;• Murray Mouth opening regime</td>
<td>• Hydrology models ‘with-’ and ‘without-Basin Plan’</td>
</tr>
<tr>
<td>In what ways has the condition of environmental assets improved?</td>
<td>Connectivity (vertical)</td>
<td>• Compliance with groundwater provisions in WRPs</td>
<td>• Hydrology models ‘with-’ and ‘without-Basin Plan’</td>
</tr>
<tr>
<td>Have the specific flow &amp; connectivity targets set in the BP been met?</td>
<td>Water quality</td>
<td>• Salinity levels</td>
<td>• Compliance with water resource plans</td>
</tr>
<tr>
<td></td>
<td>Diversity</td>
<td>• Vegetation diversity</td>
<td>• MDBA monitoring of salinity targets and salt loads&lt;br&gt;• Asset surveys as part of state reporting</td>
</tr>
</tbody>
</table>
### Table 2 Outcome ‘Better decisions made at the right level’ – example questions, indicators and data sources

<table>
<thead>
<tr>
<th>Evaluation questions</th>
<th>Theme</th>
<th>Example indicators</th>
<th>Data sources</th>
</tr>
</thead>
</table>
| To what extent have the planned activities and outputs under the Environmental Watering Plan, the Water Quality and Salinity Management Plan and the Groundwater Planning programs been achieved? | Environmental water planning              | - Purpose of environmental water use  
- Alignment with annual Basin-wide environmental watering priorities  
- How Basin states and others coordinated, consulted and cooperated for environmental watering and planning | Basin states  
CEWH  
MDBA (reporting under Schedule 12, matters 12 & 14) |
| How has the Basin Plan contributed to environmental watering in the Murray–Darling being coordinated between managers of planned environmental water, owners and managers of environmental assets, and holders of held environmental water? | Water Quality and Salinity Management Plan | - How decisions on river flow and environmental watering had regard to the water quality objectives in the Basin Plan  
- Measures implemented from water quality plans (part of water resource plans)  
- How has engagement with the local community informed environmental water and water resource planning?  
- How has engagement with the local community informed implementation of the Basin Plan? | Basin states  
CEWH  
MDBA (reporting under Schedule 12, matters 12 & 14) |
| How has the Basin Plan contributed to protection/restoration of water-dependent ecosystems? | Involving the community                    | - Water resource plans in place in accordance with the agreed timetable for accreditation  
- Accredited water resource plans provide for critical human water needs  
- Accreditation for each WRP | Basin states  
MDBA  
CEWH (reporting under Schedule 12, matters 6 & 10) |
| To what extent were the actions required by the Basin Plan (relating to the protection and restoration of water-dependent ecosystems) suited to meeting the objectives of the Basin Plan? | Water resource plans                       | - Transaction time  
- Patterns of water trading | Basin states  
MDBA  
CEWH (reporting under Schedule 12, matters 17, 18, 20, 21, Statements of Assurance) |
| Have the water trading rules contributed to efficient water markets?                 | Water trading                              | -                                     | Basin states  
Irrigation Infrastructure Operators  
Reporting under the Basin Plan water trading rules |
### Table 3 Outcome ‘Productive and resilient industries, confident communities’ – example questions, indicators and data sources

<table>
<thead>
<tr>
<th>Evaluation questions</th>
<th>Theme</th>
<th>Example indicators</th>
<th>Data sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>What are the major factors enabling/constraining the capacity of industries/communities to respond?</td>
<td>Water trading</td>
<td>• Patterns of water trading</td>
<td>• Basin states</td>
</tr>
<tr>
<td>What have been the social and economic benefits (including ecosystem service benefits) associated with improved environmental outcomes?</td>
<td>Water trading</td>
<td>• Number of trading restrictions notified to MDBA</td>
<td>• Irrigation Infrastructure Operators</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Availability of information to water market</td>
<td>• Reporting under the Basin Plan water trading rules</td>
</tr>
<tr>
<td>What have been the social and economic benefits and costs to water-dependent industries, from the implementation of the Basin Plan?</td>
<td>Irrigated agriculture</td>
<td>• Area irrigated and output by crop type</td>
<td>• Irrigation operators</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Stocking rates and output</td>
<td>• Local councils</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Patterns of water trading</td>
<td>• Water registries</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Water used for irrigated agriculture</td>
<td>• State agencies</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Measures of productivity</td>
<td>• Consultants</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Rate of return per unit of water used</td>
<td>• Industry groups</td>
</tr>
<tr>
<td>Were there any unexpected or unintended social or economic consequences arising from the Basin Plan?</td>
<td>Irrigated agriculture</td>
<td></td>
<td>• Australian Bureau of Statistics (ABS)</td>
</tr>
<tr>
<td>To what extent have infrastructure investments and buybacks assisted communities &amp; industry to transition to the SDLs?</td>
<td>Benefits from improved environmental outcomes</td>
<td>• Economic and social importance</td>
<td>• Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES)</td>
</tr>
<tr>
<td>Has the Basin Plan provided greater certainty for industries and communities?</td>
<td>Benefits from improved environmental outcomes</td>
<td></td>
<td>• MDBA</td>
</tr>
<tr>
<td>What are the major factors that have enabled or constrained the capacity of industries and communities to respond to the Basin Plan and to achieve intended Basin Plan outcomes?</td>
<td>Benefits from improved environmental outcomes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How have the different components of the Basin Plan interacted as a package to help water-dependent industries and communities to adapt to reduced water for consumption?</td>
<td>Benefits from improved environmental outcomes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Roles and reporting

Who must report on Basin Plan progress?

The Basin Plan sets out who has obligations to report particular information\(^6\). This includes not only broad-scale information on how well the Plan is being implemented and how effective it is, but also achievement against targets identified in the Plan. For example, Basin states, the CEWH and MDBA are required to report annually on ‘the identification of environmental water and the monitoring of its use’.

Not everything must be reported immediately—the requirements build over time. This is in recognition that the implementation of the Basin Plan is being phased in. For example, state governments have until 2015 to publish their long-term environmental watering plans and until 2019 to bring their water resource plans into line with the Basin Plan’s requirements. As this work progresses monitoring, data collection and reporting of progress will also expand to cover these activities and their expected outcomes.

Figure 6 shows when various elements of the Basin Plan are implemented as well as the schedule for MDBA to publish reports on the effectiveness of the Basin Plan and conduct reviews.

MDBA role and reporting

It is our role to evaluate all the data we collect and that we receive from other bodies. After each water year (a water year corresponds to a financial year), we will publish the Annual Basin Plan effectiveness report. A draft will be produced by December and the final report will be published every March, starting in 2015.

Every five years the report we produce will be more detailed, starting in 2016–17. This will include a more in-depth evaluation of social and economic outcomes and an assessment of the implementation of water quality and salinity management targets and the environmental watering plan.

Every ten years, a thorough evaluation of the Basin Plan will be conducted.

As part of our monitoring and evaluation program, we will also publish:

- Statements of Assurance from the Basin state governments, the CEWH and MDBA’s reporting of compliance with our own Basin Plan obligations
- links to annual outcomes reports by the CEWH and other environmental water holders
- audit reports.

\(^6\) Schedule 12 of the Basin Plan
Figure 6 Detailed timeline of Basin Plan implementation and reporting steps
Role of the Commonwealth government

The Department of the Environment and the Commonwealth Environmental Water Holder have reporting responsibilities as set out in Schedule 12 of the Basin Plan. Some of this information is required annually and some every five years. The CEWH manage Commonwealth environmental water to protect or restore the environmental assets of the Murray–Darling Basin. Each year they will account for the volume and use of this water, and report on how they coordinated their watering activities in accordance with the Basin Plan’s environmental watering and water quality and salinity management plans. The Department of the Environment is responsible for investments in water-saving infrastructure and water purchases to achieve more efficient outcomes for the environment. Each year they will report on the progress of the Commonwealth’s water recovery program, including entitlement volume and security.

A number of other Commonwealth agencies collect valuable data which we will use for our evaluation and reporting. These include the Australian Bureau of Statistics, the Bureau of Meteorology and the Australian Bureau of Agricultural and Resource Economics and Sciences.

Role of Basin state governments

Basin states already have a range of their own requirements for monitoring and evaluating many of their own programs and activities. These may be set out in state water resource plans, environmental water planning, or are associated with specific government programs. The Basin Plan evaluation does not seek to duplicate these; rather it aims to draw on them where they meet our needs, or to build on them where further information is required.

Basin states are responsible for implementing many of the key parts of the Basin Plan. They are also required to report a variety of information to the MDBA (and to other Commonwealth agencies). Some of this information is required annually and some every five years. It covers progress towards implementing the Basin Plan, as well as more detailed information relating to some of the changes under the Plan—such as that associated with environmental watering.

Role of local government

Local government will be an important source of information, particularly in relation to the social and economic indicators. The MDBA has sought input from local governments in developing the social and economic indicators; and we will continue to work with them on collecting data and when evaluating the effectiveness of the Basin Plan.

Role of local communities

While developing this framework, we conducted interviews and workshops with key stakeholders. This includes the Basin state governments as well as through our advisory committees (including the Basin Community Committee) and community representatives. In particular, to develop suitable social and economic questions and indicators that would capture the Plan’s impact, we consulted extensively with community representatives and technical experts across the Basin from May 2013; and this will continue as the Basin Plan is implemented.

Our evaluation includes testing the extent to which local knowledge informs the Plan’s implementation. We have acknowledged in the Basin Plan that better outcomes for the Basin’s communities, economy and environment will be achieved by building on the intimate knowledge
of local people. This includes that of landholders, Aboriginal representatives, communities and industry advisory groups.

The Basin Plan requires that community views and expertise (including through representative organisations) are taken into account. This has already happened and will continue to occur throughout the implementation of the Plan and in developing the water resource plans and the constraints management strategy; when setting annual environmental watering priorities and developing principles to guide such watering; and while evaluating the effectiveness and effects of the water reform.

We also seek the involvement of Aboriginal people in planning for programs such as environmental water delivery—and states must consider indigenous values and uses when developing their water resource plans. The evaluation will seek to confirm that this occurs and contributes to the successful implementation of the Basin Plan.

Other involved groups

Other stakeholder groups expected to be involved in the evaluation (particularly in the social and economic evaluation work) include organisations that can provide us with data and information. For example: irrigation operators, industry, tourism operators, scientists, economists, local organisations such as natural resource management groups and those people who visit rivers and water-dependent ecosystems in the Basin.

Other government agencies are involved in the Basin water reform process and may use the evaluation findings to contribute to their decision-making processes. Apart from the Basin state governments, this includes the Department of Environment and the Commonwealth Environmental Water Holder.
Adaptive management

Adaptive management is a systematic process for continually improving management practices through learning from the outcomes of previous management\(^7\). The Basin Plan defines adaptive management\(^8\) as taken to include (among other things) ‘…linking knowledge, management, evaluation and feedback over a period of time’.

![Figure 7 Basin Plan adaptive management cycle](image)

**Figure 7 Basin Plan adaptive management cycle**

The MDBA and the Basin states must ‘have regard to the findings and recommendations of evaluations when implementing the Basin Plan and when proposing any amendments’\(^9\).

In essence, what we learn through monitoring and evaluation is expected to lead not only to an improved knowledge base and continuous improvement to water resource planning in general, but in particular to potential revision of the environmental watering plan and the water quality and salinity management plan. The findings and recommendations from the evaluation process will also be reflected in the 10-yearly reviews of the Basin Plan.

**Linking findings to future management**

Separate to this framework, the Basin Plan sets out a range of mechanisms for review and revision of various parts. This includes the SDL adjustment mechanism, the Northern Basin review, and the review of several groundwater SDLs. The Basin Plan and Water Act also include periodic reviews.

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\(^7\) SEWPAC (2013) A guide to undertaking strategic assessments, Commonwealth of Australia, Canberra.
\(^8\) Section 1.07
\(^9\) Section 13.12
The Commonwealth Environmental Water Holder, the Commonwealth and Basin state governments and the MDBA will report to the Authority every year on the ‘implementation of the environmental management framework’. This will include reporting on: the purposes of environmental water actions; the actual volumes delivered (and how these aligned with the Basin-wide ‘annual environmental watering priorities’ for that reporting period); as well as how those organisations coordinated, or contributed to coordination, across the Basin. While compliance with Basin-wide annual environmental watering priorities is not mandatory, Basin states and the CEWH must report to us if environmental water is delivered other than in accordance with them\(^{10}\).

Evaluation of this information will enable us to identify the factors that enable or act as barriers to coordination of environmental watering and achievement of Basin-wide priorities (noting that, in some cases, there will be sound reasons for watering that is not consistent with Basin-wide priorities). In some years, our findings may influence Basin-wide priorities that we set the following year. What has been learned is also expected to feed into decisions by the Basin states and the CEWH over the following years.

**Improving monitoring and evaluation capability**

We will conduct an assessment of the capability for monitoring, evaluation and reporting\(^{11}\) in the Basin by November 2017. We will then work with the Basin states, Commonwealth and other stakeholders to implement the assessment recommendations; which may also lead to refinements to the evaluation framework itself.

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\(^{10}\) Basin Plan Section 8.44 and Schedule 12, Matter 10

\(^{11}\) As per Chapter 13, Part 6 of the Basin Plan