Waterways and the bay

Economic Values in IWM Evaluation – May 2023

Economic Values in IWM evaluation factsheets provide planners with guidance on the selection of values for estimating the economic value of benefits from integrated water management (IWM) projects. The economic values in the Fact Sheets have been chosen so they are directly relevant to investments in the Greater Melbourne area.
These economic values can be used to establish high-level estimates of the potential benefits of proposed IWM and blue-green infrastructure investments. You can then use these high-level benefit estimates in economic analyses, including cost-benefit analysis.
The factsheets are a joint initiative by Melbourne Water, Greater Western Water, South East Water and Yarra Valley Water for consistency in collaborative IWM investment evaluation.

Assessing the economic benefit of waterways and Port Phillip Bay

Greater Melbourne has a complex network of waterways, wetlands and estuaries that flow into Port Phillip and Westernport bays that underpin the region's amenity, vegetation, biodiversity, liveability and economy[1].

The waterways, estuaries, wetlands and surrounding riparian areas provide services and benefits to communities and businesses. Waterway benefits (and services) depend on the natural condition (and/or departure from it). Urban development is the most significant threat to the condition and health of Melbourne's waterways and the bays[1].

Melburnians value and support the preservation of their waterways[1]. The value that society places on waterway systems is associated with the range of benefits that they perceive waterways to provide . Examples are shown in Table 1.

The condition of Melbourne's waterways and bays will degrade in future under a business-as-usual trajectory with increase in urbanization (stormwater run-off, wastewater) and climate change. Targets for pollution management were set to prevent further the deterioration of waterway , Port Phillip Bay and Westernport Bay[2]. Integrated water management and water sensitive urban design can help reduce the damage.

The economic evaluation of any development project should consider the reduction of community benefits from degradation of waterways and bays caused by an increase in pollution and stormwater run-off, and the costs of measures to mitigate such impacts.

The services provided by natural systems are often not fully quantified as economic data is often scarce. Economic values for natural systems often underestimate the full range of benefits provided to society and their associated economic value.

Table 1. Common benefits that community associates with waterways and the bay[1]

Benefit category	Examples
Environmental	Habitat for plants and animals, which support and sustain biodiversity and ecosystems. Regulation of carbon cycle. Regulation and treatment of water by natural systems, water cycle recharge, temperature regulation.
Social	Places to escape the busy urban landscape, for enjoyment of nature, recreation and community well-being and activities.
Cultural	Spiritual connection, ancestral history and places of memories.
Economic	Provision of drinking water for urban areas, water for livestock and crop irrigation, places to travel, tourism and hospitality

What are the different values that can be used?

There are a range of key values that can be considered when valuing the benefits of waterways, wetlands and the bays:

1. **Willingness for amenity from waterways:** willingness to pay (WToP) for amenity from waterways is associated with properties' proximity and access to waterways, urban wetlands and/or lakes and is estimated using the hedonic pricing

[1] Healthy Waterway Strategy (2018- 2028)

[2] Port Phillip Bay Environmental Management Plan (2017-2027)

technique (% increase in property price). It requires the number and type of properties within proximity to the waterway section/water body, their distance to the water asset (up to 300m) and an estimate of median property prices in the original and considered study area (Marsden Jacob 2017).

2. **Willingness to pay for condition of waterways:** the community WToP for a shift in the condition of urban waterways states (Highly modified, sustainable amenity, near natural, ecologically healthy (high amenity and high ecological value) was identified for Melbourne households as $/km/hh/once-off payment based on choice modelling (Cooper et al, 2015). The valuation requires an estimate of the length of waterways whose condition would improve/deteriorate from one state to the another (Table 3).
3. **Willingness to pay to maintain the bay condition:** nitrogen is the limiting factor in Port Phillip Bay (PPB) and total suspended solids (TSS) for Western Port Bay. Recent reviews have established a lack of relevant economic data for valuing the ecological health of PPB[3]. The consolidated findings from the review were:
    - A proxy for the economic value for nitrogen as a to the health of the bay: can adopt either a replacement service cost for N removal or estimate the WToP to preserve PPB water quality.
    - Costs for nutrient removal from stormwater: depend on location, technology and inflows and further data collation is needed.
    - The Melbourne Water nitrogen offset value does not represent the lifecycle cost of nutrient removal and is not recommended as an economic value for Bay condition.
    - No robust economic studies exist that examined the value community places on the health of the Bay. Studies on willingness to pay exist for Sydney only.
    - In the long term an economic evaluation study should be commissioned to close this important knowledge gap.

    In the interim, Melbourne Water recommends:
    - In the absence of a meaningful economic value for Bay condition and given the uncertainty, users can adopt for the value of nitrogen, the cost range for nitrogen removal from stormwater: $6645 per kg TN (as an interim only) with a range of $2,250 - $11,000 per kg TN.

    This cost range is for a limited sample of technologies for N-removal from stormwater (collected by MW).
4. **Willingness to pay for benefits from environmental water release into significant urban, peri-urban and rural waterways:** there is evidence of community WTP for biodiversity and ecological benefits associated with a change in environmental water release into significant urban, peri-urban and rural waterways for the Yarra, Tarago and Werribee, particularly in drought years (Cooper et al 2017). The valuation requires an assessment of
    - the additional amount of water released into the Melbourne system (GL/yr),
    - the waterway length
    - health condition improvement associated with the environmental water release and
    - the number of households (2017$0.991-1.497 GL/hh/once-off environmental water release)
5. **Willingness to pay for wetlands biodiversity and ecology improvement in wetlands:** There is good evidence that Australian households are willing to pay for biodiversity, ecology for healthy wetlands, and wetland rehabilitation and maintenance programs for large regional programs and wetlands, that deliver regional ecology and biodiversity outcomes (WToP for wetlands $/ha/hh/once-off). But there is little evidence that households are willing to pay for additional biodiversity and ecology benefits provided by urban wetlands (Marsden Jacob 2020). The valuation requires the estimate of the areas of additional urban wetlands, their health condition and the number of households impacted (e.g. Greater Melbourne).
6. **Value of recreation at waterways:** few studies exist on the WTP for a recreational visit to freshwater/riverside and the beach/coast, these were estimated as respectively 2017$5-36/person/trip to riverside and 2017$23-57/person/trip to beach using the travel cost method. Valuation requires an assessment of the number of visits per person per year and the number of visitors. There are also values for specific recreational activities in water (e.g. fishing, swimming) (Bennett et al, 2017).

[3] References: (a) McCormick, F. (2016) Valuing the benefits provided by Port Phillip Bay, Internal working paper, DELWP; (b) Marsden Jacob Associates (2020) Melbourne Water monetised social and environmental value guidance, draft report prepared for Melbourne Water; (c) INFFEWS Non-Market Value Tool and resources (2020), CRC Water Sensitive Cities , (d) Melbourne Water (2021) Condition of the Bay and the value of nitrogen in Economic valuation and investment for Port Phillip Bay – Report, August 2021.

- Other values for waterways (e.g.cultural, recreation and regulating services) can be found in the CRC WSC INFFEWS non-market values and the Social and Environmental Values database (MW SEVT). For example, carbon storage and sequestration, flood management, habitat for specific biodiversity species, removal of rubbish and waste from waterways and wetlands each year (Bennett et al 2017), and WTP for stormwater pollutant removal before reaching creek in Sydney (Ifthekar 2019).

When to use each value?

1. Start an assessment with qualitative and quantitative descriptions of the development impacts on local and down-stream water assets, their links to and effects on the natural and man-made environment.

2. Describe how the intervention will affect the local environment (e.g. land, local waterway, wetland and/or bay) and the benefits/disbenefits derived, and how this links to the outcomes that the community values.

3. Define the reference baseline case for the assessment based on the business-as-usual condition of the waterway/wetlands/ bay for the evaluation period.

Table 2 outlines some scenarios where the values previously mentioned are applicable

What values are appropriate to use?

Table 3 outlines common recommended values based on available data. These are approximate and suitable for the early planning stage only. It important to test the sensitivity of the project to low, medium, and high value assumptions (+/-50%).
For additional values refer to the SEVT(2021).

What are the different values that can be used?

There are a range of key values that can be considered when valuing the benefits of waterways, wetlands and the bays:

Willingness for amenity from waterways: willingness to pay (WToP) for amenity from waterways is associated with properties' proximity and access to waterways, urban wetlands and/or

Factors to Consider

Double Counting – In cost-benefit analyses, this can be a significant risk. For example, if the analysis includes both estimates of market benefits (property price uplift) and results from a WToP survey, there is an overlap in the benefits they are measuring. The method used for property price uplift (hedonic pricing) infers that the reason that house prices have risen is that potential property owners will receive the extra benefits (recreation, connection, health, etc) associated with access to the water asset, which raise the price they are willing to pay for the house as a result. Thus inclusion of additional benefit values, would be a double count. SEVT and CRC WSC INFFEWS provides guidance on how to avoid double counting.

Using Willingness to Pay – WToP for waterway ecosystem benefits are assumed to be indicative of the value of the waterways to society. WToP is often used to demonstrate customer support for a project and its outcomes. However, WToP studies are complex to design and there is conjecture about the reliability of WToP studies to accurately reflect customers' ability/acceptance to pay. There is also no direct correlation between the value of the benefit and the ability of community or agencies to invest in a project. This means that if you are looking to justify new and large investments you should run a dedicated WToP survey, using best practice WTP approaches. For further guidance on how to design a robust WToP study consult WSAA (2019).

Partnerships for realization of waterway benefits – the Healthy Waterways Strategy assumes that a collaborative approach is adopted for the protection of waterways across the whole of Melbourne through the combined actions and investment of community, local and State government agencies, industry, utilities and CMAs. Therefore, investment decisions are often assessed on a project by project basis subject to prioritization and contribution by all interested parties to the catchment outcomes.

How to evaluate economic values in IWM evaluation in 'todays dollars'?

All of the economic values in the Fact Sheets are presented in $2021 dollars.
It is essential that the costs and benefits used in an economic analysis are compared on an equal footing. This means all costs and benefits should either include or exclude inflation. When transferring values from the Fact Sheets you will need to make this adjustment to include or exclude inflation yourself.
Typically, cost benefit analysis is undertaken using a real discount rate (i.e. excluding inflation). This means that the discount rate applied does not consider how the value of money will change into the future due to inflation. Instead, all costs and benefits, both now and in

the future, are presented in 'todays dollars'. With 'today' representing the year of the analysis.

For example, imagine an IWM business case is being prepared in 2023 to consider the costs and benefits associated with a recycled water project.

It is proposed that the project will be constructed in 2025, the cost estimate for the project was prepared in 2019 and the potable water saving benefits due to project are expected to be realized in 2030.
This project's costs and benefits should both be expressed based on their value in 'todays dollars', i.e. in real dollars based on the year of the analysis (in this case 2023). This means that the:

- Cost estimate from 2019 needs to be adjusted to reflect the inflation from 2019 to 2023. This can be done based on the Consumer Price Index (CPI) published by the Australian Bureau of Statistics (ABS), by using the Reserve Bank of Australia's Inflation Calculator or the ESC's CPI estimator(2021)[4].
- The benefit value used to monetize the potable water savings should be adjusted to reflect the inflation. For example, if the values are in $2019, they need to be inflated to $2023.

References

Bennett, J.,Cheesman, J; Blamey, R, Kragt, M (2016) Estimating the non-market benefits of environmental flows in the Hawkesbury-Nepean River, Journal of Environmental Economics and Policy, 5:2, 236-248 (in SEVT 2021)

Cooper, B; Crase, L; Burton, M; Maybery, D; Cunningham,C. (2015). The Value of Melbourne's Waterways: A Report on Preliminary Estimates Using Choice Modelling, Centre for Water Policy and Management. La Trobe University. (in SEVT 2021)

Cooper, B., Crase, L. and Burton, M. (2017) The Value of Melbourne's Environmental Water Entitlements: A Report on Preliminary Estimates Using Choice Modelling prepared for Melbourne Water. (in SEVT 2021)

Marsden Jacob Associates and DesignFlow (2017). Lake Management Assessment. Costs, benefits and risks (report prepared for Wyndham City Council) (in SEVT 2021)

Marsden Jacob (2020) Melbourne Water monetised social and environmental economic values guidance, Prepared for Melbourne Water (SEVT 2.5)

Useful Resources

MW SEVT (2021) Social and Environmental Values Table, developed by Marsden Jacob Associates for Melbourne Water

Iftekhar, M.S, Gunawardena, A., Fogarty, F., Pannell, D. and Rogers, A. (2019). INFFEWS Value tool: Guideline (Version 2): IRP2 Comprehensive Economic Evaluation Framework (2017 – 2019). Melbourne, Australia: Cooperative Research Centre for Water Sensitive Cities.

INFFEWS Non-Market Value Tool and resources (2020), CRC Water Sensitive Cities, https://watersensitivecities.org.au/investment-framework-for-economics-of-water-sensitive-cities-inffews-value-tool/, last accessed Sep.2021.

Water Services Association of Australia (WSAA). (2019). Willingness to Pay, Principles for a robust study. August 2019, https://www.wsaa.asn.au/publication/willingness-pay-studies-%E2%80%93-principles-and-guidance, last accessed Sept.2021.

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Last update December 2021. For more information about this factsheet or other information associated with IWM investment evaluation please contact your water utility representative

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[4]For the ESC's CPI converter.

Table 2: Scenarios for waterway analysis

Scenario	Values to Consider					Notes
	1. Amenity Property Price Uplift *	2. Waterways Community WToP for better waterway condition, or to prevent degradation.	3. Bays value of removal of TN into PPB or TSS into Westernport	4. Biodiversity	5.Recreation	
Stormwater infiltration or harvesting above BPEM will reduce run-off into waterways	**Yes**	**Yes**	**Yes**			Consider impacts to waterways and the Bay. Replacement cost is a more appropriate approach, in the absence of an economic value for improvements in the Bay. Refer to the SEVT on how to apply the values.
Transforming an urban drain into stream for local amenity	**Yes**	**Yes**	**Depends**			WToP as per (4). Note that amenity and waterway health are not always mutual. Improvements to the Bay only occur if the drain transformation reduces TN to Port Philip Bay or TSS into Westernport. Refer to the SEVT on how to apply the values.
Management action to improve waterway health (e.g. prevent sewage spills or restore bank vegetation)	**Yes**	**Yes**	**Yes**	**Threatened or iconic species**		WToP would indicate benefits to the community whose preference may be based on water amenity or enhanced environmental values (assumes implicit conservation of biodiversity in waterway). The value of threatened or iconic species could be added, but there is lack of studies.

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	1. Amenity Property Price Uplift *	2. Waterways Community WToP for better waterway condition, or to prevent degradation.	3. Bays value of removal of TN into PPB or TSS into Westernport	4. Biodiversity	5.Recreation	
New development built in proximity to waterway or other water body	**Yes**	**Yes. Loss of waterway heath unless stormwater impact is mitigated**	**Yes. Loss of PPB WPB health unless stormwater impact is mitigated**	**Loss of waterway heath or species habitat**	**No**	WToP would indicate benefits to the community whose preference may be based on water asset. But new development could have negative impacts associated with waterway health that may need investigation.
Increase in environmental flows into waterways for waterway health	**No data**	**Yes**		**(5)**		WToP associated with improvement in waterway environmental health. It may result in additional benefits associated with habitat for threatened or iconic species and/or recreation in some cases or amenity improvement
Recreation at waterway					**(6)**	WToP associated with additional access to recreation sites. Beware of substitution effects.
Wetlands areas increase or conservation	**Low confidence value**	**No data**	**Depends**		**(6)**	See also to increase in number of recreation visits

Note: Amenity captured through property price uplift is an overarching value that captures other local benefit

Table 3: Economic values for waterways and the bay

Economic benefit	Description	Value[5]	Unit	Frequency of Payment	Study year	Source
1. Property Price Uplift						
Residential (Houses and townhouses)	Proximity to urban wetland (marginal impact)	0.2%	% of average property price for houses	One-off	n.a	Increased property value for each additional % closer to the asset, up to 300 metres. In SEVT (2021)
Residential (Houses and townhouses)	Proximity to urban recreational lake (marginal impact)	0.4%	% of average property price for houses	One-off	n.a	Increased property value for each additional % closer to the asset, up to 300 metres. in SEVT
2. Recreational amenity benefits						
Recreation benefits	WTP for visiting an urban waterway (average)	$16	$/person trip		2018	Range $5-36 using the travel cost method In SEVT (2021). This requires estimation of the number of visitors in a year.
Recreation benefits	WTP for visiting a beach or coast	$23-57	$/person/day trip		2018	Range based on the travel cost method. This requires estimation of the number of visitors in a year in SEVT (2021).
3. Health benefits						
Health benefits	Total benefit of a person actively recreating for 75 minutes outdoors each week for the remainder of their lifetime; the sum of the physical health, mental health and productivity benefits (average)	$300	$/person once off		2018	In SEVT (2021)
4. Community willingness to pay for waterway health						

[5] Note: Values will need to be adjusted to the year of the evaluation.

Economic benefit	Description	Value[5]	Unit	Frequency of Payment	Study year	Source
Urban Waterway – Highly Modified to Amenity improvement	WToP for a 1 km Shift in Urban Waterway from Highly Modified (low amenity and low ecological value) to Sustainable Amenity (high amenity and low ecological value) ($2015)	$0.05	$/km/household	Once-off	2015	SEVT based on Cooper et al (2015)
Urban Waterway - Highly Modified to Near Natural	WToP for a 1 km Shift in Urban Waterway from Highly Modified to Near Natural (low amenity and high ecological value)	$0.185	/km/household	Once-off	2015	SEVT based on Cooper et al (2015)
Urban Waterway - Highly Modified to Ecologically Healthy	WToP for a 1 km Shift in Urban Waterway from Highly Modified to Ecologically Healthy (high amenity and high ecological value)	$0.075	$/km/household	Once-off	2015	SEVT based on Cooper et al (2015)
Urban Waterway – Sustainable Amenity to Ecologically Healthy	WToP for a 1 km Shift in Urban Waterway from Sustainable Amenity to Ecologically Healthy	$0.185	$/km/household	Once-off	2015	SEVT (2021) based on Cooper et al (2015)
Urban Waterway - Sustainable Amenity to Near Natural	WToP for a 1 km Shift in Urban Waterway from Sustainable Amenity to Near Natural	$0.075	$/km/household	Once-off	2015	SEVT (2021) based on Cooper et al (2015)
Urban Waterway - Ecologically Healthy to Near Natural	WToP for a 1 km Shift in Urban Waterway from Ecologically Healthy to Near Natural	$0.04	$/km/household	Once-off	2015	SEVT (2021) based on Cooper et al (2015)
5.**Willingness to pay for environmental water release into surface waters**						
Environmental water release into waterways	WToP for biodiversity and ecological outcomes associated with a change in environmental water release into significant urban, peri-urban and rural waterways for the Yarra, Tarago and Werribee, particularly in drought years	$1.244	$/GL/household	once off	2017	Cooper et al (2017) in SEVT(2021)

Economic benefit	Description	Value[5]	Unit	Frequency of Payment	Study year	Source
6. Values of nitrogen removal to maintain Port Phillip Bay condition						
Port Philip Bay	Service replacement cost for nitrogen removal from stormwater to maintaining maintain Port Philip Bay in current good condition	$2,460-12,000	$/kg TN	Once-off	2015	Range based on MW interim advice in SEVT (2021)
7. Willingness to pay for healthy wetlands						
WTP for additional healthy wetlands	WToP for additional area of healthy urban wetlands providing ecology and biodiversity outcomes	$0.0016	$ per hectare per household	Once-off	2017	Based on Melbourne households in SEVT (2021)