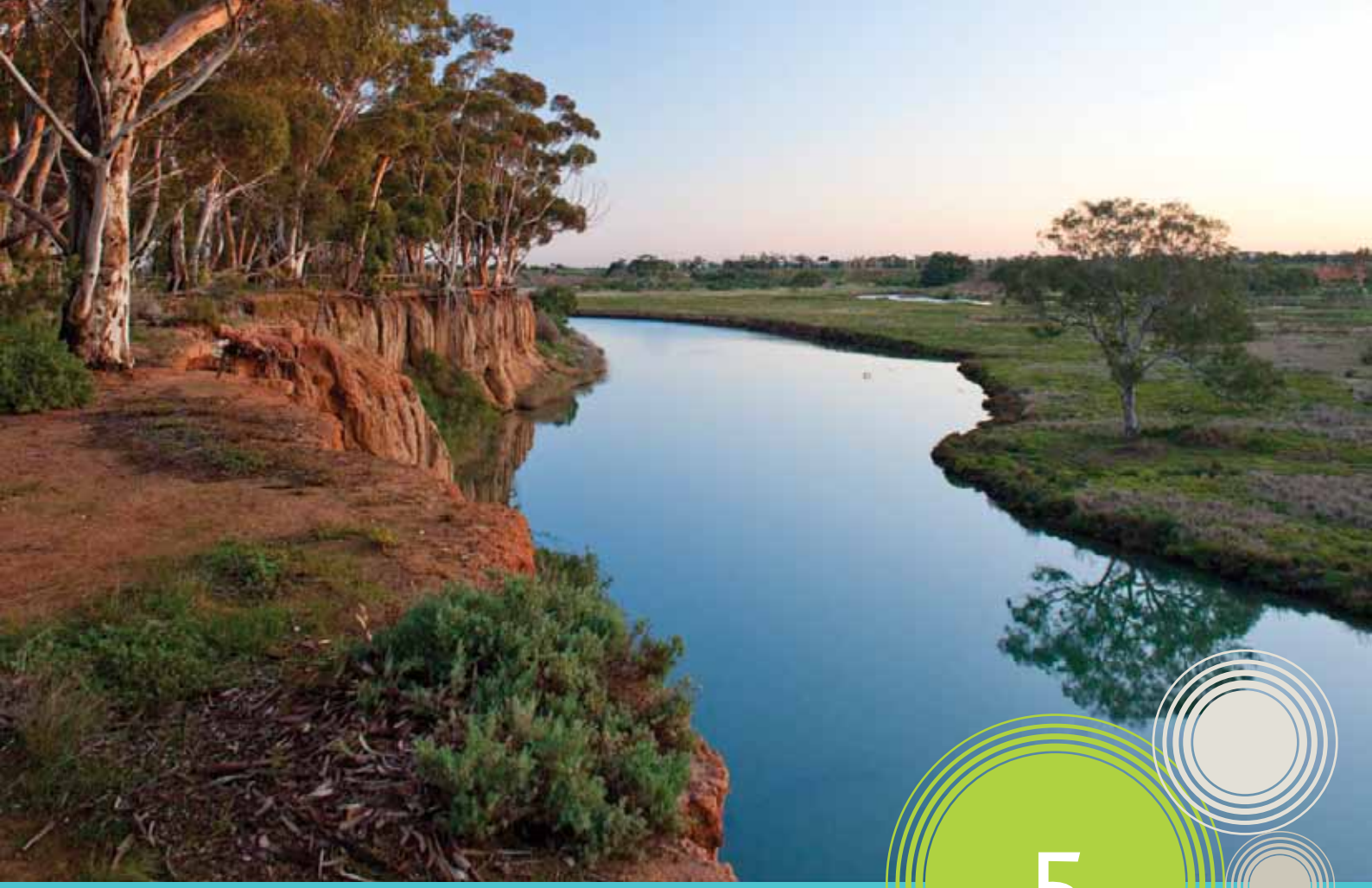


5

Catchments and systems

The following chapter introduces the five major catchments in the Port Phillip and Westernport region – Werribee, Maribyrnong, Yarra, Dandenong and Westernport – and provides an overview of land use and the rivers, estuaries and wetlands in each catchment.

Each major catchment consists of several sub-catchments, known as systems. It is at this scale that the expected outcomes (the condition rating we expect to see in the future) for key values and implementation targets are presented, while more localised information about waterways and key values is provided at management unit scale.

The system boundaries have been selected to follow natural catchment boundaries, reflect key values species' distribution, and provide a scale appropriate to measure change in these values over time. As a small catchment, the Dandenong catchment is one system.

For each of the 14 systems, this chapter presents information about the waterways, priorities and implementation targets and the expected outcomes for key values to which the targets will contribute. The content includes:

- An overview of the waterways, values and challenges
- The historic trend and current condition for each key value, and the expected outcomes over 20 years and in the long term
- Strategic priorities for the next 20 years
- Priority areas for investment, corresponding management objectives and implementation targets for the five year life of this strategy
- Regional program priorities

The following pages provide a quick guide to interpreting the information presented.

Figure 5.1 provides a summary of the current condition and expected outcomes ratings for the key values in each system. The expected outcomes have been established after an assessment of what condition is desired and what condition is possible for these values. In establishing these outcomes, we have assumed our actions have a greater influence than threats such as urbanisation and climate change.

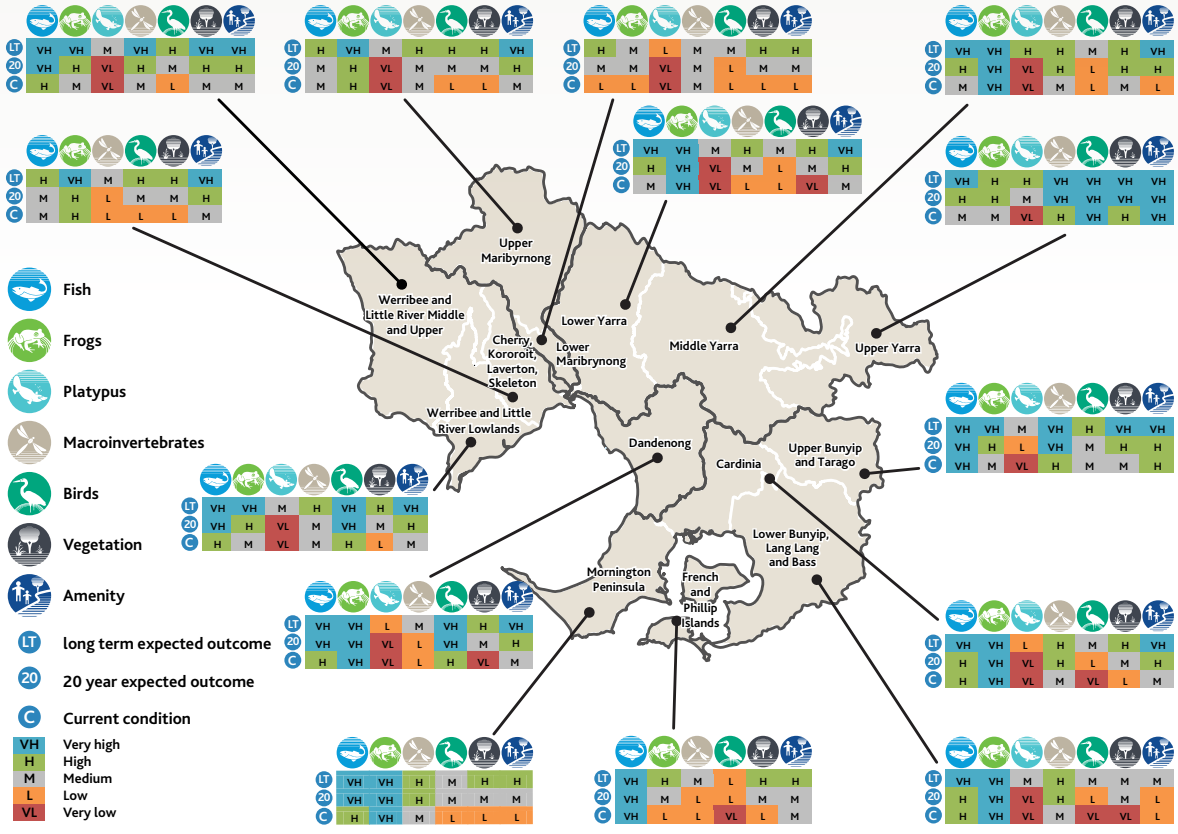


Figure 5.1 Overview of current condition and expected outcomes by value per system

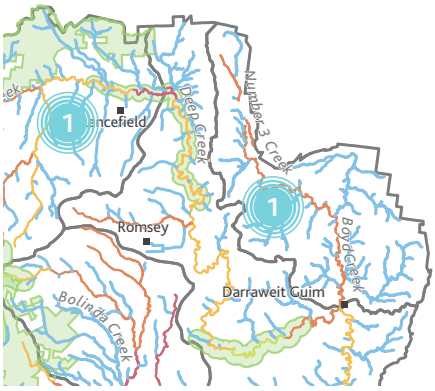
Table 5.1 Condition ratings explained

Value	Rating	Explanation
Fish	Very high	Almost all native species that have been recorded in the catchment present. Native species greatly outnumber exotics
	High	Most native species that have been recorded in the catchment present. Native species outnumber exotics
	Moderate	About half the expected species present. Significant proportion of exotic species recorded
	Low	Large proportion of expected species not recorded. Exotic species likely to dominate. Poor diversity and abundance.
	Very low	Most expected species not recorded. Exotic species dominate. Very poor diversity and abundance.
Platypus	Very high	Platypus abundant
	High	Platypus very common
	Moderate	Platypus common
	Low	Platypus present in low numbers
	Very low	Platypus present in very low numbers
Frogs	Very high	Almost all species present
	High	Most species present
	Moderate	About half the expected species present
	Low	Significant proportion of the expected species not recorded. Poor diversity
	Very low	Few of expected species recorded. Very poor diversity
Macroinvertebrates	Very high	Excellent state of stream water quality
	High	Healthy state of stream water quality
	Moderate	Mild pollution
	Low	Moderate pollution
	Very low	Severe pollution
Birds	Very high	Almost all expected streamside and wetland species recorded
	High	Most expected streamside and wetland species recorded
	Moderate	About half the expected streamside and wetland species recorded
	Low	Poor diversity, most expected streamside and wetland species not recorded. Low abundance
	Very low	Very poor diversity, most expected streamside and wetland species not recorded. Low abundance
Vegetation	Very high	Vegetation largely same as the reference condition (Index of Stream Condition). Waterway largely vegetated along and out from waterway onto floodplain
	High	Vegetation largely the same as reference condition although species may be missing and some weed invasion present. Waterway is vegetated along and out onto floodplain although some gaps exist
	Moderate	Vegetation resembles reference condition although species may be missing and weeds present. Gaps along and out from the waterway onto the floodplain
	Low	Vegetation may have some components of reference community but has exotic species and fragmented
	Very low	Fragmented and degraded vegetation
Amenity	Very high	High level of satisfaction with amenity, appropriate facilities and good visitation
	High	High satisfaction with amenity but not widely known for amenity in the region
	Moderate	Moderate satisfaction with amenity but opportunity to improve satisfaction through improved waterway condition or awareness
	Low	Low satisfaction but with concerted effort (maintenance and/or improved condition) may change
	Very low	Low satisfaction, poor facilities, poor condition

Guide to interpreting system information, priorities and targets in Chapter 5

System overview

Information about the main waterways, records of key values and priority areas for 2013/14–2017/18 and a future vision is provided for each management unit within the system.



1 Upper Deep Creek management unit

Waterway overview Deep Creek rises near Newham in the Macedon Ranges and flows through the rural townships of Lancefield, Romsey and Darraweit Guim before joining Jacksons Creek at Bulla to become the Maribyrnong River. The upper reaches of Deep Creek lie above Romsey. Major tributaries within this area include Dry, Garden Hut, Monument, Boyd, Slab Hut, Number 3 and Linton creeks.

Platypus During the 2011/12 survey period, one platypus was captured; a young adult male in excellent condition. Upper Deep Creek contains highly suitable platypus habitat and it is thought that the impact of drought and low water levels contributed to the low rates of recording.

Frogs Twelve of the expected 13 species have been recorded in this management unit which is home to vulnerable and endangered species such as Bibrons toadlet, growling grass frog and southern toadlet.

Fish Thirteen of the expected 17 species have been recorded, eight of which are native. Vulnerable and endangered species such as Australian Grayling, mountain galaxias and Yarra Pygmy Perch are present.

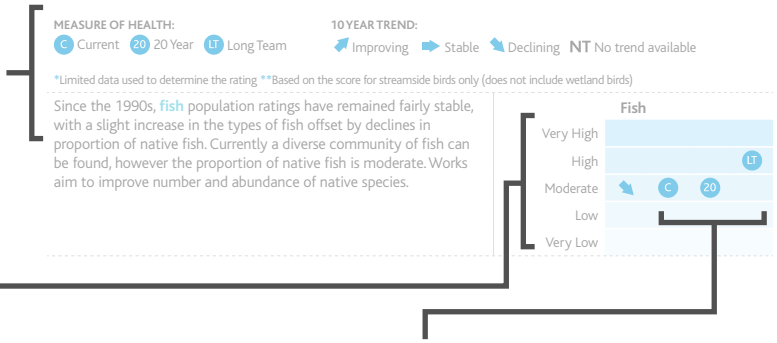
Birds Insufficient surveys at management unit scale.

Priority areas Upper Deep Creek contains priority areas for fish, macroinvertebrates and vegetation. Management objectives are to maintain the high species richness and abundance of fish; maintain macroinvertebrate diversity and maintain high quality vegetation.

Future management In 2030 stock have been excluded from waterways, and continuous streamside vegetation exists along waterways with a biolink connecting the upper catchment to the Macedon Regional Park. Water sensitive urban design has been incorporated into developed areas such as Lancefield and drought refuge areas are protected

Expected outcomes for key values

The historic trend and current condition is described for each key value. Expected outcomes for value condition at 20 years and in the long term are proposed by considering the waterway condition improvements that will be possible to achieve in these timeframes. All ratings are averages for the system with local variations at individual waterways.



Conditions ratings: The ratings are used to describe the condition of the value within the system. e.g. Very low means platypus are present in very low numbers while moderate means they are common. For information on what the ratings mean for each value, see Table 5.1.

Why no change? For some values the condition rating is unlikely to change over 20 years, but that doesn't mean that no work is being done. In natural systems there is often a time lag between works and measurable improvement, especially if condition has declined over the past 10 years.

What do these expected outcomes mean for my local waterway?

System averages: Each system contains a number of waterways that vary in size, complexity, function and in their ability to support waterway values. The current condition, 20-year and long-term expected outcomes for each key value is an average for the system.

The use of an average for the system is a necessary compromise between the desire to understand and plan for key value condition at the local waterway scale and being able to accurately represent a baseline condition score and observe change over time from the monitoring data available. It means, for example, that at a local level, waterway and value condition may improve, decline or stay the same, although over the system as a whole improvement is occurring.

Conditions ratings: The same condition rating (e.g. high, low) for key values will look different between systems. For example, annual rainfall, topography and underlying geology of the Werribee and Little River Middle and Upper system is very different to that of the Upper Yarra system. Because of these differences, we expect the vegetation to look very different between these areas, even though both systems have vegetation considered to be of high quality. Similarly, there will be different fish species present in the Upper Maribyrnong system compared to the Cherry, Kororoit, Laverton and Skeleton system, although both fish communities are in moderate conditions.

20 year strategy priorities

In order to achieve these long-term outcomes, several key areas require our focus over the next 20 years including:

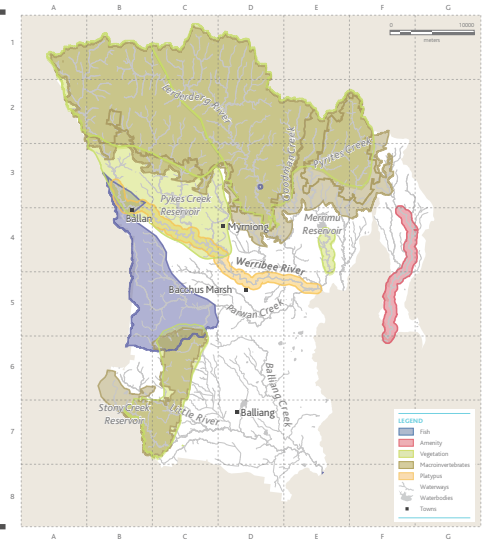
- Implementing appropriate environmental flows regimes particularly in Jacksons Creek downstream of Rosslynne Reservoir for fish
- Improving environmental flows in Deep Creek and Jacksons Creek (particularly low flows) for platypus, and revegetating degraded streamside zones, targeting the section around Sunbury for platypus

20 years strategic priorities are the management actions that require a focus over the next 20 years in order to achieve the expected outcomes for value condition.

Priority areas for investment 2013/14–2017/18

Priority areas are where protecting and improving waterway condition will have the greatest benefit for the key values. These are the areas where Melbourne Water will focus investment in on-ground management approaches such as vegetation and habitat management from 2013/14–2017/18. Melbourne Water also invests outside priority areas to maintain system health and long-term potential where possible and to address local priorities by working with others.

Each priority area has a management objective to express the primary management intent for the area and to guide work by Melbourne Water and others over the life of the strategy. While works in each priority area will benefit multiple values, the management objective ensures the aim for the primary values is understood.



Note: These maps show priority areas for key values - they don't show all values or areas of local priority

Table 5.3: Management objectives for priority areas

Key value	Priority area	Key management objective	Grid reference
Fish	Parwan, Yaloak and Spring Creek above the confluence	Maintain high species richness and abundance of fish populations	6,B4
	Lerderderg River at McKenzie Flat		D3,D3-1,C3-1,B2-1

Implementation targets for 2013/14–2017/18

	Amount
Km vegetation established to the required level to support waterway values	106
Km of vegetation managed to the required level to support waterway values	487
Km of waterway protected by stock exclusion fencing	128
Number of fish barriers removed	1
Ha of wetland habitat enhanced	0

Implementation targets for each system represent the management actions we will undertake over the next five years to contribute to the long-term outcomes.

A full list of targets is in Appendix 1

Regional programs priorities

Regional programs are applicable to the system as a whole, with priorities determined in consideration of program principles and system needs. Implementation targets for the regional management approaches are included in Chapter 4.

Management approach	Actions
Planning, strategy and guidelines	Advocate for healthy waterways outcomes in statutory planning issues, when issuing drainage and planning permits for buildings, undertaking flood studies and advising on planning scheme amendments
	Provide advice on local implementation plans and other guidelines, as appropriate to assist in the management of healthy waterways
Advocacy	Build relationships with public land managers and advocate to ensure waterway environmental values are not compromised and social values are maximised
	Advocate with local government regarding planning mechanisms to ensure appropriate land use, with a focus on high priority areas (for example, urban consolidation activity near waterways)

5.3 Yarra catchment

Catchment overview

The Yarra catchment lies north and east of Melbourne, beginning on the southern slopes of the Great Dividing Range in the forested Yarra Ranges National Park, and covering an area of about 4046 . Average annual rainfall ranges from 615mm at Burnley to 1080mm near Warburton.

More than one-third of Victoria's population lives in the Yarra catchment and land uses are varied – from protected forests and rural areas to urban development and established industry.

More than one-third of Victoria's native plant and animal species occur in the Yarra catchment. The middle and upper sections of the river retain much of the original vegetation and provide good habitat for native animals.

The Traditional lands of the Wurundjeri are south of the dividing range and those of the Taungurang are north of Wallaby Creek. The wetlands, river and creek corridors in the area would have provided an abundance of animals and freshwater for Aboriginal people. More than 3000 Aboriginal sites are recorded in the Yarra catchment, with most of these artefact scatters. Most of these sites occur within 100m of a permanent watercourse and/or in association with ephemeral creeks and swamps (such as scarred trees). Coranderrk, one of Victoria's most culturally and historically significant sites, is also in the Yarra catchment.

Rivers

The main stem of the Yarra River flows from its source on the southern slopes of the Great Dividing Range in the forested Yarra Ranges National Park, through the Yarra Valley and greater Melbourne into Port Phillip Bay at Newport. It has been identified as a Victorian Heritage River between Warburton and Warrandyte, meaning that it has significant recreation, nature conservation, scenic and cultural heritage attributes.

The upper reaches of the Yarra River and its major tributaries flow through forested, mountainous areas, which have been reserved for water supply purposes for more than 100 years. About 70% of Melbourne's drinking water comes from these pristine upper reaches.

The catchment includes numerous major water storages and farm dams, and waterway diversions for agriculture are prevalent. This means that flows in the Yarra River and many of its tributaries have changed significantly since European settlement.

Water quality in the Yarra River is much better today than it was in the 1970s, and it has remained relatively stable over the past 10 years despite increased pressure from continued urbanisation and population growth.

Today the river is highly valued and attracts millions of visitors a year to walk, ride, row, fish, picnic and camp.

Yarra River, Lower Plenty

Estuaries

The Yarra River estuary extends about 22km from Dights Falls to Newport, north of Hobsons Bay. It has high ecological, social, aesthetic and recreational values as it flows through the city and eastern suburbs of Melbourne to Port Phillip Bay. It is a 'salt-wedge' estuary, where the mixing of salt and freshwater is influenced by freshwater inflows over Dights Falls.

Wetlands

Wetlands are prominent throughout the Yarra catchment and range in type, quality and size. These areas provide important conditions for specific vegetation and habitat for birds, frogs, platypus and macroinvertebrates. Examples of significant wetlands in the catchment include the Bolin Bolin Wetlands and Yarra Flats billabongs around Heidelberg and the Yering Backswamp near Yarra Glen.

Figure 5.9: Yarra catchment and systems

Upper Yarra system

This system is located high up in the Yarra Ranges. Major waterways include the main stem of the Yarra River above Upper Yarra Reservoir, Hoddles Creek, Grace Burn Creek, New Chum Creek, Coranderrk Creek, Watts River, Little Yarra River and O'Shannassy River. Natural wetlands are limited to flatter floodplain areas along the major creek systems such as the Yarra Junction wetlands and heathy and sphagnum (mossy) swamps in the headwaters.

The waterways in this system are highly valued by locals and visitors alike. Some run through towns such as Powelltown and Yarra Junction and are valued for their amenity and recreational values, but most are found in forested catchments and have high intrinsic values including many significant animal species such as powerful owls, Leadbeater's possums and platypus. The waterways incorporate significant Indigenous and European heritage values.

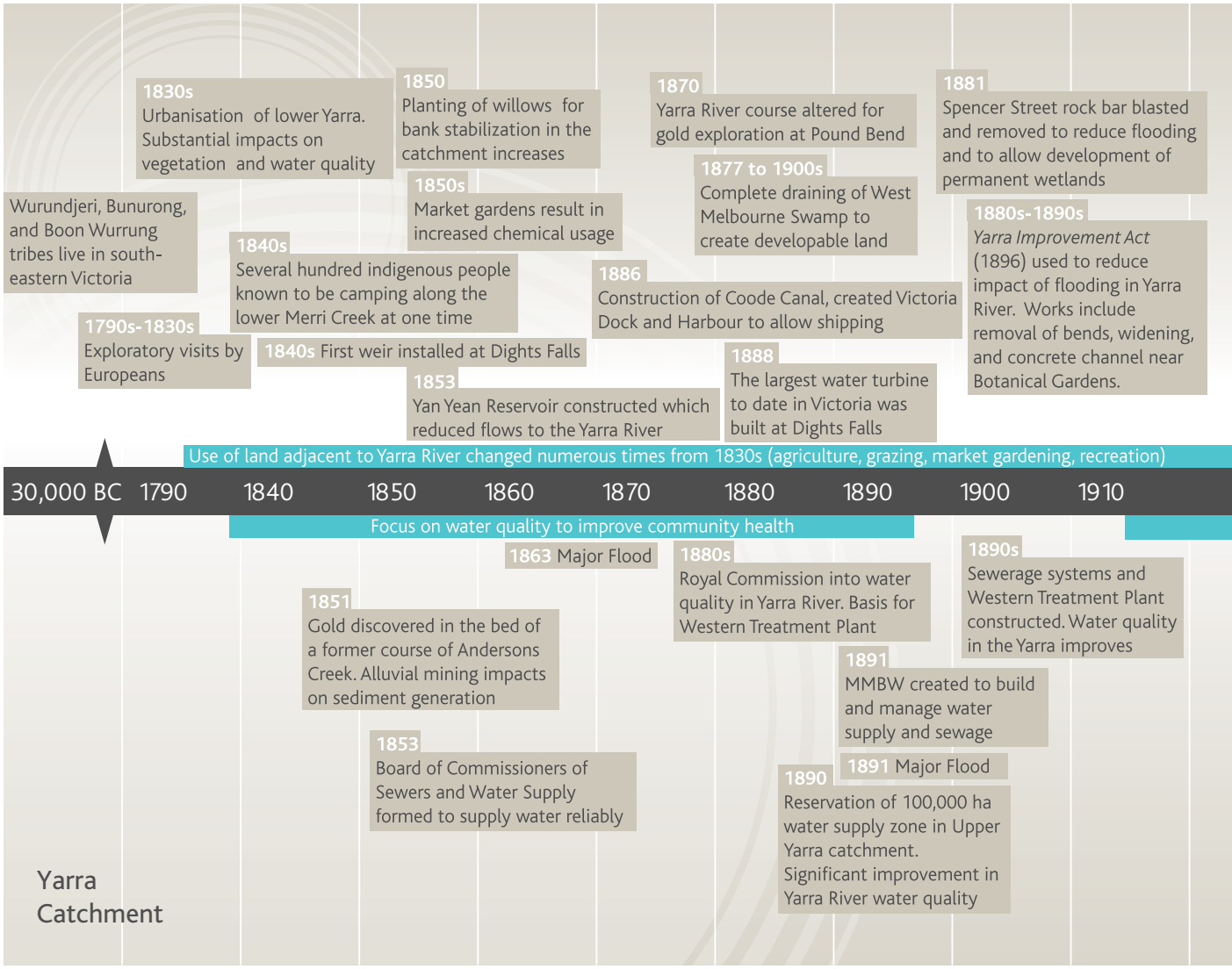
About 70% of Melbourne's drinking water comes from these pristine upper reaches. Many of these areas are also important for passive recreational values such as bushwalking and picnicking.

Community feedback outlined a broad spectrum of values across the Upper Yarra catchment. These included waterfalls, bushwalking sites, forests and native animals. Challenges for waterway health in this system include the impacts of rural roads and agricultural activity and balancing social, environmental and economic value needs in the water supply catchments.

History

Melbourne and Metropolitan Board of Works (MMBW) created in 1891

Upper Yarra Reservoir constructed



First environmental flow delivered to the Yarra 2011

1924-29 MMBW removed 24,400 items of natural debris from the river to improve flood control and navigation

1928 O'Shannassy Reservoir constructed

1929 New river channel cut at Burnley (Herring Island created)

1927 Maroondah Reservoir constructed resulting in closed catchment

1930s Major works to stabilize banks of South Melbourne Swamp (now Albert Park Lake)

1950s Alteration to Moonee Ponds Creek

1957 Upper Yarra Reservoir constructed

1960s Loop in Yarra River at Merri Creek shortened for Eastern Freeway construction

1980-81 Yering Gorge Pumping Station, Sugarloaf Reservoir and WTP completed

1987-1996 Brown trout, a popular angling species, regularly stocked into the Yarra River

1990s Silvan Reservoir constructed

1990s Increasing involvement of community groups in waterway management

1993 Fishway installed at Dights Falls Weir

1989 Melbourne Water formed under Water Act (1989) – to be responsible for wholesale water supply and sewerage and waterway management

2000 Victorian Stormwater Action Program established

The post-WWII industrial boom and migration from Europe saw enormous growth and development in the region.

Prolonged period of drought

1920 1930 1940 1950 1960 1970 1980 1990 2000 2010

Focus on river flows to reduce flooding

Focus on river erosion and incision

Focus on river health, including WQ, flows and streamside condition.

1920 MMBW assumes drainage and waterways responsibilities

1923 Major Flood

1928 Kinglake National Park established

1934 Major flood that spread from South Yarra to Warrandyte

1939 Black Friday fires

1968 Final alterations to Dights Falls Weir

1970s The Age 'Give the Yarra a Go' campaign raised pollution awareness

1970s Recognition that Yarra River and environs should be protected as recreational and nature reserve areas

1973 All new sub-divisions to contain wastewater on-site or connect to reticulated sewerage system

2002 Water Act (1989) amended. Diamond Creek, a tributary of the Yarra declared a water supply protection area

2002 Planning for the Northern Sewerage project begins to increase capacity and eliminate sewer spills

2006 17GL environmental entitlement for Yarra River announced

1987 Dandenong Ranges National Park declared

1995 Yarra Ranges National Park established incorporating former closed catchments

1995 Major Flood

2007 Temporary qualification of rights relaxed minimum flows requirements

2009 Black Saturday Bushfires affect 30% of Melbourne's water supply catchments

2011 First environmental flow delivered to the Yarra

1 Watts River source management unit

Waterway overview The Watts River rises in the Yarra Ranges National Park near Mount Donna Buang. The Watts River source reaches and tributaries feed the Maroondah Reservoir upstream of Healesville.

Platypus No platypuses were captured in the tributaries upstream of Maroondah Reservoir during the 2011/12 survey period. No platypuses have been recorded at this location since 2009 despite apparently good habitat.

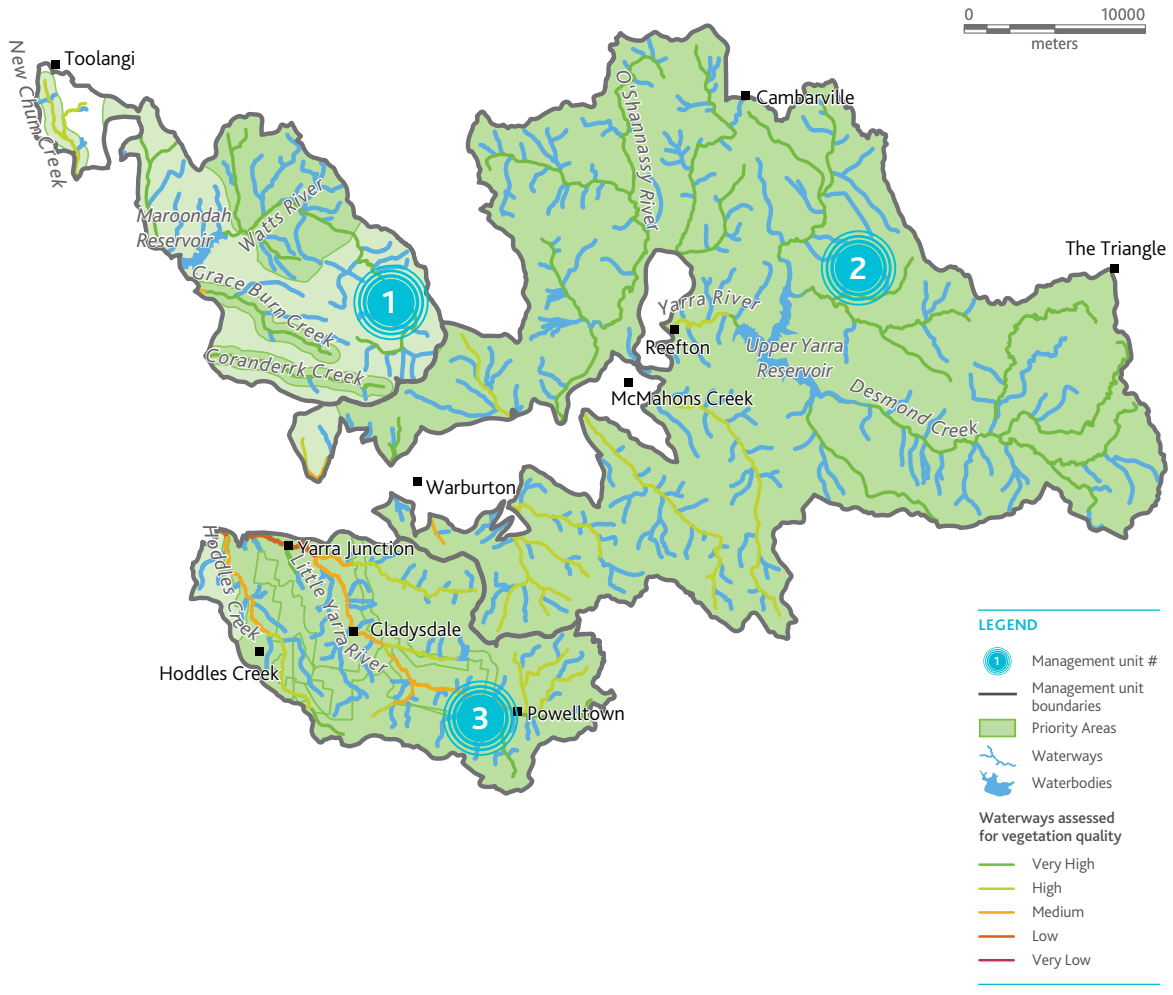
Frogs All 9 of the expected species have been recorded in this management unit which is home to endangered and vulnerable species such as Bibrons toadlet, growling grass frog and southern toadlet.

Fish: Eight of the expected 16 species of fish have been recorded, six of which are native. This management unit is home to endangered species such as the mountain galaxias, Murray cod, river blackfish and spotted galaxias.

Birds Insufficient surveys at management unit scale.

Priority areas Watts River source has been identified as a priority area for vegetation and macroinvertebrates. Management objectives are to maintain vegetation condition and to maintain macroinvertebrate diversity to its current high quality.

Future management In 2030 reserve areas have been linked through streamside fencing and revegetation programs and fencing excludes stock and has helped support native vegetation.



2 Upper Yarra River Source management unit

Waterway overview: The Yarra River rises in the forested slopes of the Yarra Ranges National Park and Yarra State Forest. The upper sections of the Yarra River and its tributaries flow through forested, mountainous areas that have been reserved for water supply purposes for over 100 years.

Frogs: Seven of the expected 9 species have been recorded in this management unit which is home to the endangered growling grass frog.

Fish: Eleven of the expected 16 species have been recorded, six of which are native. This management unit is home to endangered and vulnerable species such as mountain galaxias and river blackfish.

Birds: Insufficient surveys at management unit scale.

Priority areas: Upper Yarra Source has been identified as a priority area for vegetation and macroinvertebrates. Management objectives are to maintain vegetation condition and macroinvertebrate diversity to its current high quality.

Future management: In 2030 stock has been excluded from waterways throughout and streamside vegetation is now established.

3 Little Yarra River and Hoddles Creek management unit

Waterway overview The headwaters of the Little Yarra River and Hoddles Creek rise in the forested slopes of the Yarra Ranges and join the Yarra River near Yarra Junction to the north east of Melbourne. Tributaries of Little Yarra River include Sally, Britannia, Edwardstown, Ely and Tugwell creeks.

Platypus During the 2011/12 survey period four platypuses were captured at Warburton: two adult females, one sub-adult female and one sub-adult male. A further five were captured during additional surveys for an acoustic tracking pilot study. At Yarra Junction, one new adult female in poor condition was captured. There is evidence of decline due to drought in both areas.

Frogs All nine of the expected nine species have been recorded in this management unit which is home to endangered and vulnerable species such as Bibrons toadlet and growling grass frog.

Fish Ten of the expected 16 species have been recorded, seven of which are native. This management unit is home to endangered and vulnerable species such as the mountain galaxias and river blackfish.

Birds Insufficient surveys at management unit scale.

Priority areas Little Yarra and Hoddles Creek management unit has priority areas for vegetation, macroinvertebrates and amenity. Management objectives are to maintain vegetation condition and macroinvertebrate diversity to its current high quality, and improve the level of amenity.

Future management In 2030 fencing will have allowed the establishment of native vegetation and created links between the floodplains and the forested headwaters, an unbroken corridor of streamside vegetation extends along the waterways and fish barriers have been removed.

Expected outcomes for key values

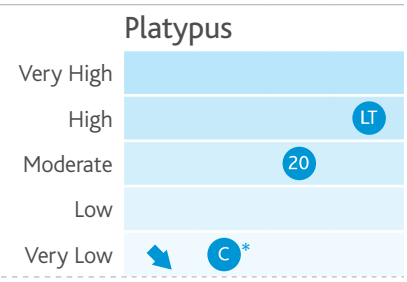
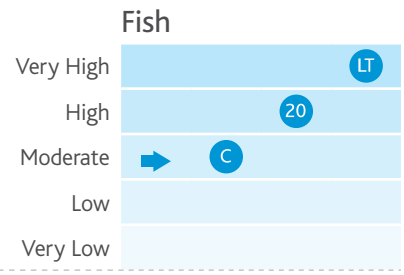
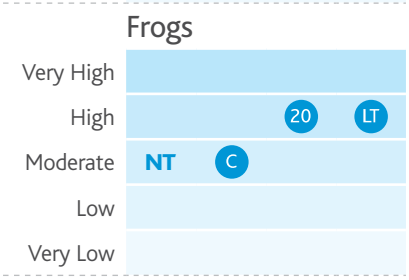
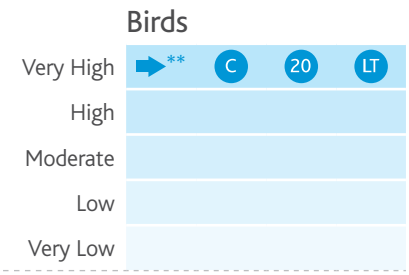
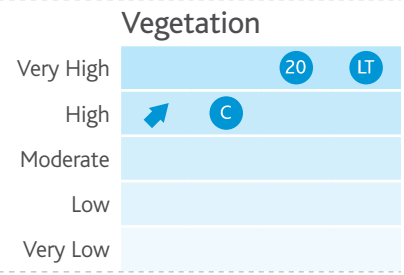
Table 5.22 summarises the historic trend, current condition and expected outcomes for each key value. In setting expected outcomes, we consider the values and challenges present in this system and balance community desires with what is practical.

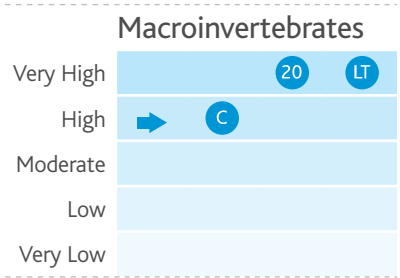
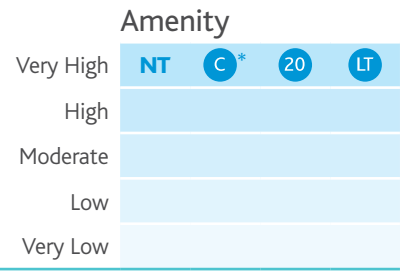
Table 5.22: Historic trend, current condition and expected outcomes for key values in the Upper Yarra system

MEASURE OF HEALTH: C Current 20 20 year LT Long term

10 YEAR TREND: Improving Stable Declining **NT** No trend available

*Limited data used to determine the rating **Based on the score for streamside birds only (does not include wetland birds)

Platypus populations have declined over the past decade, which is attributed to the long drought. However, platypus populations are still relatively large and so sightings of platypus in the upper tributaries are common. Over the next 20 years, works including flow and habitat management aim to improve population condition to moderate.	
Fish populations have declined, in numbers and diversity, over the past 200 years. However, a large number of native species occur and populations have been stable over the past 10 years. The decline is largely due to introduced fish such as trout preying on native fish. Works aim to improve the condition of fish from moderate to high.	
Investigations to determine the diversity of **frog** populations are limited, but the current rating is moderate and works over the next 20 years aim to increase this condition to high.	
The high quality of vegetation and a long history of habitat protection have allowed the condition of **bird** populations to remain very high. Ongoing works aim to maintain this condition.	
Much of the native **vegetation** is protected within public land and is of very high quality with minimal weed invasion. The current high rating is targeted for improvement to very high through protection and weed control works.	

Macroinvertebrate populations are generally high due to the high quality of vegetation and water. Improvements to vegetation and water quality through continued protection of this system aim to improve macroinvertebrate condition to very high.	
The management of public land means it has retained many natural features. Very high **amenity** is still enjoyed through natural forests, picnic areas at the dams, and views along the waterway corridors.	

20 year strategic priorities

In order to achieve these long-term outcomes, several areas require our focus over the next 20 years including:

- Providing fish passage and improving flows throughout the system to enhance the native fish population
- Reducing competition and predation by introduced fish species through habitat and stocking management
- Improving the quality and quantity of streamside and wetland habitat for frogs
- Improving habitat in waterways for platypus through revegetation and weed control, especially willows
- Implementing environmental flows for platypus
- Improving water quality for macroinvertebrates and fish in rural areas by managing streamside vegetation
- Maintaining and improving amenity by protecting and managing vegetation and planning controls.

These strategic priorities will require ongoing investment over the next 20 years and beyond, so it may not be possible to invest in all priorities within the five year period of the strategy.

Priority areas for investment 2013/14–2017/18

Priority areas for investment have been identified as regionally important for on-ground works over the life of this strategy. Each priority area has a management objective to guide works. These works, which contribute to the long-term outcomes based on principles outlined in Chapter 2, will be complemented by regional programs in this system. Most places that the community identified as being of value coincide with these priority areas.

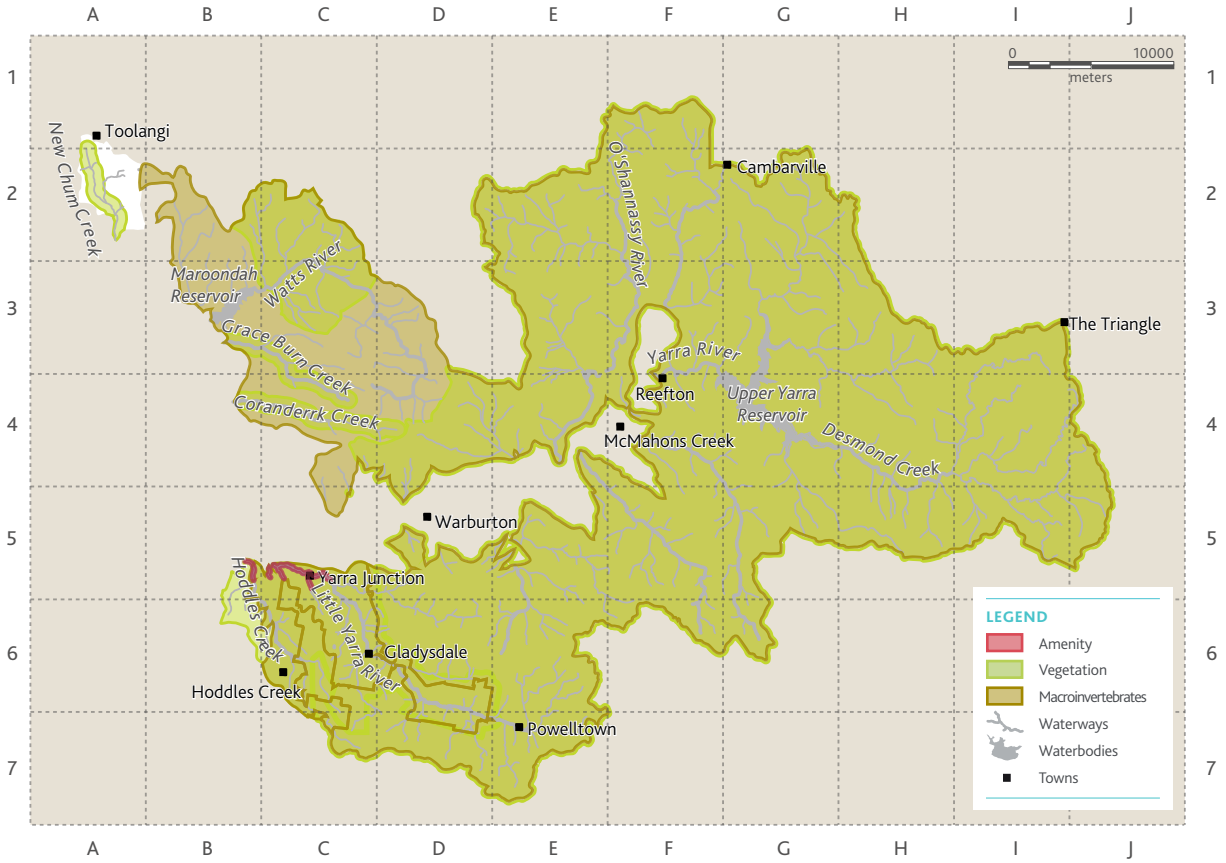


Figure 5.10: Upper Yarra system priority areas

Table 5.23: Management objectives for priority areas

Key value	Priority area	Key management objective	Grid reference
Macroinvertebrates	Yarra River forested headwaters	Maintain the number of macroinvertebrate families present	B2 to J5 to C6
	Yarra River forested headwaters interface at Hoddles Creek and Little Yarra River		D6, C6
Amenity	Hoddles Creek and Little Yarra River at Warburton	Improve amenity	C5
Vegetation	Upper New Chum Creek (Yarra headwaters)	Maintain vegetation to high quality	A2
	Grace Burn and Coranderrk Creek		C4, C3
	Watts River forested headwaters		C3, C2
	Yarra River forested headwaters		B2 to J5 to C6
	Middle Little Yarra River		D7, C6

Implementation targets

Implementation targets are a summary of the works we will undertake over the next five years to contribute to the long-term outcomes. Most of these works will be focused in priority areas, but regional programs will also contribute to meeting these targets.

Table 5.24: Implementation targets for the Upper Yarra system

Target	Amount
Km vegetation established to the required level to support waterway values	21
Km of vegetation managed to the required level to support waterway values	968
Km of stock exclusion fencing constructed	–
Number of fish barriers removed	–
Ha of aquatic habitat improved to the level required to support waterway values	0

Regional program priorities

In addition to the works targeting priority areas, the following regional actions will be undertaken in this system.

Table 5.25: Regional program actions for the Upper Yarra system

Management approach	Actions
Planning, strategy and guidelines	Advocate for healthy waterways outcomes in statutory planning when issuing drainage and planning permits for buildings, undertaking flood studies and advising on planning scheme amendments
	Provide advice on local implementation plans and other guidelines to assist in the management of healthy waterways
Advocacy	Build relationships with public land managers and advocate to ensure waterway environmental values are not compromised and social values are maximised (for example, Upper Yarra River township environments)
Enforcement	Work with other agencies to clarify roles and responsibilities and enforce regulations concerning poor land practices where appropriate
	Continue to take compliance action against illegal water extractions and against unauthorised works and encroachment issues where appropriate
Building stewardship and sharing knowledge	Provide incentives and support for individuals, community groups and local government for waterway management activities such as fencing, weed control, vegetation establishment and pest control
	Continue to support community initiatives such as Waterwatch and Frog Census
	Implement a knowledge-sharing program with communities, stakeholders and Traditional Owners throughout the Port Phillip and Westernport region, with activities including field days, seminars, written information and online resources
Habitat management	Implement seasonally adaptive management plans for identified refuge sites, and identify new sites as new knowledge becomes available
Asset protection and renewal	Manage high priority erosion issues including new erosion problems and repair and replace degraded infrastructure. Techniques will involve 'soft' and 'hard' engineering options including vegetation-based interventions, grade control structures (rock chutes) and rock-armoured banks. Preference will be given to solutions based solely on streamside vegetation (because these provide multiple benefits of stability, habitat and cost-effectiveness)
	Ensure existing hydraulic capacity issues are managed appropriately through a program of maintenance, and ensure any works do not reduce hydraulic capacity

Stormwater management	Deliver rural and urban runoff management programs to protect and improve key values in priority areas including: • Working with local government and the community to deliver on-ground works and planning activities to protect and improve waterways • Facilitating the adoption of sustainable road upgrade practices by road managers in rural and peri-urban areas
Environmental water	Deliver environmental water from the entitlement and monitor its effectiveness to improve environmental values in the Upper Yarra River
	Understand the catchment impacts on streamflows, and work with communities to mitigate these impacts
Diversions	Continue to manage extractions within allocated volumes and in accordance with streamflow management plans. Implement the new Little Yarra River management plan. Explore opportunities to improve water usage information

Middle Yarra system

The major waterways in this system include the Yarra River between Warburton and Warrandyte, Arthurs, Diamond, Steels, Pauls, Olinda, Woori Yallock and Stringybark creeks. Significant wetlands include Yering Backswamp and other floodplain wetlands around Yarra Glen, which are listed in the *Directory of Important Wetlands in Australia*.

The waterways in this system are highly valued especially the Yarra main stem and tributaries, which have areas of natural beauty, support many recreational activities and important animal species such as platypus. These waterways incorporate significant Indigenous and European heritage values.

Community feedback outlined a broad spectrum of values across the Middle Yarra system, reflecting its size and diversity. These included helmeted honeyeaters, lyrebirds, areas that provide habitat such as Mullum Mullum Creek, and popular recreational areas such as Warburton and Warrandyte State Park.

Challenges for waterway health include the impacts of urbanisation and agricultural activity and balancing social, environmental and economic values.

Expected outcomes for key values

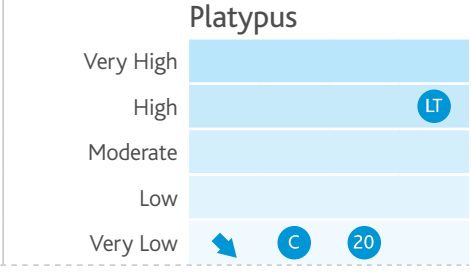
Table 5.26 summarises the historic trend, current condition and expected outcomes for each key value. In setting expected outcomes, we consider the values and challenges present in this system and balance community desires with what is practical.

Table 5.26: Historic trend, current condition and expected outcomes for key values in the Middle Yarra system

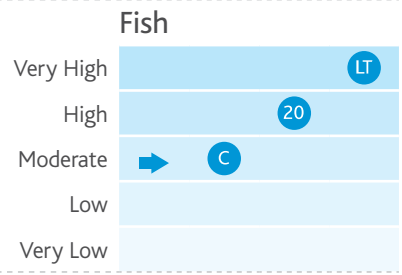
MEASURE OF HEALTH: C Current 20 20 year LT Long term

10 YEAR TREND: Improving Stable Declining **NT** No trend available

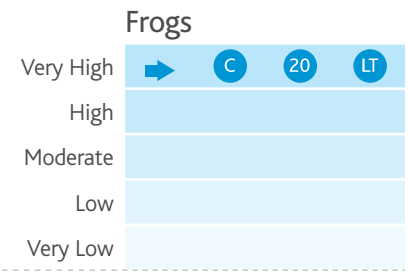
*Limited data used to determine the rating **Based on the score for streamside birds only (does not include wetland birds)

The past decade of drought has seen **platypus** numbers reduce from the 1990s. Platypus populations in the Middle Yarra are still common although population sizes are smaller than those found in the Upper Yarra. The population at Diamond Creek has increased in response to successful restoration works such as removing willows, stabilising the stream banks and replanting streamside vegetation. Continued works on flows and habitat aim to stabilise platypus condition and allow for improvements in the long term.	

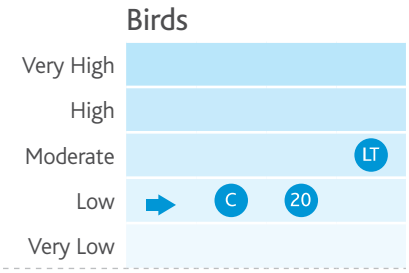
Native freshwater **fish** species recorded in this system have been stable over the past decade, with introduced fish widespread. Works aimed at improving passage and flows will result in significant improvements to the fish populations.



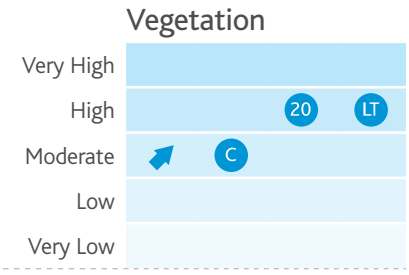
The diversity of **frog** populations is very high and stable. Works aim to maintain this level.



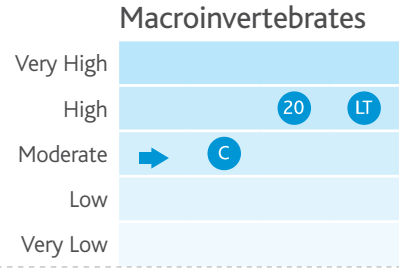
Extensive vegetation clearing has occurred, which is reflected in the low condition of **bird** populations. These populations appear to be stable from the 1990s. Works focusing on linking habitat and revegetating streamside areas are aimed at improving this condition over the long term to moderate.



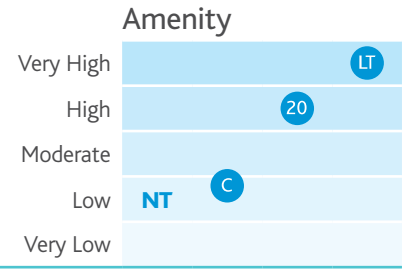
A significant decline in the condition of **vegetation** has occurred over the past 100 years due to extensive clearing for rural and urban development. However, this trend has reversed in the past 10 years. The quality of vegetation is rated moderate to low. Works aim to continue to improve vegetation condition from moderate to high over the next 20 years.



The condition of **macroinvertebrate** communities is highly dependent on the quality of water in the system. Rural and urban development has led to a decline in water quality and macroinvertebrate condition is moderate. Works to improve water quality aim to improve the range and variety of macroinvertebrates to high over the next 20 years.



Many areas provide high **amenity** through intact streamside vegetation, natural waterway features and parkland where relaxation can occur, but the average score is low. Continued work on linking vegetated areas will improve the amenity.



1 Diamond Creek rural management unit

Waterway overview Diamond and Arthurs creeks rise in the Kinglake National Park and flow through rural landscapes for most of their length. Diamond Creek passes through semi-rural areas before flowing into the urban area of Eltham.

Platypus: No platypuses were captured at Eltham during the 2011/12 survey. A single capture by the Australian Platypus Conservancy (APC) in November 2011 indicates platypus are still present, but abundance appears to be low.

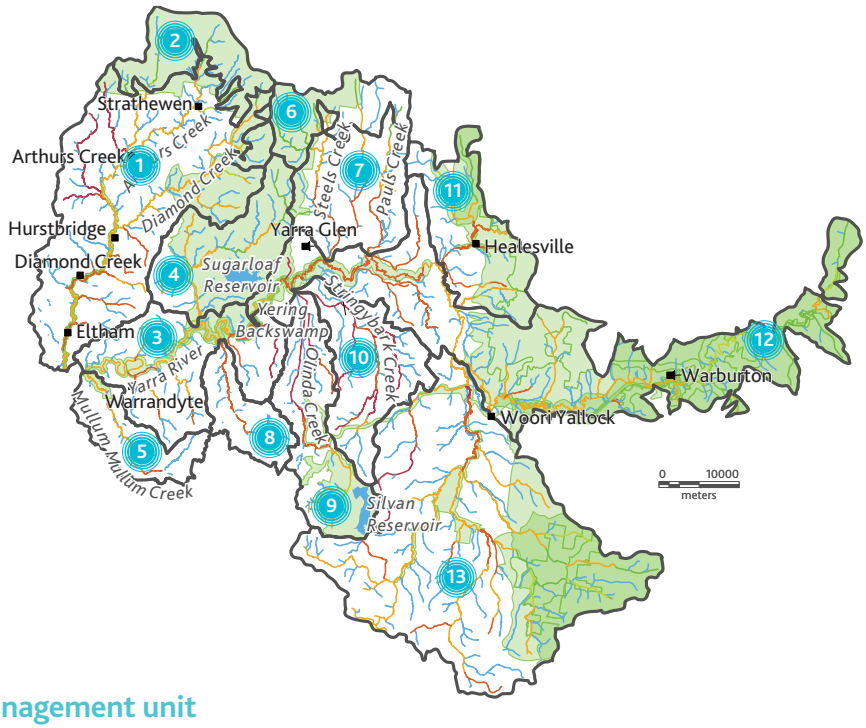
Frogs Twelve of the expected 13 species have been recorded in this management unit which is home to endangered and vulnerable species such as Bibrons toadlet, growling grass frog and southern toadlet.

Fish Seventeen of the expected 28 species have been recorded, ten of which are native. This management unit is home to endangered and vulnerable species such as the Macquarie perch, mountain galaxias, Murray cod, river blackfish and spotted galaxias.

Birds Seventy of the expected 113 species of streamside birds have been recorded.

Priority areas Diamond Creek rural contains priority areas for platypus, vegetation and social value. Management objectives are to stabilise platypus populations, maintain vegetation to a high quality, and maintain the high level of amenity.

Future management In 2030 fencing will extend along the majority of the waterways, excluding stock and improving vegetation and fish barriers will have been removed in the lower Yarra River catchment which supports a wide range of migratory fish.



2 Diamond Creek source management unit

Waterway overview Diamond Creek rises in the Kinglake National Park near St Andrews and flows though Hurstbridge and Diamond Creek townships before joining the Yarra River at Eltham. Arthurs Creek rises in the Kinglake National Park near Kinglake and flows through Strathewen and Arthurs Creek before joining Diamond Creek upstream of Hurstbridge. Other tributaries include Kangaroo Creek, Running Creek, Stewart Gully, Deep Creek and Smiths Gully.

Platypus No platypus were captured at Arthurs Creek near Hurstbridge or at Running Creek during the 2011/12 survey period. Running Creek once supported a small platypus population which declined significantly during the drought and none have been seen since 2004.

Frogs Nine of the expected 13 species have been recorded in this management unit which is home to endangered and vulnerable species such as Bibrons toadlet, growling grass frog and southern toadlet.

Fish Five of the expected 28 species have been recorded, four of which are native. This management unit is home to endangered and vulnerable species such as the mountain galaxia and river blackfish.

Birds Insufficient surveys at management unit scale.

Priority areas Diamond Creek source has been identified as a priority area for vegetation and the management objectives is to maintain vegetation to a high level.

Future management In 2030 stock have been excluded from streamside areas, a continuous corridor of vegetation has been established along most creeks and fish barriers have been removed in the lower Yarra River catchment and on the local creeks.

3 Middle and Lower Yarra River management unit

Waterway overview The middle and lower sections of the Yarra River lie downstream of Warrandyte. The middle section of the Yarra flows through the Warrandyte State Park and Yarra Valley Parklands. Tributaries in this area include Cherry Hill and Chirnside Park drains, and Jumping, Andersons, Harris Gully, Ruffeys and Salt creeks. Tributaries in the lower section include Merri and Gardiners creeks and the Plenty River.

Lower Yarra Frogs Fourteen of an expected 13 species have been recorded. This management unit is home to endangered and vulnerable species such as Bibrons toadlet, growling grass frog and southern toadlet.

Fish Twenty-eight of an expected 28 species have been recorded, 20 of which are native.

Birds Eighty-six of the expected 113 species of streamside birds and 44 of the expected 57 species of wetland birds have been recorded.

Priority areas Middle and Lower Yarra River contains priority areas for platypus, vegetation, amenity and fish. Management objectives are to stabilise platypus populations, maintain vegetation and maintain amenity.

Future management In 2030 fish barriers have been removed and weed control and revegetation programs link remnant areas and provide a continuous vegetated zone along the river.

4 Watsons Creek management unit

Waterway overview Watsons Creek originates in the forested Kinglake National Park, flowing through cleared land at Christmas Hill and Kangaroo Ground before entering the Yarra River near Wonga Park. Tributaries of Watsons Creek include Long Gully, Five Mile, Sugarloaf and Stevenson creeks. Sugarloaf Reservoir is within this catchment.

Frogs Eleven of the expected 13 species have been recorded in this management unit which is home to endangered and vulnerable species such as Bibrons toadlet, growling grass frog and southern toadlet.

Fish Nine of the expected 28 species of fish have been recorded in this management unit, four of which are native. This management unit is home to the endangered river blackfish.

Birds Insufficient surveys at management unit scale.

Priority areas Watsons Creek contains a priority area for vegetation. The management objectives are to maintain vegetation to a high level.

Future management In 2030 stock have been excluded from Watsons Creek, invasive weeds have been controlled through treatment and monitoring and fish barriers have been removed in both the lower catchment and on the local creeks.

5 Mullum Mullum Creek management unit

Waterway overview Mullum Mullum Creek flows from Croydon through Ringwood and Warrandyte and enters the Yarra River in the Yarra Valley Parklands at Templestowe.

Platypus During the 2011/12 survey period four adult male platypuses were captured at Mullum Mullum Creek. Two were in poor condition and two were in average condition. Mullum Mullum Creek didn't show evidence of declining populations during the drought, which is likely due to the link with the Yarra River and connectivity with other populations.

Frogs Eleven of the expected 13 species have been recorded in this management unit which is home to endangered and vulnerable species such as Bibrons toadlet, growling grass frog and southern toadlet.

Fish Thirteen of the expected 28 species have been recorded, six of which are native. This management unit is home to endangered and vulnerable species such as Macquarie perch and spotted galaxias.

Birds Sixty-nine of the expected 113 species of streamside birds and 8 of the expected 57 species of wetland birds have been recorded.

Priority areas Mullum Mullum Creek contains a priority area for vegetation and the management objective is to improve vegetation condition.

Future management In 2030 wetlands along sections of the creek's floodplain have been developed to improve water quality and link streamside and floodplain habitat, and fish barriers have been removed in the lower Yarra River catchment and on Mullum Mullum Creek.

6 Steels and Pauls Creek Source management unit

Waterway overview The headwaters of Steels Creek rise in the Kinglake National Park and flow through the Steels Creek township before joining the Yarra River near Yarra Glen. Pauls Creek rises in the Toolangi State Forest near Toolangi and joins the Yarra upstream of Steels Creek, near Tarrawarra.

Frogs Nine of the expected 13 species have been recorded in this management unit which is home to endangered and vulnerable species such as growling grass frog and southern toadlet.

Fish One of the expected 28 species has been recorded from this management unit, the endangered mountain galaxias.

Birds Insufficient surveys at management unit scale.

Priority areas Steels and Pauls Creek (source) management unit contains a priority area for vegetation and the management objective is to maintain vegetation to a high quality.

Future management In 2030 stock exclusion fencing extends along the majority of the waterways and fish barriers have been removed in the lower Yarra River catchment and in the local creeks.

7 Steels and Pauls Creek rural management unit

Waterway overview The headwaters of Steels Creek rise in the Kinglake National Park and flow through the Steels Creek township before joining the Yarra River near Yarra Glen. Dixons Creek is the main tributary of Steels Creek, flowing into it just upstream of the Yarra. Other tributaries include Jehosophat, Pinchgut, Dry, Full and Plenty creeks. Pauls Creek rises in the Toolangi State Forest near Toolangi and joins the Yarra upstream of Steels Creek, near Tarrawarra.

Frogs Ten of the expected 13 species have been recorded in this management unit which is home to endangered and vulnerable species such as growling grass frog and southern toadlet.

Fish Eleven of the expected 28 species have been recorded, five of which are native. This management unit is home to the endangered mountain galaxias.

Birds Insufficient surveys at management unit scale.

Priority areas Steels and Pauls Creeks rural management unit contains priority areas for vegetation and amenity. Management objectives are to maintain vegetation to a high quality and improve the level of amenity.

Future management In 2030 stock exclusion fencing extends along the majority of the waterways and fish barriers have been removed in the lower Yarra River catchment and in the local creeks.

8 Brushy Creek management unit

Waterway overview Brushy Creek rises in Mooroolbark and joins the Yarra River at Wonga Park. Tributaries of Brushy Creek include Mooroolbark, Lincoln Road, Five Ways and Warrien Road Main drains.

Frogs Ten of the expected 13 species have been recorded in this management unit which is home to endangered and vulnerable species such as growling grass frog and southern toadlet.

Fish Eleven of the expected 28 species have been recorded, four of which are native. This management unit is home to endangered and vulnerable species such as the Macquarie perch and freshwater catfish.

Birds Insufficient surveys at management unit scale.

Future management In 2030 constructed wetland systems downstream of the Yarra Valley Wastewater Treatment Plant will have removed pollutants from the system, wetlands will have provided a vegetated link between the floodplain and streamside zone, and stock exclusion and revegetation of the lower reaches will have been implemented.

9 Olinda Creek management unit

Waterway overview Olinda Creek rises in the Dandenong Ranges near the Olinda township and flows through the Dandenong Ranges National Park, Kalorama, Mt Evelyn and Lilydale before joining the Yarra River at Yering. The main tributaries of Olinda Creek are Lyrebird Gully Creek and Lilydale East Drain.

Platypus Six platypuses (three adult males, one adult female, one juvenile female and one juvenile male) were captured during the 2011/12 survey period. Abundance declined significantly during the drought and it's encouraging to see some signs of recovery.

Frogs Nine of the expected 13 species have been recorded in this management unit which is home to endangered and vulnerable species such as growling grass frog and southern toadlet.

Fish Thirteen of the expected 28 species have been recorded, six of which are native. This management unit is home to endangered and vulnerable species such as the mountain galaxias and river blackfish.

Birds Insufficient surveys at management unit scale.

Priority areas Olinda Creek management unit contains priority areas for platypus, macroinvertebrates and amenity. Management objectives are to stabilise platypus populations, maintain macroinvertebrate diversity, and improve the level of amenity.

Future management In 2030 revegetation has been undertaken, stock have been excluded from waterways, weed control along the lower reaches of Olinda Creek has improved waterway condition and fish barriers have been removed.

10 Stringybark Creek management unit

Waterway overview Stringybark Creek originates near Silvan and flows through Coldstream before joining Olinda Creek just upstream of the Yarra River. Tributaries of Stringybark Creek include Little Stringybark and Log creeks.

Platypus No platypuses were captured in Stringybark Creek during the 2011/12 survey period. Stringybark Creek is unlikely to support a resident platypus population.

Frogs Ten of the expected 13 species have been recorded in this management unit which is home to endangered and vulnerable species such as Bibrons toadlet and growling grass frog.

Fish Nine of the expected 28 species have been recorded, four of which are native. This management unit is home to the endangered mountain galaxias.

Birds Insufficient surveys at management unit scale.

Priority areas Stringybark Creek contains areas a priority area for amenity. The management objective is to improve the level of amenity.

Future management In 2030 stock exclusion fencing extends along the majority of the waterways, streamside vegetation has been established and major weed threats have been controlled through regular maintenance and treatment.

11 Watts River rural management unit

Waterway overview The rural reaches of the Watts River extend downstream from the Maroondah Reservoir and through Healesville before joining the Yarra River below the Maroondah Highway. Major tributaries include Meyers, Chum and Grace Burn creeks. Piccaninny and Coranderrk creeks also lie nearby.

Platypus One adult male in good condition was captured at Chum Creek during the 2011/12 survey period.

Frogs Eleven of the expected 13 species have been recorded in this management unit which is home to endangered and vulnerable species such as Bibrons toadlet, growling grass frog and southern toadlet.

Fish Twenty-two of the expected 28 species have been recorded, 13 of which are native. This management unit is home to endangered and vulnerable species such as the Macquarie perch, mountain galaxias, Murray cod, river blackfish and spotted galaxias.

Birds Insufficient surveys at management unit scale.

Priority areas Watts River rural contains priority areas for vegetation, macroinvertebrates and amenity. Management objectives are to maintain vegetation to a high quality, maintain macroinvertebrate diversity and improve the level of amenity.

Future management In 2030 vegetation has been re-established, stock has been excluded from waterways and fish barriers have been removed.

12 Upper Yarra River Rural management unit

Waterway overview The rural sections of the upper Yarra River extend from the Upper Yarra Reservoir downstream to Warrandyte. This area also includes the Don River, which rises in the Yarra Ranges National Park and joins the Yarra downstream of Yarra Junction.

Frogs Eleven of the expected 13 species have been recorded in this management unit which is home to endangered and vulnerable species such as growling grass frog and southern toadlet.

Fish Nineteen of the expected 28 species have been recorded, 11 of which are native. This management unit is home to endangered and vulnerable species such as Australian grayling, Macquarie perch, mountain galaxias, river blackfish and spotted galaxias.

Birds Insufficient surveys at management unit scale.

Priority areas Upper Yarra River Rural contains priority areas for platypus, fish, birds, vegetation, macroinvertebrates and amenity. Management objectives are to stabilise platypus populations, maintain and increase fish diversity and abundance of streamside and wetland birds, maintain macroinvertebrate diversity and maintain and improve amenity.

Future management In 2030 a program of environmental flows has been implemented, removal of fish barriers has assisted with migration in the lower catchment and in a number of tributaries, and stock exclusion supports the establishment of native vegetation.

13 Woori Yallock Creek management unit

Waterway overview Woori Yallock Creek rises near Macclesfield in the Yarra Ranges and joins the Yarra River near Healesville. The Wandin Yallock Creek rises near the Silvan Reservoir and joins Woori Yallock Creek just upstream of the Yarra. Other tributaries of Woori Yallock Creek include Cockatoo, Shepherd and McCrae creeks.

Platypus One new adult male in average condition was captured at Seville and three adult/sub-adult females ranging from poor to excellent condition at Woori Yallock during the 2011/12 survey period. Five platypuses were also caught during a fish survey in a nearby tributary of Woori Yallock Creek. A general decline is evident due to drought.

Frogs Nine of the expected 13 species have been recorded in this management unit which is home to the endangered growling grass frog.

Fish Fourteen of the expected 28 species have been recorded, seven of which are native. This management unit is home to endangered and vulnerable species such as mountain galaxias and river blackfish.

Birds Eighty-six of the expected 113 species of streamside birds have been recorded.

Priority areas Woori Yallock contains priority areas for platypus, birds, vegetation, macroinvertebrates and amenity. Management objectives are to stabilise platypus populations, maintain diversity and abundance of streamside and wetland birds, maintain vegetation, maintain macroinvertebrate diversity and improve amenity.

Future management In 2030 reserve areas have been linked through streamside fencing and revegetation programs and fencing excludes stock and helps support native vegetation.

20 year strategic priorities

In order to achieve these long-term outcomes, several areas require our focus over the next 20 years including:

- Improving habitat in waterways for fish, frogs and platypus through revegetation and weed control, especially willows
- Improving water flows by implementing environmental flows for fish, frogs and platypus
- Investigating and providing fish passage throughout the system
- Improving water quality and reducing the impacts of stormwater on waterways for fish, platypus, frogs and macroinvertebrates
- Linking floodplains to waterways to improve connectivity for frogs
- Revegetating and stabilising rural reaches for macroinvertebrates, which will also improve vegetation condition
- Improving water quality and flows for macroinvertebrates and fish by renewing existing urban drainage systems over the long term and implementing stormwater treatment in new urban developments
- Improving water quality for macroinvertebrates and fish in rural areas by managing streamside vegetation
- Revegetating streamside areas for vegetation, amenity and birds – particularly by linking high quality habitat.

These strategic priorities will require ongoing investment over the next 20 years and beyond, so it may not be possible to invest in all priorities within the five year period of the strategy.

Priority areas for investment 2013/14–2017/18

Priority areas for investment have been identified as regionally important for on-ground works over the life of the strategy. Each priority area has a management objective to guide works. These works, which contribute to the long-term outcomes based on principles outlined in Chapter 2, will be complemented by regional programs in this system. Most places that the community identified as being of value coincide with these priority areas.

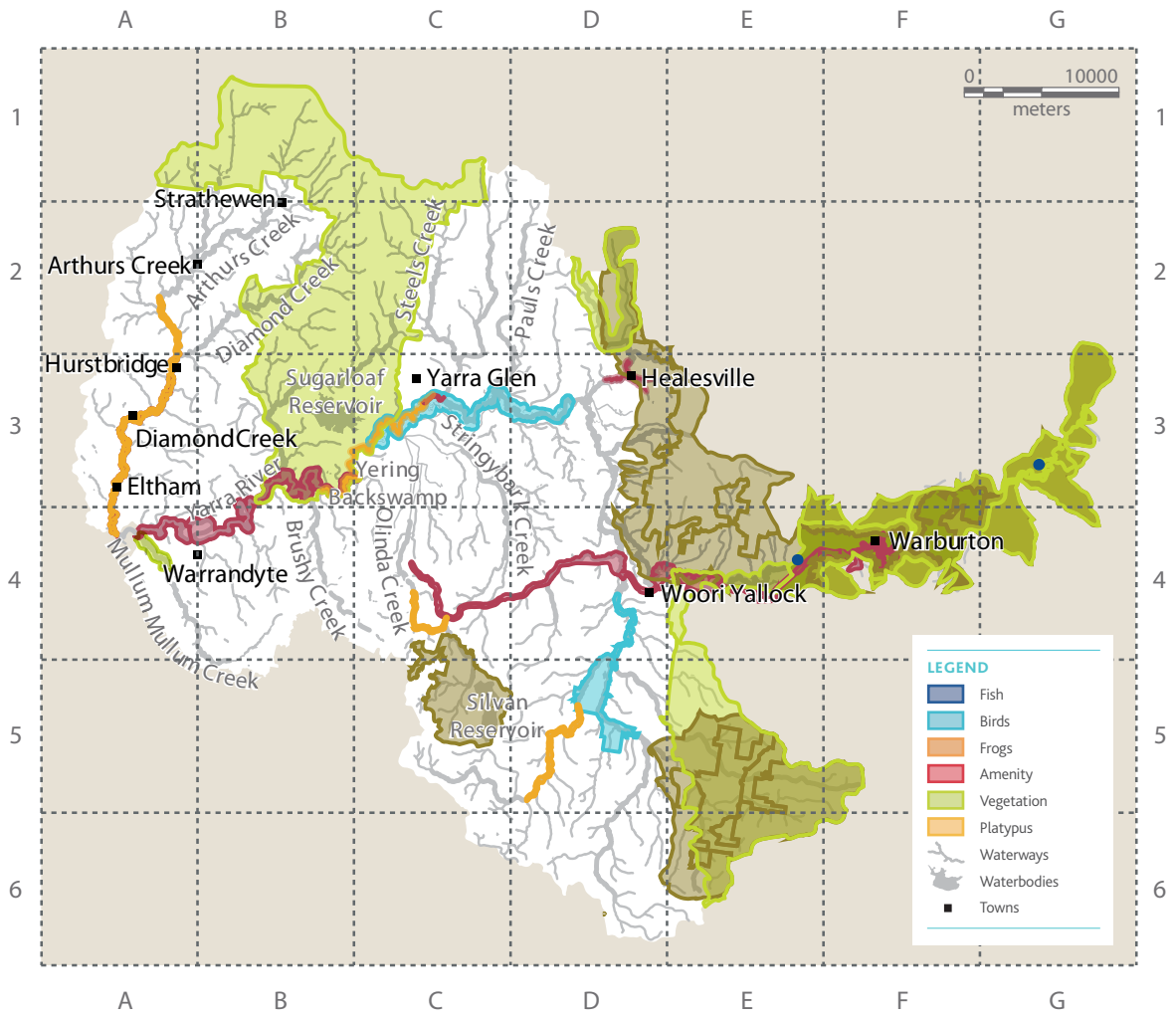


Figure 5.11: Middle Yarra system priority areas

Table 5.27: Management objectives for priority areas

Key value	Priority area	Key management objective	Grid reference
Birds	Yarra River floodplain around Yarra Glen	Maintain the high species richness and abundance of streamside and wetland bird populations	C3, D3
	Woori Yallock and Cockatoo Creek at Yellingbo Nature Conservation Reserve		D5, D4
Fish	Yarra River around Dee River confluence	Maintain nativeness and abundance through improved fish passage	E4
	Yarra River around Yarra Diversion tunnel	Maintain or increase species richness and increase abundance of fish populations	G3
Macroinvertebrates	Woori Yallock Creek and Yarra River forested headwaters interface	Maintain the number of macroinvertebrate families present	E6, E5 and D3, E4
	Olinda Creek headwaters and Silvan Reserve		C5
	Yarra River forested headwaters west		E5, F5, and E3, G3

Platypus	Middle Yarra upstream of Brushy Creek confluence	Stabilise the relative abundance of platypus population	B4, C4
	Woori Yallock Creek upstream of Yellingbo		D5
	Olinda Creek from Mt Evelyn to Lilydale Lake		C4
	Diamond Creek	Link Yarra and Diamond Creek platypus populations to increase resilience of Diamond Creek population	A4, A3
Amenity	Yarra River around Yarra Valley parklands north	Maintain the high level of amenity	
	Yarra River around Warrandyte State Park		B4, B3
	Diamond Creek and Mullum Mullum Creek		A3
	Yarra River at Healesville, Warburton, Yarra Glen	Improve the level of amenity	C3 and D3 and F4
	Yarra River tributaries at Warburton Rail Trail intersections		C4, F4
Vegetation	Yarra River-Mullum Mullum Creek confluence	Improve vegetation condition and minimise impacts on high value areas	A4
	Big Pats Creek and Upper Yarra River to O'Shannassy River confluence		F3, F4
	Upper Scrubby Creek and Diamond Creek and Watsons Creek forested headwaters	Maintain vegetation to high quality	B3, B1, C3, C1
	Meyers Creek and Lower New Chum Creek		D2
	Yarra forested headwaters interface		E6, G3

Implementation targets

Implementation targets are a summary of the works we will undertake over the next five years to contribute to the long-term outcomes. Most of these works will be focused in priority areas, but regional programs will also contribute to meeting these targets.

Table 5.28: Implementation targets for the Middle Yarra system

Target	Amount
Km vegetation established to the required level to support waterway values	135
Km of vegetation managed to the required level to support waterway values	2235
Km of stock exclusion fencing constructed	116
Number of fish barriers removed	2
Ha of aquatic habitat improved to the level required to support waterway values	59

Regional program priorities

In addition to the works targeting priority areas, the following regional actions will be undertaken in this system.

Table 5.29: Regional program actions for the Middle Yarra system

Management approach	Actions
Planning, strategy and guidelines	Advocate for healthy waterways outcomes in statutory planning when issuing drainage and planning permits for buildings, undertaking flood studies and advising on planning scheme amendments
	Provide advice on local implementation plans and other guidelines to assist in the management of healthy waterways
Advocacy	Build relationships with public land managers and advocate to ensure waterway environmental values are not compromised and social values are maximized (for example, Yarra Valley parklands)
	Advocate with local government on planning mechanisms to ensure appropriate land use, with a focus on high priority areas (for example, urban consolidation activity near waterways)
Enforcement	Work with other agencies to clarify roles and responsibilities and where necessary enforce regulations concerning poor land practices (for example, vegetation removal in peri-urban reaches of the middle Yarra River)
	Continue to take compliance action against illegal water extractions and against unauthorised works and encroachment issues where necessary
Building stewardship and sharing knowledge	Provide incentives and support for individuals, community groups and local government for waterway management activities such as fencing, weed control, vegetation establishment and pest control
	Continue to support community initiatives such as Waterwatch and Frog Census
	Implement a knowledge-sharing program with communities, stakeholders and Traditional Owners throughout the Port Phillip and Westernport region, with activities including field days, seminars, written information and online resources
Habitat management	Implement seasonally adaptive management plans for identified refuge sites, and identify new sites as new knowledge becomes available
	Implement and review management plans for Melbourne Water's Sites of Biodiversity Significance including Yering Backswamp, Anderson Creek East Retarding Basin and Cardigan Road Retarding Basin
Asset protection and renewal	Manage high priority erosion issues including new erosion problems and repair and replace degraded infrastructure. Techniques will involve 'soft' and 'hard' engineering options including vegetation-based interventions, grade control structures (rock chutes) and rock-armoured banks. Preference will be given to solutions based solely on streamside vegetation (because these provide multiple benefits of stability, habitat and cost-effectiveness)
	Ensure existing hydraulic capacity issues are managed appropriately through a program of maintenance and ensure any works do not reduce hydraulic capacity especially in sensitive areas, for example through Warburton
Stormwater management	Deliver rural and urban runoff management programs to protect and improve key values in priority areas including: • Working with local government and the community to deliver on-ground works and planning activities to protect and improve waterways • Facilitating the adoption of sustainable road upgrade practices by road managers in rural and peri-urban areas • Working with agricultural landowners to implement on-farm practices and on-ground works to reduce pollutants and runoff into waterways
Environmental water	Deliver environmental water from the entitlement and monitor its effectiveness to improve environmental values in the Middle Yarra River
	Manage groundwater dependent ecosystems and re-engage disconnected billabongs and wetlands
Diversions	Continue to manage extractions within allocated volumes and in accordance with streamflow management plans. Implement the new Woori Yallock Creek management plan. Explore opportunities to improve water usage information

The Lower Yarra holds significant amenity value

Lower Yarra system

The major waterways in this system are the main stem of the Yarra River downstream of Templestowe, Plenty River, Darebin, Merri, Moonee Ponds and Gardiners creeks. Much of the floodplain is protected in public open spaces such as the Yarra Valley parklands, and the system is fortunate to contain many floodplain wetlands with natural values such as Bolin Bolin Wetlands.

Many creeks within the lower Yarra also contain floodplain wetlands or have had stormwater wetlands built within the floodplain. Examples include Glen Iris Wetlands, Banyule Swamp and Huntingdale Wetlands. The waterways in this system are highly valued by locals and visitors alike. Most are found in urban environments and are very well utilised by the community, particularly the extensive network of pathways beside most of the waterways. These waterways incorporate significant Indigenous and European heritage values, with important locations and attractions including Dights Falls and the Heidelberg Artists Trail.

Community feedback outlined a broad spectrum of values across this system including remnant vegetation, places for relaxation and recreation and native animals. The estuary is economically and socially significant to Melbourne and Victoria, containing the Port of Melbourne as well as being highly used by recreational and commercial boats. It is a salt wedge estuary and provides important habitat and passage for migratory fish, the short-finned eel and several bird species.

Challenges for waterway health include the impacts of urbanisation, with most waterways in the system having undergone significant alteration in channel form and water quality. Many waterways have been substantially modified including straightening, channelling and concrete-lining, reducing the amount and quality of natural vegetation and ecosystem function. Large amounts of stormwater enter these waterways and play a significant role in reducing water quality and altering water flow rates. Combined with diversion of water upstream, this can result in low flows and low dissolved oxygen, which are detrimental to plants and animals in the waterway.

1 Merri Creek rural and forested management unit

Waterway overview Merri Creek flows from the foothills of the Great Dividing Range near Wallan, through basalt plains north of Melbourne and joins the Yarra River at Fairfield. The upper sections include the catchment upstream of Craigieburn Road. Major tributaries of Merri Creek in this section are Kalkallo, Malcolm and Aitken creeks.

Frogs Thirteen of the expected 15 species have been recorded in this management unit. Endangered and vulnerable species such as Bibrons toadlet, growling grass frog and southern toadlet are present.

Fish Eight of the expected 32 species of fish have been recorded, six of which are native. This management unit is home to the endangered river blackfish.

Birds Insufficient surveys at management unit scale.

Priority areas Merri Creek rural and forested contains priority areas for frogs, amenity and vegetation. Management objectives are improving abundance and diversity of frogs, maintaining and improving amenity and maintaining vegetation to a high quality.

Future management In 2030 revegetation activities have linked many of the remnant areas and habitat protection and restoration around floodplain wetlands have strengthened populations of growling grass frog.

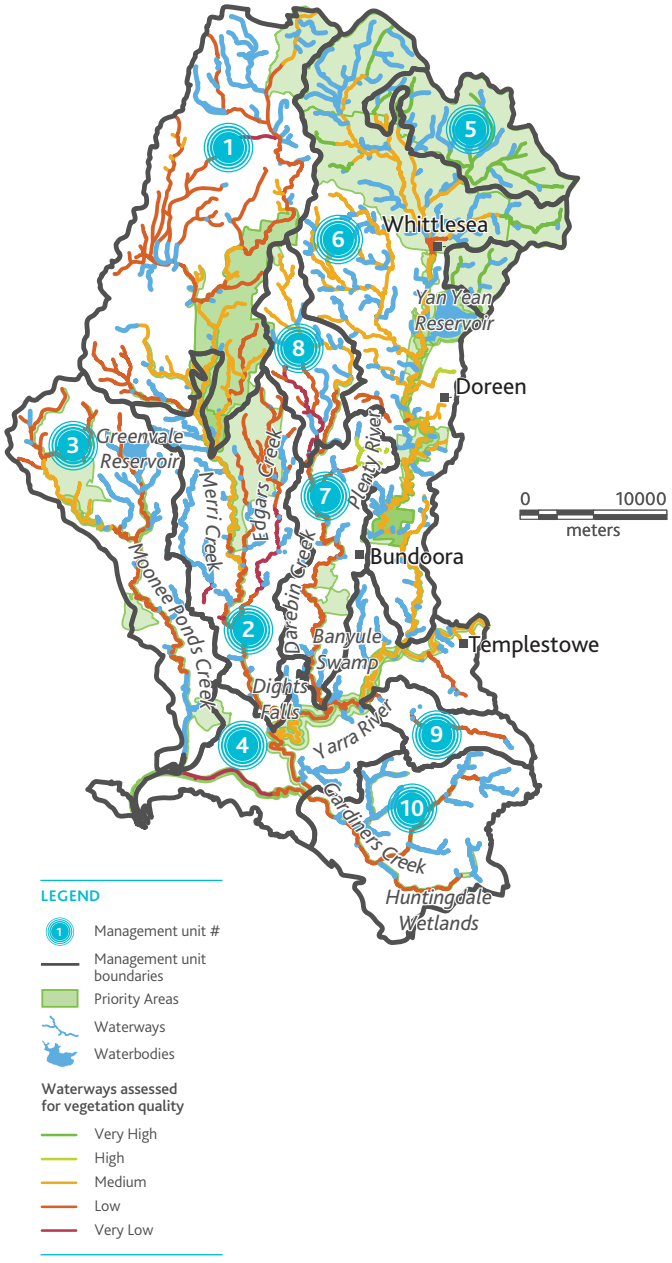
2 Merri Creek urban management unit

Waterway overview Merri Creek flows from the foothills of the Great Dividing Range near Wallan, through basalt plains north of Melbourne and joins the Yarra River at Fairfield. This lower section lies downstream of Craigieburn Road. Major tributaries in this section include Edgars, Central and Merlynston creeks.

Platypus During the 2011/12 survey period, no platypuses were captured in Merri Creek. Surveys in Merri Creek were prompted by a number of reliable platypus sightings over the previous eighteen months.

Frogs Eleven of the expected 15 species have been recorded in this management unit which is home to endangered and vulnerable species such as Bibrons toadlet and growling grass frog.

Fish Nineteen of the expected 32 species have been recorded, 11 of which are native. This management unit is home to endangered and vulnerable species such as Australian mudfish and spotted galaxias.



Birds Sixty-four of the expected 113 species of streamside birds and 29 of the expected 57 species of wetland birds have been recorded.

Priority areas Merri Creek urban contains priority areas for frogs, amenity and vegetation. Management objectives are maintaining frog species richness and abundance, maintaining amenity and maintaining and improving vegetation.

Future management In 2030 revegetation and weed removal have improved vegetation condition in the streamside zone, a continuous habitat corridor now extends along the length of the creek and fish barriers have been removed in both the lower Yarra River and on Merri Creek.

3 Moonee Ponds Creek management unit

Waterway overview Moonee Ponds Creek originates north of Greenvale and flows through Woodlands Historic Parklands and along the Citylink route before joining the Yarra River at Docklands. Yuroke Creek is a tributary and joins Moonee Ponds Creek upstream of the Jacana wetlands.

Frogs Eleven of the expected 15 species have been recorded in this management unit which is home to endangered and vulnerable species such as Bibrons toadlet, growling grass frog and southern toadlet.

Fish Nine of the expected 32 species have been recorded, five of which are native. This management unit is home to the endangered Macquarie perch.

Birds Seventy-four of the expected 113 species of streamside birds and 41 of the expected 57 species of wetland birds have been recorded.

Priority areas Moonee Ponds Creek has priority areas for amenity and frogs. Management objectives are to maintain amenity and improve abundance, distribution and diversity of frogs.

Future management In 2030 upper sections around Woodlands Historic Park have been revegetated and weed control measures have been put in place and streamside condition along the urbanised sections of catchment has been improved.

4 Middle and Lower Yarra River management unit

Waterway overview The middle and lower sections of the Yarra River lie downstream of Warrandyte. The middle section of the Yarra flows through the Warrandyte State Park and Yarra Valley Parklands. Tributaries in this area include Cherry Hill and Chirnside Park drains, and Jumping, Andersons, Harris Gully, Ruffeys and Salt creeks. Tributaries in the lower section include Merri and Gardiners creeks and the Plenty River.

Frogs Fourteen of an expected 15 species have been recorded and endangered and vulnerable species such as Bibrons toadlet, growling grass frog and southern toadlet are present.

Fish Twenty-eight of an expected 32 species have been recorded, 20 of which are native.

Birds Eighty-six of the expected 113 species of streamside birds and 44 of the expected 57 species of wetland birds have been recorded.

Priority areas Middle and Lower Yarra River contains priority areas for platypus, vegetation, amenity and fish. Management objectives are to stabilise platypus populations, maintain vegetation to a high quality and maintain the high level of amenity.

Future management In 2030 fish barriers have been removed and weed control and revegetation programs link remnant areas and provide a continuous vegetated zone along the river.

5 Plenty River source management unit

Waterway overview The Plenty River rises in the Mt Disappointment State Forest. Both the Yan Yean and Toorourrong water storages lie within the catchment. Water is diverted from the King Parrot Creek catchment on the northern side of the Great Dividing Range into the Toorourrong Reservoir.

Platypus No platypuses were captured at Toorourrong during the 2011/12 survey period. However, sightings near Wallaby Weir during surveys confirm platypuses are still present. Abundance has declined due to drought conditions, bushfires and the isolation of the population.

Frogs: Thirteen of the expected 15 species have been recorded in this management unit which is home to endangered and vulnerable species such as Bibrons toadlet, growling grass frog and southern toadlet.

Fish: Seven of the expected 32 species have been recorded, five of which are native. This management unit is home to endangered and vulnerable species such as mountain galaxias and river blackfish.

Birds: Insufficient surveys at management unit scale.

Priority areas: Plenty River source contains a priority area for vegetation. The management objective is to maintain vegetation to a high quality.

Future management: In 2030, there has been excellent regeneration of the forested upper catchment that was severely affected by the 2009 bushfires.

6 Plenty River rural and lower management unit

Waterway overview The Plenty River rises in the Mt Disappointment State Park and flows through Whittlesea, Plenty Gorge and Greensborough before joining the Yarra River at Viewbank. The river has a number of tributaries, including Falls, Jacks, Bruces, Scrubby and Barbers creeks.

Platypus No platypuses were captured at Lower Plenty and Plenty Gorge during the 2011/12 survey period. There has been a significant decline in abundance at Plenty Gorge over the last several years.

Frogs Thirteen of the expected 15 species have been recorded in this management unit which is home to endangered and vulnerable species such as Bibrons toadlet, growling grass frog and southern toadlet.

Fish Nineteen of the expected 32 species have been recorded, eleven of which are native. This management unit is home to endangered and vulnerable species such as the Macquarie perch, mountain galaxias, Murray cod, river blackfish and spotted galaxias.

Birds Seventy-six of the expected 113 species of streamside birds and 39 of the expected 57 species of wetland birds have been recorded.

Priority areas Plenty River rural and lower has priority areas for birds, frogs, amenity and vegetation. Management objectives are to maintain diversity and abundance of birds and frogs, improve amenity and maintaining and improving vegetation.

Future management In 2030 erosion will have decreased through stock exclusion, revegetation and weed management programs and fish barriers will have been removed in the lower Yarra River catchment and on the Plenty River.

7 Darebin Creek urban management unit

Waterway overview Darebin Creek rises near Woodstock on Melbourne's northern outskirts. The creek flows through Epping and Reservoir before joining the Yarra River at Alphington. The main tributary of Darebin Creek is Hendersons Road Drain which originates in South Morang and joins the creek at Mill Park.

Frogs Thirteen of the expected 15 species have been recorded in this management unit. Endangered and vulnerable species such as Bibrons toadlet, growling grass frog and southern toadlet are present.

Fish Nine of the expected 32 species have been recorded in this management unit, three of which are native.

Birds Forty-six of the expected 113 species of streamside birds have been recorded.

Priority areas Darebin Creek urban contains priority areas for amenity. The management objective is to maintain and improve amenity.

Future management In 2030 fish barriers will have been removed in both the lower Yarra River catchment and on Darebin Creek and supporting an urban tolerant community of native fish including several galaxias species, short-finned eel and flat-headed gudgeon.

8 Darebin Creek rural management unit

Waterway overview Darebin Creek rises near Woodstock on Melbourne's northern outskirts. The creek flows through Epping and Reservoir and Heidelberg West before joining the Yarra River at Alphington. Tributaries of Darebin Creek (rural) include Findons Creek.

Frogs Eight of the expected 15 species have been recorded in this management unit which is home to the endangered growling grass frog.

Fish One of the expected 32 species has been recorded in this management unit, the exotic Oriental weatherloach.

Birds Insufficient surveys at management unit scale.

Priority areas Darebin Creek rural contains priority areas for amenity. The management objective is to maintain and improve amenity.

Future management In 2030 stock will have been excluded from streamside areas, revegetation and weed management programs will have been implemented and removal of fish barriers in the lower Yarra River catchment and on Darebin Creek will have improved fish passage.

9 Koonung Creek management unit

Waterway overview Koonung Creek rises near Nunawading and follows the Eastern Freeway corridor for much of its length before entering the Yarra River at Bulleen.

Frogs Eight of the expected 15 species of frogs have been recorded in this management unit which is home to the endangered growling grass frog.

Fish Eight of the expected 32 species of fish have been recorded, four of which are native. This management unit is home to the endangered spotted galaxias.

Birds Fifty-six of the expected 113 species of streamside birds have been recorded.

Future management In 2030, erosion control and bank protection works will have stabilised Koonung Creek and wetlands along sections of the creek's floodplain will have improved water quality and flood protection.

10 Gardiners Creek management unit

Waterway overview Gardiners Creek originates near Blackburn and flows through Burwood and Malvern East before following the Monash Freeway corridor to the Yarra River. Major tributaries include Scotchmans and Damper creeks.

Frogs Twelve of the expected 15 species have been recorded in this management unit which is home to endangered and vulnerable species such as growling grass frog and southern toadlet.

Fish Fifteen of the expected 32 species have been recorded, eight of which are native. This management unit is home to endangered and vulnerable species such as golden perch, Murray cod, river blackfish and silver perch.

Birds Sixty-three of the expected 113 species of streamside birds and 23 of the expected 57 species of wetland birds have been recorded.

Priority areas Gardiners Creek has been identified as a priority area for amenity. The management objective is to maintain and improve amenity.

Future management In 2030 extensive revegetation on public land along Gardiners, Scotchmans and Damper creeks has been established, wetlands along sections of the creek's floodplain have been created to improve water quality and flood protection and fish barriers have been removed.

Expected outcomes for key values

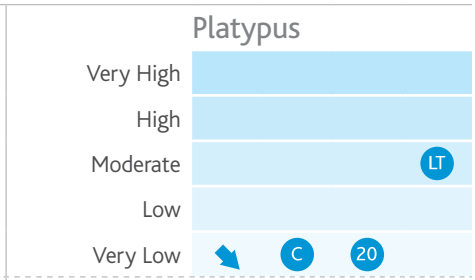
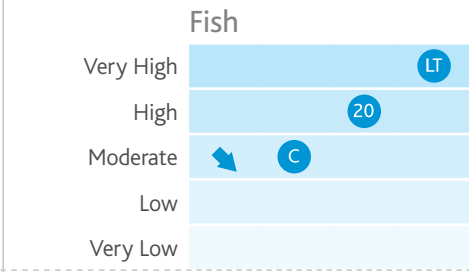
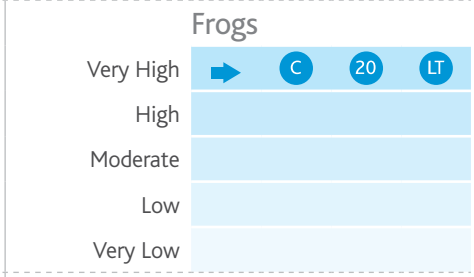
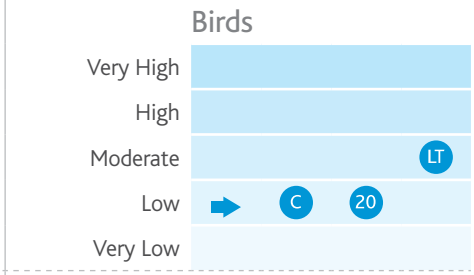
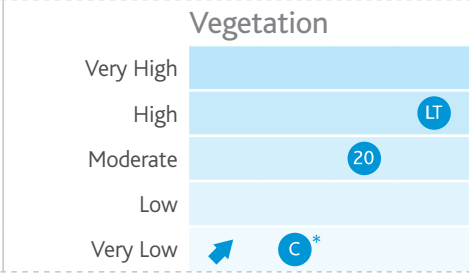
Table 5.30 summarises the historic trend, current condition and expected outcomes for each key value. In setting expected outcomes, we consider the values and challenges present in this system and balance community desires with what is practical.

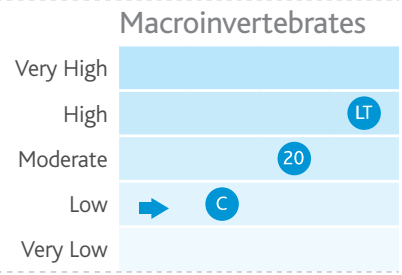
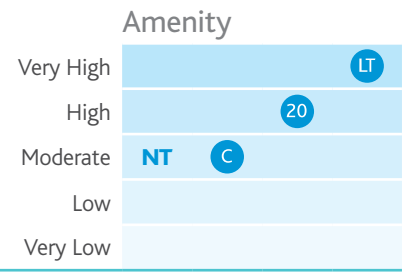
Table 5.30: Historic trend, current condition and expected outcomes for key values in the Lower Yarra system

MEASURE OF HEALTH: C Current 20 20 year LT Long term

10 YEAR TREND: Improving Stable Declining **NT** No trend available

*Limited data used to determine the rating **Based on the score for streamside birds only (does not include wetland birds)

Platypus habitat has been significantly altered by the impacts of urban development. Platypus population sizes have declined since 1990, possibly due to the effects of reduced flows. Platypus are now rare, however medium-size populations are found in some urban sections of the Yarra River and tributaries. Works aim to stabilise conditions for platypus populations and allow for an increase in populations over time.	
A decline in the variety and proportion of native **fish** species has occurred since the 1990s. There is a moderate variety of fish species, and introduced species are relatively abundant. A range of works aim to improve fish population from moderate to high over the next 20 years.	
Diversity of **frog** populations within the Lower Yarra system is very high and stable. Works within this system aim to maintain this condition.	
Urban development has been substantial and the condition of **bird** populations is rated as low. Works focused on improving streamside and floodplain vegetation aim to hold bird diversity and abundance stable over the next 20 years and allow for future improvements. The long-term potential is limited due to restricted availability of land to create large-scale connectivity.	
Extensive clearing of **vegetation**, due to urban development, has occurred over the past 200 years. Consequently, streamside vegetation quality is rated as very low. Continued investment in vegetation will support an improvement in the condition and extent of streamside vegetation over the next 20 years to moderate and high in the long term.	

Urban development and poor water quality have affected **macroinvertebrate** communities, and their condition of is low. Improvements to stormwater treatment and vegetation condition are aimed at improving macroinvertebrate condition to moderate in the next 20 years.	
The **amenity** enjoyed from waterways is moderate, with specific areas providing important areas for relaxation and rejuvenation. Works including vegetation and litter management aim to improve amenity to high over the next 20 years.	

20 year strategic priorities

In order to achieve these long-term outcomes, several key areas require our focus over the next 20 years including:

- Improving habitat through revegetation and weed control, especially willows, in waterways for fish and frogs
- Improving water flows by delivering environmental flows in Yarra River and tributaries for fish and platypus
- Reducing competition and predation from introduced fish, particularly mosquito fish, through habitat manipulation
- Investigating and providing fish passage throughout the systems
- Improving connectivity by linking floodplains to waterways for frogs
- Improving habitat in lower and middle Plenty River to try to reconnect isolated platypus populations in Plenty Gorge and Yarra River
- Revegetating and stabilising rural reaches of rivers and creeks for macroinvertebrates
- Improving water quality and flows for macroinvertebrates and fish by renewing existing urban drainage systems over the long term and implementing stormwater treatment in new urban developments
- Continuing focus on improving vegetation, which will also benefit amenity and birds
- Working with partners to develop litter prevention programs.

These strategic priorities will require ongoing investment over the next 20 years and beyond, so it may not be possible to invest in all priorities within the five year period of the strategy.

Priority areas for investment 2013/14–2017/18

Priority areas for investment have been identified as regionally important for on-ground works over the life of the strategy. Each priority area has a management objective to guide works. These works, which contribute to the long-term outcomes based on principles outlined in Chapter 2, will be complemented by regional programs in this system. Most places that the community identified as being of value coincide with these priority areas.

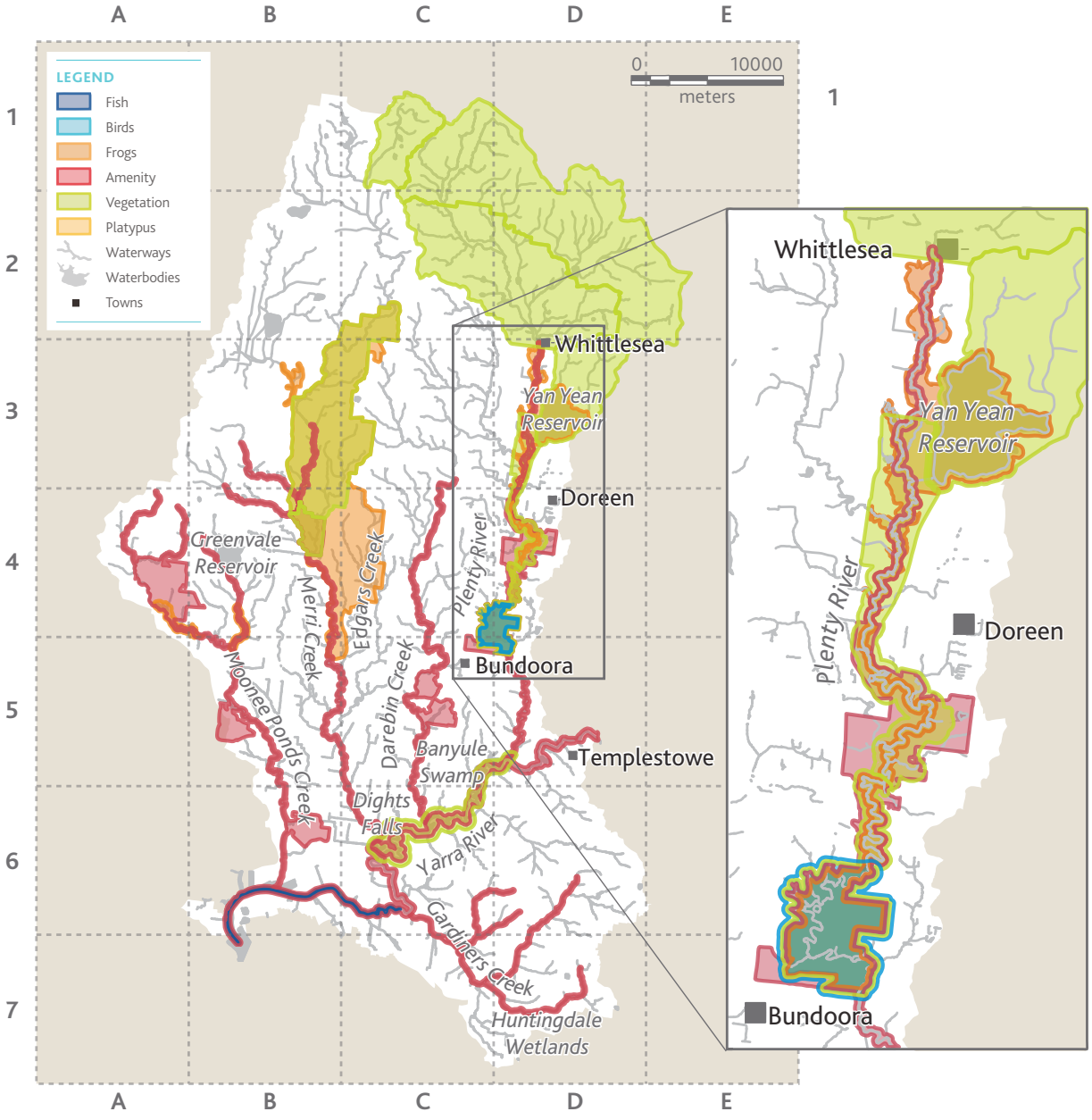


Figure 5.12: Lower Yarra system priority areas

Table 5.31: Management objectives for priority areas

Key value	Priority area	Key management objective	Grid reference
Birds	Plenty River at Plenty Gorge Park	Maintain the high species richness and abundance of streamside and wetland bird populations	D5, C4
Fish	Yarra River mouth upstream to Dights Falls	Maintain the high species richness and abundance of fish populations	B6, C6
Frogs	Middle Plenty River floodplain	Maintain species richness and improve overall abundance and distribution of expected species of frog populations	D4, D3
	Middle Merri Creek		B5, B3
	Moonee Ponds Creek around Tarnuk Waterway Reserve and Yuroke Creek at Broadmeadows Valley parklands	Improve overall abundance, distribution of expected species and species richness of frog populations	A4 and B4
Amenity	Aitken and Malcolm creeks	Improve amenity	B4, B3
	Yarra River mouth upstream to Dights Falls		B6, C6
	Plenty River	Maintain amenity	D5, D3
	Yarra River around Yarra Valley parklands		C6, D5
	Moonee Ponds Creek		B6, A4
	Middle and lower Merri Creek		C6, B3
	Gardiners Creek		C6, D7
	Darebin Creek		C6, C4
Vegetation	Middle Merri Creek	Maintain and improve vegetation	B4, C2
	Plenty River forested headwaters	Maintain vegetation to high quality	C1, D2
	Merri Creek headwaters		C1
	Middle Plenty River	Improve vegetation condition and minimise impacts on high value areas	D5, D3
	Upper Plenty River		C2, D2
	Yarra River from Merri Creek confluence to Plenty River confluence		C6, D5

Implementation targets

Implementation targets are a summary of the works we will undertake over the next five years to contribute to the long-term outcomes. Most of these works will be focused in priority areas, but regional programs will also contribute to meeting these targets.

Table 5.32: Implementation targets for the Lower Yarra system

Target	Amount
Km vegetation established to the required level to support waterway values	111
Km of vegetation managed to the required level to support waterway values	928
Km of stock exclusion fencing constructed	9
Number of fish barriers removed	–
Ha of aquatic habitat improved to the level required to support waterway values	41

Regional program priorities

In addition to the works targeting priority areas, the following regional actions will be undertaken in this system.

Table 5.33: Regional program actions for the Lower Yarra system

Management approach	Actions
Planning, strategy and guidelines	Advocate for healthy waterways outcomes in statutory planning when issuing drainage and planning permits for buildings, undertaking flood studies and advising on planning scheme amendments
	Provide advice on local implementation plans and other guidelines to assist in the management of healthy waterways
Advocacy	Build relationships with public land managers and advocate to ensure waterway environmental values are not compromised and social values are maximised (for example, Yarra Bend parklands)
	Advocate with local government on planning mechanisms to ensure appropriate land use, and to minimise obtrusive development in waterway corridors with a focus on high priority areas (for example, urban consolidation activity near waterways)
Enforcement	Work with other agencies to clarify roles and responsibilities and enforce regulations concerning poor land practices where appropriate (for example, vegetation removal from private frontages in lower Yarra River priority reaches)
	Continue to take enforcement action against illegal water extractions and against unauthorised works and encroachment issues where appropriate
Building stewardship and sharing knowledge	Provide incentives and support for individuals, community groups and local government for waterway management activities such as fencing, weed control, vegetation establishment and pest control
	Continue to support community initiatives such as Waterwatch, EstuaryWatch and Frog Census
	Implement a knowledge-sharing program with communities, stakeholders and Traditional Owners throughout the Port Phillip and Westernport region, with activities including field days, seminars, written information and online resources
Habitat management	Implement seasonally adaptive management plans for identified refuge sites, and identify new sites as new knowledge becomes available
	Implement and review management plans for Melbourne Water's Sites of Biodiversity Significance including Tarnuk Waterway Reserve, Galada Tamboore and Dunnetts Road Wetland
Asset protection and renewal	Manage high priority erosion issues including new erosion problems and repair and replace degraded infrastructure. Techniques will involve a combination of 'soft' and 'hard' engineering options including vegetation-based interventions, grade control structures (rock chutes) and rock-armoured banks. Preference will be given to solutions based solely on streamside vegetation (because these provide multiple benefits of stability, habitat and cost-effectiveness)
	Ensure existing hydraulic capacity issues are managed appropriately through a program of maintenance and ensuring any works do not reduce hydraulic capacity, particularly around sensitive areas, for example around Chandler Highway

Stormwater management	Deliver rural and urban runoff management programs to protect and improve key values in priority areas including: • Working with local government and the community to deliver on-ground works and planning activities to protect and improve waterways • Litter management activities in key hotspots • Identifying key pollution hotpots for ecosystem and public health, and facilitating an appropriate management response • Facilitating the adoption of sustainable stormwater practices in new urban developments to protect waterways through policy change advocacy and targeted protection works in high value catchments • Working with others to establish processes to enforce improved sediment management on building sites • Facilitating the adoption of sustainable road upgrade practices by road managers in rural and peri-urban areas
Environmental water	Deliver environmental water from the environmental water entitlement and monitor its effectiveness to improve environmental values in the lower Yarra River
	Manage stormwater harvesting with an integrated water management approach to improve environmental flows
Diversions	Continue to manage extractions within allocated volumes and in accordance with streamflow management plans. In urban areas, work with local government and Yarra Valley Water to identify and develop stormwater harvesting opportunities. Explore opportunities to improve water usage information