Economic evaluation for regional IWM projects

Part B - Valuing regional IWM benefits 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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Introduction

Implementation of Integrated Water Management (IWM) projects provides benefits ranging from drinking water savings to improved aesthetics and wellbeing benefits.

Some of these benefits are easy to measure, quantify and evaluate using existing market price information. For example, the monetary value of drinking water savings benefits to the Council could be calculated by using the long-run marginal cost of water supply.

Many benefits generated or provided by IWM projects, however, are intangible without any direct market prices to assess their monetary values. For example, well-maintained public open spaces could provide amenity benefits to residents as well as water quality benefits to broader communities. However, there is no direct market price of amenity benefits and water quality benefits. Consequently, these benefits are often excluded or poorly defined in formal project evaluations. Such underestimation of benefits could disadvantage IWM projects as their total costs may be perceived as higher than the estimated benefits (Gunawardena et al. 2020; Iftekhar and Pannell 2022).

Proper evaluation of IWM projects is particularly challenging for authorities in regional Victoria due to their scale and distributed nature of operations. Often, they have limited internal capacities and resources to undertake a proper evaluation of such projects (Encader Consulting and Foresight Advisory 2021). There are also no dedicated guidelines on how to assess the nonmarket benefits of IWM projects for regional Victoria.

Recognising the limitations, DELWP has funded the overall project, 'Economic evaluation in regional Victoria', to improve understanding of the benefits of implementing water sensitive urban design (WSUD), water sensitive cities (WSC) and IWM projects in small towns and shires while supporting regional stakeholders by improving capacity to undertake economic evaluation and deliver business cases.

This document presents a readily accessible guide on how to use existing nonmarket value information to evaluate and assess IWM projects in regional Victoria using the benefit transfer method. Such information could be useful for 3 main user groups:

- consultants engaged by the project proponent for rapid economic assessment of IWM projects
- in-house experts who are planning to conduct rapid economic assessment as part of prioritization of project concepts or ideas for further evaluation
- external agencies assessing IWM grant applications.

The guidelines and recommendations presented in this document are most useful for rapid economic assessment. The use of approximate nonmarket values of IWM benefits is preferable to not including the benefits at all during the rapid economic assessment process. However, benefit transfer process is not a substitute for proper economic evaluation and economic assessment of projects.

After this introduction, a brief overview of the benefit transfer method and the methodology used to develop this guideline is presented. Then, the main guideline is presented. The concluding section presents some final remarks.

Methodology

This section introduces the benefit transfer method and outlines the methodology used to develop the guideline.

A brief overview of the benefit transfer method

Collecting information on nonmarket values of IWM projects through primary studies (e.g., conducting a nonmarket valuation survey) could be costly and time consuming. Benefit transfer methods could be a suitable alternative to conducting primary studies, especially when projects are at the design phase and the agencies are interested in the rapid economic assessment of projects.

The benefit transfer method involves using economic information captured at one place and time to make inferences about the economic value of goods and services at another place and time (Figure 1).

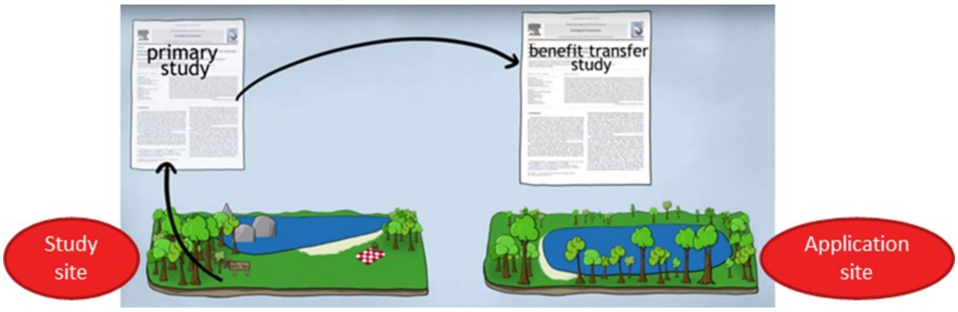

Figure 1: Schematic of transferring nonmarket value information from the study site to the application site Source: Conservation Strategy Fund (https://www.youtube.com/watch?v=xpXvnbNeOEo)

Baker and Ruting (2014) provide a decision tree on when to include information about nonmarket benefits in project evaluation and when to use benefit transfer methods (Figure 2). It could be observed that benefit transfer methods are recommended only when good quality market and nonmarket value information is available.

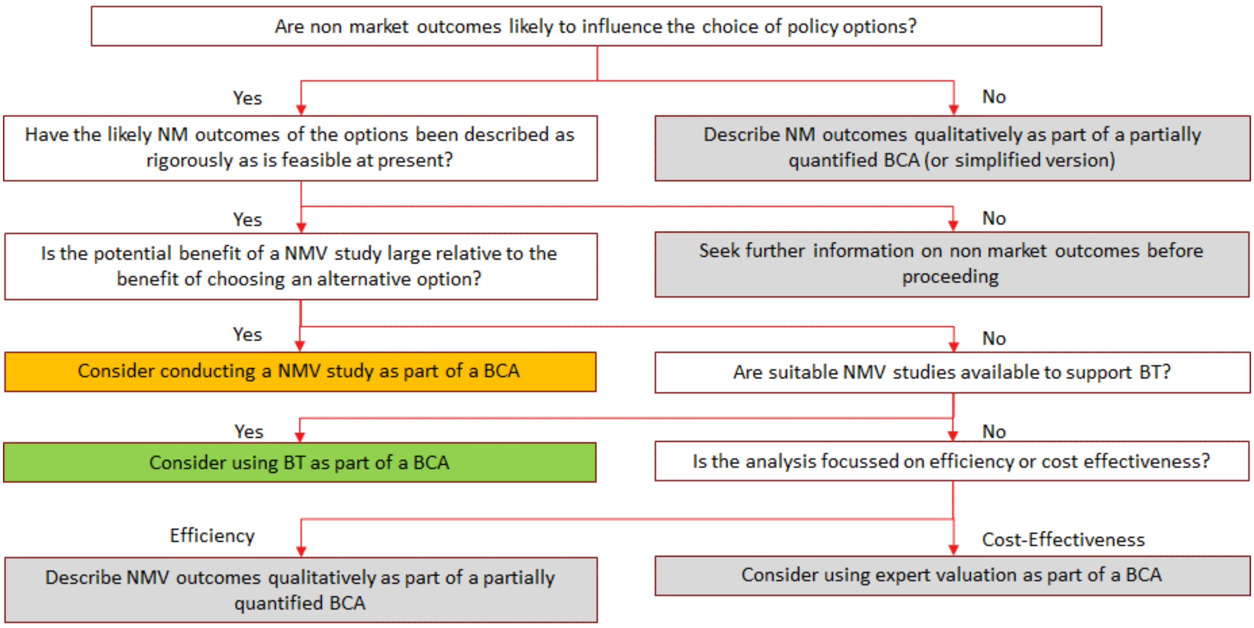

Figure 2: Steps to include nonmarket outcomes in policy analysis. Source: Baker and Ruting (2014)

As part of the benefit transfer process, several issues need to be factored in, including broad policy context, inflation, differences in real income, differences in demographic condition, distance decay, double counting, substitution effect, and non-correspondence bias. Table 1 contains a brief description of each factor.

Table 1: Key adjustment factors to consider during a benefit transfer. Source: Iftekhar *et al.* (2022)

Adjustment factors	Description
Broad policy context	The policy context has to be relevant. For example, if a study provides willingness to pay estimates for protecting public open space for *recreation benefits*, applying those willingness to pay estimates to protect public open space for *biodiversity benefits* may not be suitable.
Inflation	Use an inflation index (typically the consumer price index) to adjust the original willingness to pay estimate to the present. Try to use information from recent studies as much as possible since people's taste and awareness might have changed.
Differences in real income	It is expected people with higher disposable income would have a higher willingness to pay or consumer surplus for a good. A commonly used way to adjust unit value transfers is to assume constant income elasticity of willingness to pay.
Differences in geographic condition	Differences in geographic conditions, such as, climate, remoteness, access to services, size of township can influence the nonmarket value. Try to find original studies that are as close as possible to the application sites.
Differences in demographic condition	If the information on the proportion of people under different income groups is available for both study and application sites, then weighted average income could be used to adjust willingness to pay using the income adjustment formula mentioned above. If the application site has high-income people compared with the study site, then their willingness to pay could be adjusted higher or vice versa.
Distance decay	It is generally expected that the further people live from an environmental asset the less they are willing to pay. In some studies, information on the distance decay function is available. If available, it is recommended to use these functions.
Double counting	If the original studies do not clearly mention or identify the explicit reasons for preferring different types of services, it is possible to double count the benefits in economic analysis. Iftekhar, Gunawardena et al. (2022) have outlined a number of steps on how to reduce double counting.
Substitution effect	It is generally expected that when similar sites already exist in the project, then fewer people are willing to pay. For example, is the proportion of public open space much higher in the application site compared with the study site? If so, willingness to pay for public open space would need to be adjusted lower as the marginal value of an additional proportion/area of public open space will be lower if the proportion/area of public open space is already high.
Non-correspondence bias	This factor is most prevalent when aggregating values derived from survey-based methods. We need to consider what proportion of people or households are willing to pay for a good or service.

Steps to develop the guide

We carried out the following steps to develop the guideline.

Identification of benefit types relevant for IWM projects in regional Victoria

As part of the broader project, several focus group discussions were carried out with representatives of different regional water forums in Victoria. Relevant types of benefits of IWM projects were identified through this consultation process. Details of the consultation could be found in WSCA (2022)

Review of primary nonmarket valuation studies and updating of the INFFEWS Value Tool: As part of the process, the INFFEWS Value Tool and associated guidelines have been updated based on an extensive literature review. See Appendix A for list of additional papers that have been included in the updated version of the Value tool. Information from most recent studies has been included with particular attention paid to values and information relevant to Victoria. New filters have been added to the Value Tool for easy identification of values related to regional and metropolitan Victoria.

This guideline presents information that is most likely to be relevant for assessing IWM projects in regional Victoria. However, in many cases, it was not possible to identify studies from regional Victoria. Therefore, relevant information from metropolitan Victoria or other states were reported.

Review of existing guidelines

Guidelines relevant to the economic evaluation of IWM projects in Australia were critically examined. Examples include:

- AITHER (2015). *Valuing externalities for integrated water cycle management planning*, A report prepared for the Victorian Department of Environment, Land, Water, and Planning
- Baker, R. and B. Ruting (2014). *Environmental Policy Analysis: A Guide to Non-Market Valuation*. Staff Working Paper. Canberra, Productivity Commission
- DPE (2022). *Interim Framework for Valuing Green Infrastructure and Public Spaces*, NSW Department of Planning and Environment
- DPE (2022). *Interim Framework for Valuing Green Infrastructure and Public Spaces: Technical appendices for recommended approaches*, NSW Department of Planning and Environment
- Iftekhar, M. S., A. Gunawardena and F. Fogarty (2022). *INFFEWS Value Tool*. Cooperative Research Centre for Water Sensitive Cities Ltd. Melbourne.
- Iftekhar, M. S., A. Gunawardena, F. Fogarty, D. Pannell and A. Rogers (2022). *Value tool of water sensitive systems and practices: Guideline (V4).* Cooperative Research Centre for Water Sensitive Cities Ltd. Melbourne.
- Melbourne Water (2021). *Melbourne Water Social and Environmental Values Tool (SEVT) version 2.5*, March, 2021. Melbourne, Melbourne Water and Marsden Jacob.
- Encader Consulting and Foresight Advisory (2021). *Green Blue Infrastructure Guide – A guide for small towns in Victoria's Central Highlands region*. Victoria, The Victorian Government supported the Green-Blue Infrastructure Guide through the Central Highlands Integrated Water Management Forum (Phase 1) and the Grampians Region Climate Adaptation Group (Phase 2). Victorian Government.
- WSAA (2019). *Health benefits from water centric liveable communities*. Melbourne, Australia, Water Services Association of Australia (WSAA) and Frontier Economics.

Case study application

The principles proposed in this guideline have been tested in 2 IWM case studies in regional Victoria. Details of the case studies could be found here

- Iftekhar, M.S., Jayawardana, N. I., Ewert, J., Davies, R., Taye, F. and Harshana, P. V. S., (2022). *Beaufort Linear Park Project: Rapid BCA (Draft)*. Water Sensitive Cities Australia, Melbourne, Australia.
- Iftekhar, M.S., Jayawardana, N. I., Ewert, J., Taye, F. and Harshana, P. V. S., (2022). *Baranduda Fields Stormwater Harvesting: Rapid BCA (Draft).* Water Sensitive Cities Australia, Melbourne, Australia.

Stakeholder consultation

The draft report was shared with the relevant agencies for their feedback.

The major benefits of regional IWM projects

This section provides guidance on how to assess monetary values of major services of IWM projects. The information has been presented for major benefit types. First, we describe relevant studies and the nonmarket value information. Then we set out the steps required to use those values in a rapid economic assessment of IWM projects.

Ecological improvement, biodiversity

Several nonmarket valuation studies have provided information on people's values for ecological improvement and biodiversity protection services that could be potentially used to evaluate IWM projects.

The main categories of information relate to improving vegetation options in public open spaces, restoring ecology, protecting and improving native fish, protecting and improving water birds, improving waterway health, improving local streams, and managing stormwater.

Improving vegetation condition in public open space

Iftekhar et al. (2022) reported people's willingness to pay to improve vegetation condition as part of different stormwater management options for the Main Outfall Sewer (MOS) reserve, Melbourne. They surveyed a sample of representative households within 5 km of the site.

If the IWM project includes such features, the values mentioned could be used by following these steps:

1. Identify the expected level of improvement of the vegetation conditions in the public open space due to the IWM project.

2. Estimate the number of households that are willing to pay for such features. Such information could be found via prior studies, expert judgement, and community consultations. For example, in the original study, Iftekhar, Polyakov *et al.* (2022) found that 86% of the households within 5 km of the site were willing to pay for such an improvement.

3. Gather income information (e.g., median household income) from the Australian Bureau of Statistics (ABS). Adjust the willingness to pay data presented above according to the difference in median income of the households and the Melbourne population. A simple ratio of median income values of the study location and the application location could be a good approximation to adjust the willingness to pay values.

4. Adjust the willingness to pay information for inflation using the consumer price index.

5. Multiply the inflation-adjusted willingness to pay by the number of relevant households (calculated in step 2) to calculate the aggregate value of vegetation improvement.

Table 2: Household willingness to pay for improvement in the vegetation condition of public open space. Source: Iftekhar, Polyakov et al. (2022)

Household willingness to pay…	WTP estimate ($/household, one-off, 2022 $AU)
For Grass only as vegetation facilities compared with the current situation of no vegetation facilities	38.35
For Grass and some trees as vegetation facilities compared with the current situation of no vegetation facilities	159.96
For Grass and many trees as vegetation facilities compared with the current situation of no vegetation facilities	196.12

Restoring ecology

Matzek *et al.* (2019) provided people's willingness to pay across Australia for different options which could be used to estimate the value of ecological restoration services of IWM projects.

If the IWM project includes such features, the values mentioned could be used by following these steps:

1. Identify the main purpose and condition of the ecological restoration with and without the IWM project.

2. Estimate the number of households that are willing to pay for such features. In the original study, Matzek, Wilson *et al.* (2019) found that approximately half of the sample respondents were willing to pay for such improvement.

3. Gather income information (e.g., median household income) from ABS data. Adjust the willingness to pay data presented above according to the difference in median income of the households and the Australian population.

4. Adjust the willingness to pay information for inflation using the consumer price index.

5. Multiply the inflation-adjusted willingness to pay by the number of relevant households (calculated in step 2) to calculate the aggregate value for ecological restoration.

Table 3: Willingness to pay for ecological restoration options. Source: Matzek, Wilson et al. (2019)

Willingness to pay per person (respondent)	WTP estimate ($/person, one-off, 2022 $AU)
For ecological restoration with benefits from biodiversity (ecological enhancement and threatened species protection) and ecosystem services (carbon sequestration, soil improvement, water quality, water supply, on-farm benefits, harvest of forest products, cultural and social benefits)	26.30
For ecological restoration with biodiversity benefits (ecological enhancement and threatened species protection)	24.18
For ecological restoration among respondents choosing biodiversity attributes (ecological enhancement and threatened species protection) as their preferred outcome from restoration	28.23
For ecological restoration among respondents choosing ecosystem services (carbon sequestration, soil improvement, water quality, water supply, on-farm benefits, harvest of forest products, cultural and social benefits) as their preferred outcome from restoration	22.00
For ecological restoration among respondents choosing regulating services (carbon sequestration, soil improvement, and water quality) as their preferred outcome from restoration	23.16
For ecological restoration among respondents choosing provisioning services (water supply, on-farm benefits, and harvest of forest products) as their preferred outcome from restoration	25.83
For ecological restoration among respondents choosing cultural services (cultural and social benefits) as their preferred outcome from restoration	25.77

Protecting and improving native fish

Bennett *et al.* (2008) provided people's willingness to pay for in-catchment residents for different native fish species and population improvement options which could be used to estimate the value of protecting and improving the native fish population due to an IWM project.

If the IWM project includes such features, the values mentioned could be used by following these steps:

1. Identify the expected level of improvement in native fish population and species due to the IWM project. Note the willingness to pay numbers presented in Bennett, Dumsday *et al.* (2008) are more suitable for sites close to the condition described in the study.

2. Estimate the number of households that are willing to pay for such features or benefits. It is reasonable to assume that people living close to the site, or the current and potential users of the site, would be a relevant group.

3. Gather income information (e.g., median household income) from ABS data. Adjust the willingness to pay data presented above according to the difference in median income of the households and the study area population.

4. Adjust the willingness to pay information for inflation using the consumer price index.

5. Multiply the adjusted willingness to pay by the number of relevant households (calculated in step 2) and the level of improvement to calculate the aggregate value.

Table 4: Willingness to pay for improvement in native fish populations. Source: Bennett, Dumsday et al. (2008)

Household willingness to pay for…	WTP estimate ($/%/household, one-off, 2022 $AU)
1% increase in the percentage of pre-settlement fish species and population levels (the current level is 5%) in Moorabool River (for in-catchment respondents)	7.27
1% increase in the percentage of pre-settlement fish species and population levels (the current level is 5%) in Moorabool River (for Melbourne respondents)	7.84
1% increase in the percentage of pre-settlement fish species and population levels (the current level is 15%) in Gellibrand River (for in-catchment respondents)	3.21
1% increase in the percentage of pre-settlement fish species and population levels (the current level is 5%) in Goulburn River (for out-of-catchment (Gellibrand) respondents)	8.16
1% increase in the percentage of pre-settlement fish species and population levels (the current level is 5%) in Goulburn River (for in-catchment respondents)	6.44
1% increase in the percentage of pre-settlement fish species and population levels (the current level is 5%) in Goulburn River (for Melbourne respondents)	6.56

Improving waterway health

Bennett, Dumsday *et al.* (2008) have provided people's willingness to pay for in-catchment residents for healthy native riverbank vegetation options which could be used to estimate the value of protecting and improving the riverbank vegetation due to an IWM project.

If the IWM project includes such features, the values mentioned could be used by following these steps:

1. Identify the expected level of improvement in the healthy native riverbank vegetation condition (i.e., the percentage level of improvement from the current condition) due to the IWM project. Such information could be found from ecological modelling, expert judgement and prior studies. Note the willingness to pay numbers presented in Bennett, Dumsday *et al.* (2008) are more suitable for sites close to the condition described in the study.

2. Estimate the number of households that are willing to pay for such features or benefits. It is reasonable to assume that people living close to the site and/or the current and potential users of the site would be relevant groups.

3. Gather income information (e.g., median household income) from ABS data. Adjust the willingness to pay data presented above according to the difference in median income of the households and the study area population.

4. Adjust the willingness to pay information for inflation using the consumer price index.

5. Multiply the adjusted willingness to pay by the number of relevant households (calculated in step 2) and the level of improvement to calculate the aggregate value of recreation opportunities.

Table 5: Willingness to pay for the improvement of healthy native vegetation. Source: Bennett, Dumsday et al. (2008)

Household willingness to pay for…	WTP estimate ($/%/household, one-off, 2022 $AU)
1% increase in the percentage of river's length with healthy native vegetation on both banks (the current level is 25%) in Moorabool River (for in-catchment respondents)	8.16
1% increase in the percentage of river's length with healthy native vegetation on both banks (the current level is 25%) in Moorabool River (for Melbourne respondents)	7.82
1% increase in the percentage of river's length with healthy native vegetation on both banks (the current level is 12%) in Gellibrand River (for in-catchment respondents)	4.27
1% increase in the percentage of river's length with healthy native vegetation on both banks (the current level is 50%) in Goulburn River (for out-of-catchment (Gellibrand) respondents)	6.83
1% increase in the percentage of river's length with healthy native vegetation on both banks (the current level is 50%) in Goulburn River (for in-catchment respondents)	5.23
1% increase in the percentage of river's length with healthy native vegetation on both banks (the current level is 50%) in Goulburn River (for Melbourne respondents)	8.12

Improving local streams

Brent *et al.* (2017) have provided people's willingness to pay for improvement in local stream health for the Melbourne population which could be used to estimate the value of protecting and improving the local stream health due to an IWM project.

If the IWM project includes such features, the values mentioned could be used by following these steps:

1. Identify the expected level of improvement in the health of local waterways due to the IWM project. Such information could be found from ecological modelling and expert judgement.

2. Estimate the number of households that are willing to pay for such features or benefits.

3. Gather income information (e.g., median household income) from ABS data. Adjust the willingness to pay data presented above according to the difference in median income of the households and Melbourne population.

4. Adjust the willingness to pay information for inflation using the consumer price index.

5. Multiply the adjusted willingness to pay by the number of relevant households (calculated in step 2) and the level of improvement to calculate the aggregate value of recreation opportunities.

Table 6: Willingness to pay for the improvement of healthy local streams. Source: Brent, Gangadharan et al. (2017)

Household willingness to pay per year for…	WTP estimate ($/Level/Household/Year, annual, 2022 $AU)
Improvement in local stream health characterised as a natural channel form and function with high species diversity and low populations of nuisance insects in Melbourne	278.25
Reductions in bank erosion, banks being free of litter, greater biodiversity and the return of some iconic species in Melbourne	99.88

Improving and protecting native waterbirds and other animals

Bennett, Dumsday et al. (2008) have provided people's willingness to pay for in-catchment residents for native waterbirds and other animals improvement options which could be used to estimate the value of protecting and improving the native waterbirds and other animals due to an IWM project.

If the IWM project includes such features, the values mentioned could be used by following these steps:

1. Identify the level of improvement in the condition of native waterbirds and other animals due to the IWM project. Note the willingness to pay numbers presented in Bennett *et al.* (2008) are more suitable for sites close to the condition described in the study.
2. Estimate the number of households that are willing to pay for such features or benefits. It is reasonable to assume that people living close to the site and/or the current and potential users of the site would be relevant groups.
3. Gather income information (e.g., median household income) from ABS data. Adjust the willingness to pay data presented above according to the difference in median income of the households and the study area population.
4. Adjust the willingness to pay information for inflation using the consumer price index.
5. Multiply the adjusted willingness to pay by the number of relevant households (calculated in step 2) and the level of improvement to calculate the aggregate value.

Table 7: Willingness to pay for the improvement of native waterbirds and other animals. Source: Bennett, Dumsday et al. (2008)

Household willingness to pay for…	Unit of measurement	WTP estimate (one-off, 2022 $AU)
An increase in the number of native waterbirds and other animal species with sustainable populations (the current level is 5 species) in Moorabool River (for in-catchment respondents)	$/Number/Household	32.40
An increase in the number of native waterbirds and other animal species with sustainable populations (the current level is 5 species) in Moorabool River (for Melbourne respondents)	$/Number/Household	26.70
1% increase in the number of native waterbirds and other animal species with sustainable populations (the current level is 3 species) in Gellibrand River (for in-catchment respondents)	$/%/Household	25.44
1% increase in the number of native waterbirds and other animal species with sustainable populations (the current level is 35 species) in Goulburn River (for out-of-catchment (Gellibrand) respondents)	$/%/Household	4.46
1% increase in the number of native waterbirds and other animal species with sustainable populations (the current level is 35 species) in Goulburn River (for in-catchment respondents)	$/%/Household	5.72
1% increase in the number of native waterbirds and other animal species with sustainable populations (the current level is 35 species) in Goulburn River (for Melbourne respondents)	$/%/Household	4.92

Managing stormwater

Two different approaches are often used to estimate and monetise the water quality benefits of stormwater management: the cost savings approach and the willingness to pay approach.

Cost savings approach

Total Nitrogen (TN) is commonly used as a proxy to represent various types of pollutants that can be removed by stormwater treatment initiatives. It is assumed that TN is the limiting pollutant (in other words, if the TN target is met then other pollutants will be removed at the target level). Melbourne Water has an offset rate of $6,645/kg of TN (2022). The offset rate is based on implementing constructed wetland projects (land price and construction costs) in the outer Melbourne region (mainly in Mooreland, Brimbank, Casey, Knox, Monash, and Kingston).

If the IWM project generates significant TN removal benefits, the values mentioned above could be used by following these steps:

1. Identify and estimate the expected volume (quantity) of TN to be removed due to the IWM project.
2. Gather land price information for outer Melbourne regions and the project location. Adjust the offset rate according to the land price differences assuming the construction cost wetland would be the same. Note the offset rates are most suitable for locations close to outer Melbourne. Simple adjustments for land prices may not reflect the true opportunity costs of removing TN.
3. Adjust the offset rate for inflation using the consumer price index if required.
4. Multiply the inflation-adjusted offset rate by the quantity of TN removed to calculate the aggregate value of vegetation improvement.

Willingness to pay approach

Iftekhar, Polyakov *et al.* (2022) reported people's willingness to pay for improvement in stormwater management options for the Main Outfall Sewer (MOS) reserve, Melbourne. They surveyed a sample of representative households within 5 km of the site.

Table 8: Willingness to pay for the improvement of stormwater management. Source: Iftekhar, Polyakov et al. (2022)

Household willingness to pay…	WTP estimate ($/household, one-off, 2022 $AU)
For pollutant removal as rainwater management facilities compared with the current situation of no rainwater management facilities	124.90
For pollutant removal and water reuse as rainwater management facilities compared with the current situation of no rainwater management facilities	147.91

If the IWM project includes such features, the values mentioned could be used by following these steps:

1. Identify the expected level of improvement in the stormwater management conditions in the local park or public open space due to the IWM project.
2. Estimate the number of households that are willing to pay for such features. The original study found 86% of the households within 5 km of the site were willing to pay for such an improvement.
3. Gather income information (e.g., median household income) from the ABS. Adjust the willingness to pay data presented above according to the difference in median income of the households and the Melbourne population.
4. Adjust the willingness to pay information for inflation using the consumer price index.
5. Multiply the inflation-adjusted willingness to pay by the number of relevant households (calculated in step 2) to calculate the aggregate value of vegetation improvement.

Improved opportunities for recreation

IWM projects could generate substantial opportunities for recreation by attracting new visitors to the region or creating new recreation opportunities for residents.

Existing information on nonmarket valuation studies could be divided into 2 broad groups: the value of visiting a site for recreational purposes, and the value of potential improvement of a site for recreational purposes.

Value of visiting a site for recreational purposes

Melbourne Water (2021) has reported several look-up values for greater Melbourne areas that could be used to assess the recreation value of an IWM project. The values are expressed as the benefits (surplus benefits above the expenditure) received by a visitor in the greater Melbourne region.

These values could be used in a rapid economic assessment by following these steps:

1. Estimate the number of additional visitors/trips generated due to the IWM project. When calculating the number of additional visitors/trips exclude the number of trips/visits/visitors that are simply a transfer from one site to another site within the same catchment or project scope area.
2. Collect the origin (location) information of the visitors. Gather income information (e.g., median household income) of the visitors' locations from ABS data. Adjust the consumer surplus data presented above according to the difference in median income of the visitors and the greater Melbourne population. It is expected people with higher disposable income would have a higher willingness to pay or consumer surplus for visiting a site for recreational purposes.
3. Adjust the consumer surplus information for inflation using the consumer price index.
4. Multiply the adjusted consumer surplus by the additional trips due to the IWM project (calculated in step 1) to calculate the aggregate value of recreation opportunities.

Table 9: Consumer surplus of trips for different recreational purposes. Source: Melbourne Water (2021)

Purpose	Unit of measurement	Consumer surplus (2022 $AU)
Recreational boating or fishing	Person/trip	26
Visiting an urban park or freshwater/riverside	Person/trip	16
Visiting a beach/coast	Person/trip	31
General recreational benefit of a visit	Person/trip day	50

Value of improvement of a site for recreational purposes

Two relevant studies could be used to calculate the value of potential improvement of a site for recreational purposes.

Iftekhar, Polyakov *et al.* (2022) reported people's willingness to pay for additional recreational facilities as part of the improvement options for the Main Outfall Sewer (MOS) reserve, in Melbourne. They surveyed a sample of representative households within 5 km of the site.

If the IWM project includes such features, the values mentioned could be used by following these steps:

1. Identify the level of improvement or recreational features to be included in the IWM project.
2. Estimate the number of households that are willing to pay for such features. The original study found 86% of the households within 5 km of the site were willing to pay for such improvement.
3. Gather income information (e.g., median household income) from ABS data. Adjust the willingness to pay data presented above according to the difference in median income of the households and the Melbourne population.
4. Adjust the willingness to pay information for inflation using the consumer price index.
5. Multiply the adjusted willingness to pay by the number of relevant households (calculated in step 2) to calculate the aggregate value.

In another study, Bennett, Dumsday *et al.* (2008) reported household willingness to pay for a 1% increase in the percentage of the river suitable for primary contact recreation without threat to public health (the current level is 70%) in Goulburn River (for in-catchment respondents). They found people were willing to pay $3.11 (2022 AUD) per household (one-off) for a 1% improvement in the river condition.

If the IWM project includes such features, the values mentioned above could be used by following these steps:

1. Identify the level of improvement or recreational features to be included in the IWM project. Note the willingness to pay numbers presented in Bennett, Dumsday *et al.* (2008) are more suitable for sites close to the condition described in the study.
2. Estimate the number of households that are willing to pay for such features or benefits. It is reasonable to assume that people living close to the site or the current and potential users of the site for recreation purposes would be relevant groups.
3. Gather income information (e.g., median household income) from ABS data. Adjust the willingness to pay data presented above according to the difference in median income of the households and the Goulburn River catchment population.
4. Adjust the willingness to pay information for inflation using the consumer price index.
5. Multiply the adjusted willingness to pay by the number of relevant households (calculated in step 2) and the level of improvement to calculate the aggregate value of recreation opportunities.

Table 10: Household willingness to pay for the improvement of public open space that includes recreational features. Source: Iftekhar, Polyakov et al. (2022)

Household willingness to pay for…	WTP estimate ($/household, one-off, 2022 $AU)
Seats as park facilities compared with the current situation of no park facilities	92.03
Seats + Drink fountain as park facilities compared with the current situation of no park facilities	97.51
Seats + Drink fountain + BBQs as park facilities compared with the current situation of no park facilities	149.00
Seats + Drink fountain + BBQs + Toilets as park facilities compared with the current situation of no park facilities	242.13
Exercise equipment as exercise facilities compared with the current situation of no exercise facilities	70.12
Playground as exercise facilities compared with the current situation of no exercise facilities	95.32
Exercise equipment + Playground as exercise facilities compared with the current situation of no exercise facilities	132.57
Exercise equipment + Playground + Skate park as exercise facilities compared with the current situation of no exercise facilities	140.24
For Foot bridge as Local crossing facilities compared with the current situation of no Local crossing facilities	98.61
For Narrow crossing as Local crossing facilities compared with the current situation of no Local crossing facilities	82.17
For Wide crossing as Local crossing facilities compared with the current situation of no Local crossing facilities	83.27
For Renovated shared path as Path facilities compared with the current situation of no Path facilities	85.46
For Renovated separate path as Path facilities compared with the current situation of no Path facilities	85.46

Improved aesthetics

In the existing studies, amenity and recreational benefits are often estimated together. Such values are likely to cover multiple benefits including recreation, amenity, and health benefits. Take care to avoid double counting.

Several studies could be relevant to assess the aesthetic benefits of an IWM project in regional Victoria.

RMCG (2015) found that in Melbourne converting a Melbourne Water asset/space that is currently generating little or no community value as public open space to the same standard as an average council park would generate a 1.5% uplift in prices for properties within 300 m of the asset.

Melbourne Water (2021) recommended using an average 1% uplift in prices for properties within 300 m of a green infrastructure.

Iftekhar, Polyakov *et al.* (2022) found constructing a local park in Melbourne (Brooklyn Park) resulted in an uplift in property price by about 5% for properties within 50 m of the site.

Based on these studies, we recommend applying a one-off price premium (capitalised value) of about 1% of prices for properties within 300 m of an IWM project site that has substantial recreational and amenity benefits. If a 50 m distance/buffer is used, then we recommend applying a 5% uplift.

If the IWM project includes such features, the values mentioned above could be used by following these steps:

1. Identify the spatial extent or buffer of the project. Existing studies show the amenity benefits of small-scale projects are likely to extend up to 300 m and disappear after that.
2. Estimate the number of properties that are within the relevant zone of the IWM project.
3. Gather information on current house prices. Often, the median price is used as a proxy.
4. Multiply the one-off price premium (%) with the median house price to calculate the expected contribution ($/property) of the IWM project.
5. Multiply the expected contribution by the number of properties (calculated in step 2) to calculate the aggregate value.

Evangelio *et al.* (2019) reported the impact of different types of parks in regional Victoria in terms of distances.

- Reducing the distance to the nearest community and cultural park would add value to a property at a rate of $44/m/property. This rate is applicable for houses located between 50 m and 1500 m of such parks.
- Reducing the distance to the nearest sports and recreational park would add value to a property at a rate of $22/m/property. This rate is applicable for houses located between 40 m and 500 m of such parks.

If the IWM project includes such features, the values mentioned could be used by following these steps:

1. Calculate the average distance of houses to existing parks with and without the IWM project. Calculate the average reduction in distance due to the IWM project.
2. Identify the spatial extent or buffer of the project.
3. Estimate the number of households that are within the relevant zone.
4. Adjust the willingness to pay information for inflation using the consumer price index.
5. Multiply the number of households, the average reduction in distance, and the inflation-adjusted willingness to pay to calculate the aggregate value of recreation opportunities.

For example, assume that without the project, the average distance to the nearest community and cultural park is 900 m.

After establishing a new community and cultural park (providing the same service), the average distance will reduce to 600 m. That is, the reduction in distance is 300 m.

The added property price premium benefit of this new park would be 300 m x $44 = $13,138 on average for a property within the buffer zone of the park.

Reduced recurring energy costs

A potential benefit of IWM projects (especially urban greening projects) is the savings in electricity costs.

Whiteoak and Saigar (2019) estimated the economic values produced by urban heat island (UHI) mitigation via urban greening and IWM in a new suburban development. Their case study location was in the west of Melbourne, Australia (the approximate coordinate of the location is -37.580060, 144.735870). Some key features of the case study were:

- The case study area was a greenfield site, and it was expected that the homes are built to current standards of insulation and energy efficiency.
- While green infrastructure is likely to reduce summer maximum temperatures, winter temperatures will remain largely unaffected.
- The standard home being built in the case study area was a 3-bedroom, 2-bathroom brick home with air conditioning and roof insulation.
- Savings were based on a flat tariff of $0.28/kWh.

Whiteoak and Saigar (2019) noted that electricity savings can occur at household and regional levels:

- At the household level, increased shading and cooling could reduce electricity demand (volumetric use) in the summer period with direct savings in electricity bills.
- At a regional level, reduced demand for electricity could result in reductions in the scale of distribution infrastructure needed to service an area or region. It is also possible that temperature reductions might reduce the number of faults in the infrastructures.

However, due to the small-scale nature of IWM projects, electricity savings benefits are most likely to happen at the household level.

Whiteoak and Saigar (2019) estimated electricity cost savings benefits for 2 different appliances which could be potentially considered:

- living-room-only air conditioning savings: $21 to $31 per degree Celsius reduction per household per year
- central ducted air conditioning savings: $32 to $47 per degree Celsius reduction per household per year.

If the IWM project includes such benefits, the values mentioned above could be used by following these steps:

1. Estimate the extent of residential energy savings benefits, using biophysical models to understand the impact of the IWM project on maximum temperature. For rapid assessment, the TARGET (The Air-temperature Response to Green/blue infrastructure Evaluation Tool) module developed by the CRC for Water Sensitive Cities (https://watersensitivecities.org.au/content/scenario-tool-now-includes-target/) could be used. Once the expected reduction in maximum temperature due to the IWM project is established, a unit value transfer method could be used.
2. Estimate the number of households that are likely to receive the energy savings benefits from the IWM project.
3. Collect information on local tariffs. Adjust the cost savings information presented above by the differences in tariff. It is expected that higher local tariffs would generate higher cost savings benefits.
4. Adjust the cost savings benefits for inflation using the consumer price index.
5. Multiply the number of households and the adjusted cost savings benefits to calculate the aggregate value.

Improved wastewater management

Two alternative approaches could be used to estimate the monetised benefits of improving wastewater management.

Cost savings approach

The benefits of wastewater recycling could be calculated using an opportunity cost method; the value of recycled water supply is the cost of obtaining the same level of services or the same volume of water from an alternative source. Usually, market prices or costs (long-run marginal costs) are used to estimate such benefits.

The cost savings approach is easier to apply, even though it will probably underestimate benefits because it does not capture people's willingness to pay for general environmental and sustainability improvement.

Willingness to pay approach

There is some evidence that people are willing to pay for better wastewater management through recycling. However, for regional Victoria, we found only one willingness to pay study in Bendigo by Hurlimann (2009); people were willing to pay $10.35 per household per year to get recycled water delivered to their home.

If the IWM project includes such features, the values mentioned above could be used by following these steps:

1. Identify the expected improvement in the capacity to supply recycled water for residential use due to the IWM project.
2. Estimate the number of households that would receive such benefits and are willing to pay for such features or benefits.
3. Gather income information (e.g., median household income) from ABS data. Adjust the willingness to pay data presented above according to the difference in median income of the households and the Bendigo population.
4. Adjust the willingness to pay information for inflation using the consumer price index.
5. Multiply the adjusted willingness to pay by the number of relevant households (calculated in step 2) to calculate the aggregate value.

Improved security of water supply

Evidence shows people are willing to pay to avoid water restrictions and improve the reliability of the water supply. Existing studies could be divided into 2 groups: willingness to pay to avoid water restrictions and willingness to pay to improve monitoring and regulations.

Willingness to pay to avoid restrictions

Several studies have reported willingness to pay estimates to avoid water restrictions which could be used to assess such benefits of IWM projects.

If the IWM project provides water restriction benefits, the values mentioned could be used by following these steps:

1. Identify the expected improvement in the capacity to supply recycled water for residential use due to the IWM project.
2. Estimate the number of households that would receive such benefits and are willing to pay for such features or benefits.
3. Gather income information (e.g., median household income) from ABS data. Adjust the willingness to pay data presented above according to the difference in median income of the households and the study population.
4. Adjust the willingness to pay information for inflation using the consumer price index.
5. Multiply the adjusted willingness to pay by the number of relevant households (calculated in step 2) to calculate the aggregate value.

Table 11: Willingness to pay to avoid water restrictions

Citation	Value location	Household willingness to pay..	Unit of measurement	Adjusted estimate (Annual, 2022 $AU)
Cooper *et al.* (2011)	Victoria and New South Wales	Per year to avoid urban water restrictions	$/Level/Household/Year	8.25 – 160.85
Brent, Gangadharan *et al.* (2017)	Moonee Valley and Manningham in Melbourne	Per year for eliminating exposure to water restrictions in Melbourne (baseline – full range of restrictions are applied to outdoor water use)	$/Level/Household/Year	184.31
Brent, Gangadharan *et al.* (2017)	Moonee Valley and Manningham in Melbourne	Per year for improvement in local stream health corresponded with reduction in water restrictions such as lawn watering only being permitted on specified days of the week in Melbourne (baseline – full range of restrictions are applied to outdoor water use)	$/Level/Household/Year	5.95
Cooper *et al.* (2018)	Eastern Australia	For 1% reduction in the probability of experiencing 'high' water restrictions (current level is 5%)	$/%/Household/Year	3.23
Cooper, Burton *et al.* (2018)	Eastern Australia	For 1% reduction in the probability of experiencing 'medium' water restrictions (current level is 21%)	$/%/Household/Year	0.90
Cooper, Burton *et al.* (2018)	Eastern Australia	For 1% reduction in the probability of experiencing 'low' water restrictions (current level is 47%)	$/%/Household/Year	0.17
Cooper *et al.* (2019)	Wodonga in Victoria	To avoid water restrictions in Wodonga during drought in 2008 (conservative estimates)	$/Level/Household/Year	151.22
Cooper, Burton *et al.* (2019)	Wodonga in Victoria	To avoid water restrictions in Wodonga after drought in 2012, maintaining sociodemographic at mean 2008 values (conservative estimates)	$/Level/Household/Year	59.93
Cooper, Burton *et al.* (2019)	Melbourne	To avoid water restriction in Melbourne during drought in 2008 (conservative estimates)	$/Level/Household/Year	180.09
Cooper, Burton *et al.* (2019)	Melbourne	To avoid water restrictions in Melbourne after drought in 2012, maintaining sociodemographic at mean 2008 values (conservative estimates)	$/Level/Household/Year	202.26
Cooper, Burton *et al.* (2019)	Bendigo in Victoria	To avoid water restrictions in Bendigo during drought in 2008 (conservative estimates)	$/Level/Household/Year	203.46

Improved monitoring

Cooper *et al.* (2012) have reported willingness to pay estimates to improve monitoring and regulations in metropolitan and regional centres in Victoria and New South Wales.

If the IWM project provides water restriction benefits, the values mentioned could be used by following these steps:

1. Identify the expected improvement in the capacity to monitor water use due to the IWM project.
2. Estimate the number of households that would be willing to pay for such features or benefits.
3. Gather income information (e.g., median household income) from ABS data. Adjust the willingness to pay data presented above according to the difference in median income of the households and the Victoria and New South Wales population.
4. Adjust the willingness to pay information for inflation using the consumer price index.
5. Multiply the adjusted willingness to pay by the number of relevant households (calculated in step 2) to calculate the aggregate value.

Table 12: Willingness to pay for the improvement of monitoring and regulation. Source: Cooper, Rose et al. (2012)

Household willing to pay…	WTP estimate $/Level/Household/ Year, Annual, 2022 $AU)
To have 1 inspector per 1,000 households (compared with 1 inspector per 10,000 households) to patrol outdoor water usage	9.29
To have 1 inspector per 2,000 households (compared with 1 inspector per 10,000 households) to patrol outdoor water usage	26.16
To have 1 inspector per 5,000 households (compared with 1 inspector per 10,000 households) to patrol outdoor water usage	20.33
To have 1 inspector per 8,000 households (compared with 1 inspector per 10,000 households) to patrol outdoor water usage	17.68
To have 1 inspector per 50,000 households (compared with 1 inspector per 10,000 households) to patrol outdoor water usage	-24.84
To have 1 inspector per 200,000 households (compared with1 inspector per 10,000 households) to patrol outdoor water usage	-47.98
To increase frequency of information on water restrictions in the media from once in every 90 days to once in less than every 14 days	1.07
To increase frequency of information on water restrictions in the media from once in every 90 days to once in every 31 days	1.07
To be able to report neighbours' noncompliance via a hotline to a team who would process the complaint	8.32

Increased work productivity

The link between green space and work productivity has been studied to some extent.

Zander *et al.* (2015) have provided productivity loss due to heat stress for different groups of workers for samples across Australia. For example, they estimated annual total productivity loss due to heat stress was about $176 per worker per year, based on people who reported being less productive due to heat stress in Victoria.

These values could be used to calculate the cost savings benefits due to IWM projects.

If the IWM project includes such features, the cost savings information mentioned could be used by following these steps:

1. Identify the expected number of workers that are likely to receive such benefits due to the IWM project.
2. Gather income information (e.g., median household income) from ABS data. Adjust the cost savings data presented above according to the difference in median income of the households and the Australian population.
3. Adjust the cost savings information for inflation using the consumer price index.
4. Multiply the adjusted cost savings by the number of relevant workers to calculate the aggregate value.

Table 13: Savings in annual total productivity loss due to heat stress. Source: Zander, Botzen et al. (2015)

Savings in annual total productivity loss due to heat stress per worker per year for those who reported being less productive ..	Cost estimate* ($/Worker/Yr, annual, 2022 $AU)
Male worker	290.67
Female worker	157.22
>10% time working outside	183.65
10% – 50% time working outside	285.38
< 50% time working outside	235.18
Low physical exertion while working	142.69
Medium physical exertion while working	208.75
High physical exertion while working	360.69
Cleric/administrative worker	163.83
Community/personal service worker	179.69
Labourers	261.60
Machinery operator/drivers	513.95
Manager	243.10
Professionals	264.24
Sale workers	157.22
Technicians/trades workers	389.76

*Australian average

Improved health benefits

The health benefits of IWM projects could be substantial, because various studies have found people are more likely to be active if they live close to public open space. However, the size or area of the public open space needs to be substantial.

Two relevant studies from Melbourne suggest people are 35% to 60% more likely to engage in physical activities (such as walking) if they live close to large parks.

There are three main types of benefits people are more likely to enjoy from more active lifestyles: healthcare cost savings, improved workforce productivity, and mental wellbeing benefits. Two relevant studies, MJA (2018) and WSAA (2019) have provided information that could be used to quantify such benefits for regional Victoria.

MJA (2018) has reported that permanently shifting one Victorian from the 2016 population aged 15+ from being physically inactive to being physically active will deliver present value benefits in the $300–$1,350 range over the individual's lifetime, on average, using a 7% real discount rate. This estimate is conservative because it excludes recreation, leisure, and home-based production activities to avoid double counting.

WSAA (2019) estimated the healthcare cost savings for each person who becomes physically active are in the order of $90–$180 on average over their lifetime. This estimate assumes urban greening results in an incremental increase in passive recreation of around 75 minutes a week and that this passive recreation is maintained throughout their lifetime.

Table 14: Probability of being more physically active due to the presence of green spaces

Citation	Impact	Odds ratio	Probability
King *et al.* (2012)	Chance of being at least a weekly walker for an individual living within 800 m of public open spaces in the middle tertile (16.58 ha) compared with an area with public open spaces area in the bottom tertile (7.78 ha)	0.65	0.39
King, Thornton *et al.* (2012)	Chance of being at least a weekly walker for an individual living within 800 m of a park with area in the top tertile (42.66 ha) compared with a park with area in the bottom tertile (7.78 ha)	0.65	0.39
King, Thornton *et al.* (2012)	Chance of being at least a weekly walker for an individual living within 1200 m of a park with area in the middle tertile (42.95 sq m) compared with a park in the bottom tertile (21.47 ha)	0.56	0.36
King, Thornton *et al.* (2012)	Chance of being at least a weekly walker for an individual living within 1200 m of a park with area in the top tertile (917064 sq m) compared with a park with area in the bottom tertile (21.47 ha)	0.65	0.39
Koohsari *et al.* (2018)	Chance of people doing any walking for exercise when their nearest public open spaces is bigger than 1.5 ha compared with those people whose nearest public open space is smaller than 1.5 ha	0.90	0.47
Koohsari, Badland *et al.* (2018)	Chance of people doing any walking when their nearest public open spaces is bigger than 1.5 ha compared with those people whose nearest public open space is smaller than 1.5 ha	1.66	0.62

Table 15: Per capita benefit from physical activities. Source: WSAA (2019)

Per capita benefit from…	Value estimate (NPV/person, one-off, current 20-year lifespan, 6% discount rate, 2022 $AU)
Increased physical activity (Case study – large-scale greenfield development where water infrastructure is provided for the first time affecting 1.5 million people)	180.26
Increased wellbeing benefit from exposure to greenspace (Case study – large-scale greenfield development where water infrastructure is provided for the first time affecting 1.5 million people)	211.15
Increased physical activity (Case study – an urban stormwater channel rehabilitation project affecting 10,000 people)	75.09
Increased wellbeing benefit from exposure to greenspace (Case study – an urban stormwater channel rehabilitation project affecting 10,000 people)	105.57
Increased physical activity (Case study – providing for current and future water needs in a semi-arid regional town affecting 50,000 people)	90.75
Increased wellbeing benefit from exposure to greenspace (Case study – providing for current and future water needs in a semi-arid regional town affecting 50,000 people)	105.57

If the IWM project includes such features, the values mentioned could be used by following these steps:

1. Estimate the number of people likely to receive such benefits.
2. Gather income information (e.g., median household income) from ABS data. Adjust the value estimates presented above according to the difference in median income of the households and the Victorian population.
3. Adjust the value estimates for inflation using the consumer price index.
4. Multiply the adjusted willingness to pay by the number of relevant individuals to calculate the aggregate value.

Reduced water consumption

Reduction in water consumption could be generated by using more water-efficient appliances or changing water consumption behaviour at the household and community level.

Monetising such benefits would depend on whether the economic assessment takes a household or community perspective. At a household level, the benefit of reduced water consumption would be the avoided cost or cost savings (savings in water bills) due to reduced consumption of drinking water. At the community level, the marginal cost of water supply should be considered to calculate the value of water savings benefits. This data could be obtained from the water authorities.

These kinds of benefits are often estimated using market prices. Take care to avoid double counting if both benefits are included in the same analysis.

Reduced or delayed investment in infrastructure

IWM projects can reduce or delay investment in major infrastructures, which in turn generate cost savings benefits to the agencies (who may or may not be the proponent of the IWM project). For example, implementing IWM projects in the upstream to remove pollutants at the source may reduce the need for costly infrastructure installation or upgrade downstream.

The cost savings from reduced investment or expenditure (capital expenditure or operating expenditure) can be incorporated directly in an economic assessment. The benefits are usually incorporated in a benefit-cost analysis by shifting the year of investment (or expenditure) to a later year, which lowers the present value of costs due to discounting. The difference in the present value (discounted) of cost at the original year and the present value (discounted) of cost at the delayed year is used as the monetised value (or savings) of delayed investment.

These kinds of benefits are often estimated using market prices.

Reduced greenhouse gas emissions, increased CO2 sequestration

A few studies across Australia could be used to calculate people's willingness to pay to adopt climate mitigation options.

If the IWM project includes such features, the values mentioned below could be used by following these steps:

1. Identify the potential level of improvement.
2. Estimate the number of people/households that are willing to pay for such benefits.
3. Gather income information (e.g., median household income) from ABS data. Adjust the value estimates presented above according to the difference in median income of the households and the value location.
4. Adjust the value estimates for inflation using the consumer price index.
5. Multiply the adjusted willingness to pay by the number of relevant individuals/households/units to calculate the aggregate value.

Table 16: Willingness to pay for climate mitigation options

Citation	Value location	Definition of marginal change	Unit of measurement	Frequency of payment	Adjusted estimate (current $AU)
Akter and Bennett (2009)	Across Australia	Household willingness to pay per month to avoid future climate change by supporting a national emissions trading scheme known as the Carbon Pollution Reduction Scheme (CPRS)	$/Level/Month	Monthly	217.21
Landstra and Kragt (2015)	New South Wales, Queensland, Victoria, and Western Australia	Public willingness to pay per year for every metric tonne reduction in carbon emissions (current Australian emissions are about 575 million tonnes of CO_2-equivalent per year)	$/MT CO_2-e/Person/Year	Annual	2.40
Kragt *et al.* (2016)	Rural and urban areas across Australia	Household willingness to pay per year for the next 100 years for every metric tonne reduction in CO_2-equivalent (current Australian emissions are about 575 million tonnes of CO_2-equivalent) for the sample average	$/MT CO_2-e/Household/Year	Annual	1.38

Reduced flood risk and damage

Two different approaches could be taken to assess the monetary value of reducing flood risk and damage: cost savings approach and the willingness to pay approach.

Cost savings approach

Olesen et al. (2017) have developed a flood state damage cost function for Elster Creek Catchment, Melbourne which could be used to assess flood damage costs in regional Victoria where there is no other more direct information to estimate flood damage is available.

For roads, the damage has been estimated to be about $4 per metre of length.

If the IWM project includes such features, the values mentioned above could be used by following these steps:

1. Identify the number and types of properties that are likely to be saved from flood impact due to the IWM project.

2. Gather property price information from relevant sources. Adjust the property damage estimates presented above according to the difference in property prices of the affected regions and Melbourne.

3. Adjust the cost savings information for inflation using the consumer price index.

4. Multiply the adjusted cost savings by the number of relevant households to calculate the aggregate value.

Willingness to pay approach

A willingness to pay approach might be useful to estimate society's value for reducing flood risk. For example, Brent, Gangadharan *et al.* (2017) found people in Melbourne were willing to pay $87/year/household to eliminate flash flooding.

If the IWM project includes such features, the values mentioned could be used by following these steps:

1. Identify the level of improvement in the reduction of flash flood frequency due to the IWM project.

2. Estimate the number of households that would be willing to pay for such features or benefits.

3. Gather income information (e.g., median household income) from ABS data. Adjust the willingness to pay data presented above according to the difference in median income of the households and the Melbourne population.

4. Adjust the willingness to pay information for inflation using the consumer price index.

5. Multiply the adjusted willingness to pay by the number of relevant households (calculated in step 2) to calculate the aggregate value.

Table 17: Potential damage to content and properties. Source: Olesen, Löwe et al. (2017)

Inundation depth (metre)	Damage to residential property and content				Damage to commercial or industrial property
	Content		Property		
	Relative damage (%)	$/ property (2022 $AU)	Relative damage (%)	$/ property (2022 $AU)	$/sq metre (2022 $AU)
0.10	14	10,170	10	50,850	184
0.20	30	20,936	10	52,730	256
0.30	45	31,640	12	61,818	277
0.40	52	36,425	12	65,249	333
0.50	59	41,416	13	67,625	381
0.60	64	44,641	14	75,485	398
0.70	68	47,460	15	81,517	424
0.80	75	52,825	16	87,515	446
0.90	82	57,399	18	97,179	474
1.00	84	58,964	19	99,129	493
1.10	86	60,393	19	103,394	547
1.20	88	61,832	20	105,654	591
1.30	90	63,584	21	113,564	643
1.40	91	63,845	22	117,996	696
1.50	91	64,039	23	121,297	748
1.60	92	64,386	24	128,819	759
1.70	92	64,774	26	139,907	780
1.80	92	64,975	28	148,997	802
1.90	92	64,975	29	155,610	863
2.00	92	64,975	30	161,024	933

Improved air quality

WSAA (2019) has estimated the air quality benefits from a large-scale green development project that could be implemented to assess the air quality benefits of IWM projects of similar size.

If the IWM project includes such features, the values mentioned could be used by following these steps:

1. Estimate the improvement in air quality due to the IWM project.
6. Estimate the number of people likely to receive such benefits.
7. Gather income information (e.g., median household income) from ABS data. Adjust the value estimates presented above according to the difference in median income of the households and the Victorian population.
8. Adjust the value estimates for inflation using the consumer price index.
9. Multiply the adjusted willingness to pay by the number of relevant individuals to calculate the aggregate value.

Table 18: Per capita benefit from physical activities. Source: WSAA (2019)

Per capita benefit from…	Value estimate (NPV/person, one-off, current 20-year lifespan, 6% discount rate, 2022 $AU)
Increased air quality (Case study – large-scale greenfield development where water infrastructure is provided for the first time affecting 1.5 million people)	16.44

Traditional owner values

The inclusion of Traditional Owner values and culture, including the protection of cultural heritage sites has been identified as a potential benefit of IWM projects. A need to include cultural, ecological, and inclusion (reconciliation) benefits in BCA is growing, in recognition of societal changes in values and priorities, including a growing expectation for equity. However, for now, there is a very limited nonmarket value information that could be used for benefit transfer in a rapid economic assessment.

Jackson *et al.* (2019) have estimated household willingness to pay for the reallocation of irrigation water to the Aboriginal nations in the Murray-Darling Basin.

If the IWM project includes such features, the values mentioned could be used by following these steps:

1. Estimate the number of people willing to pay for such a benefit.

2. Gather income information (e.g., median household income) from ABS data. Adjust the value estimates presented above according to the difference in median income of the households and the Victorian or the sample states' population.

3. Adjust the value estimates for inflation using the consumer price index.

4. Multiply the adjusted willingness to pay by the number of relevant households to calculate the aggregate value.

Elkins *et al.* (2016) have estimated people's willingness to pay through direct contributions to maintain the current level of arts events and activities in Melbourne city as $47.42 per household per year. However, these values are not specifically to maintain Traditional Owner arts and culture.

If the IWM project includes such features, the values mentioned above could be used by following these steps:

1. Estimate the number of people willing to pay for such a benefit.

2. Gather income information (e.g., median household income) from ABS data. Adjust the value estimates presented above according to the difference in median income of the households and Melbourne city.

3. Adjust the value estimates for inflation using the consumer price index.

4. Multiply the adjusted willingness to pay by the number of relevant households to calculate the aggregate value.

However, none of the studies mentioned above particularly examine the views of Indigenous communities.

Therefore, we recommend either conducting a primary nonmarket valuation study or reporting this benefit qualitatively.

Table 19: Willingness to pay for irrigation water reallocation to Aboriginal nations. Source: Jackson, Hatton MacDonald et al. (2019)

Household willing to pay…	WTP estimate $/Level/Household, One-off, 2022 $AU)
To support a specific percentage of irrigation water (5% of irrigation water or approximately 300 GL) being reallocated to Aboriginal communities with a cost to their household in the form of a levy on their 2018 water bill – Victoria	16.93 – 24.28
To support 5% of irrigation water or approximately 300 GL being reallocated to Aboriginal communities with a cost to their household in the form of a levy on their 2018 water bill – NSW, VIC, QLD, SA and ACT (whole sample)	24.25 – 24.80

Other benefits

During the regional consultations, several other types of benefits were mentioned, for example, water resource stewardship and reduction of wastage.

Water resource stewardship attitudes are often the required enabling factor to implement IWM projects and influence the risk of implementing such projects. Therefore, it might be more suitable to include them as part of the overall project management perspective.

Reduction of wastage is related to sustainability practices and reduction of costs. The cost saving approach could be applied to calculate and quantify such benefits.

Conclusion

The information presented in this guideline is most suitable for rapid economic assessment of IWM projects at a high design or concept level. It shows that it is possible to conduct a rapid assessment and quantify the monetary values of many of the benefits of IWM projects in regional Victoria. However, there are a few points/caveats to consider:

- The values generated through the process described in this guideline would be rough and approximate. We suggest conducting a comprehensive sensitivity analysis using a wide range (+/- 50%) to understand the implications of using uncertain values on the overall economic performance of a project. This will also guide where more data/information is required.
- In many cases, the use of approximate values is preferable to not including the benefit at all.
- During the rapid economic assessment process, benefit transfer methods could be well suited due to their low cost and time requirement.
- Users must define the scope of the project (with and without scenarios) as clearly as possible. Biophysical modelling, expert judgement and review of prior studies are necessary. The cause and effect or attribution of benefits to the IWM project must be established.
- Economic assessment is an iterative and consultative process. Users need to be prepared to revise their assumptions based on expert feedback and the consultation process.

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