

# Water (Lake Eildon Recreational Area) (Houseboats) Regulations 2024 Regulatory Impact Statement





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.

DEECA is committed to genuinely partnering with Victorian Traditional Owners and Victoria's Aboriginal community to progress their aspirations.



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# Table of Contents

<b>Executive Summary</b> .....	<b>4</b>
<b>1. Introduction and context</b> .....	<b>10</b>
<b>1.1 Lake Eildon’s history</b> .....	<b>10</b>
<b>1.2 Reviewing and remaking the Houseboat Regulations</b> .....	<b>10</b>
<b>1.3 Stakeholder consultation informing this regulatory reform</b> .....	<b>10</b>
<b>1.4 Houseboats and the houseboating industry</b> .....	<b>11</b>
<b>1.5 Water pollutants in Lake Eildon</b> .....	<b>11</b>
<b>1.6 Water pollutants from houseboats</b> .....	<b>12</b>
1.6.1 Blackwater.....	12
1.6.2 Greywater.....	12
1.6.3 Other water pollutants.....	13
<b>2. Legislative and strategic context</b> .....	<b>14</b>
<b>2.1 Regulation of houseboats on Lake Eildon</b> .....	<b>14</b>
<b>2.2 Broader legislative and regulatory context</b> .....	<b>15</b>
<b>2.3 Policy and strategic context for Lake Eildon</b> .....	<b>17</b>
<b>2.4 Key changes to context since 2013 and approach to regulation elsewhere</b> .....	<b>18</b>
<b>3. Defining the problem</b> .....	<b>22</b>
<b>3.1 Problem statement</b> .....	<b>22</b>
<b>3.2 Causal link from houseboat wastewater to risk of harm to human health, the environment and broader amenity of the lake</b> .....	<b>22</b>
<b>3.3 Evidence of the problem</b> .....	<b>25</b>
<b>3.4 Summary of the residual problem</b> .....	<b>29</b>
<b>3.5 Broader problems with houseboating on Lake Eildon</b> .....	<b>29</b>
<b>4. Objectives</b> .....	<b>30</b>
<b>5. Options</b> .....	<b>31</b>

5.1	Houseboat licensing .....	31
5.2	Houseboat blackwater .....	33
5.3	Houseboat greywater.....	34
6.	Options assessment.....	36
6.1	Overview of the approach to options assessment.....	36
6.2	Packaging options for assessment .....	38
6.3	Impacts .....	41
6.4	Break even analysis results .....	43
6.5	Distributional analysis .....	49
6.6	Preferred package.....	51
7.	Implementation plan .....	52
7.1	Regulations.....	52
7.2	Continuation of licensing arrangements, blackwater requirements and broader regulation of houseboats .....	53
7.3	Transition for greywater requirements .....	53
7.4	Ongoing monitoring and enforcement of greywater requirements .....	53
7.5	Stakeholder communications and engagement.....	54
7.6	Resourcing needs .....	54
8.	Evaluation strategy .....	55
	Appendix 1 Environmental Reference Standard (Government of Victoria, 2021) .....	58
	Appendix 2 Houseboat numbers and greywater discharge estimates .....	60
	Appendix 3 Further details on legislative and regulatory context .....	62
	Appendix 4 Economic analysis Impact quantification methodology and inputs.....	66

# Executive Summary

## Context

Lake Eildon is a large man-made lake on the upper reaches of the Goulburn River. The original storage known as Sugarloaf Reservoir was completed in 1929.<sup>1</sup> In 1951, work commenced to enlarge the lake to its present capacity to meet Victoria's irrigation and electricity needs. The enlargement was completed in 1955 and the storage was renamed Lake Eildon.

Lake Eildon is the largest water storage in Victoria and supplies around 60% of water used in the Goulburn-Murray Irrigation District (GMID). Some 96% of the water diverted from the GMID is delivered to water entitlement holders for irrigation or environmental purposes. The remaining 4% is supplied to urban water authorities for domestic water supply.

Although Lake Eildon was built to supply water for irrigation, towns and cities and other downstream users along the Goulburn River, it has become one of Victoria's most popular tourist resorts. The lake and surrounding national park are appreciated for their scenic beauty and outdoor activities. Lake Eildon is also the only inland waterway in Victoria where houseboating is allowed, with around 700 houseboats on the lake. Since 29 September 1971, houseboating on Lake Eildon has been regulated in Victoria (Governor in Council, 1971). The current Water (Lake Eildon Recreational Area) (Houseboats) Regulations (2013) will sunset on 11 June 2024.

The Department of Energy, Environment and Climate Action (DEECA) is reviewing the current Houseboat Regulations to see what changes are needed for the next version of the regulations. One key change since the previous regulations were introduced in 2013 is the introduction of the General Environmental Duty contained in the *Environmental Protection Act 2017*. The General Environmental Duty imposes a requirement on every Victorian to minimise risks of harm to human health and the environment from pollution or waste 'as far as reasonably practicable'. This requirement, and how it applies to houseboat owners on Lake Eildon, is an important consideration informing the regulatory refresh process. The remade regulations will help ensure houseboat owners are complying with the law and doing their part to protect the lake, both now and for future generations.

This Regulatory Impact Statement (RIS) looks at remaking the Houseboat Regulations.

## Defining the problem

For the purposes of this regulatory refresh, the problem statement is defined as:

Without appropriate management controls, houseboat wastewater entering Lake Eildon poses a risk of harm to human health, the environment, and the broader amenity of the lake.

Although houseboat blackwater (wastewater from toilets) discharges are fully regulated, houseboats on Lake Eildon are currently granted an exemption from statewide regulations that require all greywater discharges to waterways to be either fully contained or treated. This exemption is given on the understanding that appropriate greywater management approaches will be established through the houseboat regulations when they are remade. As such the focus of the regulatory refresh is on greywater.

Greywater is a mixture of everything that goes down a houseboat drain, apart from toilets, and is currently permitted to go straight into the lake untreated. Houseboat greywater discharge is a small but confirmed contributor to pollution in Lake Eildon. Greywater contains a range of pollutants, with nutrients and pathogens of most concern from the perspective of the Department of Health and Environment Protection Authority. The nutrients in greywater (nitrogen and phosphorus) contribute to algal blooms which contain toxins that are harmful to humans and the environment. The kinds of pathogens often found in greywater can cause gastro-intestinal illnesses that can lead to vomiting and diarrhea. Sometimes these infections can be severe and have serious consequences. Lake users can pick up pathogens through swimming and other direct contact with the lake's water and by using untreated lake water onboard houseboats for showering and drinking.

The risks of possible illness are higher in the waters around houseboats that are releasing untreated greywater into the lake. The risks go up where there are more houseboats in a small area without much

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<sup>1</sup> Goulburn-Murray Water, *Welcome to Lake Eildon*, ([https://www.gmwater.com.au/downloads/gmw/Storages/Lake\\_Eildon\\_Fact\\_Sheet\\_FINAL\\_for\\_web.pdf](https://www.gmwater.com.au/downloads/gmw/Storages/Lake_Eildon_Fact_Sheet_FINAL_for_web.pdf))

water flow, like marinas, bays and inlets. Risks also increase when lake water levels are low, like during the Millennium Drought.

## Objectives

The overall objective being sought through regulation is to:

Support continued community benefits from use and enjoyment of waters and surrounds of Lake Eildon Recreational Area through achieving low risks (likelihood and consequence) to human health and environment associated with pollutants from houseboat wastewater entering Lake Eildon.

In addition to this primary objective, there is also a need to:

- minimise regulatory burden
- ensure the way ahead is implementable (with particular focus on functionality of any treatment systems required on houseboats)
- provide clarity for houseboat owners and industry, and
- be conscious of the broader impacts of the houseboating and related activities on the regional economy.

## Options

This RIS analyses options relating to three areas of regulation: houseboat licensing, blackwater and greywater. Given interdependencies between these areas, the options have been packaged for the purpose of assessment. These packages are summarised in Table 1 and vary only in terms of the level of intervention for greywater, ranging from a low level of intervention in Package A to a high level of intervention in Package C. This is because greywater is the focus of the RIS, as it is not currently regulated. The status quo around houseboat licensing and blackwater are working well and hence the only options analysed for these areas are to replicate the existing regulations (with a small update to the terminology used around blackwater systems to reflect new technologies). A simple greywater system referenced in Table 1 would include lighter touch interventions such as sink strainers/filters and grease traps. A comprehensive system may include a filtration system and disinfection unit in addition to sink strainers/filters and grease traps.

**Table 1: Packages of options for assessment**

Package	Licensing	Blackwater	Greywater
Base case	Licensing through other means	No specific regulation	No specific regulation
Package A – low	Replicate current licensing provision through updated regulations*	Replicate and update the current blackwater provisions in regulations	Simple greywater treatment interventions for all Category 3 and above houseboats (i.e. simple devices such as sink strainers/filters and under-sink grease traps)
Package B – central	Replicate licensing provision through updated regulations*	Replicate and update the current blackwater provisions in regulations	Simple greywater treatment interventions for all private Category 3 and above houseboats (i.e. simple devices such as sink strainers/filters and under-sink grease traps) and comprehensive greywater treatment systems for new <sup>2</sup> and commercial hire category 3 and above houseboats <sup>3</sup> .
Package C – high	Replicate licensing provision through updated regulations*	Replicate and update the current blackwater provisions in regulations	Comprehensive greywater treatment systems for all Category 3 and above houseboats

\* The language of the regulations would be updated to incorporate relevant new technology such as macerator and vacuum toilets in the regulation schedules. The updates do not change the nature nor burden of the requirements.

## Analysis

Houseboat greywater is an established source of pollutants that increase the risk to human health and the risk of algal blooms, which have consequential impacts on tourism and recreation within the Lake Eildon region. We have used a cost benefit analysis (CBA) framework and break even analysis (BEA) to assess the relevant economic, environmental and social impacts of each package. Specifically, we have calculated the increase in tourism and reduction in health risk needed for the benefits of the packages to meet the costs (or 'break even').

Key results are set out in Table 2, (all costs and benefits are presented incremental to the base case). The key driver of this change in costs is the cost of a comprehensive greywater treatment system, including installation, which costs in excess of \$10,000 compared to a simple greywater treatment system which costs under \$1,000 including installation. Given Package C requires the most comprehensive greywater treatment systems, it is the highest cost package. Full details on the input costs are provided in Appendix 4.

We found that an increase in tourism of less than 1% and decrease in the risk of health of less than 1% would be needed for each of the packages to break even. For example, for Package B to break even, the regulation would need to lead to an increase in 0.2% in tourism to Lake Eildon (over and above the projected 4% per annum growth to 2030) and a reduction in the health risk of 0.2%.

<sup>2</sup> A **new houseboat** is defined in the exposure draft regulations to mean a houseboat for which—

- (a) an application for a houseboat licence is made on or after 11 June 2026; and
- (b) no houseboat licence has previously been issued

<sup>3</sup> For noting: The regulations nomenclature uses 'type 1' to refer to commercial hire houseboats category 3 and above, 'type 2' to refer to new houseboats category 3 and above and 'type 3' to refer to private houseboats category 3 and above.



Linking these results back to the underlying driver of the benefits, when water quality issues do arise, they may affect these factors for a prolonged period of time. For example, the blue-green algae warning for Lake Eildon that was issued by Goulburn Murray Water (GMW) on 21 April 2023 remained in place for 88 days.

**Table 2: Summary of quantitative and qualitative analysis results – 30 year appraisal period**

	Package A	Package B	Package C
Present value of costs (\$m FY23)	2.8	5.7	18.4
Present value of break even benefits (\$m FY23)	2.8	5.7	18.4
Break even increase in tourism (%)	0.1%	0.2%	0.7%
Break even reduction in gastro cases (%)	0.1%	0.2%	0.5%
Impact on biodiversity	Minor positive	Minor positive	Minor positive
Heritage and cultural value	Neutral	Neutral	Neutral
Impact on waterbody health	Minor positive	Minor positive	Minor positive

A distributional analysis demonstrates that houseboat owners are bearing most of the costs in this economic analysis. While they do accrue some benefits from the regulation, their net position is still negative. This aligns with the premise of the regulation – reducing the negative impact that houseboat owners impose on society from their greywater discharge into Lake Eildon. All other parties benefit from the packages compared to the base case.

The analysis assumes simple greywater interventions and comprehensive greywater systems will be installed progressively in the years leading up to the compliance deadline (see below and Appendix 4 for more detail). This assumes installation of greywater interventions will occur with the slipping of houseboats (every 5-7 years) for maintenance and inspections. This also accounts for industry capacity to undertake installations (see Section 5). Other initiatives will support and encourage uptake before the deadline (see Section 7).

Under each option analysed there would be transition periods for installing greywater interventions.

- houseboats requiring simple greywater interventions must have them installed by 1 January 2034
- new houseboats<sup>4</sup> requiring comprehensive systems must have them installed by 11 June 2027
- private and commercial houseboats requiring comprehensive systems must have them installed by 1 January 2034

It is assumed a comprehensive system will be available on the market within 2 years. This assumption is based on there already being suppliers with comprehensive greywater treatment system technologies being developed and tested on Lake Eildon houseboats. The technology for simple interventions is readily available to houseboat owners.

## Preferred option

### The preferred package is Package B

Package B would require simple greywater treatment interventions (i.e. simple devices such as sink strainers/filters and under-sink grease traps) for private Category 3 and above houseboats and comprehensive greywater treatment systems for new and commercial hire category 3 and above

<sup>4</sup> A **new houseboat** is defined in the exposure draft regulations to mean a houseboat for which—

- an application for a houseboat licence is made on or after 11 June 2026; and
- no houseboat licence has previously been issued

houseboats<sup>5</sup>. Package B would not require any existing private houseboat to retrofit a comprehensive greywater treatment system.

The key reasons Package B is the preferred package is that it:

- It is expected to best balance the anticipated additional costs for houseboat owners with the benefits to the broader community.
- Balances costs on houseboat owners with benefits delivered to the broader region. It requires houseboat owners to make changes that are reasonably practicable as part of meeting their general environmental duty to limit risk and targets a key source of the highest risk pollutants: pathogens and nutrients from kitchen wastewater. Existing private owners with Category 3-6 houseboats would face an upfront cost of around \$1,000 to install a simple greywater intervention (i.e. devices such as sink strainers/filters and under-sink grease traps). Put into context, a Category 3-6 licence can have a resale value of \$80,000-100,000 (which provides a proxy for houseboats owners willingness to pay to be on Lake Eildon), making the cost of the greywater intervention a relatively modest cost.
- Provides a practical implementation pathway with an extended transition period.

Competition and small business impacts of the preferred option were considered. It is not clear that the preferred package would impact on competition. There is the potential for the first supplier to meet specifications and testing requirements of greywater systems to corner the market though it should not be a large barrier to other suppliers entering the market. More broadly, the package is likely to benefit small businesses as the houseboat industry at Lake Eildon, which will benefit from installing and maintaining the greywater systems, largely comprise small businesses.

## Implementation and evaluation

The proposed regulations are intended to take effect on 11 June 2024. Under the preferred option (Package B), new houseboats category 3 and above would need to install a comprehensive greywater treatment system by 11 June 2027 (3 years after the regulations are remade). For commercial houseboats category 3 and above a comprehensive greywater treatment system would need to be installed by 1 January 2034 (almost 10 years after the regulations are remade). Private houseboats category 3 and above would need to install simple greywater treatment interventions by 1 January 2034 (same date as commercial houseboats).

As part of ongoing engagement with houseboat owners and operators, DEECA will undertake public consultation on the RIS. This forms part of a broader engagement strategy that has informed development of the RIS. The implementation plan for the proposed regulations also includes:

- supporting testing of comprehensive greywater treatment technology against specifications for use on houseboats
- support for houseboat owners to adopt greywater treatment requirements
- updating compliance monitoring processes such as houseboat inspections to include greywater treatment installation requirements.

A midterm evaluation will be completed after the regulations have been in effect for 5 years and a subsequent evaluation before they sunset on 11 June 2034. (See Section 7 and 8 for more detail)

## Next steps

We are seeking feedback on this RIS from all stakeholders through public consultation from 27 March to 24 April 2024.

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<sup>5</sup> For noting: The regulations nomenclature uses 'type 1' to refer to commercial hire houseboats category 3 and above, 'type 2' to refer to new houseboats category 3 and above and 'type 3' to refer to private houseboats category 3 and above.

## Structure of this document

The remaining sections of this RIS covers the following:

- Section 1 provides background about reviewing and remaking the Houseboat Regulations and how this RIS fits within the broader reform process
- Section 2 outlines the legislative and strategic context
- Section 3 defines, and provides evidence, of the problem
- Section 4 identifies objectives for regulatory reform
- Section 5 details the reform options
- Section 6 assesses options
- Section **Error! Reference source not found.** describes the implementation plan
- Section 8 describes the evaluation strategy
- Appendix 1 outlines the Victorian Government's Environmental Reference Standard
- Appendix 2 contains details on houseboat numbers and greywater discharge estimates
- Appendix 3 provides further detail on the legislative and regulatory context, and
- Appendix 4 details the methodology and inputs used to value the costs and benefits of different regulatory interventions.

# 1. Introduction and context

This section provides background on the history of Lake Eildon, reviewing and remaking the Houseboat Regulations and how this RIS fits within the broader reform process.

## 1.1 Lake Eildon's history

Lake Eildon is a large man-made lake on the upper reaches of the Goulburn River. The original storage known as Sugarloaf Reservoir was completed in 1929.<sup>6</sup> In 1951, work commenced to enlarge the lake to its present capacity to meet Victoria's irrigation and electricity needs. The enlargement was completed in 1955 and the storage was renamed Lake Eildon.

Lake Eildon is the largest water storage in Victoria and supplies around 60% of water used in the Goulburn-Murray Irrigation District (GMID). Some 96% of the water diverted from the GMID is delivered to water entitlement holders for irrigation or environmental purposes. The remaining 4% is supplied to urban water authorities for domestic water supply.

Although Lake Eildon was built to supply water for irrigation, towns and cities and other downstream users along the Goulburn River, it has become one of Victoria's most popular tourist resorts. The lake and surrounding national park are appreciated for their scenic beauty and outdoor activities. It is also the only inland waterway in Victoria where houseboating is allowed, with around 700 houseboats on the lake. Since 29 September 1971, houseboating on Lake Eildon has been regulated in Victoria (Governor in Council, 1971). The current Water (Lake Eildon Recreational Area) (Houseboats) Regulations (2013) will sunset on 11 June 2024.

## 1.2 Reviewing and remaking the Houseboat Regulations

The Department of Energy, Environment and Climate Action (DEECA) is reviewing the current Houseboat Regulations to see what changes are needed for the next version of the regulations.

DEECA is working with the houseboating community to understand and manage the risks to people and the lake, in line with Victoria's current laws and regulations. The Houseboat Regulations are reviewed every 10 years, to make sure they are working well to protect the health of the lake and the people who rely on it. 10-yearly reviews are common with all subordinate legislation in Victoria.

The focus of the regulations is to develop fit for purpose requirements for three key areas of the houseboat regulatory framework:

- licences
- blackwater management, and
- greywater management.

The current regulations were last reviewed and remade in 2013 and were due to expire on 12 June 2023. The regulations have been extended for another 12 months, to 12 June 2024 to provide more time to test the changes that are being considered through additional consultation and technical work.

DEECA engaged Frontier Economics to provide expert economic analysis of alternative policy options and assist with preparing this RIS.

## 1.3 Stakeholder consultation informing this regulatory reform

Consultation is an important element of developing a RIS. DEECA has made consultation a key element of their review of the Water (Lake Eildon Recreational Area) (Houseboats) Regulations (2013).

As part of this consultation, DEECA formed a Houseboat Stakeholder Working Group. The purpose of the Stakeholder Working Group is to provide input from stakeholders on the evidence base and to inform the policy pathway for improving the management of greywater generated from the Lake Eildon fleet as part of the review of regulations. Two stakeholder workshops have been held with the Houseboat Stakeholder

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<sup>6</sup> Goulburn-Murray Water, *Welcome to Lake Eildon*, ([https://www.gmwater.com.au/downloads/gmw/Storages/Lake\\_Eildon\\_Fact\\_Sheet\\_FINAL\\_for\\_web.pdf](https://www.gmwater.com.au/downloads/gmw/Storages/Lake_Eildon_Fact_Sheet_FINAL_for_web.pdf))

Working Group specifically on the RIS. Attendees at these workshops have included representatives from Goulburn Murray Water, houseboats owners, the houseboat industry and local council (Murrindindi Shire).

The Houseboat Stakeholder Working Group were provided with a Consultation Paper which followed the structure of this RIS<sup>7</sup> and had opportunity to provide feedback on the Consultation Paper to inform this RIS.

DEECA has also formed both a Technical Working Group and a Water Quality Working Group. The Technical Working Group (which is a subset of the Houseboat Stakeholder Working Group) comprises members with technical expertise in houseboat construction and plumbing in addition to Competent Persons who undertake compulsory houseboat inspections. Their role is to provide advice to DEECA and GMW staff on the suitability of technical provisions with the Houseboat Regulations. The Water Quality Working Group includes representatives from the Victorian Environmental Protection Agency, Victorian Department of Health, Goulburn Murray Water and Goulburn Valley Water. The Water Quality Working Group is intended to support effective policy pathways for improving the management of wastewater from the Lake Eildon houseboat fleet, with a focus on greywater and develop shared understanding of key risks to human health and the environment related to houseboat greywater discharge, identifying pollutants of concern to be targeted through policy interventions and associated generation and pollution pathways. Both these Working Groups have assisted in developing regulation options that are both technically feasible and deliver benefits in reducing pollution.

DEECA will continue engaging with stakeholders across the remainder of the regulation development and implementation process.

#### 1.4 Houseboats and the houseboating industry

The Lake Eildon Boat Club (2023) dates the first use of houseboats on Lake Eildon in the early 1960's. In subsequent years the numbers of houseboats rose and relevant authorities took action to manage their use and impact on the lake. This included requiring licences and placing conditions on the capture and disposal of blackwater (wastewater from toilets).

The growth in houseboat numbers on the lake also led to the development of a range of commercial services such as:

- marinas and slipping facilities<sup>8</sup>
- houseboat building and maintenance businesses
- houseboat hire and sales businesses, and
- storage businesses for houseboat owners to keep smaller boats and other items near the lake.

These services provide significant local economic activity and employment opportunities. There is a desire from those involved in the houseboat industry to sustain and grow the industry given its regional importance.

GMW regulate the use of houseboats on the lake. This includes administering houseboat licences as well as providing houseboat domestic waste management at marinas (skips) and operating wastewater barges at Point Worner and Jerusalem Creek.

As of 2023 GMW has issued 724 houseboats licences for Lake Eildon. These range across seven size categories, from 10m x 3.5m for Category 1 to 18.3m x 7.25m for Category 6. There is a larger (Category 7) houseboat classification although no houseboat is currently licenced outside categories 1 to 6. Licensing by size category helps address practical issues, such as ensuring marinas have appropriately sized moorings for the fleet. Temporary licences are available for short periods (e.g. school holidays) for small houseboats of less than 10m x 3.5m, so long as they are can be transported by trailer, and are able to be transported without the need for a Vic Roads permit.

#### 1.5 Water pollutants in Lake Eildon

Given its many and varied uses, reducing risks to water quality in Lake Eildon is a shared objective held by a range of stakeholders. There is a need to supply suitable quality water to downstream customers and minimise pollutants given the risks to human health and environmental values. Many recreational users of

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<sup>7</sup> The only difference was the consultations excluded the implementation plan and evaluation strategy chapters, and instead included a next steps chapter.

<sup>8</sup> Slipping facilities provide for houseboats to be removed from the lake so that upgrades and essential maintenance can be undertaken.

the lake indicate that they take actions to minimise water pollution given that they enjoy visiting the lake because of its natural amenity and want to preserve it so they and future generations can continue to do so.

However, pollutants enter Lake Eildon from a variety of sources including:

- upstream erosion
- faecal matter from livestock and other animals
- poorly managed septic tanks
- runoff containing fertilizers, litter
- contaminants from previous mining operations, and
- houseboat wastewater

There are a variety of pollutants that enter the lake from these sources with varying impacts such as:

- sediments that raise turbidity levels and contain nutrients, including those that are required by toxic Blue-green algae to grow
- pathogens that can cause disease in people and animals
- salts that increase salinity levels which at high concentrations have environmental and irrigation water impacts
- heavy metals that are toxic to plants, animals and people at high levels
- pharmaceuticals that can affect physiological processes in fish and other aquatic species
- microplastics that can be consumed by fish and other aquatic species, and
- solids and emulsions that can accumulate into floating slicks and scums, impacting on the lake's amenity and coating objects like pontoons.

## 1.6 Water pollutants from houseboats

Houseboats have been identified as a source of wastewater pollutants to Lake Eildon for many years, with concerns about water pollution from the fleet as early as 1962 (2017; Jacobs Group (Australia) Pty Ltd, 2017). Houseboats produce blackwater and greywater that contain a range of pollutants.

### 1.6.1 Blackwater

Blackwater is the water and waste that is flushed down the toilet. Houseboat blackwater has been required to be contained and stored in houseboats for many decades. Once stored, it is then pumped out into wastewater barges at Point Worner and Jerusalem Creek. The blackwater is transferred from the barges to the Eildon Treatment Plant, where it goes through the same treatment process as wastewater from local houses and businesses.

Blackwater contains high concentrations of pathogens that can lead to severe, even fatal illnesses if consumed. It also has a very unpleasant smell and appearance.

### 1.6.2 Greywater

Greywater is the used water and waste that goes down all houseboat drains, apart from toilets - that is, any wastewater which isn't covered by blackwater (as defined in section 1.6.1). This includes the kitchen and bathroom sinks, showers, dishwashers and washing machines.

Depending on the source, greywater can contain a range of impurities, bacteria, microbial pathogens and pollutants. For instance, greywater can be contaminated by bacteria and microbial pathogens through simple daily activities such as handwashing after using the toilet. In addition, many products used in washing dishes, showering and doing the laundry are phosphate and nitrogen rich, and can promote cyanobacteria, or blue green algal growth on discharge into lake water.

Greywater includes wastewater that has been discharged from a kitchen sink. This water has been used in the galley during food preparation and/or for cleaning dishes. Greywater from the kitchen can contain a range of impurities, bacteria, microbial pathogens and pollutants. Dissolved or suspended solids such as fats, oils, food scraps and nutrients arise from meal preparation and cooking, particularly from a barbeque. Microbiological pathogens such as bacteria or viruses can result from food preparation, particularly fresh meat and chicken preparation.

Greywater is discharged by most houseboats without prior treatment. As such, greywater is a direct pollution source introduced into Lake Eildon.

Figure 1 summarises the risks associated with water pollution from houseboats, along with the key pollutant source. The priority risks for this regulatory reform are pathogens which impact human health and nutrients which cause algal blooms.

**Figure 1: Houseboat greywater products and contaminants**



### 1.6.3 Other water pollutants

Houseboats and houseboating can also cause water pollution in other ways. These include accidental spills from decanting petrol from fuel storage containers into ancillary boats, and the release of bilge oil and oily bilge water from bilge pumps contained in non-air-tight subfloor flotation pontoons, or grease discharged from engine maintenance.



## 2. Legislative and strategic context

To understand the current regulation of houseboats on Lake Eildon, it is useful to briefly review the legislative and strategic context and how this has evolved over time. The sections below set out further details on these areas.

### 2.1 Regulation of houseboats on Lake Eildon

Since 29 September 1971, houseboating on Lake Eildon has been specifically regulated in Victoria (Governor in Council, 1971). Licensing was introduced and houseboat owners were required to fit on-board blackwater holding tanks to address increasing public health and water quality concerns. Up until that time houseboats had typically discharged blackwater directly into the lake.

The original houseboat licencing system introduced categories and fees that reflected the size of vessels, the number of berths and therefore the likely use of sewage disposal facilities. Following consultation with the houseboat industry at the time, the maximum vessel length was set at 45 feet (13.7m).

The number of vessels on the lake increased rapidly until the number was frozen for category 2 to 5 boats in 1976. The limit for category 2 to 5 boats was fixed at 630, of which 559 were private vessels and 71 commercial hire vessels. As a result of recommendations contained in a recreation and land use study completed in 1979, an additional 80 licences were issued in 1983.

Recreation uses of Lake Eildon, including houseboating, are currently permitted under conditions set out in:

- Water (Lake Eildon Recreational Area) (Houseboats) Regulations (2013) (Houseboat Regulations)
- Water (Recreational Area) Regulations (2023)
- Houseboat Licence Terms and Conditions (Goulburn Murray Water Corporation, 2019)

There is also a range of other regulations that apply to aspects of houseboat construction and use. These are summarised in section 2.2.

The objectives of the Houseboat Regulations are to 'provide for the control and management of houseboat operations in the Lake Eildon Recreational Area.' These objectives have been unchanged since 1971. Provisions within the regulations have been primarily concerned with mitigating risks of water pollution in Lake Eildon and facilitating recreational uses of the lake. The regulations have sought to achieve this by:

- establishing a regime for houseboat licencing and compliance, and
- ensuring integrity of houseboats on licence, alteration and transfer – ensuring that their wastewater systems are in suitable condition, and they fit within the size limits of the category they are licenced in etc.

Given the recognised level of risk of blackwater to the Lake Eildon catchment and populations drawing water from it, the State Government has sought to eliminate risks from blackwater as far as practicable. Blackwater discharge into Lake Eildon has been regulated since 1971 (Governor in Council). In 1991 blackwater provisions (Section 12 and Schedule 2), were complemented by the addition of requirements for installation, operation and maintenance for venting, piping and hoses, as well as testing and a requirement for operating instructions to be visible (2003). The amendments also required an identification plate to be installed on blackwater systems.

In the 2013 remake of the Houseboat Regulations, the Government introduced measures to reduce pollution from houseboat greywater by requiring all houseboats to install greywater treatment systems certified according to *Australian Standard 4995-2009 Greywater treatment systems for vessels operated on inland waters* (Standards Australia, 2009) by 2020. The then Minister for Water revoked these measures in 2017 after a review by Jacobs (2017) found that the greywater measures identified were not fit for purpose. The review was undertaken in response to concerns by houseboat owners around the suitability of the regulations and effectiveness of some certified systems installed for operation on the lake. The Minister committed to developing suitable regulations to address greywater pollution when remaking the regulations prior to their sunset. This would be undertaken in consultation with houseboat owners and other stakeholders.

As with all regulations, under section 5 of the *Subordinate Legislation Act 1994* the current regulations were set to sunset on 12 June 2023. DEECA sought the maximum possible extension of one year for the current



regulations. The extension was granted on 30 May 2023, until 11 June 2024. This RIS looks at options for the regulations after 11 June 2024.

## 2.2 Broader legislative and regulatory context

In addition to the 2013 Houseboat regulations (Governor in Council, 2013), there are a number of other legislative and regulatory settings which have a broader relevance to houseboating on Lake Eildon. Table 3 summarises these key legislative and regulatory settings.

**Table 3: Summary of most relevant broader legislative and regulatory context**

Act	Summary of scope	Key elements for houseboating on Lake Eildon
<i>Water Act 1989</i>	In Victoria, the <i>Water Act 1989</i> determines water uses, duties and obligations of all water holders. Section 324 of the <i>Water Act 1989</i> enables the development of houseboat related regulations.	Key element is the Water Act regulations Water (Lake Eildon Recreational Area) (Houseboats) Regulations S.R. No 60/2013 (2013) – outlined above in Section 2.1  Water (Recreational Area) Regulations 2023 contains a range of objectives related to the maintenance of water quality in waterways, promotion of safety, enjoyment and recreation of visitors as well as the maintenance and improvement of biodiversity.
Water (Recreational Area) Regulations 2023	These regulations apply to recreational activities on and around 40 of Victoria’s water storages, which have been determined as Recreational Areas under section 122ZA of the Water Act 1989. This includes Lake Eildon.	Not permitted to use or dispose of any soap or detergent within 50 metres of full storage level of a storage. There are two exceptions – in an exempt area or on a houseboat.  Vessels with toilet facilities and portable toilets can anchor, berth or operate in recreational areas.  No overnight camping is permitted on a vessel unless it is a houseboat or has express permission.  Lake Eildon is the only recreational area where houseboats can be anchored, berthed or operated.
<i>Environmental Protection Act 2017</i>	The objective of the Environmental Protection Act 2017 is to protect human health and the environment by reducing the harmful effects of pollution and waste.	This legislation imposes a General Environmental Duty (GED) on every Victorian to minimise risks of harm to human health and the environment from pollution or waste ‘as far as reasonably practicable’. Harm can be an adverse effect on human health or the environment.
Environmental Protection Regulations 2021	The regulations impose obligations in relation to environmental protection from waste, air, noise, land and water pollution. Part 5.4 includes regulations regarding the discharge or deposit of waste from vessels.	No permitted discharge or deposition of waste from vessels into surface or marine waters environments unless the waste is in the form of greywater from houseboats operating on Lake Eildon and it is compliant with the Water (Lake Eildon Recreational Area) (Houseboats) Regulations.

Act	Summary of scope	Key elements for houseboating on Lake Eildon
Pollution of Waters by Oil and Noxious Substances Act	The Pollution of Waters by Oil and Noxious Substances Act (1986) which applies on State Waters to pleasure vessels including houseboats.	Together the Environmental Protection Regulations (2021) and the Pollution of Waters by Oil and Noxious Substances Act (2022) aim to prevent pollution by oil, other noxious substances, garbage, and sewage and other discharge from vessels into surrounding waters.
Plumbing Regulations 2018	The regulations specify work that is plumbing work and the qualifications, experience and standards to carry it out.	Houseboats are defined as 'vessels' within the regulations and sanitary plumbing on vessel as needs to be carried out by licenced or registered plumbers according to standards within the regulations.

Other acts and regulations with varying levels of relevance for houseboating on Lake Eildon include:

- *Safe Drinking Water Act 2003*
- *Safe Drinking Water Regulations 2015*
- *Marine Safety Act 2010*
- *Marine Safety Regulations 2022*
- *Vessel Operating and Zoning Rules for Victorian Waters*
- *Building Act 1993*
- *Catchment and Land Protection Act 1994*
- *Australian Marine Safety Authority Act 1990*

Appendix 3 provides further details on these acts and regulations.

In addition to the various regulations and acts which impact houseboating in a range of ways, there are also some greywater discharge standards which are of broader interest. There is an expired Australian standard (AS4995) and the European Union urban wastewater standard. These standards provide useful broader context for discharge requirements that have previously or are currently considered appropriate to protect the environment. These are summarised in Table 4.

**Table 4: Greywater discharge standards**

Parameter	AS 4995:2009 treatment discharge requirements	97/271/EEC urban wastewater discharge requirements
Suspended solids	< 50 mg/L	< 100 mg/L
Grease	< 25 mg/L	-
Nitrogen / Total Kjeldahl nitrogen	< 10 mg/L	< 10 mg/L
Phosphorous / Total phosphorous	< 1 mg/L	<1 mg/L
Enterococci	< 40 cells per 100 mL	-
E. coli	< 100 cells per 100 mL	< 10 cells per 100 mL
Biological oxygen demand	Reduced (no target)	< 25 mg/L O <sub>2</sub>
Chemical oxygen demand	-	< 125 mg/L O <sub>2</sub>

## 2.3 Policy and strategic context for Lake Eildon

There are a range of policies and strategies relevant to Lake Eildon. These policies and how they relate to the remit of an organisation are outlined in Table 5 with a summary of these documents provided below.

**Table 5: Summary of relevant remits, organisations and policies**

Remit	Organisation	Relevant policy document(s)
Victorian water policy	DEECA	<ul style="list-style-type: none"> <li>Water for Victoria</li> <li>Northern Region Sustainable Water Strategy</li> </ul>
Goulburn catchment management	Goulburn Broken Catchment Management Authority	<ul style="list-style-type: none"> <li>Goulburn Broken Regional Catchment Strategy 2021-27</li> </ul>
N/A - Indigenous group	Taungurung Land & Waters Council	<ul style="list-style-type: none"> <li>Taungurung Country Plan 2021-25</li> </ul>
Recreational uses of Lake Eildon	Goulburn Murray Water	<ul style="list-style-type: none"> <li>Land and on Water Strategy 2022</li> </ul>
Economic development of Lake Eildon region	Murrindindi Shire Council	<ul style="list-style-type: none"> <li>Activating Lake Eildon- Lake Eildon Masterplan</li> </ul>

The overarching Victorian water policy, Water for Victoria (Department of Energy Land Water and Environment, 2016) provides a strategic framework for all activity in water and catchments in Victoria.

Objectives of the policy which apply to the management of water in Lake Eildon include:

- protecting waterway catchment and health
- managing water for agriculture and other users (e.g. towns, environment)
- ensuring water quality meets regulatory standards and community expectations, and
- recognising the recreational value of water in rural and regional communities.

Underpinning Water for Victoria are regional sustainable water and catchment wide strategies which provide specific directions for sustainable water use in the northern region and the Goulburn River catchment. The Northern Region Sustainable Water Strategy (2009) applies to the Lake Eildon. Broadly, the strategy seeks to enhance water sharing arrangements, provide certainty and flexibility, and protect high-value rivers, wetland and floodplains, while securing water supplies for a variety of needs (consumptive and environmental).

The Goulburn Broken Regional Catchment Strategy 2021-27 (Goulburn Broken Catchment Management Authority, 2021) establishes catchment wide priority directions for both the long and short term, as well as for local areas including the Upland Slopes and Southern Forests areas which are bisected by Lake Eildon. Priority actions for these areas are similar and include:

- promoting community adaptation to a future with less water
- better engaging visitors in increasingly sensitive tourism, and
- building a culture of land and water knowledge and stewardship among landholders and visitors.

Similarly, statewide policy for waterway management is outlined in the Victorian Waterway Management Strategy 2013 (Department of Environment and Primary Industries, 2013) which aim to maintain or improve the condition of waterways so they can support environmental, social and cultural outcomes using a regional planning and decision-making framework. Developed under this statewide framework, the Goulburn Broken Waterway Management Strategy 2014-2022 (Goulburn Broken Catchment Management Authority, 2014) is the local water management strategy for Lake Eildon and the Goulburn River and includes actions to improve water quality in the Goulburn River downstream of Eildon and upstream tributaries like Big River, Howqua and Taggerty Rivers given their status in legislation and/or ecological condition.

The Taungurung Country Plan 2021-25 (Taungurung Land & Waters Council) covers Lake Eildon and articulates the expectations and opportunities the Taungurung People see for caring for their Country given the signs they see of degradation of waterways and poor land management. This includes joint management

of public lands and developing opportunities for Taungurung People to work on Country (e.g. Taungurung Rangers) delivering on-ground works and driving management, education and tourism programs.

Land and on Water Strategy 2022 (GMW, 2022) provides a high-level outline of how GMW will deliver on obligations to support recreational values that support regional communities' social fabric, health and wellbeing within a financially sustainable and safe context. It sets forward a vision and goals for land and on water management as well as a series of actions that align with them. It includes houseboats as one of four services and functions groups provided by GMW.

Developed by Murrindindi Shire Council (in partnership with Tourism North East, Goulburn Murray Water and Mansfield Shire) Activating Lake Eildon- Lake Eildon Masterplan (Urban Enterprise, 2020) outlines a vision for the region to "fulfil its potential as Australia's premier inland water destination." The Masterplan sets out four themes for investment:

- 1) Improve the experience for existing visitor markets
- 2) New product to reach target markets
- 3) Investment in enabling infrastructure
- 4) Improved destination management.

The Masterplan focuses on identifying a number of potential tourism and supporting infrastructure investments in the Lake Eildon region, rather than on-water investments. One notable identified potential investment is a sewerage pipeline from Jerusalem Creek to Eildon which would service houseboats

## 2.4 Key changes to context since 2013 and approach to regulation elsewhere

As this is a sunseting RIS, it is important to be clear on relevant changes around houseboating on Lake Eildon since the previous regulations were established in 2013. Table 6 sets out key changes since 2013 with respect to licensing, blackwater and greywater.

One key change since 2013 is the introduction of the GED contained in the *Environmental Protection Act 2017* (summarised in Table 3 above). The GED is a positive duty to proactively identify and manage environmental risk and is a shared responsibility of all Victorians.<sup>9</sup> It requires every Victorian to minimise risks of harm to human health and the environment from pollution or waste 'as far as reasonably practicable'.

Table 7 provides additional detail on licensing as it sets out the change in licences by category over time together with definitions of each category and Table 8 provides some broader context on the houseboat fleet and the key contributors to greywater load.

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<sup>9</sup> Victorian Government Solicitor's Office, The General Environmental Duty under Victoria's new environmental regulatory regime, June 2021, Available from: <https://www.vgso.vic.gov.au/general-environmental-duty-under-victorias-new-environmental-regulatory-regime>

**Table 6: Summary of most relevant broader legislative and regulatory context**

Area	Changes since 2013 regulations
Licensing	<p>Overall houseboat numbers have remained relatively consistent over time. However, Houseboat Licence Terms and Conditions (Goulburn Murray Water Corporation, 2019) allow for houseboats to be upgraded over time to a higher category within two brackets.</p> <ul style="list-style-type: none"> <li>• Category 1 can be upgraded to Category 2</li> <li>• Category 3 or above can be upgraded to Category 6.</li> </ul> <p>As a result, the houseboat fleet has changed profile over time towards larger houseboats. As shown in Table 7 below, while there has been a modest change from Category 1 to Category 2 houseboats over time, the larger shift has been from Category 3 and 4 houseboats to Category 6 houseboats.</p>
Blackwater	<p>Advances in houseboat construction and plumbing (i.e. multi-deck and bathroom on houseboats) means that the technologies and systems used to capture and hold houseboat blackwater have changed. Specifically, on new houseboats there has been a shift from pump toilets to vacuum/macerator toilets.</p>
Greywater	<p>Provisions introduced in 2013 for installation of greywater treatment systems certified according to <i>Australian Standard 4995-2009</i> across the fleet by 2020 were revoked in 2017. These were revoked due to stakeholder concerns around the costs and operation of some of the certified systems such as noise, odour, vibration and power draw. There were also concerns about the costs and challenges of retrofitting them to existing houseboats (e.g. slipping capacity). These concerns were validated by an independent review by Jacobs in 2016-17 which found that <i>Australian Standard 4995-2009</i> was unsuitable for the Lake Eildon context. <i>Australian Standard 4995-2009</i> has since been withdrawn as a standard.</p> <p>Before the requirements for greywater treatment systems on Lake Eildon were withdrawn in 2017, 81 greywater systems were installed from five different manufacturers. All have now either been removed or disconnected. These systems were removed or disconnected for a variety of reasons including noise, odour and, in some instances, weight. They also avoid operating and maintenance costs.</p> <p>Manufacturers exited the market upon the revoking of the greywater provisions with no demand for new systems. It is understood that there was only one local manufacturer with most of the 81 systems that were installed being manufactured in Albury and Sydney.</p>

**Table 7: Lake Eildon houseboats licences by category over time**

Category	Maximum size	Description	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
1	10m x 3.5m	A trailable houseboat	42	39	43	41	41	41	40	37
2	10.6m x 4.5m	One enclosed level	9	11	8	8	8	8	8	12
3	10.6m x 4.5m	Two or more enclosed levels	32	25	24	23	23	21	18	11
	13.7m x 5.5m	One enclosed level								
4	13.7m x 5.5m	Two or more enclosed levels	389	276	289	287	287	283	264	223
	15.2m x 6.25m	One enclosed level								
5	15.2m x 6.25m	Two or more enclosed levels	211	254	243	239	239	237	238	233
	18.3m x 7.25m	One enclosed level								
6	18.3m x 7.25m	Two or more enclosed levels	17	111	117	123	123	132	154	208
7	20m x 8m		1	1	0	0	0	0	0	0
<b>Total</b>			<b>701</b>	<b>717</b>	<b>724</b>	<b>721</b>	<b>721</b>	<b>722</b>	<b>722</b>	<b>724</b>

Source: Goulburn Murray Water and (Jacobs Group (Australia) Pty Ltd, 2017)

**Table 8: Lake Eildon houseboat fleet composition and contribution of greywater by houseboat category size**

Houseboat type	Number of boats	Boat size and estimated contribution to greywater discharge in Lake
Existing private houseboats	724 boats	Category 1 & 2 (7% of fleet) contribute 3% greywater load Category 3 & 4 (33% of fleet), 25% of greywater load Category 5 & 6 (60% of fleet), 70% of greywater load
Existing commercial houseboats	21 boats	Mostly Category 4 & 5 with one Category 7 boat being built (greywater contribution not assessed)
New boat builds (commercial & private)	Approx. 8 built each year	Greywater contribution generally in line with category size as per existing private houseboats

Source: (NCEconomics, 2022)<sup>10</sup>

For broader context, Table 9 provides an overview of how houseboat greywater is regulated elsewhere.

**Table 9: Approach to regulating greywater elsewhere**

Location	Approach to regulating greywater
South Australia	In South Australia the Code of practice for vessel and facility management (marine and inland waters) (South Australia Environment Protection Agency, 2019) includes mandatory requirements for management of blackwater and greywater. In simple terms, the code of practice is clear that it is not permitted for any blackwater to enter inland waters whereas there are different options for greywater. These options include containing greywater on board to be pumped for on land disposal, treating to Australian Standard 4995 prior to discharge or partitioning – with greywater from galley sinks contained on board for on shore pumping and greywater from bathrooms and laundries treated with a bromination/chlorination function before being discharged back to the river.  The 2019 code of practice replaced a 2008 code of practice which required containing or treating greywater on board the vessel. Issues arose with commercially available on-board treatment systems and the maintenance requirements for other systems.
New South Wales	In NSW regulations there is a requirement for containment or treatment of greywater for all commercial hire houseboats (NSW Government, 2021). There are no specific requirements for recreational vessels though there is a broader requirement for them to ensure they do not pollute (NSW Government, n.d.).
Western Australia	According to Statewide Policy No. 7 Houseboats – June 2001 “Policy Statement No.2: Houseboat owners are encouraged to install an approved design waste and sewage water holding tank, in accordance with the relevant Australian Standard and retain all rubbish on board” (Water and Rivers Commission, 2001)

<sup>10</sup> Note: the ordering of the rows differs from the original but the content of the cells is unchanged.



### 3. Defining the problem

This section characterises the nature and extent of the problems and risks associated with wastewater from houseboats on Lake Eildon. It begins by providing an overarching problem statement before linking the cause and effect of the problem and then identifying evidence of the problem. Following this, a summary of the residual problem in the absence of the current Lake Eildon houseboat regulations is provided together with a high-level overview of some broader problems.

#### Defining the problem where regulations are sunseting

In line with guidance the problem is defined as if existing regulations did not exist (Commissioner for Better Regulation, 2016). That is, the residual problem absent the regulations which are subject to sunseting.

For houseboats on Lake Eildon, it is assumed that the status quo would largely hold even in the absence of Water (Lake Eildon Recreational Area) (Houseboats) Regulations (2013). Specifically, blackwater would not be discharged in the absence of these regulations due to other relevant regulations such as the General Environmental Duty under the *Environmental Protection Act 2017* and hygiene requirements under the Water (Recreational Area) Regulations 2023. We also understand that all existing houseboats have blackwater tanks installed and that blackwater tanks are standard on new houseboats. As such, the main focus of this problem section is on the impacts on greywater discharge from houseboats given that this is not regulated at present.

#### 3.1 Problem statement

Without appropriate management controls, houseboat wastewater entering Lake Eildon poses a risk of harm to human health, the environment and the broader amenity of the lake.

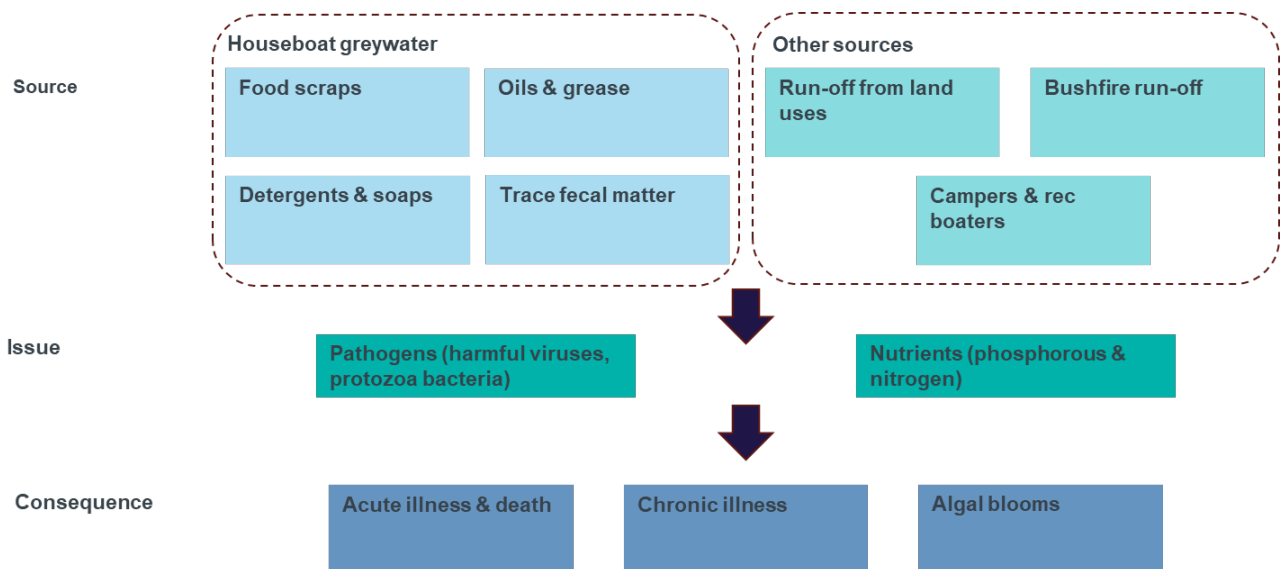
#### 3.2 Causal link from houseboat wastewater to risk of harm to human health, the environment and broader amenity of the lake

A high-level summary of the linkages between key pollutants from greywater to human health and environmental outcomes is provided in Figure 2. It should be noted that blackwater also contains these pollutants, just in greater concentrations.

Houseboat greywater is a small but confirmed contributor to pollution in Lake Eildon and is a cause of localised risk. Greywater contains a range of pollutants, with nutrients and pathogens of most concern from the perspective of the Department of Health and Environment Protection Authority. The figure below also acknowledges a range of other sources of pathogens and nutrients. As per a risk assessment for greywater discharge into Lake, nutrients from houseboats are orders of magnitude lower than from other sources. However, there is localised risks to water quality and algal bloom outbreaks around marinas, or other areas with high density of houseboats (Feehan, Lake Eildon Houseboat greywater discharge - Second Pass risk assessment, 2022). Similarly, there is the potential for houseboats to be point sources for pathogen. Kitchen wastewater is a key source of both nutrient and pathogen risk.



**Figure 2: Houseboat greywater products and contaminants**



Guidance states that it can be useful to characterise a problem in terms of a market failure (Commissioner for Better Regulation, 2016). This can also provide a rationale for government intervention in a market. For houseboat wastewater the market failure is that it is as a negative externality.<sup>11</sup> Economics tells us that a good or service which is a negative externality tends to be over-provided as the producer does not experience the full cost of this output. That is, other users of Lake Eildon, the surrounding area and the water from the lake bear some costs of houseboat wastewater through increased risk of sickness, increased water treatment costs and reduced amenity. Governments often intervene in markets with negative externalities to seek more efficient outcome for society.

### Link to human health impacts

Greywater can be a source of pathogens (e.g. viruses and bacteria). These pollutants are also found in other sources including run-off from surrounding land uses, campers and recreational boaters. The risk to human health from pathogens in lake water is through ingestion or contact with the water.

Recreational water bodies, such as Lake Eildon, are occasionally tested for bacterium including *Escherichia coli*, commonly known as *E. coli*, and *Enterococcus*. Both are found in the lower intestines of warm-blooded animals including humans and are an indicator of faecal contamination. Neither *E. coli* nor *Enterococcus* are causative agents of disease but correlate with disease outcomes in humans. Higher levels of contamination from *E. coli* and *Enterococcus* are indicators of higher potential health risks to humans including of wound infection, enteric illnesses such as diarrhea and gastrointestinal conditions, ear, skin and respiratory infections, and liver or renal disease. The level of risk depends on the vulnerability of the person impacted.

The water in Lake Eildon is classified as non-potable and so is unfit for drinking. Houseboats typically draw water direct from the lake for on-board use, including for cleaning, dishwashing, food preparation and showering, often without prior treatment, which provides an opportunity for direct contact with water containing pathogens and other pollutants. Occasionally houseboat users may drink water from the lake instead of bottled water. Some houseboats have installed water treatment (disinfection) systems to remove pathogens before water is used onboard. Beyond houseboating, the lake also supports a range of other on water recreation pursuits (e.g. swimming, paddling, rowing, fishing, water-skiing).

A risk assessment (Feehan, Eildon Houseboat Greywater Risk Assessment Framework, 2020) found that ingestion or contact with lake water at Lake Eildon can occur from accidental ingestion or inadvertent immersion. It can also occur with whole-body contact during recreational activity where some or all of the body is immersed, there can be spray to the face and it can be likely that some water will be swallowed.

<sup>11</sup> The NSW Government's Guide to Market Failure (NSW Department of Industry, 2017) states "A negative externality is caused by an action (or market transaction) that affects a third party in a negative way. These are sometimes referred to as negative spill-overs or external costs." When a good or service has a negative externality, it is generally over-provided (relative to what an efficient market would provide), as the producer (and consumer) of the good or service seldom fully take into consideration the externality that they cause."

## Link to the environmental impacts

Human waste in blackwater together with food scraps, detergents and soaps in greywater are a source of nutrients (nitrogen and phosphorous). As with human health impacts, these pollutants also occur from other sources particularly run-off from surrounding agricultural land uses.

The United States Environmental Protection Agency state “Excess nutrient (nitrogen and phosphorus) loadings and concentrations are a leading cause of increased occurrence of cyanobacterial bloom formation in water bodies (Yuan and Pollard, 2015)”<sup>12</sup> (United States Environmental Protection Agency, 2015). Lower water levels both warm the water body and concentrate pollution, thus concentrating levels of cyanobacteria and promoting algal bloom outbreaks during warmer weather.

In Australia, the National Health and Medical Research Council’s *Guidance for Managing Risks in Recreational Waters* (2008) also provides information on cyanobacteria, more commonly known as blue-green algae. Cyanobacteria are photosynthetic bacteria, which are common and naturally occurring components of most aquatic ecosystems, and generally found at low levels that pose negligible risks.

Although Lake Eildon is a large water body, and levels of concentration of cyanobacteria are generally low overall when the lake is at high levels as a result of the dilution effect, outbreaks of blue-green algae still occur, for example a bloom was present for much of 2023 despite the very high water levels. They are most likely to occur where nutrients are most concentrated and water is slow moving and has a relatively modest dispersal effect, for instance around marinas, particularly during warm, dry weather. Their likelihood also increases as water levels reduce given the concentration of nutrients and higher water temperatures.

When blooms of blue-green algae occur they have consequences for the environment, interfere with other uses of the water, can affect human health and the economy. They affect water quality by causing undesirable odours, discolouration and unsightly scum.

Exposure to algal toxins has been linked to fatalities of livestock, wildlife and pets. As the bloom subsides, the dead and decaying algae can reduce the oxygen levels in the water, causing stress or death to aquatic animals. During periods of drought, aquatic ecosystems can be severely degraded by algal blooms through extensive and repeated fish death events.

Blue green algal blooms are also identified as a potential hazard in waters used for ‘human and animal drinking-water supplies, aquaculture, agriculture and recreation’, such as Lake Eildon, because of its capacity to produce toxins that have a harmful effect on recreational water users. Blue-green algae varieties fall into three different toxic groups, cyclic peptides, alkaloids or lipopolysaccharides, distinguished because they have different primary organ targets in all mammals. Cyclic peptides impact the liver. Alkaloids more broadly target nerve axioms and synapses, skin, liver and the gastrointestinal tracts, whereas lipopolysaccharides are an irritant to all exposed tissue.

Concern about blue-green algae arises because of its capacity to cause acute toxicity through absorption via the skin, irritation of skin, eye, mucous membranes or risks from being ingested if it is somehow harboured on food. Both exposure pathway, and the concentrated levels of exposure, are factors in acute toxicity. Exposure can occur through direct dermal contact, accidental swallowing or the aspiration of water containing blue-green algal cells.

More broadly, there are other recent emerging issues of concern arising from water quality issues relating to wastewater such as ingestion of microplastics. There are also chemical contaminants of concern that include biologically active compounds such as endocrine disruptors and pharmaceuticals from medicines or pest control treatments (Environment Protection Authority Victoria, 2021). No data is available to understand the risks of these pollutants to human health and the environment for Lake Eildon users.

## Link to broader amenity

The link between wastewater in Lake Eildon and amenity is relatively self-evident. Wastewater, especially where they cause slicks and scums, can have unpleasant appearance and potentially odours which lower the amenity of the lake. There can also be second order effects where houseboat wastewater can be a contributing factor, blue-green algal blooms are an example of this.

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<sup>12</sup> Reference in United States Environmental Protection Agency for this paper is “Yuan, L. L. and Pollard, A. I. 2015. Deriving nutrient targets to prevent excessive cyanobacterial densities in U.S. lakes and reservoirs. *Freshwater Biology*. (60)(9): 1901–1916”

### 3.3 Evidence of the problem

Given that water pollution is a key element of the causal link from houseboats wastewater and both human health issues and the environment, evidence of water pollution issues is covered first before stepping back to human health and environmental issues. Consideration is also given to evidence of broader amenity concerns.

#### **Water pollution evidence**

To understand water quality levels and trends, GMW regularly conduct water quality testing at the lake. A concerted program of testing and analysis was undertaken by GMW to understand water pollution issues associated with houseboating. A GMW 2021 report found “no evidence of houseboats being the main, or sole, contributor to increased levels of lake pollutants” (Goulburn Murray Water Corporation, 2021). It did note, however, that there may be a need to diversify testing regimes. Current monitoring does not measure parameters such as bacteria (*E.coli* and *enterococci*), surfactants (from detergents and cleaning products), nor hydrocarbons such as oil and grease. That is, a number of key pollutants related to houseboat wastewater are not captured in the current monitoring program.

The report also discusses special sampling in 2017 and 2018, where samples were taken at regular sampling sites and at extra locations specifically chosen as there were many houseboats present (there was also an attempt to take samples at a control location – where no houseboats were directly visible however this was not possible with houseboats present even in the Big River Arm of Lake Eildon).

- During the special sampling event a maximum pH value of 7.8 was observed in a sample taken in an area with a large number of houseboats on 2 January 2018 whereas the pH at another location on the lake on the same day was 7.5. Greywater is generally slightly higher in pH (less acidic) than the source water — however the observed difference was not considered to be significantly different. No significant differences were observed in other metrics.
- The 2017-2018 special sampling detected surfactants at Lake Eildon only once from the 10 samples collected. A result of 0.1mg/L at the boat area on 2 January 2018 may be significant as the type of surfactant tested for (anionic) are generally synthetic and therefore do not occur naturally in the source water.
- During the course of the 2017-2018 special sampling event, oil and grease was not detected. It is worth noting, that oil and grease, due to its insoluble nature, can at times be very difficult to successfully sample.
- Microbial source tracking in the 2017-2018 special sampling program indicated there was human bacteria present at Jerusalem Creek on 18 April 2017. Human bacteria was not detected in the nine other samples, including two other samples taken in Jerusalem Creek. It is also worth noting that factors like water temperature and sunlight affect how long microbes can live in lake waters.

Further sampling in 2020 occurred under a pilot sampling program. This considered the optimal time to sample, given the objective, is when houseboat usage is at its peak, both time of year and time of day.

- Houseboat usage on Lake Eildon reaches its peak in the week between Christmas and the New Year. However, when considering public holidays causing the closure of laboratories and couriers, there was only one day where it was practical to sample and be assured of National Association of Testing Authorities laboratory endorsed results, the 29th of December 2020. At the time of sampling a blue-green algae warning was current for the Lake.
  - blue-green algae contain nutrients such as nitrogen and phosphorus, therefore nutrient sampling was not included in the special sampling event.
  - high blue-green algae levels could have an impact on several physical chemistry parameters as well. blue-green algae cause increases in pH, turbidity, biochemical oxygen demand and suspended solids.
- It was assumed that showering would produce the most greywater volume and that most people shower before 10am or in the evening. Unfortunately, these times were not very suitable for sampling as for these particular tests the samples need to arrive at the laboratory within 24 hours and the courier departure time at Eildon would result in 36 to 48 hours holding time, exceeding recommended times for some parameters.

During the 2020 special sampling event, *E.coli* and therefore faecal contamination was observed at all sampling locations and depths. Enterococci was observed at six sampling locations at varying depths, which

is additional evidence of faecal contamination. The report does not include discussion of whether the source is likely to be human, from houseboats or otherwise.

No other significant differences could be established in 2020 given the conditions of the sampling event.

Overall, the report (Goulburn Murray Water Corporation, 2021) found that despite sediments and impurities that flow into the water body, water in Lake Eildon is found to be generally of a reasonably high quality because of the dilution effect such a large body of water.

Internationally, increased *E. coli* levels and therefore health risks to recreational users from houseboat wastewater (greywater) have been documented for Shuswap Lake in British Columbia, Canada (Ministry of Environment, 2009).

Other lake users also have a responsibility to manage the impact of their activities on the lake's water quality. Several other mechanisms are used to achieve this such as regulations, land use planning controls and incentives to improve land management practices.

### **Responsibilities of other lake users**

Parks Victoria publish a Visitor Guide — Lake Eildon National Park that outlines how visitors can enjoy the park as well as care for the park. The guide notes that campers pay for sites (except at Taylors Creek, Mountaineer Creek and Coopers Point campgrounds, which can only be accessed by boat or on foot) and must take all rubbish home for recycling and disposal.

The guide also notes that Boating and water sports users must follow the regulations and guidelines in the Victorian Recreational Boating Safety Handbook. The handbook (p.62) states that “the discharge of waste from boats may add nutrients and pollutants to our waterways and can pose a risk to ecosystems and human health. The discharge of oil, chemicals, sewage, garbage, litter or any other waste is prohibited in any waters in Victoria.”

Further, Water (Recreational Area) Regulations 2023 requires that a person must not use or dispose of any soap, detergent or similar substance in a recreational area unless they are more than 50 metres from any waterway (unless in an exempt area or a houseboat).

## Houseboat behaviours to minimise impacts of greywater discharge

BehaviourWorks Australia, based out of Monash University, completed a survey of Lake Eildon houseboat owners to better understand the prevalence of houseboats that relate to greywater-related contaminants entering the lake (Plant, 2021). Through an online survey of 273 non-commercial houseboat owners, key findings from respondents included:

- 88.2% scrape food scraps into a bin when washing dishes
- 57.8% wipe down oily dishes with a paper towel
- 60.2% use cleaning products labelled as low or free of phosphates, nitrates and salts
- 57.6% use products labelled as low in or free of phosphates, nitrates and salts
- 44.2% use products labelled as low in or free of phosphates, nitrates and salts for showering or bathing
- 56.4% use products labelled as low in or free of phosphates, nitrates and salts for cleaning bathroom.

That is, while there is a high proportion of houseboat users that are taking behavioural steps to minimise the impact of their greywater discharge there are barriers and challenges to overcome to increase it. For example, some respondents raised concerns about the added time or effort involved to perform the behaviour, including when there are more occupants on board.

## Human health issues

Following on from the water quality evidence, the issue of human health is really a risk factor rather than there being a clear, ongoing issue with impacts to human health i.e. definitive evidence of illness of lake users due to wastewater pollutants.

An ECOS risk assessment (Ecos, 2006) provides the most comprehensive assessment of the risk of illness from a variety of pathogens expected to be present in houseboat greywater. The study investigated a variety of pathogens: Cryptosporidium, Norovirus and Campylobacter bacteria. The study considered likely concentrations and loads of pathogens, dilution factors, and decay rates of pathogens in the water. The study found that:

- An outbreak of gastroenteritis was plausible among houseboaters.
- That outbreaks would not be expected to occur frequently but could be 'realistically expected to take place'.
- Lake Eildon provides pre-treatment drinking water supply and therefore pathogens in the water provide an increased risk to consumers should water not be treated effectively.
- Standard drinking water treatment processes are generally effective at treating bacteria.
- Viruses and protozoa can be harder to treat using conventional processes and may add cost and risk to drinking water supply processes although no data exists to suitably demonstrate this.

There has been a change in the risk to human health from wastewater over time. This links back to the increased average size of vessels in the houseboat fleet on Lake Eildon over time (see Table 7 in section 2.4). Larger houseboats are understood to contribute greater greywater loads due to their ability to accommodate more passengers and more frequent use (Plant, 2021). That is, if anything, the findings of the ECOS risk assessment would be expected to be more relevant now than when it was undertaken in 2006.

## Environmental issues

Although Lake Eildon is a large water body, and levels of concentration of cyanobacteria are generally low overall when it is at high levels as a result of the dilution effect, outbreaks of blue-green algae still occur. For example, a bloom was present for much of 2023 despite very high water levels during this time. Potentially this was due to a high nutrient load washed in during the 2022 floods. Algal blooms are most likely to occur where nutrient levels are most concentrated and water is slow moving and has a relatively modest dispersal

effect, for instance around marinas, particularly during warm, dry weather. The likelihood also increases as water levels reduce given the concentration of nutrients and higher water temperatures.

*Guidance for Managing Risks in Recreational Waters* (National Health and Medical Research Council, 2008) provide two levels of risk. Level one risk is based on the toxicity of microcystins located in surface scum, the algal bloom, which is of the most significant public health concern. Level two risk is based on the probability of increased likelihood of nonspecific adverse health outcomes, principally respiratory, irritation and allergy symptoms, from exposure to very high cell densities of cyanobacterial materials found in persistent surface scum.

GMW issues blue-green algae warnings when results from water quality testing exceed national health guidelines. During periods where blue-green algae warnings are in place GMW recommends:

- People and pets avoid contact with the water
- People who come into contact with affected water should wash affected skin immediately in clean cold water
- Seeking an alternative water supply for stock and pets where possible
- Not to use affected water for cooking, drinking, washing or showering. Boiling the affected water will not make it safe for these purposes (Goulburn-Murray Water, 2023).

The most recent blue-green algae warning for Lake Eildon was removed on 21 April 2023 having been in place for 88 days (Goulburn-Murray Water, 2023).

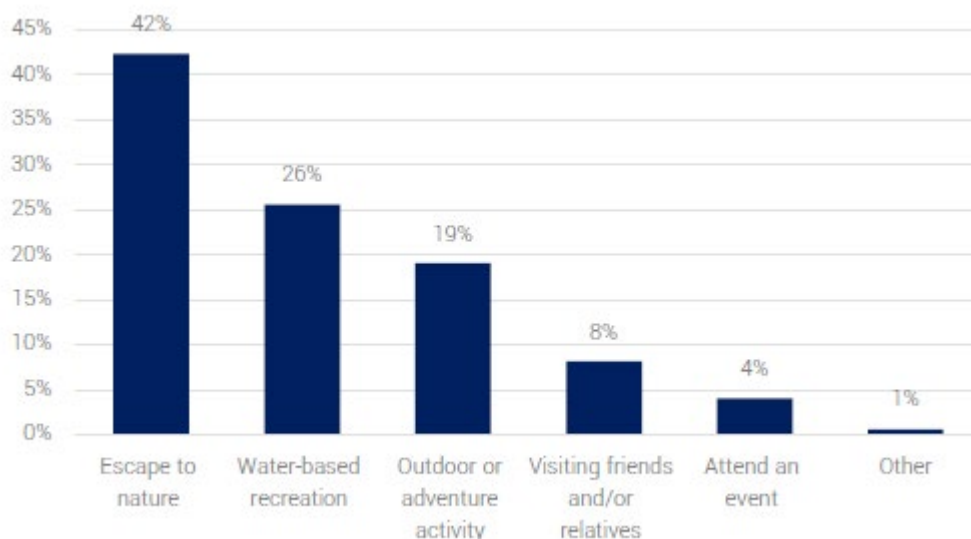
As with risks to human health, the key driver of change since 2013 is the average size of vessels in the houseboat fleet. Larger houseboats are likely to discharge more greywater which increases risks to the environment.

Climate change impacts are also expected to increase risks with decreasing average annual inflows into Lake Eildon due to changing rainfall patterns and higher average temperatures. (DELWP, BoM, CSIRO and University of Melbourne, 2020). This in turn will mean average water levels in Lake Eildon will be lower, concentrating pollutant loads. It will also increase average water temperatures which will increase the frequency, duration and severity of blue green algal blooms.

### Importance of amenity to users of Lake Eildon region

The importance of amenity to users of Lake Eildon is reflected in visitor survey results for the Lake Eildon region. Most notably 87% of visitors were visiting for nature-related purposes including to escape to nature (42%), water-based recreation (26%) and outdoor or adventure activity (19%). With approximately 900,000 visitors per annum that is over 750,000 visitors who come for nature-related purposes (Urban Enterprise, 2020).

**Figure 3: Visitor survey – purpose of visit to Lake Eildon**



Source: (Urban Enterprise, 2020)

### 3.4 Summary of the residual problem

A summary of the residual problem (i.e. the problem in the absence of Water (Lake Eildon Recreational Area) (Houseboats) Regulations 2013) against the three focus areas of this regulatory reform are provided in Table 10. The key residual problem of nutrients and pathogens aligns with the area of most concern from the perspective of the Department of Health and Environment Protection Authority.

**Table 10: Summary of the residual problem**

Area	Residual problem
Houseboat licensing	Without management controls it would be harder to manage houseboat numbers, and in turn wastewater discharge which poses a risk to human health for lake users and downstream users and to the environment.
Houseboat blackwater	Without management controls it would be expected that there would be relatively little change in practice around blackwater. A lack of mandated inspections may mean that blackwater system leaks and other maintenance issues are not spotted as quickly – this could be characterised as a low likelihood, high consequence risk.
Houseboat greywater	Without management controls there would continue to be houseboat greywater discharged in Lake Eildon (as it is not currently regulated). While it is acknowledged that Lake Eildon is a large body of water so the concentration of pollutants may not be great (depending on the distribution of houseboats on the lake), there are still risks of harm to human health and the environment associated with these discharges principally from nutrients and pathogens. They could be characterised as a low likelihood, medium consequence risk.

Given that the residual problem is a risk of harm, rather than demonstrable ongoing harm, there will be a need to seek a proportional response which balances the costs and benefits of intervention.

It is important to reiterate the broader context around these risks to human health and the environment. Lake Eildon is a National Park which receives around 900,000 visitors annually for a range of recreation activities. The lake is also a water storage for Goulburn-Murray Water. Put another way, there is a broad range of potential beneficiaries from reducing these risk factors.

### 3.5 Broader problems with houseboating on Lake Eildon

In addition to the problems with houseboating on Lake Eildon detailed in sections 3.1-3.3, there are broader issues with houseboating.

One issue is the fixed number of houseboat licences on Lake Eildon. In the absence of the licence cap it would be expected that there would be more houseboats on the lake. While it is difficult to prove latent demand, a Category 3- 6 houseboat license for Lake Eildon is estimated by GMW to be worth between \$80,000-100,000, with some reports of licences being sold for up to \$150,000. This resale value points towards demand exceeding the current houseboat cap (Goulburn Murray Water Corporation, 2021).

The issue of the licence cap has myriad factors including the greywater load, capacity of broader houseboat infrastructure on Lake Eildon (wastewater barges, slipping facilities etc.), safety and amenity considerations.



## 4. Objectives

The overall objective being sought through regulation is to:

Support continued community benefits from use and enjoyment of waters and surrounds of Lake Eildon Recreational Area through achieving low risks (likelihood and consequence) to human health and environment associated with pollutants from houseboat wastewater entering Lake Eildon.

In addition to this primary objective, it is acknowledged that there is a need to:

- minimise regulatory burden
- ensure the way ahead is implementable (with particular focus on functionality of any treatment systems required on houseboats)
- provide clarity for houseboat owners and industry, and
- be conscious of the broader impacts of the houseboating and related activities on the regional economy.

These objectives align with the broader objectives of overarching legislation. Specifically, one of the purposes of the *Water Act 1989* is “to provide formal means for the protection and enhancement of the environmental qualities of waterways and their in-stream uses.”



## 5. Options

We are considering a broad range of options to address the problem and risks associated with wastewater from houseboats on Lake Eildon. In line with guidance for sunseting regulations, a ‘clean slate’ approach has been taken to generating options not tied to the current approach. We have also sought to identify feasible co-regulation and non-regulatory options.

The options considered in this RIS resulted from extensive review of the available literature and data, interagency and public consultation. We also consulted with communities of interest to better understand the most appropriate ways to mitigate risks from houseboat wastewater pollutants. In addition, we considered several factors that are relevant to what is reasonably practicable in relation to minimising risks associated with wastewater from houseboats (as required by the GED), including the cost, availability and suitability of different interventions.

Options have been developed for the key aspects that the Houseboat Regulations are proposed to cover:

- Houseboat licencing
- Houseboat blackwater, and
- Houseboat greywater

The focus of this section is on identifying feasible options for further analysis. The assessment of the impacts associated with these options then follows in the subsequent section (section 6). These options are assessed against a ‘base case’ where the current Regulations sunset. The base case and the options identified for further analysis are summarised in Figure 4.

**Figure 4: Base case and options identified for further analysis**

Houseboat licencing	Houseboat blackwater	Houseboat greywater
<b>Base case:</b> licencing managed through other means	<b>Base case:</b> no specific regulation	<b>Base case:</b> no specific regulation
<b>Option 1:</b> replicate current licencing provision through Water (Lake Eildon Recreational Area) (Houseboats) Regulations 2024	<b>Option 1:</b> replicate and update the current blackwater provisions	<b>Option 1:</b> simple greywater treatment systems across fleet
		<b>Option 2:</b> simple greywater treatment systems for private houseboats and comprehensive greywater treatment systems for new and commercial hire category 3 and above houseboats
		<b>Option 3:</b> comprehensive greywater treatment systems for all Category 3 and above houseboats

### 5.1 Houseboat licencing

For houseboat licencing, the most credible base case is licencing through other means (rather than no licencing). Moving away from licencing to self-regulation would not acceptably manage the negative externalities from houseboat blackwater and greywater. At the other end of the spectrum, houseboats could be banned entirely. This is inappropriate given the significant value houseboating has to users and the local economy.

While changes could be made to the existing licencing system — e.g. moving away from annual renewals — there isn’t a clear issue with the current licencing regime to suggest such a change is needed. Therefore, only one feasible option – replicating current licencing in the new regulations – has been identified for further analysis. The base case, alternate options and options not considered for further analysis are set out in further detail below.

#### **Base case: licencing managed through other means**

In the base case, the Water (Lake Eildon Recreational Area) (Houseboats) Regulations 2013 would sunset. However, there are still existing regulatory levers available that could require a form of houseboat registration. Moreover, it is still reasonable to expect that GMW would still have an obligation to regulate houseboats on Lake Eildon even in the absence of specific regulations. As part of GMW’s statement of

obligations it must “effectively integrate economic, environmental and social objectives into its business operations” (Victorian Minister for Environment, Climate Change and Water, 2015). In addition, Water for Victoria – which sets the overarching water policy for Victoria – includes recreation objectives for waterways and water storages (Victoria State Government, 2016). That is, there would still be an expectation for GMW to have oversight of houseboating on Lake Eildon.

Given GMW’s interest in continued regulation, and available regulatory levers without further government action, the base case is for permits for houseboat use to be issued by GMW through the Water (Recreational Area) Regulations 2023.<sup>13</sup> In addition, houseboat owners would continue to need to have a boat registration from VicRoads under the Marine Safety Regulations.

The permit system would be broadly similar to the current licensing system though there are some grey areas in terms of the equivalency of the permits. Specifically, unlike licences, permits can’t be transferred through purchase which would make it difficult to manage a cap on permits and hence control houseboat numbers on Lake Eildon.

It is assumed that a houseboat permit would have similar characteristics to licences at present. That is, permits would need to be renewed annually and GMW would set a permit cost based on cost recovery of their relevant compliance and infrastructure costs.

### **Option 1: licensing provision included through Water (Lake Eildon Recreational Area) (Houseboats) Regulations 2024**

This option is to continue houseboat licensing on the same basis as in the 2013 regulations. That is that GMW would license houseboats on Lake Eildon with licence requirements including:

- Management of waste (the scope of this is interdependent on the preferred option for the blackwater and greywater areas)
- A compulsory houseboat inspection program every 5-7 years<sup>14</sup>
- Defining houseboat categories (focussed on vessel dimensions) and the extent to which houseboats can move between categories
- The ability to cap the maximum number of houseboats licences issued for Lake Eildon (noting that the level of the cap is set by GMW outside of the regulations)<sup>15</sup>
- Requirements around transfer of ownership of a houseboat and houseboat licences
- Requirements around the upgrade or alteration of an existing houseboat
- Levying an annual licence fee, and
- Requiring annual licence renewal
- It is recognised that there are different approaches which could be taken to setting the licence fee. These will be considered in the implementation plan . Regardless of the approach, it is expected that the licence fee will be set at a cost recovery rate in line with the Victorian Government’s pricing principles (Victoria State Government, 2021)

As with the base case, houseboat owners would continue to need to have a boat registration from VicRoads under the Marine Safety Regulations.

We also considered several further options that were determined not to be feasible (see box below).

#### **Options considered but determined not to be feasible**

- **A self-regulation base case** would represent a “do nothing” base case. That is, in the absence of any change (regulatory or otherwise) the Water (Lake Eildon Recreational Area) (Houseboats)

<sup>13</sup> GMW are able to issue permits as a result of Division 2—Permits of Water (Recreational Area) Regulations 2023.

<sup>14</sup> Commercial houseboats are required to have an inspection by the Australian Marine Safety Authority every 3-5 years.

<sup>15</sup> There are a number of reasons for a continued use of a cap on licence numbers. These include capacity of existing houseboat infrastructure (e.g. wastewater barges, marina and slipping capacity and capacity considerations when water levels are low in the lake).

Regulations (2013) would sunset on 11 June 2024 without any alternative for licensing/permitting. However, a self-regulation base case would not acceptably manage risks given the negative externalities associated with houseboat wastewater together with risks that an unmanaged increase in houseboat numbers on Lake Eildon would create broader challenges with use of existing infrastructure (wastewater barges, slipping facilities etc.).

- **Banning houseboats on Lake Eildon** would represent the most extreme level of regulation. While there are some negative externalities from houseboats, they are not to a degree that banning houseboats is a proportionate option. Moreover, it is recognised that houseboating is an important part of the Lake Eildon regional economy. A sub-option could be to ban segments of the houseboat fleet. For example, larger vessels which have higher greywater discharge could be banned. This is not considered feasible for the same reason as banning all houseboats – it is not proportionate to the negative impacts and would reduce the positives of houseboating for the regional economy.
- **Minor changes to licensing arrangements e.g. moving away from annual licence renewal** are technically feasible. However, given that licence fees are set to recover relevant GMW costs, annual renewal best aligns with budgeting cycles. In the absence of a clear problem with this arrangement or houseboat owner feedback suggesting changes to current arrangements, alternatives have not been considered.

## 5.2 Houseboat blackwater

For houseboat blackwater, the status quo is for blackwater to be stored in tanks on houseboats then disposed into wastewater barges on Lake Eildon. Given the General Environmental Duty under the *Environmental Protection Act 2017* and need for social licence for houseboating the base case and the status quo are the same in practical terms (i.e. continuing houseboats would continue to have blackwater systems that meet current requirements). The only difference between the base case and status quo is the use of regulation. An alternative option of on-board treatment of blackwater has been considered, but there is no existing technology, so this option is infeasible. Therefore, only one feasible option has been identified for further analysis.

### **Base case: no specific regulation**

In the base case, the Water (Lake Eildon Recreational Area) (Houseboats) Regulations 2013 would sunset and there would be for no specific houseboat blackwater regulation to replace these existing regulations.

It is important to be clear that the absence of specific houseboat blackwater regulation is not the same as self-regulation. There are other regulations which still apply to houseboat owners and builders. Specifically, the General Environmental Duty under the *Environmental Protection Act 2017* requires every Victorian to minimise risks of harm to human health and the environment from pollution or waste ‘as far as reasonably practicable’ (Parliament of Victoria, 2017). Additionally, the Plumbing Regulations 2018 (Parliament of Victoria, 2018) require sanitary plumbing on a houseboat to be undertaken by a licenced or registered plumber.

We understand that enforcement and compliance associated with the General Environmental Duty can be difficult. In addition to this and other existing regulation, it is assumed in this base case that GMW would issue code of practice<sup>16</sup> for blackwater management and have awareness campaigns around houseboat blackwater management.

It is also assumed that GMW would continue to operate wastewater barges in the base case. This assumption is contingent on it being possible to recover wastewater barge costs from houseboat owners

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<sup>16</sup> A code of practice provides guidance rather than being a specific legislative or regulatory requirement.

through permits or licences (depending on the preferred option for houseboat licensing) as GMW are not permitted to cross-subsidise this service from other customers.<sup>17</sup>

### **Option 1: replicate and update the current blackwater provisions through Water (Lake Eildon Recreational Area) (Houseboats) Regulations 2024**

In this option, through updated regulation there would continue to be a requirement for houseboats to have an on-board blackwater system or a portable toilet and not to dispose houseboat blackwater in the recreational area except within a waste collection facility. There would also continue to be a requirement for a blackwater system to be encased with a strong material to provide protection against being damaged/compromised by branches or other obstructions in the water.

The language of the regulations would be updated to incorporate relevant new technology such as macerator and vacuum toilets in the regulation schedules. This doesn't change the blackwater requirement, it just more clearly allows newer technology systems.

It is not expected that there would be any transition period for this option as it essentially reflects current practice.

We also considered an option for on board treatment of blackwater, however this was determined not to be feasible (see box below).

#### **Options considered but not analysed further**

- **On board treatment of blackwater** would be a logical upper bound for consideration in this RIS. However, there is currently no feasible technology to treat blackwater to a suitable standard on houseboats and, even if there were, the risks to human health etc. from failure of such a system would be too great for this to be a desirable option.

### 5.3 Houseboat greywater

The management of houseboat greywater is the key area where there are a range of feasible options – these options are set out below. One option which is considered infeasible is comprehensive greywater treatment systems for all houseboats, this is principally due to category 1 and 2 houseboats being too small to accommodate the size of current greywater treatment systems.

#### **Base case: no specific regulation**

In the base case, as with the current scenario, there would be no specific houseboat greywater regulation.

Similar to the base case for blackwater, the General Environmental Duty under the *Environmental Protection Act 2017* to minimise risks of harm to human health and the environment from pollution or waste 'as far as reasonably practicable' (Parliament of Victoria, 2017) applies to the discharge of greywater from houseboats. Moreover, GMW could undertake non-regulatory actions such as issuing codes of practice and have awareness campaigns around appropriate houseboat greywater management.

#### **Option 1: simple greywater treatment systems across fleet through Water (Lake Eildon Recreational Area) (Houseboats) Regulations 2024**

This option would focus on a number of lighter touch, or simple, interventions for reducing pollutants in greywater discharge. These comprise sink strainers/filters and under-sink grease traps that are readily available to houseboat owners. These would form part of the compulsory houseboat inspection program and evidence of annual grease trap servicing would be required as part of licence/permit renewal with GMW. This option would apply to all houseboats, noting that it is expected to be infeasible to install grease traps on smaller houseboats (Category 1 and 2).

For Category 1 and 2 houseboats, this option would focus on behavioural change (e.g. scraping/wiping food waste off dishes before washing) around greywater discharge rather than equipment upgrades. The behavioural change would sit outside the regulations. Instead GMW may use non-regulatory levers such as codes of practice around best practice behavioural intervention and awareness campaigns.

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<sup>17</sup> In line with the *Essential Services Commission Act 2001*

There would be a transition period for this option for Category 3 and above given workforce constraints, with all Category 3 and above houseboats to comply by mid - 2034. Houseboat owners would be encouraged to align the installation of greywater treatment systems to the slipping requirements in the current licensing arrangements as there are efficiencies to be made by completing the works at the same time other maintenance and servicing is conducted on the houseboat. Alternatively, the houseboat owner could arrange for installation while the boat is still on the water.

### **Option 2: simple greywater treatment systems for private houseboats and comprehensive greywater treatment systems for new and commercial hire category 3 and above houseboats through Water (Lake Eildon Recreational Area) (Houseboats) Regulations 2024**

This option would be as per Option 1 for existing private houseboats Category 3 and above with the same transition arrangements.

For new privately operated houseboats<sup>18</sup> and commercial hire houseboats Category 3 and above there will be a need to align with best achievable, or comprehensive, greywater treatment. This could include in addition to simple intervention technologies such as grease traps and sink strainers/filters that provide primary screening, a comprehensive filtration system and a disinfection unit. The regulations for these comprehensive systems would focus on water pollution outcomes rather than specifying set equipment. Examples of greywater discharge standards are provided in Table 4.<sup>19</sup> The precise water pollution outcomes are being developed in consultation with houseboat stakeholders and technical experts.

For a comprehensive greywater treatment system to be installed, the greywater system suppliers must develop the systems in accordance with the specifications provided in the regulations and it must be tested. In addition to the water pollution outcome requirements, the specifications would also consider functional considerations around factors including noise, odour and vibration impacts on houseboats.

New houseboats would need to install a comprehensive greywater treatment system by 11 June 2027 (3 years after the regulations are remade)<sup>20</sup>. For commercial houseboats a comprehensive greywater treatment system would need to be installed by 1 January 2034 (almost 10 years after the regulations are remade).

Testing against the specifications will need to be completed before installations start on new and commercial houseboats. The economic modelling has assumed this will occur within a 2 year period as there are already suppliers with the technology being developed and tested on Lake Eildon houseboats.

### **Option 3: comprehensive greywater treatment systems for all Category 3 and above houseboats through Water (Lake Eildon Recreational Area) (Houseboats) Regulations 2024**

This option would be as per Option 2 except the best achievable, or comprehensive, greywater treatment requirement would apply to all Category 3 and above houseboats. As noted in Table 8, Category 3 and above houseboats account for around 95% of the greywater discharge into the lake. Transition arrangements would need to ensure there is sufficient slipping capacity to accommodate the timeframe.

We also considered an option for comprehensive greywater treatment systems on all houseboats, however this was determined not to be feasible (see box below).

#### **Options considered but determined not to be feasible**

- **Comprehensive greywater treatment systems for all houseboats through Water (Lake Eildon Recreational Area) (Houseboats) Regulations 2024** would result in the best greywater outcomes. However, past assessments have deemed that Category 1 and 2 houseboats are too small for appropriate greywater treatment systems to be installed (NCEconomics, 2022)

<sup>18</sup> A **new houseboat** is defined in the exposure draft regulations to mean a houseboat for which—

- (a) an application for a houseboat licence is made on or after 11 June 2026; and
- (b) no houseboat licence has previously been issued

<sup>19</sup> It is noted that for the expired Australian standard, the EPA has advised that the Enterococci and E.coli discharge levels set out in AS4995 are insufficient.

<sup>20</sup> It is assumed that a system must demonstrate completion of testing against specifications developed as part of the regulations.

## 6. Options assessment

This section details our draft assessment of the options outlined in section 5.

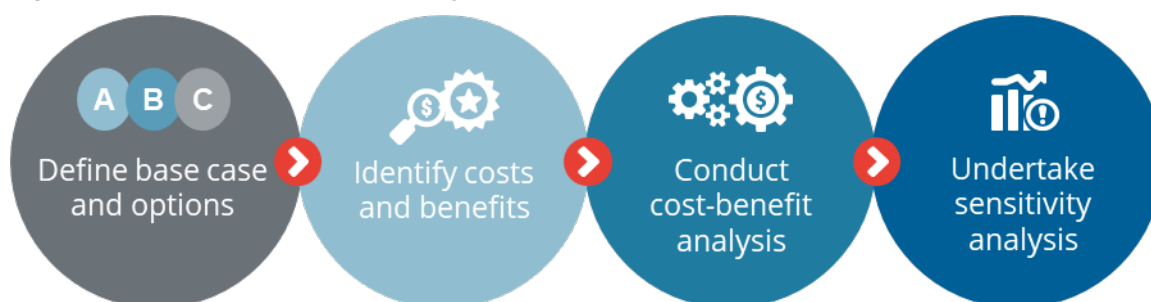
### 6.1 Overview of the approach to options assessment

We used a cost-benefit analysis (CBA) framework and break even analysis (BEA) to assess the relevant economic, environmental and social impacts.

The focus of a CBA is on quantifying costs and benefits such that options can be directly compared. CBA is an incremental analysis which compares the economic, environmental and social impacts of intervention options to a base case.

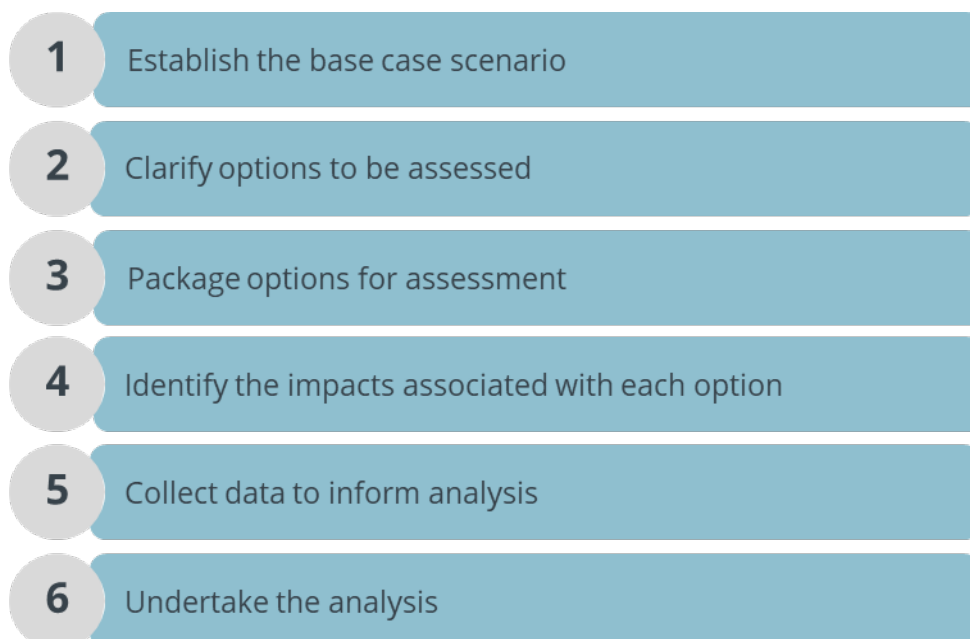
The CBA framework also allows for impacts which can't be expressed in monetary terms to still be included in the analysis qualitatively. In addition, it provides a framework to undertake a BEA, which determines the point at which the benefits of an option equal its costs.

**Figure 5: Overview of cost-benefit analysis process**



The broad steps in this CBA are set out in **Figure 6**. The base case and options for houseboat licensing, blackwater and greywater are detailed in Section 5 with Section 6.2 detailing how these options have been packaged for this analysis.

**Figure 6: Overview of the CBA process**

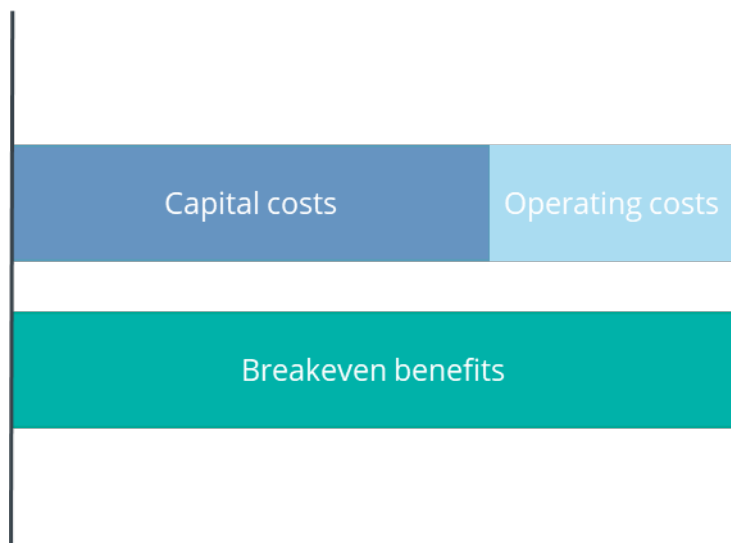


More broadly, a CBA profiles costs and benefits over time before applying a discount rate to reach present value costs and benefits which can be directly compared. BEA is a useful approach to assessing the costs and benefits of the different packages given there are some limitations to the available information on the impacts of houseboat greywater on water quality. BEA establishes how effective an option needs to be to offset its costs. Put another way, we used BEA to determine the break-even point, where the benefits of each



package equal the costs. At this point the net present value (NPV) of the costs and benefits is equal to zero and the benefit cost ratio (BCR) is equal to one – as illustrated in Figure 7. A BEA approach is commonly used in RIS impact assessments to help test whether the costs associated with an option are likely to be offset by a minimum level of benefit that can reasonably be expected to occur.

**Figure 7: Break even analysis – simplified example**



The overarching parameters for the CBA are presented in Table 11.

**Table 11: Overarching parameters for the break even analysis**

Parameter	Value
Price base	FY23 <sup>21</sup>
Appraisal start date	1 July 2024
Project appraisal period	10 years and 30 years
Appraisal end date	30 Jun 2034 and 30 Jun 2054
Discount rate	7% per annum in line with Department of Treasury and Finance guidelines <sup>22</sup>

A sensitivity analysis is then completed on the break even analysis to understand how the results would look as key assumptions are varied. The sensitivity scenarios tested are outlined in Table 12.

**Table 12: Sensitivity scenarios**

Scenario	Description
Minus 20% cost sensitivity	20% lower cost benchmarks to reflect cost uncertainty
Plus 20% cost sensitivity	20% higher cost benchmarks to reflect cost uncertainty
4% discount rate	Low discount rate sensitivity to reflect DTF guidance
9% discount rate	High discount rate sensitivity to reflect DTF guidance
High tourism benefits	Tourism benefits double health benefits to test uncertainty around the relative size of the monetised benefits
High health benefits	Health benefits double tourism benefits to test uncertainty around the relative size of the monetised benefits

<sup>21</sup> Based on June ABS CPI data for Melbourne

<sup>22</sup> Department of Treasury and Finance (2013), Economic Evaluation for Business Cases: Technical guidelines recommends a 7% per annum discount rate for interventions “which the benefits attributed to the project are more easily translated to monetary terms”

There are several impacts which it is not possible to place a monetary value on. These have been assessed qualitatively and will be incorporated into the overall assessment. The qualitative impacts are assessed against a five-point scale as outlined in Table 13.

**Table 13: Qualitative analysis assessment scoring scale**

Score	Description
Major adverse	Significant negative impact to Victorian community
Minor adverse	Slight or moderate negative impact to Victorian community
Neutral	No impact to Victorian community
Minor beneficial	Slight or moderate positive impact to Victorian community
Major beneficial	Significant positive impact to Victorian community

A CBA is undertaken from the point of view of society. However, for a regulatory reform it is clearly important to understand the composition of these impacts by stakeholder group. For example, for a reform it could be that costs are borne by business while benefits accrue to consumers. This distribution would not be highlighted in CBA results. To address this, the distribution of costs and benefits will be considered as part of this analysis.

## 6.2 Packaging options for assessment

The options for houseboat licensing, blackwater and greywater set out in Section 5 have some interdependencies, certainly in the outcomes that they contribute to. More broadly, houseboat blackwater regulation is currently monitored through houseboat licensing and, while not impossible to regulate through another lever, it makes sense to continue to regulate technical requirements through licensing. Given this, the options have been packaged for the purposes of options assessment. That is, rather than assessing each option separately, combinations of options (packages) have been established to capture these interdependencies. These packages are set out in Table 14.

**Table 14: Packages of options for assessment**

Package	Licensing	Blackwater	Greywater
Base case	Licensing through other means	No specific regulation	No specific regulation
Package A – low	Replicate current licensing provision through updated regulations	Replicate and update the current blackwater provisions in regulations	Simple greywater treatment interventions for all Category 3 and above houseboats (i.e. simple devices such as sink strainers/filters and under-sink grease traps)
Package B – central	Replicate current licensing provision through updated regulations	Replicate and update the current blackwater provisions in regulations	Simple greywater treatment interventions for private Category 3 (i.e. simple devices such as sink strainers/filters and under-sink grease traps) and above houseboats and comprehensive greywater treatment systems for new and commercial hire category 3 and above houseboats <sup>23</sup> .

<sup>23</sup> For noting: The regulations nomenclature uses 'type 1' to refer to commercial hire houseboats category 3 and above, 'type 2' to refer to new houseboats category 3 and above and 'type 3' to refer to private houseboats category 3 and above.



<b>Package</b>	<b>Licensing</b>	<b>Blackwater</b>	<b>Greywater</b>
Package C – high	Replicate current licensing provision through updated regulations	Replicate and update the current blackwater provisions in regulations	Comprehensive greywater treatment systems for all Category 3 and above houseboats

From the perspective of houseboat owners, a key element of the regulatory packages is the extent to which they require blackwater and greywater systems. For clarity, these requirements by package are summarised in Table 15. The cost of these systems is central to this analysis.

**Table 15: Summary of blackwater and greywater system requirements by package**

Category	Blackwater				Greywater			
	Base case	Package A	Package B	Package C	Base case	Package A	Package B	Package C
Cat 1-2	Blackwater capture tank				No system required			
Private cat 3-7					No system required	Simple	Simple	Comprehensive
New houseboats <sup>24</sup>					No system required	Simple	Comprehensive	Comprehensive
Commercial houseboats					No system required	Simple	Comprehensive	Comprehensive

<sup>24</sup> A **new houseboat** is defined in the exposure draft regulations to mean a houseboat for which—

- (a) an application for a houseboat licence is made on or after 11 June 2026; and
- (b) no houseboat licence has previously been issued

## 6.3 Impacts

The packages being assessed will have a range of impacts. These range from the financial costs associated with complying with regulatory options through to a range of flow on economic, environmental and social impacts. The key impacts included in this analysis are outlined in Figure 8, along with whether the impact is being assessed quantitatively or qualitatively.

**Figure 8: Overview of cost-benefit analysis process**



A summary of the driver of each impact and approach to each impact is provided in Table 16. Detail of how each impact has been calculated, input data and sources are provided in Appendix 4.

**Table 16: Summary of approach by impact**

Impact	Driver of the impact	Summary of approach
Cost of blackwater capture systems	Blackwater capture requirements across options	Capital costs, installation costs and operating and maintenance costs of blackwater systems based on Natural Capital Economics
Cost of greywater treatment systems	Greywater treatment requirements across options	Capital costs, installation costs and operating and maintenance costs of greywater systems based on Natural Capital Economics and DEECA data <sup>25</sup>
Compliance and enforcement costs	Overarching GMW compliance costs and inspection costs across options	Costs including compliance and enforcement officer costs and inspection costs based on DEECA data, and assumptions
Amenity and recreation opportunities	Flow on impacts from houseboat regulation to water quality and, in turn, a potential impact on the amenity of Lake Eildon and the attractiveness of recreation opportunities on the lake from change in algal blooms etc.	Estimated using visitor numbers, visitor spend and gross spend to value add data from sources including the Lake Eildon Tourism Masterplan and Tourism Research Australia

<sup>25</sup> The approach taken takes a conservative approach of focussing on adding new systems. Some houseboats installed greywater systems ahead of the greywater requirements which were repealed in 2017. It is understood none of these systems are in use but they could be recommissioned to comply with greywater requirements in the options.

Impact	Driver of the impact	Summary of approach
Risks to human health	Flow on impacts from houseboat regulation to water quality and, in turn, a potential impact on the risks to human health from change in pathogens and frequency of algal blooms	Estimated using visitor numbers, percentage of visitors engaging in water-based activities and cost of sickness from sources including the Lake Eildon Tourism Masterplan and an Australian National University report
Impact on biodiversity	Flow on impacts from houseboat regulation to water quality (e.g. pathogens and nutrients) and, in turn, a potential impact on biodiversity in and around Lake Eildon from change in algal blooms, pathogens etc.	Qualitative assessment of impact
Heritage and cultural value	Flow on impacts from houseboat regulation to water quality and, in turn, a potential impact on the heritage and cultural values associated with the Lake Eildon area	Qualitative assessment of impact
Impact on waterbody health	Direct impacts of houseboat regulation on water quality and flow on impacts for waterbody health such as algal blooms	Qualitative assessment of impact

### Evidence of impacts of greywater treatment systems

Greywater treatment system impacts are the driver of benefits in this analysis. DEECA commissioned Natural Capital Economics to estimate the impacts of different greywater treatment options on greywater discharge pollutants based on available evidence. Key findings are presented in Table 17.

**Table 17: Simple greywater systems expected daily pollutant reduction**

Houseboat category size	1	2	3	4	5	6
Parameter <sup>26</sup>						
Total solids (mg/L)	9-17%	9-17%	28-34%	18-25%	16-21%	15-20%
Total suspended solids (mg/L)	12-25%	12-25%	34-43%	15-30%	12-23%	11-21%
Biochemical oxygen demand (mg/L)	9-17%	9-17%	1-2%	0.7-1.5%	0.5-1.0%	0.5-1.0%
Oil and grease (mg/L)	4-8%	4-8%	17-33%	14-27%	11-21%	10-20%
Total nitrogen (mg/L)	0%	0%	0%	0%	0%	0%
Total phosphorus (mg/L)	0%	0%	0%	0%	0%	0%
Total coliforms (MPN) <sup>27</sup>	0%	0%	0%	0%	0%	0%

Source: (Natural Capital Economics, 2023)

Based on an estimate of the Lake Eildon houseboat fleet greywater discharge and pollutant concentration of this discharge, Natural Capital Economics estimate the annual reduced pollutants discharged with the simple greywater systems. These results are presented in Table 18.

<sup>26</sup> Range allows for a 50-100% operating efficacy for Lake Eildon conditions

<sup>27</sup> MPN = most probable number

**Table 18: Simple greywater systems estimated Lake Eildon annual pollutant reduction**

<b>Parameter</b>	<b>Fleet annual pollutants discharged (kg/annum)</b>	<b>Fleet annual reduced pollutants discharged (kg/annum)</b>	<b>Net reduction across fleet (%)</b>
Total solids	68-73	48-53	24-28%
Total suspended solids	53-57	37-42	27-32%
Biochemical oxygen demand	118-122	108-113	6-9%
Oil and grease	27-32	21-24	25-29%
Total nitrogen	6-8	5-8	5-8%
Total phosphorus	0.01-0.05	0.00-0.04	4-7%
Total coliforms	0.00	0.00	0.0%

Source: (Natural Capital Economics, 2023)

Like-for-like data on the comprehensive greywater systems estimated Lake Eildon annual reduction is not available in the Natural Capital Economics report. However, the report does include data on the efficacy of comprehensive systems. For example, a UV and filtration system has an average reduction of 90-100% against the pollutant categories (Natural Capital Economics, 2023).<sup>28</sup>

NCE’s analysis indicates that both the simple and comprehensive greywater treatment options reduce pollutants in houseboat greywater discharge. However, it is challenging to precisely estimate how these changes in water quality will impact on the changes in risks to human health and the risk of algal blooms. We have therefore used BEA to determine the break even point, where the benefits of each package equal the costs. That is, we have calculated the increase in tourism and reduction in gastro cases (as a proxy for risk to human health) needed for the benefits of the package to exceed the costs.

While these impacts of greywater treatment systems shown in the tables above are not used in the break even analysis, they do provide useful context on the potential benefits of the packages being assessed. Reduced greywater pollution, reduces risk of negative human health, algal bloom and biodiversity outcomes.

#### 6.4 Break even analysis results

Table 19 presents the break even results of each package compared to the base case. The break even analysis looks at scenario where the benefits are split 50:50 between tourism and health risk benefits.

Each package has the same blackwater requirements as the base case and thus does not have any incremental costs. This is because existing houseboats already have blackwater storage tanks installed and it is a standard feature on new houseboats.

Given this, the incremental costs relate to differing greywater system requirements and compliance and enforcement costs across the packages. The key cost is the greywater capital cost which is highest in Package C followed by Package B then Package A. The key driver of this change in costs is the cost of a comprehensive greywater treatment system, including installation, which costs in excess of \$10,000 compared to a simple greywater treatment system which costs under \$1,000 including installation. Given Package C requires the most comprehensive greywater treatment systems, it is the highest cost package. The difference in compliance and enforcement costs is driven by more frequent inspections being required for the comprehensive greywater treatment systems. Full details on the input costs and assumptions are provided in Appendix 4.

The break even results were calculated to be a less than 1% change in tourism and the reduction in risk of health across all the packages. For example, for Package B, for the benefits to break even with the costs, the

<sup>28</sup> The exceptions here are total solids and biochemical oxygen demand where there is a lack of data in the literature to model impacts.

regulation would need to lead to an increase in 0.2% in tourism to Lake Eildon (over and above the projected 4% per annum growth to 2030) and a reduction in the health risk of 0.2%. For Package C, as the costs increase, a higher percentage increase in tourism and a higher reduction in health risk is required to break even. Even though there is a step up in the costs, the break even change is still less than 1% for both benefits (0.7% increase in tourism and 0.5% reduction in health risk). For all packages, we consider the break even results to be plausible for the magnitude of outcome that could be realised from the regulatory change.

**Table 19: Break even analysis results (\$m FY23, present values) – 30 year appraisal period**

	Package A	Package B	Package C
Blackwater capital costs	No impact	No impact	No impact
Blackwater operating costs	No impact	No impact	No impact
Greywater capital costs	0.6	2.9	13.4
Greywater operating costs	2.2	2.6	4.4
Compliance and enforcement costs	No impact	0.1	0.5
<b>Total costs</b>	<b>2.8</b>	<b>5.7</b>	<b>18.4</b>
Increase in value of tourism	1.4	2.8	9.2
Reduction to human health risk	1.4	2.8	9.2
<b>Total benefits</b>	<b>2.8</b>	<b>5.7</b>	<b>18.4</b>
<b>Break even increase in tourism (%)</b>	<b>0.1%</b>	<b>0.2%</b>	<b>0.7%</b>
<b>Break even reduction in gastro cases (%)</b>	<b>0.1%</b>	<b>0.2%</b>	<b>0.5%</b>

Linking these results back to the underlying driver of the benefits, when water quality issues do arise, they may affect these factors for a prolonged period of time. For example, the blue-green algae warning for Lake Eildon that was issued by GMW on 21 April 2023 remained in place for 88 days.

We would expect that tourism and recreation within the Lake Eildon region would be positively affected by improvements in water quality and houseboat pollution management. In our view, a change in tourism visitation of 1-2% may be reasonable assumption, given the 'draw card' of the region is Lake Eildon as a National Park and the available water-based or water adjacent recreation opportunities and amenity.

A similar positive impact from improvements in water quality and houseboat pollution management is expected for human health, given the water-based recreation and use of lake water by houseboats. The percentage change that could be assumed to be a reasonable assumption may be lower than the tourism assumption — for example. There is a lack of actual data on water-quality related illnesses at Lake Eildon. In the absence of specific local data, one benchmark that can be used to estimate the potential scale of avoided costs is from the U.S. Environmental Protection Agency for recreational water quality, which sets a criterion of 0.036 (36 illnesses/1,000 swimmers) for the risk of gastroenteritis associated with swimming.<sup>29</sup> The costs involved in achieving a 1% improvement in water quality would equate to improving this swimmability benchmark improving by just over a quarter.

In addition to these impacts that are considered in a quantitative manner, the qualitative benefits will also act to increase the expected benefits of the option (which is equivalent to reducing the threshold required for the option to 'break even').

<sup>29</sup> In the absence of an equivalent Australian standard or criterion, the U.S. Environmental Protection Agency provides a broad benchmark for comparison. It is important to note that the unit is swimmers rather than swims and is based on a broad definition of illness which would include, for example, stomach ache.

Given the plausible natures of the break even results and the likely impact of qualitative benefits, we expect that the benefit-cost ratio for all packages is likely to be greater than 1. That is, each package would do better than break even with benefits outweighing costs.

### Sensitivity analysis

There are multiple uncertainties around the break even analysis. A series of sensitivity analyses have been undertaken to understand how results would change in different states of the world – these are presented in Table 20 - Table 26. These sensitivities look at varying costs, discount rates and extreme scenarios should there only be tourism benefits or only health benefits. These sensitivities are all for a 30 year appraisal period except for Table 26 that presents results using a 10 year appraisal period. They find that while the break even benefits requirement varies by sensitivity scenario, they remain in the same order of magnitude.

**Table 20: Break even analysis results (\$m FY23, present values) – minus 20% cost sensitivity**

	Package A	Package B	Package C
Blackwater capital costs	No impact	No impact	No impact
Blackwater operating costs	No impact	No impact	No impact
Greywater capital costs	0.5	2.3	10.7
Greywater operating costs	1.8	2.1	3.5
Compliance and enforcement costs	No impact	0.1	0.5
<b>Total costs</b>	<b>2.3</b>	<b>4.6</b>	<b>14.8</b>
Increase in value of tourism	1.1	2.3	7.4
Reduction to human health risk	1.1	2.3	7.4
<b>Total benefits</b>	<b>2.3</b>	<b>4.6</b>	<b>14.8</b>
<b>Break even increase in tourism (%)</b>	<b>0.1%</b>	<b>0.2%</b>	<b>0.6%</b>
<b>Reduction in gastro cases (%)</b>	<b>0.1%</b>	<b>0.1%</b>	<b>0.4%</b>

**Table 21: Break even analysis results (\$m FY23, present values) – plus 20% cost sensitivity**

	Package A	Package B	Package C
Blackwater capital costs	No impact	No impact	No impact
Blackwater operating costs	No impact	No impact	No impact
Greywater capital costs	0.7	3.5	16.1
Greywater operating costs	2.7	3.2	5.3
Compliance and enforcement costs	No impact	0.1	0.5
<b>Total costs</b>	<b>3.4</b>	<b>6.8</b>	<b>21.9</b>
Increase in value of tourism	1.7	3.4	11.0
Reduction to human health risk	1.7	3.4	11.0
<b>Total benefits</b>	<b>3.4</b>	<b>6.8</b>	<b>21.9</b>
<b>Break even increase in tourism (%)</b>	<b>0.1%</b>	<b>0.3%</b>	<b>0.8%</b>



	Package A	Package B	Package C
<b>Break even reduction in gastro cases (%)</b>	<b>0.1%</b>	<b>0.2%</b>	<b>0.6%</b>

**Table 22: Break even analysis results (\$m FY23, present values) – 4% discount rate sensitivity**

	Package A	Package B	Package C
Blackwater capital costs	No impact	No impact	No impact
Blackwater operating costs	No impact	No impact	No impact
Greywater capital costs	0.7	3.8	16.0
Greywater operating costs	3.3	4.0	6.7
Compliance and enforcement costs	No impact	0.2	0.9
<b>Total costs</b>	<b>4.0</b>	<b>8.0</b>	<b>23.7</b>
Increase in value of tourism	2.0	4.0	11.8
Reduction to human health risk	2.0	4.0	11.8
<b>Total benefits</b>	<b>4.0</b>	<b>8.0</b>	<b>23.7</b>
<b>Break even increase in tourism (%)</b>	<b>0.1%</b>	<b>0.2%</b>	<b>0.6%</b>
<b>Break even reduction in gastro cases (%)</b>	<b>0.1%</b>	<b>0.1%</b>	<b>0.4%</b>

**Table 23: Break even analysis results (\$m FY23, present values) – 9% discount rate sensitivity**

	Package A	Package B	Package C
Blackwater capital costs	No impact	No impact	No impact
Blackwater operating costs	No impact	No impact	No impact
Greywater capital costs	0.6	2.5	12.1
Greywater operating costs	1.8	2.1	3.4
Compliance and enforcement costs	No impact	0.1	0.4
<b>Total costs</b>	<b>2.3</b>	<b>4.7</b>	<b>15.9</b>
Increase in value of tourism	1.2	2.3	7.9
Reduction to human health risk	1.2	2.3	7.9
<b>Total benefits</b>	<b>2.3</b>	<b>4.7</b>	<b>15.9</b>
<b>Break even increase in tourism (%)</b>	<b>0.1%</b>	<b>0.2%</b>	<b>0.8%</b>
<b>Break even reduction in gastro cases (%)</b>	<b>0.1%</b>	<b>0.2%</b>	<b>0.6%</b>

**Table 24: Break even analysis results (\$m FY23, present values) – only tourism benefits**

	Package A	Package B	Package C
Blackwater capital costs	No impact	No impact	No impact
Blackwater operating costs	No impact	No impact	No impact
Greywater capital costs	0.6	2.9	13.4
Greywater operating costs	2.2	2.6	4.4
Compliance and enforcement costs	No impact	0.1	0.5
<b>Total costs</b>	<b>2.8</b>	<b>5.7</b>	<b>18.4</b>
Increase in value of tourism	2.8	5.7	18.4
Reduction to human health risk	0.0	-0.0	0.0
<b>Total benefits</b>	<b>2.8</b>	<b>5.7</b>	<b>18.4</b>
<b>Break even increase in tourism (%)</b>	<b>0.2%</b>	<b>0.4%</b>	<b>1.4%</b>
<b>Break even reduction in gastro cases (%)</b>	<b>0.0%</b>	<b>0.0%</b>	<b>0.0%</b>

**Table 25: Break even analysis results (\$m FY23, present values) – only health benefits**

	Package A	Package B	Package C
Blackwater capital costs	No impact	No impact	No impact
Blackwater operating costs	No impact	No impact	No impact
Greywater capital costs	0.6	2.9	13.4
Greywater operating costs	2.2	2.6	4.4
Compliance and enforcement costs	No impact	0.1	0.5
<b>Total costs</b>	<b>2.8</b>	<b>5.7</b>	<b>18.4</b>
Increase in value of tourism	0.0	-0.0	-0.0
Reduction to human health risk	2.8	5.7	18.4
<b>Total benefits</b>	<b>2.8</b>	<b>5.7</b>	<b>18.4</b>
<b>Break even increase in tourism (%)</b>	<b>0.0%</b>	<b>0.0%</b>	<b>0.0%</b>
<b>Break even reduction in gastro cases (%)</b>	<b>0.2%</b>	<b>0.3%</b>	<b>1.0%</b>

**Table 26: Break even analysis results (\$m FY23, present values) – 10 year appraisal period**

	Package A	Package B	Package C
Blackwater capital costs	No impact	No impact	No impact
Blackwater operating costs	No impact	No impact	No impact

	Package A	Package B	Package C
Greywater capital costs	0.6	2.0	12.5
Greywater operating costs	0.8	0.9	1.4
Compliance and enforcement costs	No impact	0.0	0.0
<b>Total costs</b>	<b>1.4</b>	<b>2.9</b>	<b>13.9</b>
Increase in value of tourism	0.7	1.4	6.9
Reduction to human health risk	0.7	1.4	6.9
<b>Total benefits</b>	<b>1.4</b>	<b>2.9</b>	<b>13.9</b>
<b>Break even increase in tourism (%)</b>	<b>0.1%</b>	<b>0.3%</b>	<b>1.4%</b>
<b>Break even reduction in gastro cases (%)</b>	<b>0.1%</b>	<b>0.2%</b>	<b>1.0%</b>

### Qualitative assessment

The qualitative assessment of packages is provided in Table 27. The results are consistent across the packages – a minor positive impact on biodiversity and waterbody health, together with a neutral impact on heritage and cultural value. The positive impacts to biodiversity and waterbody health are due to each package having a reduction in pollutants discharged into Lake Eildon relative to the base case. The impact is assessed as minor given the range of pollution sources to Lake Eildon beyond houseboats and the volume of the lake relative to the change in pollutants. The neutral impact on heritage and cultural value reflects the packages not causing impacts that have a clear link to heritage or cultural values.

**Table 27: Qualitative assessment of packages**

	Package A	Package B	Package C
Impact on biodiversity	Minor positive	Minor positive	Minor positive
Heritage and cultural value	Neutral	Neutral	Neutral
Impact on waterbody health	Minor positive	Minor positive	Minor positive

Table 28 summarises the quantitative and qualitative analysis results. On balance, Package B is the preferred option based on costs and benefits.

**Table 28: Summary of quantitative and qualitative analysis results – 30 year appraisal period**

	Package A	Package B	Package C
Present value of costs (\$m FY23)	2.8	5.7	18.4
Present value of break even benefits (\$m FY23)	2.8	5.7	18.4
Break even increase in tourism (%)	0.1%	0.2%	0.7%
Break even reduction in gastro cases (%)	0.1%	0.2%	0.5%
Impact on biodiversity	Minor positive	Minor positive	Minor positive
Heritage and cultural value	Neutral	Neutral	Neutral
Impact on waterbody health	Minor positive	Minor positive	Minor positive

## 6.5 Distributional analysis

As previously stated, CBA/break even analysis provides a result from the point of view of society. It does not provide a breakdown of which parties incur costs and which parties would realise benefits. Distributional analysis is an extension to CBA which looks into impacts by party.

The first step in a distributional analysis is to define the relevant parties for consideration. For this analysis, the identified parties are:

- Houseboat owners and users
- Other Lake Eildon visitors<sup>30</sup>
- Lake Eildon community (including Lake Eildon houseboat builders)
- Broader Goulburn region community
- Broader Victorian community

The next step is to consider which parties incur the costs and benefits included in the CBA/break even analysis. The allocation of costs and benefits are shown in Table 29 and Table 30 respectively. In short, the costs entirely fall on houseboat owners whereas the benefits are split across parties. The percentage split of the costs and benefits aren't expected to differ by package (though clearly the value of the associated cost or benefit would vary between package).

**Table 29: Distributional analysis – costs to parties**

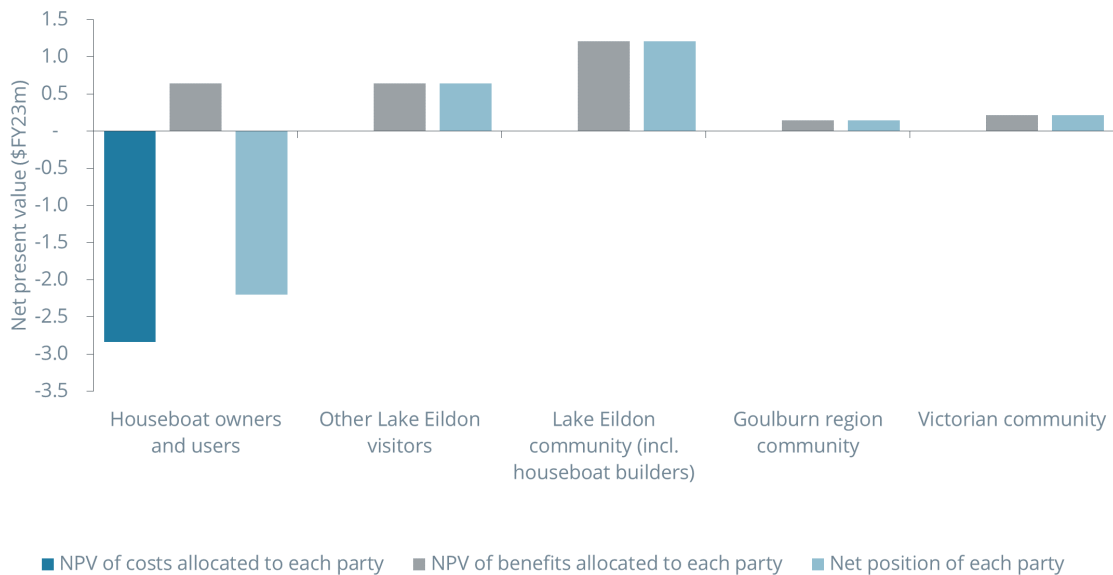
	Houseboat owners and users	Other Lake Eildon visitors	Lake Eildon community	Broader Goulburn region community	Broader Victorian community
Blackwater capital costs	100%				
Blackwater operating costs	100%				
Greywater capital costs	100%				
Greywater operating costs	100%				
Compliance and enforcement costs	100%				

<sup>30</sup> The term "Other Lake Eildon visitors" is not to suggest that all houseboat owners are tourists, but rather that some are and thus there is not overlap with the "Other Lake Eildon tourists" category.

**Table 30: Distributional analysis – benefits to parties**

	Houseboat owners and users	Other Lake Eildon visitors	Lake Eildon community	Broader Goulburn region community	Broader Victorian community
Increase in value of tourism			80%	10%	10%
Reduction to human health	45%	45%	5%		5%

**Figure 9: Net position of each party – Package B**



The distributional analysis demonstrates that houseboat owners are bearing the majority of the costs in this economic analysis. While they do accrue some benefits from the regulation, their net position is still negative. This aligns with the premise of the regulation – reducing a negative externality that houseboat owners impose on society from their greywater discharge into Lake Eildon.

In terms of the distribution of costs across the houseboat fleet. Private category 1-2 boats are not required to install a greywater system in Package B and hence do not incur additional costs. In contrast, private category 3-7 boats are required to install a simple system at a cost of approximately \$1,000 (see Appendix 4 for detailed costs included in analysis) and new and commercial houseboats are required to have a comprehensive greywater system at a cost of \$10,000-20,000. The distribution of costs across private and commercial houseboats aligns with the risks that they create with category 1-2 having less greywater discharge than category 3-7. For category 3-7, commercial houseboats are likely to have high utilisation and thus higher greywater discharge. New boats is slightly different as this is an opportunity for a step change in the greywater discharge pollutants in the long term as existing houseboats are replaced with new houseboats.

Transfer payments are not captured in economic evaluation as it does not create additional value or cost to society. However, the costs incurred by houseboat owners to install greywater systems is transferred through the Lake Eildon community and houseboat builders. The current Lake Eildon houseboat industry is significant with boat builders, specialist plumbers, and compliance officers. The majority of this industry live and work in the Eildon region.

All other parties – other Lake Eildon visitors, Lake Eildon community, Goulburn region community and Victorian community are net beneficiaries from the proposed regulation. This reflects how the benefits from increased tourism and reduced health risk is spread across the parties.

## 6.6 Preferred package

The break even analysis found that all packages could deliver net benefits to society with plausible and defensible changes to tourism and health impacts. To determine the preferred option, broader benefits, implementation and feasibility of packages was considered. There is also a relationship between the General Environmental Duty that the EPA places on individuals using houseboats and houseboat pollution management.

**The preferred package is Package B**, with the key reasons being:

- It is expected to best balance the anticipated additional costs for houseboat owners with the benefits to the broader community.
- Balances costs on houseboat owners with benefits delivered to the broader region. It requires houseboat owners to make changes that are reasonably practicable as part of meeting their general environmental duty to limit risk and targets a key source of the highest risk pollutants: pathogens and nutrients from kitchen wastewater. Existing private owners with Category 3-6 houseboats would face an upfront cost of around \$1,000 to install a simple greywater system. Compared to a Category 3-6 licence having a resale value of \$80,000-100,000 (which provides a proxy for houseboats owners willingness to pay to be on Lake Eildon) this is a relatively modest cost.
- It provides a practical implementation pathway with an extended transition period to align with slipping of the houseboat fleet (see Section 5).
- There are already suppliers with comprehensive greywater treatment system technology being developed and tested on Lake Eildon houseboats. The technology is readily available to houseboat owners for simple interventions.

### **Competition and small business impacts**

New regulations have the potential to reduce competition or adversely impact on small business. It is good practice to consider impacts on competition and small business to seek to avoid, or at least limit, any potential adverse impact of new regulations on competition or causing disproportionate impacts to small business.

It is not clear that the preliminary preferred package would impact on competition. There is the potential for the first supplier to meet the specifications and testing requirements for greywater systems, to corner the market. However, this should not be a large barrier to other suppliers entering the market and hence there is unlikely to be a significant competition effect.

More broadly, the package is likely to be net beneficial to small businesses. While commercial houseboat owners would incur additional costs from the new regulations, these would be outweighed by the benefits to houseboat builders in the Lake Eildon region, which will benefit from installing and maintaining the greywater systems, and largely comprise small businesses.

## 7. Implementation plan

The key steps for implementation of the Water (Lake Eildon Recreational Area) (Houseboats) Regulations 2024 are outlined in Table 31. Both GMW and DEECA (as the regulator and policy maker) will play roles in the implementation of the regulations. The sections below provide more detail on the implementation plan.

**Table 31: Staged approach to implementation**

Areas of work	Key outputs	Timing
Regulations	<ul style="list-style-type: none"> <li>Public consultation on draft regulations and RIS</li> <li>Introduction of Water (Lake Eildon Recreational Area) (Houseboats) Regulations 2024</li> </ul>	<ul style="list-style-type: none"> <li>Mar/April 2024</li> <li>10 June 2024</li> </ul>
Continuation of licensing arrangements, blackwater requirements and broader regulation of houseboats	<ul style="list-style-type: none"> <li>Notification around licencing and blackwater arrangements continuing largely as current</li> <li>GMW and others (e.g. RDV) to continue to explore opportunities to upgrade Jerusalem Creek Wastewater Barge in line with Lake Eildon Masterplan</li> </ul>	<ul style="list-style-type: none"> <li>June 2024</li> <li>June 2025</li> <li>Ongoing</li> </ul>
Transition for greywater requirements	<ul style="list-style-type: none"> <li>Complete detailed implementation plan by GMW and DEECA for greywater requirements</li> <li>Support mechanisms for comprehensive greywater interventions to meet specifications and testing requirements</li> <li>Undertake behaviour change work with houseboat owners to co-design appropriate support for regulation implementation (e.g. uptake of greywater interventions and measures to manage food and grease trap waste)</li> </ul>	<ul style="list-style-type: none"> <li>September 2024</li> <li>December 2024</li> <li>December 2024</li> </ul>
Ongoing monitoring and enforcement of greywater requirements	<ul style="list-style-type: none"> <li>Inclusion of greywater requirements in compulsory houseboat inspection report for when the transition period has finished and installations are compulsory</li> <li>Inclusion of greywater requirements in licence terms and conditions for when the transition period has finished and installations are compulsory</li> <li>Process developed to track intervention maintenance/servicing works required for licence renewal.</li> </ul>	<ul style="list-style-type: none"> <li>June 2024</li> <li>June 2025</li> <li>June 2025</li> </ul>
Monitoring and evaluation	<ul style="list-style-type: none"> <li>Annual reporting against key outputs (progress and efficacy)</li> </ul>	<ul style="list-style-type: none"> <li>Annually to 2033</li> </ul>

### 7.1 Regulations

The remade regulations are due to come into force on 11 June 2024. Houseboats licenced under the current regulations will continue to be so until all houseboat licences are renewed on 1 July 2024.

DEECA will review submissions on the exposure regulations and make adjustments, if necessary, which will need to be approved by the Office of the Chief Parliamentary Counsel and Minister for Water before they are submitted to Governor in Council for the regulations to be made.



## 7.2 Continuation of licensing arrangements, blackwater requirements and broader regulation of houseboats

Given the proposed provisions for houseboat licencing and blackwater management are substantively the same as those currently in place, no specific implementation plan is proposed for these aspects. GMW will continue to administer the houseboat licence program (including compulsory inspections of blackwater systems) as well as operate blackwater barges.

GMW also retains the ability to modify the cap on houseboat licences based on fluctuating lake levels at Lake Eildon, marina capacity, water quality, and other factors such as where the houseboats can be safely moored and operated when lake water levels are very low.

More broadly, GMW and others (e.g. Regional Development Victoria) will continue to explore opportunities to upgrade Jerusalem Creek Wastewater Barge in line with Lake Eildon Masterplan.

## 7.3 Transition for greywater requirements

BehaviourWorks Australia has been engaged by DEECA to work with houseboat owners to understand patterns of houseboat usage and food waste behaviours.

### Simple Interventions

Upon the commencement of the remade regulations, GMW will continue the compulsory houseboat slipping and inspection requirements within houseboat licence terms and conditions. Given this, houseboats that have not been inspected within the last 5 to 7 years will be required to be inspected. Houseboat owners will be encouraged to have simple greywater interventions installed at the same time. Alternatively, the houseboat owner could arrange for installation while the boat is still on the water. Houseboats that must meet the simple intervention requirements (of which there are currently over 700) will have up to 1 January 2034 to comply.

### Comprehensive Interventions

For a comprehensive greywater treatment system to be installed, the greywater system suppliers must develop the systems in accordance with the specifications provided in the regulations and it must be tested. In addition to the water pollution outcome requirements, the specifications would also consider functional considerations around factors including noise, odour and vibration impacts on houseboats.

New houseboats would need to install a comprehensive greywater treatment system by 11 June 2027 (3 years after the regulations are remade)<sup>31</sup>. For commercial houseboats a comprehensive greywater treatment system would need to be installed by 1 January 2034 (almost 10 years after the regulations are remade).

The economic modelling has assumed a 2 year period to be needed for suppliers to complete testing against the specifications before installations start on new and commercial houseboats. There are already suppliers with the technology being developed and tested on Lake Eildon houseboats.

## 7.4 Ongoing monitoring and enforcement of greywater requirements

GMW will develop a process for houseboat owners to include evidence of annual simple or comprehensive intervention maintenance/servicing (e.g. tax invoices) as part of their licence renewal requirements. Additional requirements (if needed) will be specified in houseboat licence terms and conditions as well as communicated through forums such as the GMW houseboating webpage.

GMW will also have authorised officers that can take action against offences that take place under the regulations including by issuing infringements.

Importantly, initiatives to support voluntary compliance with the regulations and uptake of greywater interventions will be implemented.

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<sup>31</sup> It is assumed that a system must demonstrate completion of testing against specifications developed as part of the regulations.

## 7.5 Stakeholder communications and engagement

A variety of groups have been used to provide valuable input into the development of the regulations including the:

- Houseboat Stakeholder Working Group
- Houseboat Owners' Committee
- Water Quality Working Group
- Technical Working Group (sub-group of the Houseboat Stakeholder Working Group)

These groups are likely to have some role, particularly the Houseboat Stakeholder Working Group and Houseboat Owners' Committee when it comes to informing implementation.

There are also a range of different communication channels that have been effective in providing information to the houseboat community such as newsletters, fact sheets and websites produced by DEECA, information provided by GMW through their webpage and information provided by marinas such as Eildon Boat Club's Watermark magazine.

Communications and engagement plans have been developed by DEECA for the various stages of the regulations development process to date and another plan will be developed to inform the implementation of the regulations.

## 7.6 Resourcing needs

GMW will be responsible for the implementation of the remade regulations and will continue to be responsible for the business-as-usual compliance, enforcement and administration of the regulations. This includes broader operational matters (e.g. blackwater barge operations and waste collection).

DEECA's resourcing will vary depending on the phase of regulation development and implementation. DEECA will work with GMW to determine the level of additional support required to implement and evaluate the regulations outside of GMW's resourcing capacity. Resourcing assistance will likely increase in the years prior to the regulations sunseting to review and remake them in consultation with key stakeholders.

## 8. Evaluation strategy

Linking the regulations to the problem statement and objectives associated with the RIS, there is a need to see how this plays out in practice. That is, there is a need to evaluate the impact of changes to houseboat wastewater management on risks to human health and the environment, including the success on behaviour change and uptake of the interventions. This section outlines the evaluation strategy for the Water (Lake Eildon Recreational Area) (Houseboats) Regulations 2024.

Evaluating the Regulations will draw on information from GMW's activities. GMW will continue to undertake water quality monitoring at Lake Eildon to understand trends and levels of parameters like nutrients (nitrogen and phosphorous). However, as houseboats are a small but confirmed contributor to pollution in Lake Eildon and given catchment scale impacts of nutrient input, attribution of nutrient levels to houseboat wastewater is not possible. Monitoring of blue-green algal bloom duration will also continue to be undertaken by GMW to inform trends in their duration (and potentially their size and severity). Although these monitoring programs can provide a broad indication of Lake Eildon water quality, it is not possible to attribute improvements directly to houseboat greywater interventions.

Changes in visitation numbers to Lake Eildon and tourism benefits will be evaluated through data on visitations provided by North East Tourism and local government sources. GMW also collect data on vehicle visitation to the lake. However, houseboat wastewater is assumed to have a minor impact on visitation and amenity at Lake Eildon.

Compliance indicators will be used to evaluate the Regulations. These indicators include the number of interventions installed (including via voluntary uptake), fines issued, patrols conducted, a qualitative analysis of the power of deterrence and reporting on the impact of complementary initiatives to support voluntary compliance can provide insight into the success of the regulations and their implementation.

GMW's annual survey will also be used to evaluate the effectiveness of the Regulations. This survey can include houseboat-related survey questions which are designed to evaluate knowledge of the houseboat community regarding the GED, behaviour change habits, perceived improvements in water quality around marinas (reduction in scum) and perceived increase in benefits to provide qualitative data on the success of the regulations. As houseboat owners will bear the costs of implementing the regulations, these questions can provide insight into the feasibility of the interventions (a key concern for these regulations) and the perceived increase in the benefits for themselves and the broader Lake Eildon community and visitors.

The BehaviourWorks 2021 report which surveyed houseboat owners on waste management practices can serve as a baseline as well as the survey questions prepared for the Engage Victoria public consultation of the exposure draft regulations. Further analysis can be completed to estimate litres of greywater that has been treated across the houseboat fleet and reductions in pollution load using estimates provided in section 6.3 Impacts and Table 18.

**Table 32: Staged approach to implementation**

Evaluation measure	Why the measure is relevant and how it will be baselined	How, when and by whom the data will be collected
Measure 1: Pathogen levels at priority locations (marinas)	<ul style="list-style-type: none"> <li>This measure provides a broad indication of Lake Eildon water quality, while acknowledging that it is not possible to attribute improvements directly to houseboat greywater interventions.</li> <li>Pathogens are a risk to human health and the regulations aim to reduce pathogens from houseboat greywater into the lake</li> </ul>	<ul style="list-style-type: none"> <li>Continuation of established GMW water quality monitoring (2024 onwards)</li> <li>Analyse and report on results (2028 and 2032)</li> </ul>

Evaluation measure	Why the measure is relevant and how it will be baselined	How, when and by whom the data will be collected
	<ul style="list-style-type: none"> <li>Baseline data is available from GMW monitoring 2020-22.</li> </ul>	
<p>Measure 2: Nutrient levels at priority locations (marinas)</p>	<ul style="list-style-type: none"> <li>This measure provides a broad indication of Lake Eildon water quality, while acknowledging that it is not possible to attribute improvements directly to houseboat greywater interventions.</li> <li>Nutrients are a factor in blue-green algal bloom duration, frequency and severity and the regulations aim to reduce impacts from houseboat greywater.</li> <li>Baseline data is available from GMW monitoring (for the broader lake) with over ten years' data</li> </ul>	<ul style="list-style-type: none"> <li>Continuation of established GMW water quality monitoring (2024 onwards)</li> <li>Analyse and report on results (2028 and 2032)</li> </ul>
<p>Measure 3: Frequency and length of algal blooms</p>	<ul style="list-style-type: none"> <li>This measure provides a broad indication of Lake Eildon water quality, while acknowledging that it is not possible to attribute improvements directly to houseboat greywater interventions.</li> <li>Blue-green algal bloom duration, frequency and severity is affected by nutrients from houseboat wastewater (and other sources)</li> <li>Baseline data is available from GMW monitoring (for the broader lake) for over ten years.</li> </ul>	<ul style="list-style-type: none"> <li>Collect data on blue-green algal bloom duration from GMW and Floodzoom portal</li> <li>Analyse and report on results (2028 and 2032)</li> </ul>
<p>Measure 4: Changes in visitation to Lake Eildon</p>	<ul style="list-style-type: none"> <li>Water quality can impact visitation of Lake Eildon, although houseboat wastewater is assumed to have a minor impact on water quality.</li> </ul>	<ul style="list-style-type: none"> <li>Continue to track visitor numbers via data from North East Tourism, local government and GMW data sources (ongoing).</li> <li>Analyse and report on results (2032)</li> </ul>
<p>Measure 5: Compliance and enforcement indicators</p>	<ul style="list-style-type: none"> <li>Data on compliance and enforcement including number of installations can provide an indication of the impact of the regulations and how it has supported GMW's broader compliance and enforcement framework.</li> </ul>	<ul style="list-style-type: none"> <li>Maintain GMW records on number of greywater installations (from June 2024)</li> <li>Use of GMW compliance and enforcement data (from June 2024 onwards)</li> <li>Report on the impact of complementary initiatives to support voluntary compliance and update of greywater interventions (2028 and 2032)</li> </ul>

Evaluation measure	Why the measure is relevant and how it will be baselined	How, when and by whom the data will be collected
	<ul style="list-style-type: none"> <li>The baseline is current status (e.g. no installations) as at the start of the remade regulations of June 2024</li> </ul>	<ul style="list-style-type: none"> <li>Analyse and report on results (2028 and 2032)</li> </ul>
<p>Measure 6: Changes in behaviour of Lake Eildon houseboat community, perception of improved water quality and perception of success of the regulations</p>	<ul style="list-style-type: none"> <li>Survey questions for the houseboat community can contribute towards an assessment of the success of the regulations and an understanding of the benefits compared to the costs incurred by the houseboat community.</li> <li>Baseline data is provided in behaviour change report completed by BehaviourWorks in 2021 which included a survey of waste management practices and behaviours of the houseboat community. The survey questions used on Engage Victoria to support public consultation of the exposure regulations and this RIS can also contribute baseline data.</li> </ul>	<ul style="list-style-type: none"> <li>GMW annual survey sent to customers, with specific survey questions relating to the Lake Eildon houseboat community (from 2024 onwards).</li> <li>Themes for inclusion are knowledge regarding the GED, behaviour change habits, perceived improvements in water quality around marinas (reduction in scum) and perceived increase in benefits.</li> <li>Analyse and report on results (2028 and 2032)</li> </ul>
<p>Measure 7: Estimated reduction in greywater pollution from houseboats</p>	<ul style="list-style-type: none"> <li>Provides an indication of greywater pollution reduction attributed to the regulations and their implementation.</li> <li>The baseline is current status (e.g. no installations) as at the start of the remade regulations of June 2024</li> </ul>	<ul style="list-style-type: none"> <li>Data collection from number of installations (from 2024 onwards)</li> <li>Data collection regarding behaviour change based on GMW survey questions (from 2024 onwards)</li> <li>Analyse and report on results (2028 and 2032)</li> </ul>

DEECA will develop mid-term (5 year) and final (10 year) evaluation reports into the effectiveness of the regulations in achieving their intended aims as well as provide recommendations to enhance their future implementation. They will be published on the DEECA website and circulated to key stakeholders.

# Appendix 1 Environmental Reference Standard (Government of Victoria, 2021)

Environmental value	Description of environmental value	Water quality Benchmarks	Indicators and objectives
Water dependent ecosystems and species	<p>Water quality that is suitable to protect the integrity and biodiversity of water dependent ecosystems. This integrity and biodiversity includes –</p> <ul style="list-style-type: none"> <li>the integrity of riparian vegetation as it contributes to the health of water dependent ecosystems and bank stability;</li> <li>groundwater quality that does not adversely affect surface water ecosystems;</li> <li>groundwater quality that does not adversely affect natural ecosystems that require access to groundwater to meet all or some of their water requirements on a permanent or intermittent basis to maintain their communities of organisms, ecological processes and ecosystem services. This includes wetlands, rivers and streams reliant on groundwater baseflow, some terrestrial vegetation and some estuarine and near-shore marine systems, stygofauna and troglofauna;</li> <li>maintenance of fish passage</li> </ul>	<p>The level that ensures the groundwater does not affect receiving waters to the extent that the level of any indicator in the receiving waters:</p> <p>(a) exceeds the level of that indicator (if specified as an upper limit); or</p> <p>(b) is less than the level of that indicator (if specified as a lower limit), specified for surface water in Division 3 of Part 5 of this ERS.</p>	<p>The frequency, duration or spatial extent of harmful algal blooms in marine and estuarine waters</p> <p>The level of nutrients, particularly nitrogen and phosphorus, do not cause an increase in the frequency, duration or spatial extent of harmful algal blooms</p>
Human consumption after appropriate treatment	<p>Surface water quality that is suitable for use by drinking water suppliers for delivery, after appropriate treatment, to consumers of drinking water.</p>	<p>If water is sourced for supply – in a special water supply catchment area set out in Schedule 5 of the <i>Catchment and Land Protection Act 1994</i>; or in accordance with the <i>Safe Drinking Water Act 2003</i>.</p> <p>Note : Lake Eildon is not included under Scheduled 5</p>	<p>Indicators specified in the Australian Drinking Water Guidelines (ADWG)</p> <p>Health-related guideline value for each indicator specified in the ADWG</p>
Water-based recreation	<p>Water quality that is suitable for primary contact recreation (for example swimming, diving, water skiing, caving and spas), secondary contact recreation (for example boating and fishing) and for aesthetic enjoyment</p>	<p>E. Coli 10 E. coli/100 mL (if no human faecal contamination sources identified) 0 E. coli/100 mL (if human faecal contamination sources identified)</p> <p>Chemicals Level of indicators (where specified) and descriptions in applicable guidance, in the Recreational Water Guidelines</p>	<p>E. coli, enterococci Note For freshwater either E. coli or enterococci can be used, but for marine and estuarine water only enterococci can be used.</p> <p>IND - Harmful algae, chemical hazards, aesthetic effects</p> <p>Short-term and long-term site specific microbial water quality objectives, derived from a risk assessment approach following industry best practice and guidance published or approved by EPA.</p>

Environmental value	Description of environmental value	Water quality Benchmarks	Indicators and objectives
Agriculture and irrigation	Water quality that is suitable for agricultural activities such as stock watering and irrigation, as well as a range of other uses such as the irrigation of domestic gardens, commercial agriculture, parks and golf courses	Indicators specified for irrigation and water for general on-farm use in the ANZG	<p>Level of indicators (where specified) and descriptions in applicable guidance, in the Recreational Water Guidelines</p> <p>Indicators specified for livestock drinking water quality in the ANZG Australia New Zealand Food Standards Code – Schedule 19 – Maximum levels of contaminants and natural toxicants (Includes maximum levels of arsenic, cadmium, lead and mercury and tin in livestock)</p>



## Appendix 2 Houseboat numbers and greywater discharge estimates

Houseboat category	Maximum Size	Numbers in 2011	% of 2011 fleet	Numbers in 2021	% of 2021 fleet
1	10m x 3.5m	44	6.16	37	5%
2	10.6m x 4.5m	3	0.42	12	2%
3	10.6m x 4.5m (2 or more enclosed levels) 13.7m x 5.5m, (1 enclosed level)	31	4.34	11	2%
4	13.7m x 5.5m, (2 or more enclosed levels) 15.2m x 6.25m, (1 enclosed level)	443	62.04	223	31%
5	15.2m x 6.25m (2 or more enclosed levels) 18.3m x 7.25m (1 enclosed level)	197	27.59	233	32%
6	18.3m x 7.25m (2 enclosed levels)	0	0.00	208	28%
7	20m x 8m	0	0.00	0	0%
Total		718	100%	724	100%

Category	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
1	42	39	43	41	41	41	40	37
2	9	11	8	8	8	8	8	12
3	32	25	24	23	23	21	18	11
4	389	276	289	287	287	283	264	223
5	211	254	243	239	239	237	238	233
6	17	111	117	123	123	132	154	208
7	1	1	0	0	0	0	0	0
Total	701	717	724	721	721	722	722	724

Category	Average no. of berths	2013/14 Total water per houseboat class #	2020/21 Litres Total per houseboat class #	Estimated change in greywater discharge 2013/14 compared to 2020/21 %	2020/21 Litres Total per houseboat class # Estimate of Greywater	2020/21 Litres Total per houseboat class # Estimate of Galley Water
1	3	107,9442	950,937	88.096%	819,268.8	131,668.2
2	3	231,309	308,412	133.33%	265,708.8	42,703.19
3	5	1,370,720	471,185	34.38%	405,944	65,240.98
4	7	23,327,941	13,373,087	57.33%	11,521,429	1,851,658

5	8	14,461,096	15,968,888	110.43%	13,757,812	2,211,076
6	10	1,456,390	17,819,360	1223.53%	15,352,065	2,467,295
7	10	856,70	0	0	0	0
Total		42,012,568	48,891,869	116.37%	42,122,227	6,769,642

# Assumptions from (Jacobs Group (Australia) Pty Limited, 2018, p. 19) 130 litres of greywater discharged per person per day x average number of berths x boats in class x 42 days @80% in summer peak and 323 days at 10% remainder of the year

# Appendix 3 Further details on legislative and regulatory context

Legislative and regulatory settings for management in the Lake Eildon are primarily governed in the context of acts of parliament (Victorian and Australian). These acts identify rights, duties and responsibilities on government, agencies and the community and can be implemented through underpinning regulatory schemes and standards.

The Department of Environment, Energy and Climate Action (DEECA) has carriage of the *Water Act 1989* and subordinate regulations which includes the Houseboat Regulations. As such they act in concert with all other regulators to ensure a coordinated legislative and regulatory framework development to effectively manage houseboat operations on Lake Eildon.

## Water Act 1989

In Victoria, the *Water Act 1989* determines water uses, duties and obligations of all water holders. The Act seeks to balance competing rights and interests, to among other things:

- ensure water resources are conserved and properly managed for the sustainable use for the benefit of future Victorians
- consider cultural and recreational uses and values of water, and
- provide a formal means of protection and enhancement of the environmental values of waterways.

Section 324 of the *Water Act 1989* enables the development of houseboat related regulations to:

- prescribe standards for houseboat sewerage and water supply, services, installations and ancillary equipment
- prescribe fees for an application, licence, permit, registration, variation, renewal, transfer or assignment of a houseboat

It also enables the development of other regulations that have implications for houseboat usage such as

- for the control, management and use of recreational areas (i.e. Lake Eildon),
- for the protection of people in recreational areas from nuisance and injury,
- for the conservation and preservation of flora, fauna and habitat in recreational areas,
- for the granting of leases or licences in recreational areas (e.g. marinas)

According to the General Order, the Minister for Water is responsible for the *Water Act 1989* although the Minister for Outdoor Recreation jointly and severally administers Section 324 where it relates to the making of regulations for houseboats.

Section 122ZA of the *Water Act 1989* enables the Minister for Water to determine land owned or controlled by an authority to be a recreational area. Lake Eildon is a recreational area that is managed by GMW in accordance with functions prescribed under the Act. GMW therefore issues and administers leases and licences for land adjoining the lake for purposes like marinas and livestock grazing.

## Water Act Regulations

Current recreational uses of the Lake Eildon Recreation Area including houseboating are permitted use under conditions set out in regulations and bylaws:

- Water (Lake Eildon Recreational Area)(Houseboats) Regulations S.R. No 60/2013 (2013), and
- Water (Recreational Area) Regulations 2023

The purpose of the Houseboat Regulations has been outlined in Section 2.1. Although it is acknowledged that other sources of water pollution find their way into Lake Eildon, the Houseboat Regulations can only address water quality impacts particularly of blackwater and greywater use, treatment and disposal from houseboats on Lake Eildon.

The Recreational Area Regulations have a range of objectives related to the maintenance of water quality in waterways, promotion of safety, enjoyment and recreation of visitors as well as the maintenance and improvement of biodiversity. It also seeks to protect and promote Aboriginal cultural heritage and the knowledge, rights and aspirations of traditional owners. Division 5 - Hygiene of the regulations covers the use of toilets, soap and detergents within recreational areas which includes houseboats. Managers of the

recreational area (i.e. water corporations) are typically responsible for administration and enforcement of the regulations.

### **Safe Drinking Water Act 2003**

Water in Lake Eildon is classified as non-potable and not suitable for drinking. Although water from Lake Eildon storage is extracted by Goulburn Valley Water (GVW) and treated before being supplied as drinking water for households in Bonnie Doon. Water is also extracted by GVW from the Goulburn River downstream to supply townships such as Eildon and Alexandra. The *Safe Drinking Water Act 2003* requires drinking water to be safe for human consumption and GVW is responsible for providing these services for townships in the vicinity of Lake Eildon.

### **Safe Drinking Water Regulations 2015**

The Safe Drinking Water Regulations (2015) establish requirements to manage risks to drinking water including specifying standards, which requires that drinking water contains no *Escherichia coli* (*E. coli*). Water managers and water suppliers are required to report known or suspected contamination, particularly where contamination incidents pose a risk to human health. Depending on the level and type of contamination the Secretary of the Department of Health is required to take immediate and/or precautionary actions to limit harm to people.

### **Environmental Protection Act 2017**

The objectives of the *Environmental Protection Act 2017* pertain to the protection of human health and the environment by reducing the harmful effects of pollution and waste. The Act is administered by the Environment Protection Authority (EPA) and imposes a General Environmental Duty (GED) on every Victorian to minimise risks of harm to human health and the environment from pollution or waste 'as far as reasonably practicable'. Harm can be an adverse effect on human health or the environment. Harm can also be an adverse effect on amenity of a place that unreasonably interferes with its enjoyment, or a change to the condition of the environment that makes a place offensive to the senses. Harm can arise as a single or cumulative effect, or from a combination of factors.

The GED applies equally to government, businesses and the broader community. In the context of houseboats on Lake Eildon, harm to the environment arises from polluting Lake Eildon waters with houseboat wastewater. Risks of harm to health arise from the consequential contamination of water that impacts water supplies for houseboats, township water prior to treatment and recreation users of the lake. Harm to health and the environment also arises from an increased frequency and severity of blue-green algae outbreaks because of the greywater pollutants from houseboats combined with other sources.

In exercising their general environmental duty, there must be a balance between the severity of risk to human health and the environment, with what is reasonably known about the effects health and environment of pollution and contamination both in the short and longer term, whether there are methods available to limit the risk, as well as the cost burden of elimination.

The GED encourages the implementation of both structural and behavioural measures to demonstrate a person has eliminated risks to human health and the environment 'so far as is reasonably practicable'. The provision of community information on what is known about the impacts of water pollution, what measures are available, and the relative costs of these measures would better inform the houseboating population of reasonably practicable actions that are both possible and required as part of exercising their general environmental duty to limit risk.

### **Environmental Protection Regulations 2021**

Part 5.4 of the Environmental Protection Regulations (2021) prohibit the discharge or deposit of waste from vessels on State Waters apart from water used to remove aquatic pests. These provisions apply to houseboat greywater discharge, unless any discharge is undertaken compliance with the Water (Lake Eildon Recreational Area) (Houseboats) Regulations 2013. Part 5.7 covers obligations for the operation and maintenance of on-site wastewater management systems through maintaining them correctly and in good working order as well as notifying the relevant local government authority if the system poses a risk to human health and/or the environment.

### **Pollution of Waters by Oil and Noxious Substances Act**

The *Pollution of Waters by Oil and Noxious Substances Act (POWBONS) 1986* which applies on State Waters to pleasure vessels including houseboats. The Act and subordinate regulations, the Pollution of

Waters by Oil and Noxious Substances Regulations (2022) import the 1973 International Convention for the Prevention of Pollution from Ships, and the 1978 Protocol, the International Convention for the Prevention of Pollution from Ships, known collectively as the MARPOL, into Victorian Law. Annexes to the Protocol regulate the discharge of oil, noxious and harmful substances, sewerage, garbage and air pollution from vessels. Like the Environment Protection Regulations 2021, the EPA is responsible for their implementation.

Together the Environmental Protection Regulations (2021) and the Pollution of Waters by Oil and Noxious Substances Act (POWBONS Regulations) (2022) aim to prevent pollution by oil, other noxious substances, garbage, and sewage and other discharge from vessels into surrounding waters. Both sets of regulations apply to Lake Eildon and to houseboats, particularly to issues that impact water quality including pollutants such as:

- Oil
- Oily bilge water, and
- Any mixture contains oil and a liquid substance, or oil and liquid substances, including salad or barbeque oils, and salad or barbeque oils mixed with washing up liquid.

## **Marine Safety Act 2010**

The *Marine Safety Act 2010* regulates recreational vessels and usage on Victorian state waters, including houseboats on Lake Eildon. Under the act, safety is a joint enterprise between all parties who are obliged to eliminate risk, and where this is not possible, to reduce risk as far as reasonably practical. Vessel builders, and all those who modify and maintain them, have obligations warrant the safety and integrity of the vessel through a registration process, while houseboat operators warrant a vessels safe operation through a marine licencing process. Maritime Safety Victoria (MSV) is responsible for the implementation of the act and associated instruments.

## **Marine Safety Regulations**

Under the Marine Safety Regulations (2012) a vessel cannot be registered unless it is fit for recreation use and certified as:

- maintaining watertight integrity
- having no fuel leaks from the fuel system or engine
- having a ventilation system that is functional
- having machinery which is insulated from fire or flammable materials, and
- being built of materials that provide reserve buoyancy, are intact and undamaged.

Vessels that can be certificated as fit for purpose, inherently protect water quality by preventing accidental leaks into the water body and having a lower risk of sinking or capsizing.

## **Vessel Operating and Zoning Rules for Victorian Waters**

The Vessel Operating and Zoning Rules for Victorian Waters (2022) are established under the *Marine Safety Act 2010* and apply to houseboats and other vessels on Lake Eildon. The rules establish speed limits, no wash zones, and conditions for mooring, anchoring or berthing all vessels. Schedule 90 of the rules applies specifically to all vessel behaviours on Lake Eildon and Eildon Pondage Waterway, as well as to the Waterway Manager, GMW.

## **Building Act 1993**

Part 12A – Plumbing Work of the *Building Act 1993* includes requirements for plumbers to produce their licence/registration if requested associated with carrying out plumbing works on vessels (including houseboats). It also states that plumbing inspectors or compliance auditors can inspect and test plumbing work on vessels. The Victorian Building Authority (VBA) was established by the Building Act and is responsible for regulating plumbing works and practitioners.

## **Plumbing Regulations**

The Plumbing Regulations (2018) specify works defined as plumbing work under the Building Act 1993 as well as applicable qualifications and experience needed to undertake licenced plumbing work. It also incorporates the Plumbing Code of Australia and prescribes standards or other requirements that licenced plumbers must comply with when undertaking plumbing work. In the regulations, houseboats are included

within the definition of 'vessels' with sanitary plumbing works required to be undertaken by a licenced plumber. Plumbing standards for vessels have not been included in the regulations as yet.

### **Catchment and Land Protection Act (1994)**

To protect the Lake Eildon waters in the catchment abutting the National Park, and 'ensure that any use to which the land is put is compatible with the ability of that land to sustain the proposed use and to ensure that due regard is given to water supply interests', a Land Use Determination Policy Statement (The Determination) was issued for the Upper Goulburn (Eildon) Water Supply Catchment (Soil Conservation Authority of Victoria, 1976). The Determination was triggered to address issues of concern at the time, identified as:

- Mitigating against soil erosion
- Protecting against land clearing and maintenance of forest canopy within the catchment to protect water production
- Limiting the number and size of farms along water courses or close to the full supply level of the Lake
- Discouraging recreational activity causing erosion where people and traffic movements are high, and
- Manage roadworks causing erosion.

The Determination protected eighty-seven square kilometres immediately abutting Lake Eildon under the *Soil Conservation and Land Utilisation Act 1958*. Declared lands surrounding the Lake Eildon water catchment were consolidated and incorporated under Schedule 5 the *Catchment and Land Protection Act 1994* as the Upper Goulburn special water supply catchment area. This places conditions on development of land within the schedule to mitigate water quality risks.

The Goulburn Broken Catchment Management Authority (CMA) is also required to develop a Regional Catchment Strategy for the Goulburn Catchment that covers the lake and waterways that flow into it.

### **Australian Marine Safety Authority Act 1990**

The *Australian Marine Safety Authority Act 1990* is a federal act that was established to promote maritime safety, protect the environment from shipping operations and establish the Australian Marine Safety Authority (AMSA). AMSA has the powers to set standards for commercial vessel operations. Commercial houseboat hire businesses on Lake Eildon are required to adhere to the National Standard Commercial Vessels Section F2: Leisure Craft. It outlines safety standards for the design, construction, equipping and operations of leisure craft which includes houseboats for commercial hire.

# Appendix 4 Economic analysis Impact quantification methodology and inputs

The economic analysis was conducted to ensure a proportional approach is required while being conscious of the distinction between existing and new houseboats to ensure the Packages can be robustly assessed.

This Appendix steps through the quantification methodology and key data inputs for the economic analysis.

## Impact quantification methodology

### Cost of blackwater capture systems

Under the proposed changes to the regulation, houseboats would continue the requirement for houseboats to have on-board blackwater system or a portable toilet and not to dispose houseboat blackwater in the recreational area except within a waste collection facility. There would be the continued requirement to shield blackwater pipes. The regulation would update language to incorporate relevant new technology around macerator and vacuum toilets.

We calculated the cost (capital expenditure and operating expenditure) of blackwater capture systems by multiplying the number of blackwater capture installed systems by the cost (capital expenditure and operating expenditure) per system.

### Cost of greywater treatment systems

Under the new regulation houseboats would install either simple or comprehensive greywater systems on boats (requirements varies by option).

We calculated the cost (capital expenditure and operating expenditure) of installing greywater systems (simple & comprehensive) by multiplying the number of greywater systems installed by the cost (capital expenditure and operating expenditure) per system.

### Compliance and enforcement costs

Houseboats with comprehensive greywater interventions would require additional time to inspect (compared to just blackwater) to ensure systems are operating as intended.

We calculated the cost of inspection of greywater comprehensive systems by multiplying the additional time to conduct the inspection by the number of boats inspected in a given year by the value of time for inspector.

### Amenity and recreation opportunities

Under the regulation options an improvement in water quality and amenity is likely to occur with reduced wastewater pollutants entering the lake compared to base case. This could improve tourism outcomes for the Lake Eildon area.

The benefit of increased tourism is calculated by multiplying the value-added to the region from Lake Eildon tourists by the expected increase in tourism (number of visitors) under each option. The value-add of Lake Eildon tourism is based on the observed per person expenditure and a conversion factor that represents the portion of gross expenditure that is value-add economic activity to the region (as opposed to inputs brought into the region to service the tourist purchases).

To align the benefit estimate with the installation rates of greywater system, and consequential water quality improvements, we have assumed a benefit ramp up period over 10 years (10% a year). Assuming 100% of the benefits are incurred in the first year of the regulation would overstate the value of amenity and recreation opportunities.

### Risks to human health

Under the proposed regulations an improvement in water quality and amenity is likely to occur as wastewater is managed. This could reduce the risk of lake users getting illnesses such as gastro.

The benefit to human health from improved water quality (based on a proxy of reduced gastro cases for lake users) is calculated by multiplying the number of swimmers in the lake by the likely reduction in gastro cases by the cost of gastro per person.



To align the benefit estimate with the installation rates of greywater system, and consequential water quality improvements, we have assumed a benefit ramp up period over 10 years (10% a year). Assuming 100% of the benefits are incurred in the first year of the regulation would overstate the value of reduced risks to human health.

## Houseboat numbers and installation methodology

As the options varied by houseboat type and category, the model was broken down into three houseboat types – new build, commercial and private houseboats, with each type considering up to Category 7 houseboats.

The number of houseboats was forecast to remain static across the modelling period (as the cap is determined by GMW under the regulation). We assumed 8 new houseboats are built every year from FY2026 (with a one for one replacement of an existing houseboat), and consider the split between commercial and private houseboats in FY2025.

Figure 10, Figure 11 and Figure 12 summarise the cumulative installations per Package.

**PACKAGE A (Figure 10)** - Simple interventions for all Category 3 and above houseboats. We have assumed simple systems will be installed at a rate of 10% per year over 10 years prior to the compliance deadline (1 January 2034).

**PACKAGE B (Figure 11)** - Simple interventions for private houseboats. We have assumed simple systems will be installed at a rate of 10% per year over 10 years prior to the compliance deadline (1 January 2034). Comprehensive systems for new build and commercial houseboats. We assumed new houseboats will begin to install comprehensive greywater treatment systems during construction in the two years prior to the compliance deadline for new houseboats (11 June 2027). We assumed commercial houseboats would begin to install comprehensive greywater treatment systems 7 years prior to the compliance deadline (1 January 2034) in line with the mandatory 5-7 year inspection and slipping regime. We assumed installations will be evenly spread across these seven years.

**PACKAGE C (Figure 12)** – Comprehensive systems for all Category 3 and above houseboats. We assumed new houseboats will install comprehensive greywater treatment systems during construction prior to the compliance deadline for new houseboats (11 June 2027). We assumed commercial and private houseboats would begin to install comprehensive greywater treatment systems 7 years prior to the compliance deadline (1 January 2034) in line with the mandatory 5-7 year inspection and slipping regime. We assumed installations will be evenly spread across these seven years.

**Figure 10: Number of greywater systems installed – Package A**

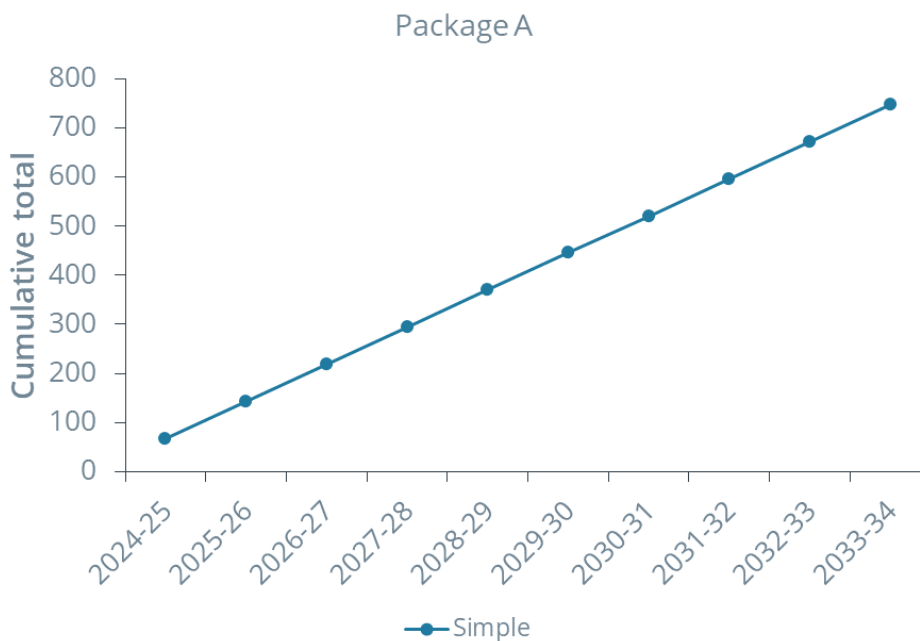


Figure 11: Number of greywater systems installed – Package B

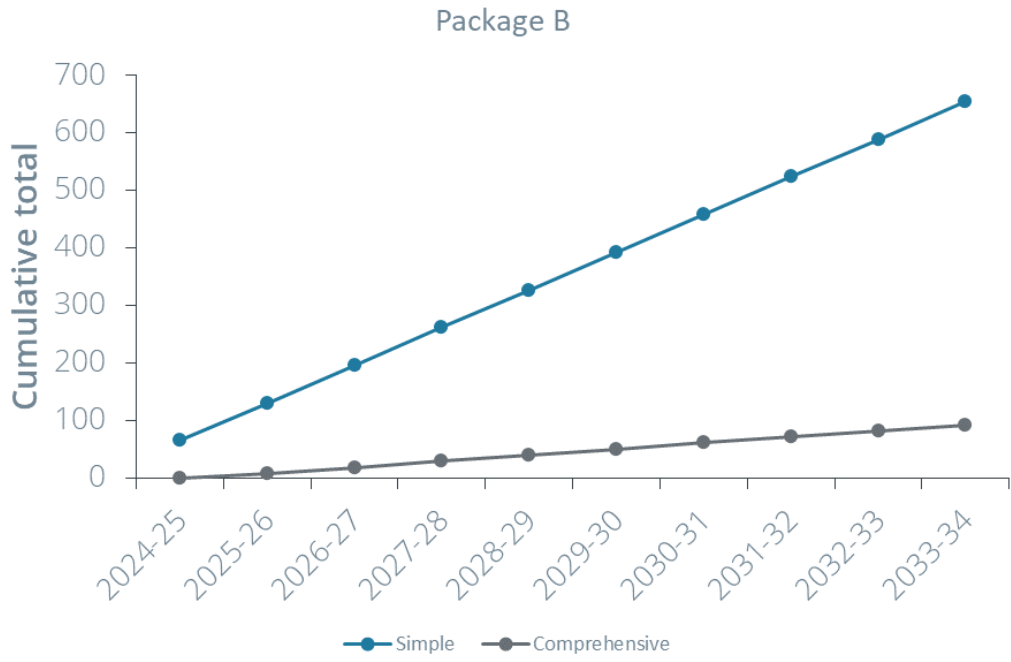
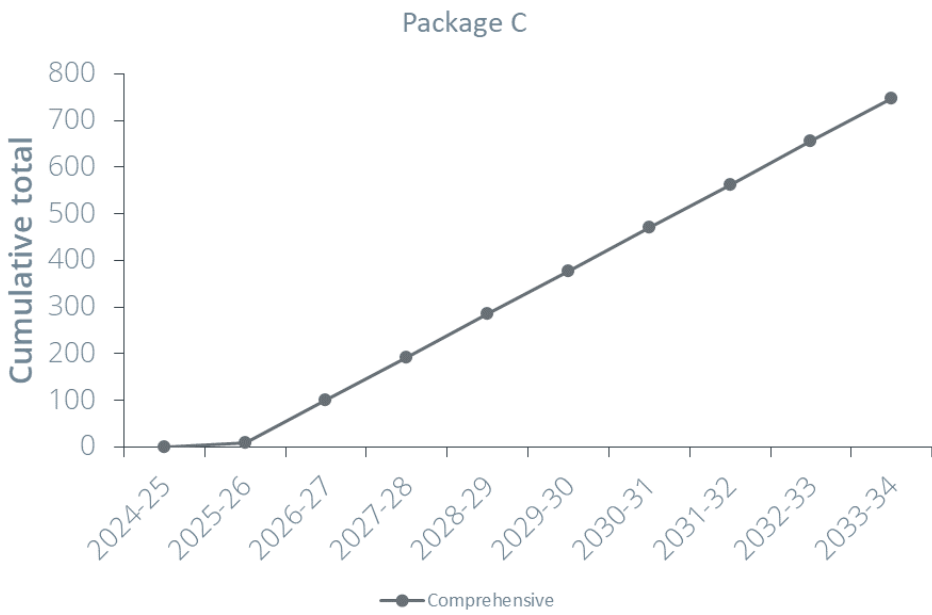


Figure 12: Number of greywater systems installed – Package C



## Quantitative analysis data inputs

Table 33: Summary of approach by impact

Impact	Data/ assumption	Value	Source
General	Discount rate	4%, 7%, 9%	Victorian DTF Economic Evaluation guidelines
General	Analysis period	30 years	FE in agreement with BRV
General - benefits	Benefit ramp up	10% a year for 10 years	FE assumption
Blackwater capture systems	Blackwater system capital costs	\$15,000 - \$20,000	TWG & DEECA
	Blackwater system operating costs	\$750 - \$1,000	TWG & DEECA
	Number of blackwater systems installed	1 (per new build boat)	DEECA
Simple greywater treatment systems	Simple greywater system device costs	Sink strainer: \$10 - \$120 OR Filter basket: \$80 - \$250 AND Grease trap: \$400 - \$650	Natural Capital Economics (2023)
	Simple greywater system installation costs	Sink strainer: \$0 OR Filter basket: \$100 - \$198 AND Grease trap: \$100 - \$350	Natural Capital Economics (2023)
	Simple greywater system annual repairs and maintenance costs	Sink strainer: \$0 OR Filter basket: \$0 AND Grease trap: \$200- \$400	Natural Capital Economics (2023)
	Number of simple greywater systems installed	For category 3 and above: 1 grease trap per houseboat, installed in galley 6 sink strainers per houseboat. Installed in galley, bathrooms (shower, bath), spa No filter baskets	DEECA
Comprehensive greywater treatment systems	Comprehensive greywater system device costs	\$10,000-\$20,000	Natural Capital Economics (2023)
	Comprehensive greywater system installation costs	Existing boats: \$3,200 - \$15,000 New build houseboats: \$6,000	Natural Capital Economics (2023) and DEECA

Impact	Data/ assumption	Value	Source
	Comprehensive greywater system annual repairs and maintenance costs	\$430-\$850	Natural Capital Economics (2023)
Comprehensive greywater treatment systems	Number of comprehensive greywater systems installed	1 per boat (category 3 and above)	DEECA
Compliance and enforcement costs	Number of compliance officers	1 (across all Packages)	FE assumption in consultation with DEECA
	Employment costs of compliance officer	\$80,000 (across all Packages)	FE assumption in consultation with DEECA
	Time to conduct an inspection of comprehensive greywater system when boat is slipped	2 – 4 hours	DEECA and industry consultation
	Frequency of inspection	Base Case: No inspection costs Simple: No inspection costs Comprehensive: 5 years for commercial, 7 years for private boats	
	Value of time for the inspector	\$50/ hour	FE assumption/ calculation based on industry consultation
Amenity and recreation opportunities	Number of visitors	1,132,702 in FY2025, growing at 4% out to 2030, then assumed to be constant.	Lake Eildon Masterplan
	Spend per visit	\$180 per person per visit	Lake Eildon Masterplan
	Gross spend to value add	53%	Tourism Australia
Reduced risk to human health	Number of lake users per year	294,502 in FY2025, growing at 4% out to 2030, then assumed to be constant.	Lake Eildon Masterplan
	Cost of gastro per person (used as a proxy for risk to human health)	\$507 per person per case	ANU (2022), The annual cost of foodborne illness in Australia