Economic evaluation for regional IWM projects

Part A - Benefit cost analysis guide

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Acknowledgment

We acknowledge and respect Victorian Traditional Owners as the original custodians of Victoria's land and waters, their unique ability to care for Country and deep spiritual connection to it. We honour Elders past and present whose knowledge and wisdom has ensured the continuation of culture and traditional practices.

We are committed to genuinely partner, and meaningfully engage, with Victoria's Traditional Owners and Aboriginal communities to support the protection of Country, the maintenance of spiritual and cultural practices and their broader aspirations in the 21st century and beyond.

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Integrated water management (IWM) investments offer a broader range of benefits and costs compared with business-as-usual water management approaches.

Business cases and grant applications must capture all these costs and benefits to ensure we understand IWM's true value.

This question about the value of a project is key to identifying which projects to fund – whether from an organisation's budget or via a grant process. A business case or grant application that is unclear about a project's benefits, or overall merit, is unlikely to be successful.

Economic evaluation is the tool to achieve this. It provides a robust and repeatable way of comparing costs and benefits to determine if the project is worthwhile doing, or to identify which option is the 'best bang for your buck'.

This sounds simple, but economic evaluations have a reputation for being complex and time consuming. In this guide, we hope to overcome this perception by presenting rapid, practical approaches to economically evaluate regional IWM projects.

While there are numerous ways to undertake an economic evaluation, we use benefit-cost analysis (BCA). BCA is widely accepted within business and government. Other useful approaches, such as multi-criteria analysis, are not covered in this guide.

One of our goals is to encourage IWM practitioners to think about economics from the earliest stages of scoping a new project. Doing so will ensure the 'problem' is defined in broad, region-wide terms, identifying multiple benefits from the options identified, and that potential beneficiaries have a seat at the table to help design the project's details.

Who should use this guide

This guide has been developed for IWM practitioners working in regional councils, in water utilities, for the Department of Environment, Land, Water and Planning (DELWP), or for other organisations such as catchment management authorities (CMA).

We recognise IWM may be only one small part of your job, and you may not be a water expert or an economist. The guide outlines what a good economic evaluation of an IWM project looks like, and how this can be done when you don't have the time, resources, or expertise to do a full analysis. This guide shows how to:

1. Do a simple BCA using the project information that is already available, together with expert stakeholders' input.

2. Ensure you identify and include the full range of IWM benefits in your BCA.

3. Properly evaluate the project and present the results to attract project funding.

We believe that this will improve how you do an economic evaluation, regardless of whether you do the assessment yourself or outsource it to others. To learn more there is further reading at the end of this document.

What is IWM?

New water cycle challenges, such as climate change and changing customer expectations for liveable cities and towns, need an integrated approach to water servicing that delivers broader benefits than what conventional water servicing can provide.

The concept of IWM has emerged as a way of managing water services to maximise these community benefits. It draws on the view that the conventional approach to managing water – compartmentalising water supply, sewerage and stormwater services – produces inefficient water management and liveability outcomes. This compartmentalisation may be physical (in terms of infrastructure), institutional (in terms of responsibility for providing services) or regulatory (in terms of the applicable legislation and policy).

As the name implies, IWM involves integrating the various water services to get a better outcome. It does this through place-based planning that responds to regional and local differences in climate, landscape and population.

It follows that a similar IWM outcome (such as providing green spaces for liveability) might be achieved in different ways across regions (such as choices between different alternative water sources). Understanding which actions and benefits are prioritised by local communities helps to shape individual IWM projects and respond to local conditions.

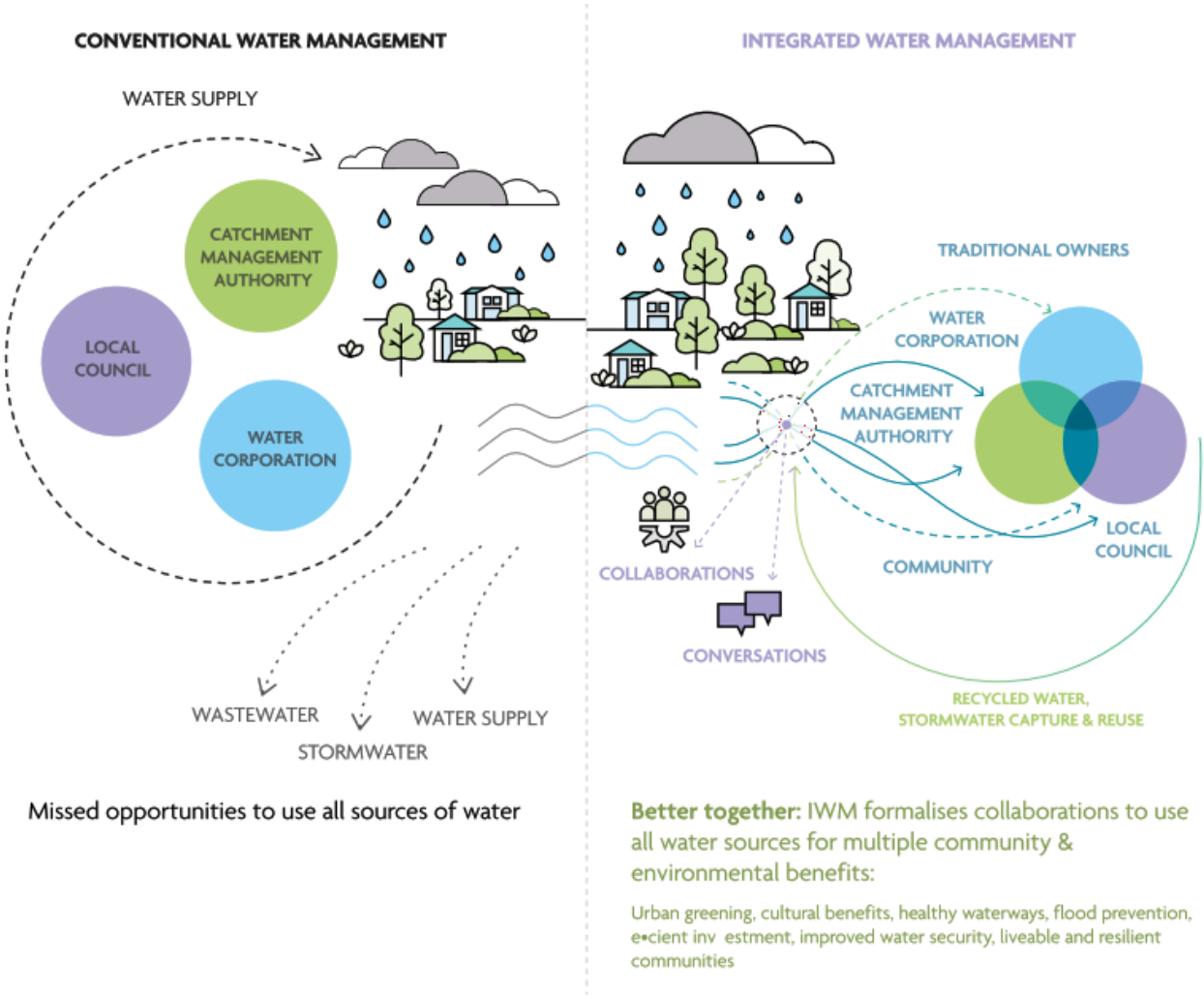

Figure 1. IWM is an alternative to conventional water management approaches. IWM brings different water managers together to explore projects that deliver multiple outcomes for local communities. (Credit: DELWP)

Victoria's IWM framework

The IWM Framework for Victoria (DELWP, 2017) is a state-wide process of identifying, investigating and prioritising IWM opportunities. The IWM framework facilitates joined-up planning between Traditional Owners, water corporations, catchment management authorities and local government, and feeds into water and land planning processes. The framework includes:

A definition – IWM is defined as: *… a collaborative approach to planning that brings together organisations that influence all elements of the water cycle, including waterways and bays, wastewater management, alternative and potable water supply, stormwater management and water treatment. It considers environmental, social and economic benefits*.

State-wide IWM outcomes – There are 7 key outcome areas across the water cycle, linked to sustainability, liveability, resilience and economic prosperity

Regional and Metropolitan IWM Forums – IWM Forums have been established across the state to identify, prioritise and oversee the implementation of IWM opportunities in Victoria's towns and cities. The forums bring together all organisations with an interest in the water cycle to facilitate collaborative planning.

Strategic Direction Statements – Each IWM Forum develops a Strategic Directions Statement that expresses the regional context, shared vision and water-related outcomes for its region, along with a list of IWM opportunities.

IWM in regional cities and towns

IWM is just as relevant for regional cities and towns as it is for Melbourne. The water cycle challenges affecting regional cities and towns include water supply, wastewater management, drainage/flooding and waterway health outcomes. The IWM benefits in regional cities and towns extend to liveability, biodiversity, community health and wellbeing as well as cost savings for utilities, councils and CMAs.

In developing this guide, we talked to Regional IWM Forum members about IWM in regional cities as well as smaller regional towns. Several themes emerged.

First, it is more obvious in the regions that urban water is a subset of wider catchment management. While the specific urban water challenges differ between regions, consistent pressures facing water managers relate to managing wastewater in inland catchments and the impact of urban development on the water cycle.

Second, a defining characteristic of the regions is the dispersed nature of towns, water sources and urban water infrastructure. We heard about the challenges this presents in meeting minimum service levels consistently across a service region, the dynamics of changing town populations and the need to respond to local environmental issues.

Third, water is not just a public health or natural resource management issue. Water servicing can relate directly to economic development. For example, the footprint of on-site wastewater disposal systems can limit dwelling density. Switching to a sewer system enables higher-density development, with benefits for economic growth.

Fourth, there is no single definition of a regional IWM practitioner! Regional IWM practitioners have varied backgrounds: some technical, but others not. IWM tools should cater for this.

We responded to these challenges by designing a guide that considers the types of regional IWM projects that will arise in the future and the most common benefits practitioners may want to include in business cases and then explains how to do a simple BCA that includes assigning a dollar value to IWM benefits.

Case studies

This guide uses 2 worked projects examples of regional IWM projects to illustrate BCA. We are grateful for the support of the City of Wodonga and Pyrenees Shire Council for providing access to these case studies:

Baranduda Fields Masterplan, Wodonga (VIC)

Baranduda Fields is a major regional sporting complex development offering a range of social interactions and recreation activities.

Irrigation is a key management issue. Following the initial investigation of recycled water, a decision was made to also investigate stormwater harvesting. Stormwater would be harvested on-site and treated by Council and then used for irrigation. Rainwater and drinking water will be used within the buildings. Having a council-owned and operated stormwater scheme will provide an alternative water source (to conserve regional drinking water supplies), improve sustainability and give Council a more flexible (to operate) irrigation solution.

As an IWM project, Baranduda Fields also includes bioretention swales to treat stormwater runoff and passively irrigate trees within the site's extensive car parks.

The stormwater harvesting option, including the car park bioswales, was evaluated as part of developing this guide.

Beaufort Linear, Beaufort (VIC)

Beaufort Linear is a master plan for a green corridor along Garibaldi Creek in Beaufort, Victoria. This green corridor runs from Beaufort Lake to Yam Holes Creek. This corridor already connects several key town features, including Beaufort Lake itself, the school precinct, sports precinct, RV park, public pools, skate park and the future town entry. Revitalising the corridor into a green link is expected to increase foot traffic along the corridor and improve the accessibility of these town features.

From an IWM perspective, the project uses green infrastructure as a way to improve the environmental condition of Garibaldi Creek, address existing flooding issues related to the congested waterway and enhance liveability and environmental stewardship.

The master plan outlines a suite of individual green infrastructure projects along the linear corridor. These include building off-stream stormwater wetlands, daylighting sections of the creek, as well as developing walking paths and numerous community recreation spaces. Individual projects can be prioritised, grouped and staged as needed. A subsection of these projects was evaluated as part of developing this guide.

Why is economic evaluation important?

Decisions about funding IWM should be underpinned by sound economic principles.

These principles tell us to identify and compare all a project's costs and benefits in consistent terms. But it is not always obvious whether the benefits of a project (often described as outcome statements) outweigh the costs to deliver them.

Economic evaluation is the process that helps us determine which projects are worth doing (because the benefits outweigh the costs) and how to rank projects (which one provides the best return for the investment being made).

There are numerous tools to undertake economic evaluations. Benefit-cost analysis (BCA) is the primary tool used by Victorian policy and funding agencies.[1] It can appear daunting to newcomers, but it can be used by anyone who understands the principles and is aware of what a good BCA involves. Many good guides are available on the step-by-step process of doing a BCA. This guide refers to these steps without repeating the detail. If you want more information about the step-by-step process, see the further reading section at the end.

How does this relate to regional IWM?

Evaluating regional IWM projects highlights several challenges that distinguish them from more traditional approaches to water management. First, IWM delivers multiple benefits rather than focusing on the optimal solution to a specific problem for one agency. These community-wide benefits can be difficult to value and raise questions about who should pay. Second, the costs are short term, but the benefits are long term. There can be a lag between investment in a project and the realisation of the benefits, particularly if the benefits relate to infrequent events such as floods. Third, there can be an economy of scale issue. Small IWM projects can appear cost prohibitive when viewed individually because there are challenges in capturing region-wide benefits in the business case for individual projects.

Linked IWM Framework guidance

DELWP provides resources and guidelines to help IWM practitioners. Some of these guides are connected to the topic of economic evaluation, and should be read in conjunction with this guide:

1. Externality valuation

Valuation involves assigning dollar values to IWM benefits, such as amenity outcomes. Assigning a dollar value ensures these benefits are properly included in economic evaluation (rather than being left out because they are hard to put a value on). In turn, this ensures the evaluation considers all the costs and benefits of a project. Valuing externalities for IWCM provides guidance on this topic.

2. Economic evaluation and cost allocation framework

IWM projects often provide benefits to multiple groups, including water utilities, waterway managers, councils, developers and the community. Providing these extra benefits can increase project costs above a normal 'business-as-usual' project approach. Additionally, these extra costs may fall on 1 or 2 specific entities. If the funding and cost recovery mechanisms are not apparent, the IWM project may not go ahead. This guide outlines how to allocate costs in these situations and justify government investment.

3. IWM funding and finance guidelines

Often, viable IWM projects are derailed by questions about who should pay, how much and when. The guide Bridging the IWM funding and financing gap gives IWM practitioners a checklist for considering funding and financing options, and the pros and cons of each. Using this guide will not guarantee every IWM project proceeds. But hopefully, it will lead to better discussions about the range of options, fewer surprises, and an increased likelihood that projects secure the resources they need.

[1] IWM practitioners can also use other economic assessment tools, such as multi-criteria analysis, but these are not covered in this guide.

So, what is benefit-cost analysis (BCA)

BCA is the process of comparing the benefits of a project with its costs to assess whether the project is worthwhile doing.

A BCA "is primarily about organising information in a logical and methodical way" (The Treasury, 2015). Its basic idea is simple: compare the benefits of a project with its costs to assess whether it is worthwhile. However, putting this simple idea into practice involves answering a range of questions, integrating various types of information and considering the outputs from several perspectives (Figure 2).

Follow some simple principles of economic evaluation:

- Make the evaluation holistic. Include all relevant costs and benefits, direct and indirect, present, and future.
- Only compare the additional cost and additional benefits of doing the project. Isolate these by writing down the 'with project' and 'without project' scenarios.
- Recognise a project is worthwhile doing if the benefits are greater than the costs.
- Understand how these costs and benefits are shared.

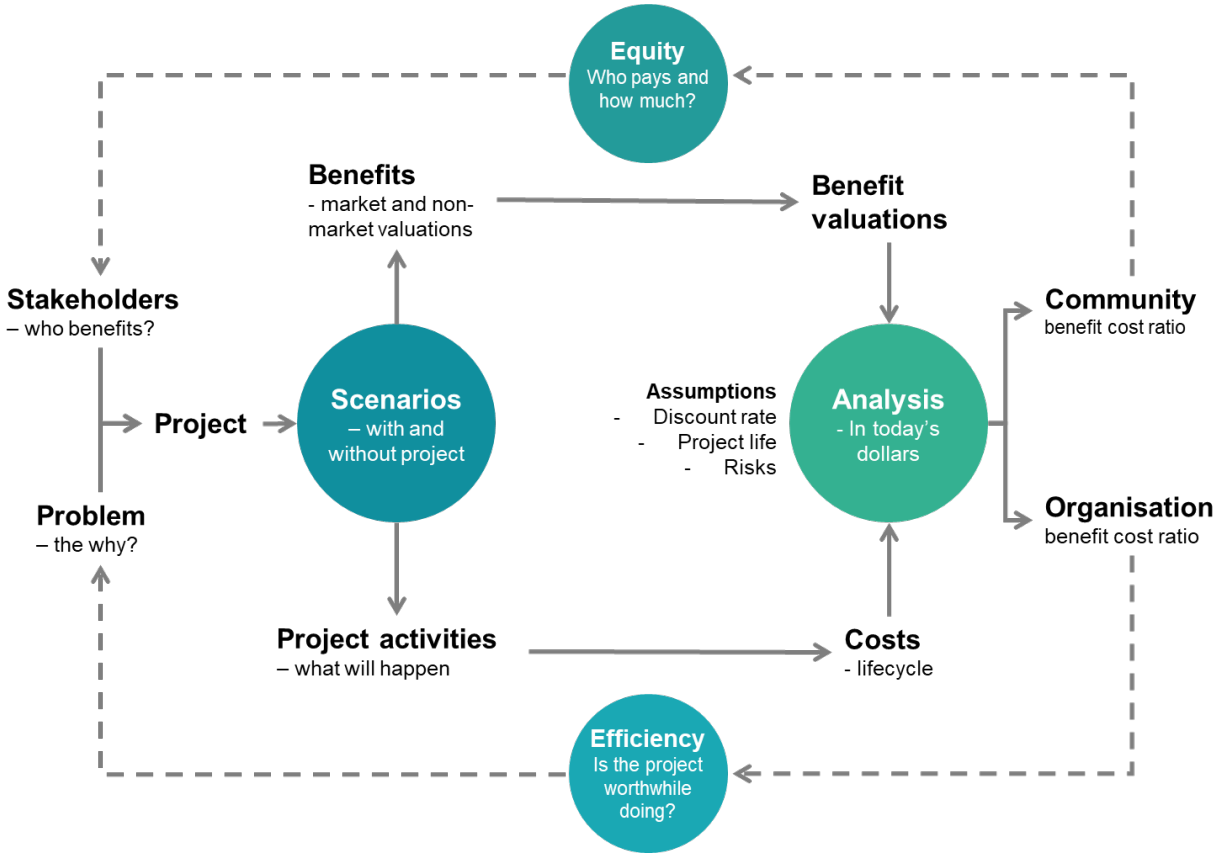

Figure 2. Developing an integrated decision support framework for water-sensitive urban design projects. (Adapted from Iftekhar and Pannell, 2022)

The steps in doing a BCA

The simple steps involved in a BCA are based on sound economics and are consistent with government economic assessment guidelines.

While we advocate for BCA as a good tool for economic evaluation, we recognise BCA has many shapes and sizes. We encourage IWM practitioners to find the right tool for the job. Later in this guide, we outline several approaches for doing a BCA. They are all based on the same principles but vary in the level of detail required. For each, the aim is the same – to guide better decision making.

The main steps in a BCA are:

1. **Getting to know the context of the project.** What problem is being solved and how will the project achieve this? Who is involved in the project? Why is the project being done?
2. **Defining what the project options are,** including the baseline option (sometimes called the do-nothing scenario, or at other times the business-as-usual approach).
3. **Identifying the activities** involved in delivering the project, and the lifecycle costs of doing so.
4. **Identifying the 'impact' of these activities.** This refers to the changes the project will produce. In IWM, the impact is usually measured as changes to the water cycle (measured as water volumes, pollutants etc), the environment (trees, habitat, temperature etc), and local economies (jobs, business profits, utility costs saved etc). The impact might be a change in the quantity (e.g. how much), location (e.g. how extensive over an area) or timing (e.g. how frequently).

Consider testing the actions in alternative future scenarios – such as future climate scenarios. How might this influence the outcomes of different IWM actions, or the importance of the benefits created?

5. **Identifying the benefits that come from these impacts.** It is helpful to think about who benefits, and then to categorise the benefits into broader benefit types. This aids the next step of valuation. Get input from project stakeholders about how realistic these benefits are – are they over- or under-estimated?
6. **Putting a value on the benefits**. The value can be a dollar value or a rating value. Again, this will likely involve discussion with project stakeholders to build a common understanding of the values, and the likelihood of it being achieved. We recommend the Value Tool developed by the CRC for Water Sensitive Cities as a way to look up dollar values.
7. **Putting the cost and benefit values into a BCA equation or spreadsheet**, adjusting them to be in today's terms if using dollar values. Calculate the BCA answer, such as a benefit-cost ratio, net present costs or net present value.
8. **Testing the sensitivity.** Which costs, benefits, project risks and assumptions have the biggest influence on the BCA result? Which could be refined to improve confidence in the results?

Case study – A simple BCA approach for the 2 regional case studies

The 2 case studies featured in this guide used a simplified BCA approach. We followed the steps above using available project data and expert judgement to develop the BCAs. For Baranduda Field and Beaufort Linear we:

1. Conducted an initial BCA based on the high-level project description, using experts' judgement and available documents that describe the project.

2. Shared the preliminary results with stakeholders to test assumptions and fill data gaps.

3. Revised assumptions based on the feedback. We then finalised the BCA.

How to: Select the right BCA approach

Deciding on the right BCA approach depends on complexity, data availability and project scale

The term 'fit for purpose' is often associated with IWM. It normally refers to choosing the right level of water quality treatment to match how the water will be used (and the environmental and human health risks associated with that): too much treatment is a waste of money. This basic concept can be applied to economic evaluation – choosing the right BCA approach for the job can save time and money while still improving decision making.

We provide several approaches for doing a BCA. We always recommend doing a full BCA if time and money permit, and if this is required by a funding agency, but we offer alternatives for other situations.

BCA approaches

We present 4 approaches on a spectrum of 'rough' to 'full' BCA. These approaches vary in the level of information required and whether they compare dollar values or just value ratings. Regardless, all use the same underlying principles and support good decision making.

Rough BCA[2]

What it is: This is used to evaluate less complex projects, or for early screening of potential options. The overall benefits and overall costs of a project are described and then assessed on a 1–5 rating scale using expert judgement. These ratings of costs and benefits are compared to determine if a project is worthwhile. This quickly prioritises options, even though dollars are not used for the assessment.

When to use: The project has been defined at a high level and needs to be quickly evaluated to determine whether it is worthwhile doing (or which option is better). For small projects, a rough BCA may be sufficient. The results may be so clear that a full BCA is not needed to make a good decision. If there are many project options but only sufficient resources to fund a few, it would not be sensible to do full BCAs of all of them. Rough BCAs could be used to help select which projects should be evaluated with a full BCA.

Qualitative BCA

What it is: This process sits between a Rough and a Full BCA. It uses the conceptual framework of a full BCA (i.e. comparing individual costs and benefits) and the qualitative assessment of the Rough BCA to individually 'value' the costs and benefits (i.e. using a rating rather than dollar values).

When to use: This process is used when data is not available (particularly data on the expected benefits), but a thorough, itemised BCA is still required. It suits collaborative design approaches involving multiple stakeholders. A qualitative BCA helps identify the information requirements to do a full BCA on the project.

Hypothetical BCA

What it is: This process establishes the basis of a BCA based on dollar values, even when detailed costs and benefits data are not yet available (e.g. modelling results are still pending). If the benefits have been identified (e.g. water quality improvement), but data is currently limited (e.g. the size of the pollution reduction), this process allows you to proceed by assigning best guess numerical values. In this example, the size of a wetland might be pragmatically estimated along with the magnitude of water quality improvements based on an understanding of previous projects. Dollar values can still be assigned based on these estimates.

When to use: An initial business case is required in dollar terms, but design and modelling of the project have yet to be undertaken to precisely calculate the outputs and impact of a project. This approach suits sensitivity assessments by quickly identifying which project items most influence the result.

Full BCA

What it is: All costs and benefits are quantified in terms of the size of the on-ground change and dollar terms. Costs and benefits are discounted back to today's dollars to calculate net cost/benefit. Economic value is evaluated from both the community's and project funder's perspectives.

When to use: Some organisations require a full BCA when presenting a business case. It relies on detailed financial data being available. It is more likely to be worthwhile investing in a full BCA if the project is large and is considered important.

[2] A Rough BCA template can be accessed at accessed at https://watersensitivecities.org.au/content/inffews-rough-bca-tool/

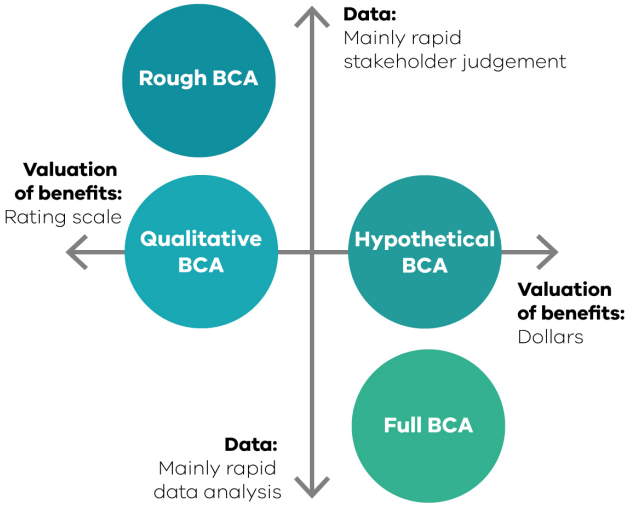

Figure 3. A spectrum of BCA approaches

Other factors to consider

There may be valid reasons for conducting a rough BCA, and we adopt the approach that a quick BCA is better than no BCA. Some factors to consider include:

- Complexity and expected cost. A BCA's complexity should reflect the project's complexity and expected costs.
- Formal requirements for a full BCA. If a business case is being developed, some organisations may require a full BCA. In other organisations, a simplified BCA may be sufficient.
- Scale and importance of the project. It is more likely to be worthwhile investing in a full BCA if the project is large and important. For small projects, a rough BCA may be sufficient.
- Costs and time to do a full BCA. The cost of conducting a full BCA depends on how clearly the project has already been defined, the complexity of the project, the availability of required information and the cost of consulting experts to gather information. Is there sufficient time to do this before decisions about the project will be made?

It is also possible to link approaches together, by starting with a rough BCA and then evaluating the preferred options in greater detail. If a rough BCA has already been done, did the results show the project is likely to be good or bad? If results indicate a low probability of the project providing good value for money, spending resources on a full BCA probably cannot be justified. This line of thinking is shown in Figure 4.

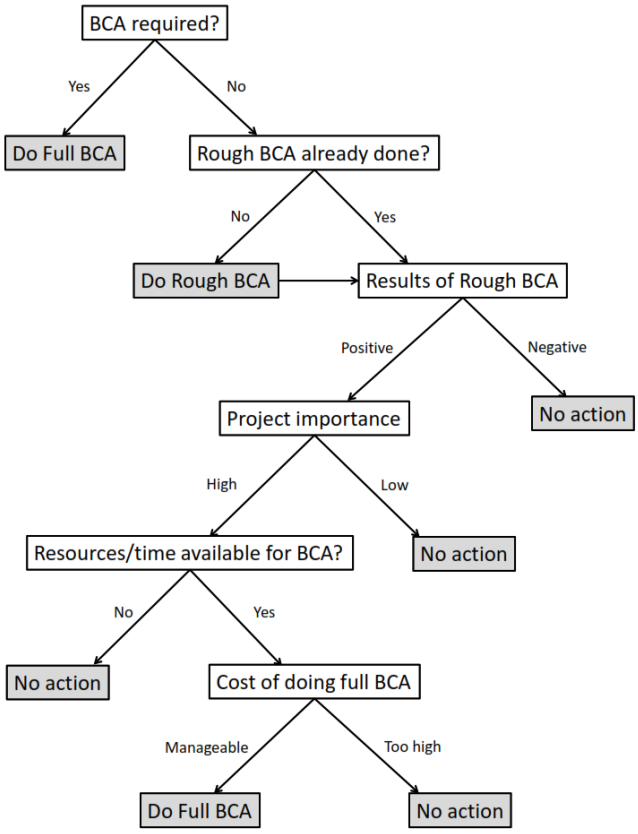

Figure 4. Decision tree for deciding whether to conduct a full BCA (Credit: Pannell, 2020)

How to: Describe the impacts of doing the project

What will change by doing the project and by how much?

In this section, we lay the foundations for the valuation of IWM benefits by establishing a clear link between project activities, project impacts/outcomes and stakeholders who benefit from these outcomes.

Consider how the project contributes to local, regional and state objectives

Although the project is solving a specific problem, there is usually an opportunity to align with local (e.g. Council Corporate Plan), regional (e.g. Regional Catchment Strategy) or State (e.g. Water for Victoria) objectives. Designing project actions and outputs that map to these strategic objectives helps to establish a clear investment logic. An example might be a strategic objective to reach 'net zero' greenhouse emissions, and the actions of an IWM might intentionally designed to help deliver this commitment.

Describe the activities involved in delivering the project

Listing all of the project activities involved in delivering a project is a first step in understanding what the costs are and what impacts will be created. It is also key in understanding the scope of the economic assessment: which activities, costs and benefits are in scope, and which are out? To do this, ask:

- **Who will implement these actions?** The actions could be undertaken as part of the project itself, or by somebody else (e.g., community members, businesses, councils, CMAs, and utilities). If it is somebody else, the role of the project is to influence their decisions such that they adopt the new actions or behaviours.
- **What will this project do?** Is it undertaking the actions itself? If so, what are they? Is it attempting to influence decisions by others about what actions they will undertake? If so, what will the project do to influence them? Early consultation and cooperation with a range of stakeholders can help define these aspects of the project, especially for projects that involve multiple beneficiaries.

Identify the impacts of these activities

This refers to the changes the actions will produce. In IWM, the impact is usually measured as changes to the water cycle (measured as water volumes, pollutants etc), the environment (trees, habitat, temperature etc), and local economies (jobs, business profits, utility costs saved etc). The impact might be a change in the quantity (e.g., how much), location (e.g., how extensive over an area) or timing (e.g., how frequently). Also estimate the number of people, householders, km of waterways etc. that will experience the benefits. Justify this using data wherever you can.

Examples of what might be calculated include changes to

- water supplies or water consumption
- water flows (e.g. in rivers, treatment plants or stormwater runoff)
- flooding and drought (extent, duration, frequency, impact)
- water quality (nutrients, salinity, other pollutants)
- vegetation/greening/tree canopy
- urban heat
- wastewater treated or recycled
- capital or operating costs, including when these changes in the timing of these costs.

Write out the '*with project*' and '*without project*' scenarios

A BCA evaluates the *additional* impact created by doing the project. A common mistake with BCA is to poorly define the 'with project' and 'without project' scenarios. A poorly defined 'without project' scenario means you end up using an unrealistic baseline to assess the project's additional impact (i.e. benefits).

Don't define the baseline as the situation before the project is implemented. Conditions may change over time even without the project, and you must account for this. For example, evaluate the effects of an alternative water source for watering street trees, not the benefits of the trees (which are being planted anyway).

Worked examples of '*with project*' and '*without project*' scenarios

Baranduda Fields

In the initial project discussions, several benefits of having alternative water sources were identified including potable water savings, increased flexibility due to Council management of the facility, removal of pollutants from stormwater, increased vegetation due to bioretention swales, and education opportunities. This list was refined through consultation with the Council, literature review and expert feedback. The final list is presented below.

Table 1: With and without scenario descriptions for Baranduda Fields

Benefit identified due to alternative water source	With project	Without project
Potable water savings due to stormwater harvesting scheme	The proposed stormwater harvesting scheme will provide stormwater for most irrigation, in place of potable water. Beneficiary: Council	There will not be any potable water saving without the stormwater harvesting scheme.
Improved flexibility for Council from having more independent operations of the system	The decisions regarding alterative water sources (e.g. duration, infrastructure) are taken freely because Council manages the facility (not a corporate entity). Beneficiary: Council	Limited flexibility and control of decisions about alternative water sources.
Pollution abatement benefits due to reduced stormwater discharge to Kiewa River	Harvesting stormwater also removes pollutants, helping to support healthy ecosystems, increase water quality and improve amenity. Beneficiary: Broader community	The untreated stormwater will continue to affect ecosystems and water quality because stormwater is a major source of pollution to urban waterways.
Pollution abatement benefits due to bioretention swales	Bioretention swales treat stormwater runoff from carparks to protect the Kiewa River. Beneficiary: Broader community	The untreated stormwater will continue to affect ecosystems and water quality because stormwater is a major source of pollution to urban waterways.
Water education benefits due to adopting alternative water sources	Raising awareness about water reuse will impact people's perceptions about saving, recycling, and effective management of water. Beneficiary: Broader community	Current awareness regarding alternative water sources will not change.
Increased amenity due to vegetation	Increased vegetation within the site through passive irrigation. Beneficiary: Local community	No additional irrigation, less viable vegetation, less canopy cover
Water security	Increased engagement on alternative water schemes will favourably affect people's perceptions about water security especially during drought. Beneficiary: Local community	The current level of engagement will not change.

Beaufort Linear

In this worked example, the definition of the with and without scenarios was crucial due to the high-level conceptual stage of the designs. In the initial project discussions, a broad range of benefits was identified by the stakeholders including increased tourism benefits, recreation, mental health, biodiversity, and amenity. This list was refined through consultation with the Council, literature review and expert feedback.

Table 2: With and without scenario descriptions for Beaufort Linear

Benefit types identified due to upgrade of the facility	With project	Without project
Tourism and visitor benefits	The proposed upgrade in the scenic facility will attract additional visitors (day, overnight, stopover). Beneficiary: Tourists and visitors (Broader community)	The current level of users will not change.
Recreational benefits to residents	The proposed upgrade in the swimming pool and children's playground will attract additional users. Beneficiary: Users of the swimming pool and playground (Local residents)	The current level of users will not change.
Health benefits	The proposed development of the walking track and scenic facility will attract additional users who receive health benefits. Beneficiary: Local residents	The current level of users will not change.
Biodiversity benefits	The proposed ecological restoration will provide additional biodiversity benefits. Beneficiary: Community	The current level of biodiversity benefits will not change.
Cultural benefits	The proposed Indigenous art trail will raise awareness about Indigenous culture. Beneficiary: Local residents	There will be no Indigenous art trails.
Amenity benefits to adjacent properties	Increased vegetation within the site from passive irrigation will provide amenity benefits to adjacent properties. Beneficiary: Adjacent property owners	Adjacent properties will not enjoy additional amenity benefits.
Public education benefits	Enhancing community awareness and education of the water cycle will impact people's perceptions about saving, recycling, and effective water management. Beneficiary: Community	Current awareness of alternative water sources will not change.
Stormwater treatment benefits	Harvesting stormwater removes pollutants, supports healthy ecosystems, increases water quality and improves amenity. Beneficiary: Broader community	Untreated stormwater will continue to affect ecosystems and water quality, because stormwater pollutes waterways.
Flood impact reduction benefits	The project will protect houses in the adjacent zones from flooding. Beneficiary: Properties	Current exposure to flood severity will not change.

How to: Identify and value the IWM benefits

One of the best ways to improve the economic evaluation of regional IWM projects is to be specific about the expected benefits of doing the project.

There are 2 ways to achieve this: identify and describe the project's benefits, and where possible put a dollar value on them.

In this section, we highlight the most common IWM benefits of regional IWM projects. This list is not meant to be exhaustive – it is a way to scan for potential benefits that your project might deliver, to ensure these are included in the BCA.

IWM outcomes

The place to start when identifying benefits is the IWM Framework for Victoria. The Framework identifies 7 IWM outcomes.

More definition of these IMW outcomes for each region is provided in the relevant Strategic Directions Statements.

Table 3 provides a further resource to understand what these outcomes look like in regional Victoria. It describes the regional benefits of delivering the state-level IWM outcomes. These regional benefits were identified in focus groups with IWM Forum members during the development of this guideline (see WSCA, 2022). Participants from each IWM Forum were invited to participate and discuss the types of IWM projects undertaken in their regions and the benefits gained from these projects.

Table 3 can be used as a checklist of the possible range of benefits that might be included in a BCA, or as a prompt to think of other benefits not listed but important to your BCA.

Valuation

Valuation is about community willingness to pay for a benefit.

We recommend using the CRC for Water Sensitive Cities' Value Tool[3] to identify dollar values that are applicable in regional Victoria. The Value Tool is a regularly updated database that:

- Includes research studies relevant to regional IWM projects (34 new studies were added to the database in 2022)
- Incudes a search function to identify studies relevant to regional Victoria
- Explains how to calculate a dollar value that is relevant to the benefits for your project.

Worked example – Baranduda Fields

Project action: stormwater harvesting to irrigate sports fields, replacing drinking water

Benefit: Enhanced water security

Beneficiaries: all community members (14,604 people)

Value of the benefit: $17.98/household/year

Household willingness to pay to avoid water restrictions in Wodonga after drought in 2012 was $59.93/household/yr. (2022CPI adjusted value). This was adjusted by 30%.to reflect water security benefits in average rainfall years.

Calculation: $59.93 x 0.30 = $17.98

Total annual value of the benefit = $17.98 x 14,604 = $262,580

[3] More information on this tool can be found at www.watersensitivecities.org.au/investment-framework-for-economics-of-water-sensitive-cities-inffews-value-tool/

Table 3: The benefits of IWM for regional cities and towns

IWM benefit categories and examples:	IWM outcomes: Safe, secure and affordable water supplies in an uncertain future	Effective and affordable wastewater systems	Managing existing and future flood risks and impacts	Healthy and valued waterways and marine environments	Healthy and valued landscapes	Traditional Owner and community values in place-based planning	Jobs, economic growth and innovation
1. Assets, infrastructure and operational benefits							
1.1 Water security -Reduce occurrence of prolonged water restrictions in towns -More regional towns enjoy good, long term water security -Increase the use of alternative water sources in towns -Reduce pressure on basin scale water resources -Reduce hard waste associated with single use water bottles	✓			✓			
1.2 Infrastructure investment -Defer the cost of operating or augmenting regional water supply, treatment and grid infrastructure? -Ensure the development potential of towns is not constrained by lack of wastewater services -Preserve capacity in regional water grids for the future -Reduce the cost of delivering IWM by delivering these works up front as part of new urban development -Enhance the ability of towns to sustainably service seasonal population peaks	✓						✓
1.3 Building resilience -Reduce clean-up costs after environment events (bushfires, floods, storms) by enhancing water sector resilience -Enhance climate mitigation and adaptation efforts through the way that urban water services are managed		✓					✓
1.4 Community capital -Increased community environmental stewardship -Enhanced community support for innovative water initiatives				✓	✓	✓	✓
2. Community, consumer and industry benefits							
2.1 Amenity -Enhance public and private space amenity in small towns -Enhance wellbeing by providing opportunities to connect with nature within towns					✓	✓	
2.2 Recreation -Enhance recreation and tourism in waterways and coasts -Reduce morbidity and mortality, enhance wellbeing, when regional sports facilities remain open for use					✓	✓	
2.3 Public health -Reduce health effects of sedentary lifestyles (specifically among older populations) -Reduce health effects of heat waves					✓		
2.4 Local business -Enhance local agricultural enterprise through the way urban water services and infrastructure are managed -Enhance tourism and recreation when major waterbodies have good water quality				✓			✓
3. Environmental benefits							
3.1 Habitats and ecosystems -Enhance regional environmental assets through the way water services, and urban development, are managed -Enhance environmental flow regimes				✓	✓		
4. Cultural benefits							
4.1 Traditional Owners -Enhance recognition and cultural values for Traditional Owners				✓	✓	✓	✓

Case studies: Identifying and valuing the benefits

Baranduda Fields

The following benefits were identified for the 2 case studies. Using willingness to pay studies located via the Value Tool and local stakeholders' expert judgments, a dollar value was estimated for each.

Table 4: Calculating the dollar value of IWM benefits for Baranduda Fields

Benefit identified	Benefit description	Impact of project actions	Dollar value
Drinking water savings	The stormwater harvesting scheme will provide the majority of irrigation, in place of drinking water from the regional system.	59.27 ML/year	$2.5/kL (based on North East Water charges)
Improved flexibility for council	Due to more independent operation of the system.	There are 2 ovals where costs can be saved.	$1,430/year/oval (Estimated cost savings, under the council management model)
Pollution abatement from reduced stormwater discharge to Kiewa River	Stormwater pollutes waterways. By harvesting stormwater, pollutants are also removed, helping to improve water quality and support healthy ecosystems.	79 kg TN/year Nitrogen is used as a proxy to represent various pollutants removed by stormwater treatment. TN is used here in lieu of a more locally relevant metric.	$4,789/kg TN (Based on Melbourne Water offset rates for the value of nitrogen load reduction, adjusted for Wodonga land prices)
Pollution abatement from bioswales	Bioswales cleanse stormwater runoff from the car park, helping to improve water quality and support healthy ecosystems.	25.3 kg TN/year	$4,789/kg TN
Education benefits to school children and seniors' groups	Raising awareness among school children and senior citizens groups about water reuse and the water cycle.	140 individuals Assuming schools and seniors would have to travel to another site to get same level education benefits.	$64 /visitor-day (Based on a value of $128/visitor day for travel costs, adjusted to a half day trip)
Increased amenity, due to vegetation	Benefits from increased, healthy vegetation within the site achieved through passive irrigation of car park gardens.	2,083 households value the increased vegetation (grass and many trees).	$27.55/household (Based on a willingness to pay study on the value of grass and trees and adjusted for Wodonga household incomes)
Water security	Regional water security benefits from using local water sources.	14,604 households (Assuming all households care about regional water security).	$17.98/ household/ year (Based on a household willingness to pay to avoid water restrictions in Wodonga after drought in 2012, adjusted for 'normal' year conditions)

Beaufort Linear

The following benefits were identified for the Beaufort Linear project. Using willingness to pay studies located via the Value Tool and local stakeholders' expert judgments, a dollar value was estimated for each.

Table 5: Calculating the dollar value of IWM benefits for Beaufort Linear

Benefit identified	Benefit description	Impact of project actions	Dollar value
Tourism and visitor benefits	Benefits to same day visitors	11,700 visitor-day/year (Assumes a 20% increase in day visitors)	$50/ visitor-day
	Benefits to overnight stay visitors	165 visitors-day/year (Assumes a 10% increase in overnight visitors)	$50 per day equivalent
	Benefits to longer stop over visitors	23,400 visitor hours/year (Assumes a 20% increase in long stop visitors)	$50/ visitor-day; $6.25/ visitor-hour
Recreational benefits	Benefits to swimming pool users	51 swimming pool users-day/year (Assumes a 5% increase in daily use)	$4.20 /person/day
	Benefits from children's use of playground, skate park	271 households value the park upgrade (Assumes 86% of the 315 local households with children positively value the improvement)	$27.16/ household (Based on the difference between 'Playground + Skate Park' and 'Playground only' options in Melbourne, adjusted for Beaufort incomes)
Health benefits	Mental and physical health benefits for aged residents using the green link for recreation and exercise	53 aged residents (Assuming a 10% increase in physically active users due to the project)	$916/Person (Based on permanently shifting one Victorian from physically inactive to physically active)
	Mental and physical health benefits for the community	Local park users (Assuming 10% more active people)	$916/ person
Biodiversity benefit	Benefits from ecological restoration related to instream biodiversity and terrestrial native species	976 community members (Assumes 50% of the population values biodiversity outcomes)	$15.34/ person (Willingness to pay for an Australian case study, adjusted for Beaufort incomes)
Cultural benefits	Benefits of installing indigenous artwork	112 households (Assumes 10% of the households have a positive value)	$31.58/ level/household/year
Amenity benefits – adjacent property owners	Amenity benefit through changes to adjacent property values	19 households within 50m of the Garibaldi Creek	$23,850/dwelling (Based on a 5.3% uplift in property price for a local park improvement)
Public education benefit	Benefits from water education – raising awareness about the water cycle	836 households (Assumes 75% of households are willing to pay for water education)	$24.69/ household/year (Household willingness to pay for environmental signage and information in Qld)

Benefit identified	Benefit description	Impact of project actions	Dollar value
Waterway health benefits	Benefits of stormwater management (Using nitrogen as a proxy for pollutants that can be removed by stormwater treatment)	625 Kg TN/Year	$4,961/KG TN (Based on Melbourne Water offset rates for the value of nitrogen load reduction, adjusted for Pyrenees Shire land prices)
Flood mitigation benefit	Cost savings from reducing flood impacts	1.6 property/year (Assumes 10% of the 16 flooded properties will be protected each year due to the project)	$4,200/property direct cost savings benefits (Based on expected flood damage of $2,937/property/event)

How to: Adjust for adoption risks

Projects don't always go smoothly. Various things can stop them from delivering their intended benefits. To avoid over-optimism about project success, it is important to consider the risk that the project might be implemented but still fail to deliver its intended benefits.

Common risks that might stop the project from delivering its intended benefits include:

- **Technical risks** – For example additional construction challenges, or new technology innovations not performing as expected.
- **Socio-political risks** – For example, there might be community protest that stops the project.
- **Financial risks** – A project may not receive ongoing funding for maintenance and operations.
- **Managerial risk** – This may arise if different projects will be managed by different organisations. These risks might include poor governance arrangements, poor relationships with partners, poor capacity of staff or poor project leadership.
- **Adoption risk** – Some projects rely on community behaviour change. If adoption is below the required level, benefits are scaled down accordingly.

Risk adjustment can be included in a BCA by assigning a probability value to the benefits.

A worked example

If an IWM project includes an alternative water component, a benefit of this activity is the reduced frequency of water restrictions in a town.

There may be a risk may that the volume of water produced is less than expected, or the number of households that can use the water is limited for some reason.

In this case, the likelihood of achieving the full benefit could be adjusted by a risk factor (say, 75%), as follows:

Number of ML x 0.75 = risk adjusted volume.

Number of households x 0.75 = risk adjusted number of beneficiaries.

The risk adjusted numbers should be used to calculate the expected project benefit.

How to: Present the results

Understand what a good result looks like and which ratio to present to decision makers

We have already talked about the importance of using economic evaluation as a part of good decision making. Now it is time to talk about how these decisions are actually made. Of course, many factors will be at play, including available budgets, strategic priorities of key organisations and community sentiment. The role of IWM practitioners is to recommend which project to undertake, and to help negotiate co-investment in worthwhile projects.

A BCA produces 2 results that can help:

- **Net present value (NPV)** calculates the benefit over the life of the project after all the costs are deducted. The higher the NPV, the better.
- **Benefit–cost ratio (BCR)** is benefits divided by costs. For every dollar spent, the BCR tells you how much you will get back in benefits. A BCR greater than 1.0 indicates an overall benefit.

Interpreting the results

The following decision tree (Figure 5) provides a guide to understanding the results of a project. It presents 2 sets of results:

- What is the BCA outcome for the organisation/s funding the project?
- What is the outcome when viewed from a whole community perspective?

Figure 5 uses NPV as its metric. It could also be interpreted using BCR (in which case it would refer to results greater to or less than 1.0).

Distribution impacts

As Figure 5 shows, the result can be calculated from the perspective of the agency delivering the project, as well as from a broader community perspective. The difference is the funding agency might not receive all of the benefits, despite paying for them. There might also be a timing difference – benefits may occur over time while the majority of the cost may be incurred upfront. In these situations, discussions about co-funding will likely occur.

Cost-sharing discussions include identifying who the beneficiaries of the project are and using this to suggest how the costs might be distributed. Discussions seeking external funding might also involve a step to frame the business case for investment in terms of the strategic objectives at local (e.g. council), regional (e.g. catchment strategy) and state levels (e.g. Water for Victoria). Readers are referred to DELWP's IWM funding and financing guidelines (CRCWSC, 2021) for further guidance on co-investment.

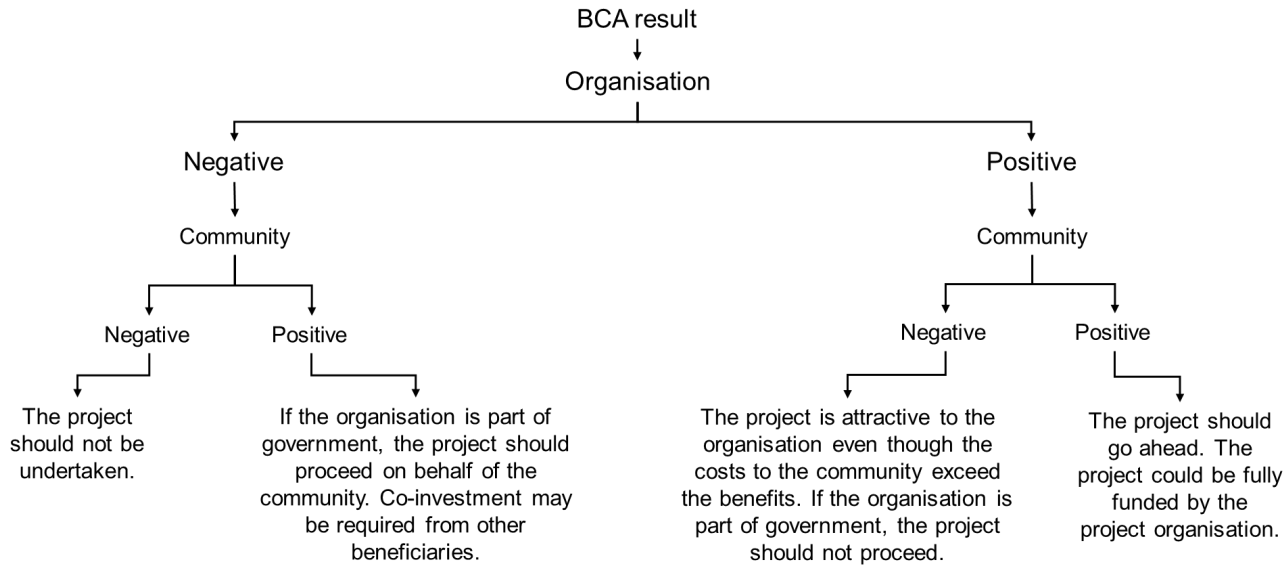

Figure 5. Interpreting the results of a BCA

Case study results

Baranduda Fields

The capital costs for the Baranduda Fields project include $1.6M for stormwater harvesting and $18,000 for the bioswales. Council estimated the annual operating costs to be 5% of the capital expenditure. The present value of cost is $3.3M. The present value of the benefits is $7.1 million, after adjusting for project risk and adoption. The results suggest the largest share of benefits is due to the regional water security benefit (60% of the total benefits), followed by drinking water savings benefits (30%).

Based on these results the project is beneficial. The community level NPV is $3.8M. However, for Council the NPV is less than zero, indicating that from its perspective the project may not be beneficial.

In this case study, the project provides benefits to the Council directly (e.g. cost savings and operational flexibility) as well as benefits to the broader community (e.g. sustainability and amenity benefits). This is reflected by showing 'results for the council' as well as 'results for the community'.

	Results for the council	Results for the community
Benefits	$2,211,323	$7,133,074
Costs	$3,084,449	$3,331,205
Net present value	-$873,126	$3,801,869
Benefit-cost ratio	0.72	2.14

Beaufort Linear

The capital costs for the Beaufort Linear project are $6.77M. Council estimates the annual operating costs to be 5% of the capital expenditure. The present value of cost is $12.24M which includes project implementation (capital and operating). The present value of the benefit is $14.6M after adjusting for project risk and adoption. The largest share of benefits is accrued to same day visitors to the region. They will receive around 57% of the total benefits of the project. This is followed by the stormwater management benefits (21%) and benefits to longer stop over visitors (14.22%).

Overall, the project is beneficial. The NPV to the community is $2.36 million, and the BCR is 1.19.

In this case study, the project is designed specifically to benefit the broader community (acknowledging that providing community benefits is a core role of local government). This is reflected by showing 'results for the council' as well as 'results for the community'.

	Results for the community
Benefits	$14,603,492
Costs	$12,240,343
Net present value	$2,363,149
Benefit-cost ratio	1.19

More detail on these case studies can be found in Iftekhar et al 2022a and 2022b.

Is NPV or BCR better?

As a rule of thumb, use BCR to rank projects when funding is limited, and either BCR or NPV to assess whether a project's overall benefits exceed costs.

Beyond this, there are 2 factors to consider when deciding whether to use NPV or BCR. One is whether there is a limited amount of money available to allocate to projects, and the other is whether the projects being compared are mutually exclusive.

Sometimes you wish to compare different versions of the same project (e.g. at different scales, or using slightly different sets of actions). These projects are mutually exclusive – you can select only one of them. In this situation, choose the one with the largest NPV.

If you are evaluating separate projects, and the budget is large enough, then all projects with NPVs greater than zero (or BCRs greater than one) should be funded.

Conclusion

This economic evaluation guide helps Victorian IWM practitioners identify and communicate the long-term benefits of IWM.

The guide supports the IWM Framework for Victoria. As part of this framework, DELWP is managing 10 regional IWM Forums operating across regional Victoria, as well as 5 metropolitan forums. These forums allow stakeholders to collaborate in planning and managing the water cycle. The guide is written with IWM projects in regional cities and towns in mind.

Economic evaluation is a key part of the process of developing these IWM projects. But there are barriers to good economic evaluation of IWM in regional Victoria. These are explained as:

1. Time constraints of stakeholders, and (in some cases) limited familiarity with economic evaluation tools

2. A mismatch in the evidence presented in support of IWM projects, particularly gaps or variations in how the benefits of IWM projects are being captured

3. Reliance of IWM business cases on intangible liveability (etc.) benefits but limited awareness of how to put a value on these benefits.

Recognising this, the guide has been developed to demonstrate how the principles and process of BCA can be rapidly applied to IWM in regional Victoria. It references commonly available BCA guidelines rather than repeating them.

In summary, good decision making is about understanding which projects are worthwhile implementing. In the context of this guide, this takes on several specific meanings:

1. Introduce economic thinking early in an IWM project. Talking about BCA early, when identifying options for a project, helps IWM stakeholders ask questions such as:
    a. What problem needs to be solved (if we are creating value for the community)?
    b. How does this problem look from the perspective of different stakeholders?
2. What are the big benefits and costs? How can IWM options be designed to maximise these benefits and decrease the costs?
3. A quick economic evaluation, following the principles of a full benefit-cost analysis, is preferable to no evaluation at all. The fundamental process is the same.
4. The economic evaluation should match the scope of the IWM project. IWM is sometimes described as a multi-benefits approach to water management. Even the step of specifically identifying these benefits in an economic evaluation, and discussing them with project stakeholders, is important in supporting better decision making.
5. An economic evaluation may show that a project has a low BCR for the implementing organisation, but a high ratio for the broader community. This is often the case with IWM projects that are designed to provide multiple outcomes. While this difference demonstrates the additional value created by adopting IMW compared with a business-as-usual approach, it raises the question of how to fund the project. When considered from a state perspective, the difference between these results quantifies how much public value will be created if the State invests in the project. Having this clear business case for co-investment increases the chances of success in grant applications.

Glossary of useful economic terms

Benefit transfer:

When looking for a dollar value for a benefit, we may need to use data from a similar situation and then adjust the value up or down to account for any differences. This adjustment process is called benefit transfer.

Benefit-cost ratio (BCR):

This is the answer you get from the benefit-cost analysis. This number shows how many dollars of benefit you will get for every dollar you spend on the project: if the number is less than one, the project is costing you money and is not worth doing.

Cash flow:

This refers to the timing of money coming in (that you receive) or going out (that you spend) over the life of a project or asset. Money coming in represents the benefits of a project. Money going out represents the costs.

Discount rate:

This is the percentage rate used to adjust a future dollar so it is equivalent to a dollar today. It is used in discounting. The discount rate typically represents the opportunity cost of that dollar (e.g. interest it could otherwise earn in the bank), although other factors may also be considered.

Discounting:

A process to convert the cash flow for each future year back to an equivalent dollar amount today. The conversion involves applying the discount rate to the cash flow for each year.

Lifecycle costs:

The total amount of money spent over time to build, operate, maintain, and decommission an asset. Each year has its costs which can be presented as part of a series of cash flows.

Net present value (NPV):

Comparing all the future costs and benefits in today's dollars. If the number is less than zero (i.e. negative), the project is costing you more money than the value it is generating. Net present costs (NPC) are similar but apply to the option that has the lowest cost (i.e., is the cheapest).

Non-market value:

Putting a dollar value on environmental goods and services, based on what people are willing to pay for them. We do this to ensure the benefits are included in benefit-cost analysis, rather than ignored.

Sensitivity analysis:

If the data you use in your analysis involves a lot of uncertainty, sensitivity analysis is a way to test your confidence in the results. It involves varying each input value (e.g., raising and lowering it by 10%) to see what happens to the results. If some changes drastically affect your results – and your decision – discuss them in your business case recommendations.

Time value of money:

Is the idea that one dollar received today is worth more to us than one dollar received in the future. Similarly, a cost in the future is worth less to us than a cost we have to pay today. This arises because of the opportunity cost of not having that dollar available for other things. How much less it is worth in today's dollars is described by the discount rate.

Today's dollars:

This is a way of standardising costs and benefits that occur at different times in the future so they can be compared reliably. So, we ask: what are their equivalent dollar values today? The time value of money means things happening in the future are worth less than things happening today, so we need to discount future dollars back to today's dollars.

Willingness to pay:

How much someone will pay to receive a good or service?

With project scenario:

This is what the future will look like after we have done the project. It describes a change(s) relative to the base case, and how the world has responded.

Without project scenario (also called the base case):

This is what the future will look like if we do not do the project. It incorporates the effects of all other projects/policies/external influences, which makes it different to the present case (or the before case). The base case is our point of comparison when evaluating options, not the present case.

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Some further reading and resources

Benefit-cost analysis

Ranking projects: A practical guide

Benefit: Cost Analysis for Water-Sensitive Cities

Enhancing the economic evaluation of WSUD

Video - Benefit: cost analysis – David Pannell

Benefits

Review of non-market values: An update

Case studies

Worked example: Princes Park Stormwater Harvesting

WEBINAR Stormwater harvesting to support Princes Park

Benefit-Cost Analysis Tool Booklet of Applied Examples

Funding and business cases

Constructing a business case – A guide for local government

Strategies for preparing robust business cases

Bridging the funding and finance gap

The Value Tool

This is a national dataset of dollar values for IWM benefits. It was updated in 2022 to include studies relevant to regional IWM projects.

The Value Tool was developed by the CRC for Water Sensitive Cities. It helps IWM practitioners find a dollar value for common IWM benefits, such as social and environmental benefits.

The Excel-based tool contains several thousand non-market values.

These are arranged into 20 different benefit types, with a spread of values available under each, including ecological improvement and biodiversity, reduced recurring costs, improved security of water supply, reduced morbidity/improved heat from extreme heat, and improved aesthetics.

Find out more about the tool here.

Subscribe to the tool here.

Access the Tool user guide here.

Read more about the proof of identifying dollar values in Economic Evaluation for Regional IWM Projects - Part B - Valuing Regional IWM Benefits Guide.

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