Aquatic Pollution Prevention Partnership (A3P) 2023-2028

Draft project proposals

Year 1: August 2023

RMIT UNIVERSITY AQUEST

A3P
Aquatic Pollution Prevention Partnership

Melbourne Water

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Intent of this Document

To provide a summary of potential research projects for year 1 of the Aquatic Pollution Prevention Partnership 2023-2028 (A3P), including their purpose and specific benefits to Melbourne Water.

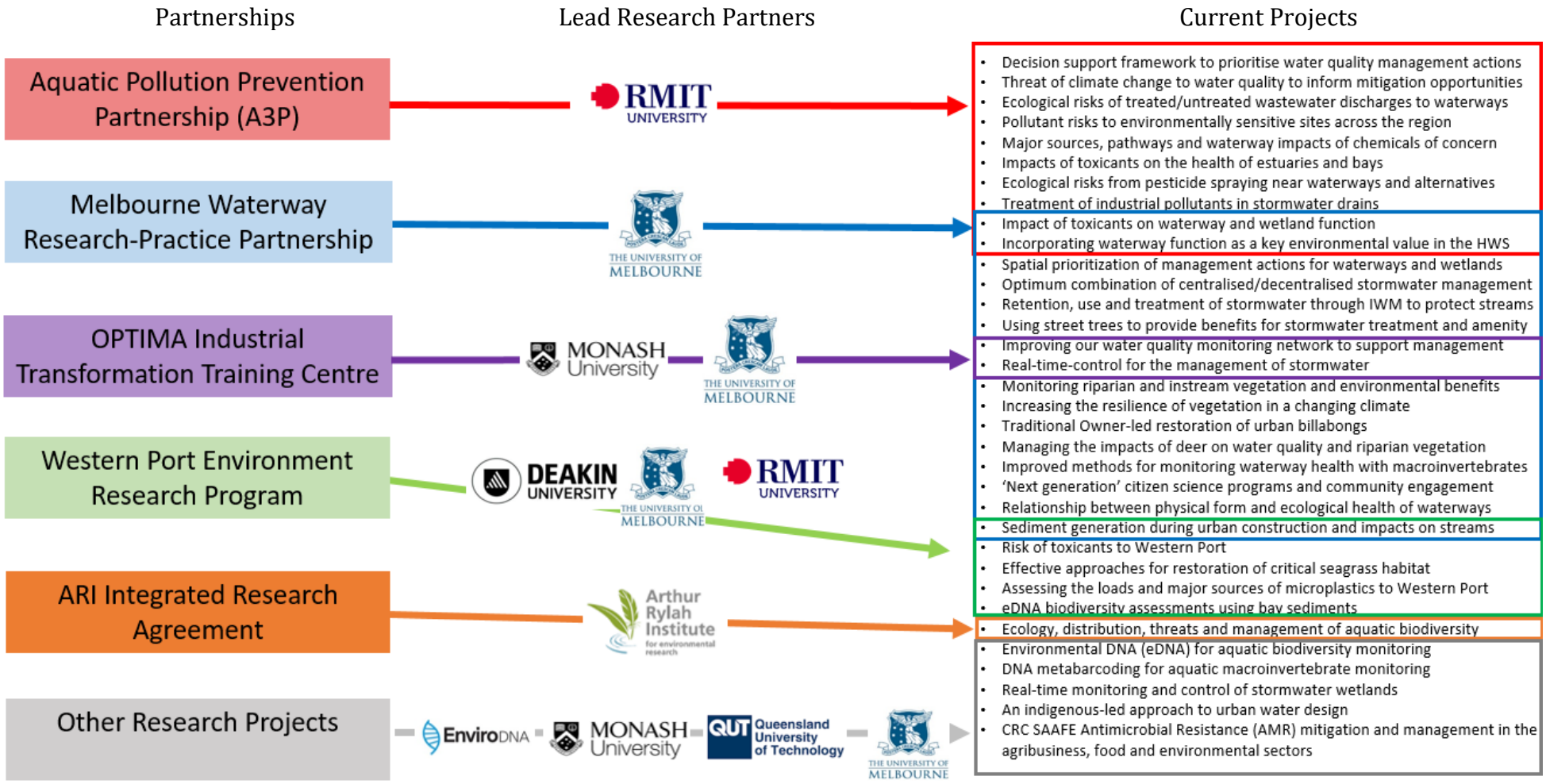
Table 1 outlines projects that are fully funded by the core research agreement between Melbourne Water (through the Research and Modelling team) and RMIT University. These projects complement other research collaborations through the Waterways and Wetlands Research portfolio (**Figure 1**) and are based on Key Research Areas and project needs identified by Melbourne Water and our stakeholders during the development of the Healthy Waterways Strategy 2018 and the recent mid-term review. The A3P 2023-2028 research projects were initially prioritised by 20 Melbourne Water representatives from across the business during a planning workshop held in June 2023, and then through subsequent email feedback from 26 individuals or teams on the project shortlist, and finally meetings with interested staff to help shape the proposals (**Appendix 1**). We are seeking broader feedback from the business regarding:

1) Projects that you think are especially important to your team (including whether you would like to nominate a representative to be on a research project team involving 2-3 meetings a year)
2) How project outputs are likely to be used by your team (this will help us refine the proposed milestones, outputs and knowledge adoption opportunities)
3) General comments on the clarity of proposals, including stated objectives, rationale, overview of methods and deliverables
4) Did we miss anything that you think is critical? (this will help with future research planning)

Based on feedback from Melbourne Water, the proposals for Year 1 of the Partnership will be finalised and presented to the A3P Research Management Committee (RMC) for approval in September 2023. The Partnership has a dedicated Knowledge Exchange and Impact Framework that will work towards efficient integration of research findings into Melbourne Water business. Included in this document is background information on the A3P, namely the aims, governance and knowledge exchange (**Appendix 2**).

A summary of each project is provided below, with full project proposals provided in the *Aquatic Pollution Partnership 2023-2028 Year 1 Project Proposals - Supporting Document*.

Figure 1: Waterways and Wetlands Research Portfolio Partnerships, Lead Research Partners and Current Projects



Title	Objective(s) and Impacts	Strategic Goal Alignment	Proposed Duration
Decision Support Framework: A decision support framework to help prioritise water quality management actions across the region, set management targets and assess management effectiveness	Develop a decision support framework (DSF) that supports the prioritisation of actions and setting of management targets to protect and improve water quality across the Port Phillip and Westernport region in the next Healthy Waterways Strategy.	Keeping the Core Strong, Managing and Governing	2023-28
Climate Change: Understanding the threat of climate change to water quality in waterways to inform mitigation opportunities	Understand the threat of climate change to water quality and key environmental values in waterways across the region to identify risks and opportunities to build climate resilience in the coming decades.	Decarbonisation and Climate Change	2023-28
Waterway and Wetland Function: Understanding how toxicants impact waterway and wetland function	Understand how toxicants impact waterway function to support how to monitor, report and interpret measures of waterway function as an environmental value for the Healthy Waterways Strategy. Additional objectives relate to understanding how toxicants effect stormwater wetland treatment performance to inform wetland design and maintenance planning.	Keeping the Core Strong, IWM	2023-28
Wastewater Inputs: Understanding the ecological risks of treated and untreated wastewater discharges to waterways	Understand risks to waterway health from treated and untreated wastewater and validate indicators of wastewater pollution in waterways, to inform the prioritisation of wastewater management interventions across the region.	Keeping the Core Strong, New Water	2023-28
Environmentally Sensitive Sites: Assessment of pollutant risks and the need for management interventions at environmentally sensitive sites across the region	Determine the risk of pollution to environmentally sensitive sites within the Port Phillip and Westernport region, including Melbourne Water's Sites of Biodiversity Significance (SoBS) and Ramsar sites of international significance. Where pollution is a major threat to these sites, to identify the major sources of contamination to inform mitigation strategies.	Keeping the Core Strong	2023-25
Chemicals of Concern: Understanding the major sources, pathways and waterway health impacts of chemicals of concern in waterways to inform risk assessments and management interventions	To meet our obligations under the General Environmental Duty and be proactive in managing the risks of emerging chemicals of concern that pose a threat to aquatic ecosystems in the Melbourne Water region and to gather information about the presence of priority chemicals in waterways, likely impacts on environmental values and possible management or water reuse options.	Keeping the Core Strong, IWM, New Water	2023-25
Estuaries and Bays: Managing the impacts of toxicants in urban stormwater and wastewater treatment plant discharges on the health of estuaries and bays	To fill a major gap in our knowledge in the Healthy Waterways Strategy by better understanding the water quality condition of estuaries and bays in the region to support management target setting, performance objectives and prioritisation of management actions.	Keeping the Core Strong	2023-28
Chemical Use: Understanding ecological risks from pesticide spraying activities on or near waterways and suitable management alternatives	To meet our obligations under the General Environmental Duty and be proactive in managing the risks associated with Melbourne Water's vegetation management activities on or near waterways. It will drive continuous improvement in Melbourne Water's approaches by exploring more environmentally friendly and effective alternative chemicals or methods to vegetation management.	Keeping the Core Strong	2023-28
Industrial Pollution: Industrial effective and affordable opportunities for the treatment of industrial pollutants in stormwater drains	To determine the most effective ways to reduce pollution from industrial estates, including structural and non-structural pollution control options. It will also trial innovative assets that treat dry weather flows in stormwater drains and assess benefits for performance and maintenance of downstream stormwater treatment wetlands.	Keeping the Core Strong, IWM	2023-28

A1: A decision support framework (DSF) to help prioritise water quality management actions across the region, set management targets and assess management effectiveness

Objective(s)

To develop a decision support framework (DSF) that supports the prioritisation of actions and setting of management targets to protect and improve water quality across Greater Melbourne.

Why this research is important

Consolidating extensive pollution monitoring and assessment data collected by A3P and Melbourne Water over several years, the development of a DSF will enable Melbourne Water to identify the most efficient and effective water quality improvement actions across the region and set water quality management priorities in the next HWS. This will include: identifying pollution hotspots, environmental risk assessment, identification of priority pollutants and major sources and intervention options. This DSF will also be informed by developing techniques to evaluate the extent to which pollution is driving declines in key environmental values in some sub-catchments and assess the effectiveness of interventions.

Contribution to Melbourne Water research priorities

This project addresses the HWS Key Research Area: Developing tools and approaches to assist in strategic planning of pollution management to protect biodiversity, amenity and recreation in waterways across the region.

Approach

- Conduct interviews across Melbourne Water and key stakeholders (EPA and DEECA) to understand needs and specific end use requirements e.g. What questions does it need to support? What outputs will be most useful? What systems it needs to integrate with? Existing datasets that would be informative?
- A review of current knowledge around DSFs used within Australia and worldwide for water quality management. It will focus on the types of DSFs being used, underpinning information, metrics, identification of critical stakeholders, measurement of intervention effectiveness and data gaps.
- A stakeholder workshop to agree on the structure and functionality of the DSF based on interviews and literature review.
- Develop and test the DSF with Melbourne Water, including helping to identify priority pollution issues to inform Performance Objectives and set water quality condition targets in the next HWS.

Key outputs

- Report on Melbourne Water pollution management DSF requirements
- Literature review on pollution management DSFs applied either nationally or internationally and alignment with Melbourne Water requirements
- Report proposed DSF design based on workshop outcomes
- A DSF for the prioritisation of management interventions to improve water quality in waterways across Greater Melbourne

Expected benefits

- More efficient and effective investment in water quality improvement activities across the region
- Provides a sound justification for investment in water quality improvement activities undertaken by Melbourne Water or our stakeholders
- Supports new water quality targets and Performance Objectives in the next HWS

Project teams

RMIT University: Sara Long, Claudette Kellar, Vincent Pettigrove, Monica Tewman, Daniel MacMahon.
Melbourne Water: TBC.

For more information, contact Claudette Kellar, claudette.kellar@rmit.edu.au, or Sara Long, sara.long@rmit.edu.au, or see the full project proposal in the prospectus supporting document.

A2: Understanding the threat of climate change to water quality in waterways to inform mitigation opportunities

Objective(s)

To understand the threat of climate change to waterway water quality and key environmental values across the region to identify risks and opportunities to build climate resilience in the coming decades.

Why this research is important

Climate change is recognized as a significant threat to waterway health in our Healthy Waterways Strategy. While we currently have predictions of climate change impacts to air temperatures and rainfall and can predict habitat suitability for environment values (e.g. macroinvertebrate, fish and platypus Habitat Suitability Models) under a range of possible climate futures, we lack an understanding of the impacts of climate change to water quality (e.g. stream temperature, dissolved oxygen, salinity) and how that relates to the tolerances of particular species. This project proposes to address experimental knowledge gaps through provision of data on ecological responses (acute and chronic thresholds) to predicted changes in water quality due to climate change.

Contribution to Melbourne Water research priorities

This project is directly aligned with the Healthy Waterway Strategy Key Research Area: Understanding the impact of climate change on water quality and management implications for the protection of aquatic biodiversity, amenity and recreation along waterways.

Approach

This project is a joint project between A3P and MWRPP through research being undertaken by Vaughn Grey at MWRRP (PhD candidate).

Step 1: Knowledge review on climate change impacts to water quality and waterway values

Undertake a desktop study to synthesize existing data on climate change impacts to water quality and environmental values. The focus will be on water quality indicators most likely to be impacted by these predictions, including extreme weather events (e.g. water temperature, salinity, dissolved oxygen, turbidity, flow), and an assessment of the key environmental values most likely to be impacted.

Step 2: Prioritize and address knowledge gaps

Based on the water quality and environmental values identified as most at risk from climate change, toxicological assessments will be undertaken to determine tolerance thresholds for key vulnerable species.

Key outputs

- Knowledge review and risk assessment of likely climate change impacts to water quality and environmental values in the region.
- Development of tolerance thresholds for impacted water quality indicators and aquatic species.

Expected benefits

- Information to help identify the most vulnerable environmental values to climate change and management opportunities to build waterway climate resilience
- Identification of climate risks and management priorities to support the development of Performance Objectives and management targets in the next HWS.

Project teams

RMIT University: Jackie Myers, Sara Long, Claudette Kellar, Vincent Pettigrove, Monica Tewman, Hung Vu, Rebecca Reid. Melbourne Water: TBC. University of Melbourne: Vaughn Grey.

For more information, contact Jackie Myers, jackie.myers@rmit.edu.au, or see the full project proposal in the prospectus supporting document.

A3: Understanding how toxicants impact waterway and wetland function

Objective(s)

To understand how toxicants impact waterway function to support monitoring, reporting and interpretation of measures of waterway function as an environmental value for the Healthy Waterways Strategy. Additional objectives relate to understanding how toxicants affect stormwater wetland performance.

Why this research is important

The Healthy Waterways Strategy 2018 defines a healthy waterway as one that maintains its ecological structure and function over time. However, Melbourne Water only assesses changes to ecosystem structure. This project will enable Melbourne Water to consider function alongside structure in monitoring programs and to assess the impacts of toxicants to ecosystem function. Functional indicators can also assist in understanding the impacts of toxicants on the performance and maintenance of Melbourne Water's stormwater wetland asset base.

Contribution to Melbourne Water research priorities

This project contributes to HWS Key Research Areas: Develop methods, metrics and strategic management frameworks for waterway function as a key environmental value; and Improving the stormwater treatment performance and determine the optimal maintenance of WSUD systems.

Approach

This research will be delivered through a collaboration between A3P and MWRPP. Initially a literature review of toxicant impacts on waterway functional indicators will be undertaken. Based on the literature review, a suite of candidate functional indicators will be selected for field trials in selected waterways, including stormwater wetlands.

Key outputs

- Literature review on the impacts of toxicants on waterway function
- Technical report on the removal of, and impacts of, toxicants on stormwater wetlands.
- Scientific paper outlining impacts of biotic and abiotic stressors on waterway function.

Expected benefits

- Guidance to Melbourne Water on the impacts of toxicants on waterway function to support the inclusion of waterway function as a value in the next HWS.
- Identify where actions to improve water quality are necessary to support healthy waterway function.
- Guidance to Melbourne Water on how toxicant data collection can complement assessments of waterway function as part of the HWS MERI.
- Recommendations for improving the design and maintenance of stormwater wetlands to reduce the risk of toxicants on reduced stormwater wetland performance.

Project teams

RMIT University: Sara Long, Jackie Myers, Claudette Kellar, Monica Tewman, Vincent Pettigrove, Hung Vu, Rebecca Reid, Michael Clark, Kathryn Hassell.
University of Melbourne: Ryan Burrows, Yung En Chee, Moss Imberger, Katherine Russell, Matthew Burns.
Melbourne Water: TBC.

For more information, contact Sara Long, sara.long@rmit.edu.au, or see the full project proposal in the prospectus supporting document.

A4: Understanding the ecological risks of treated and untreated wastewater discharges to waterways

Objective(s)

To understand risks to waterway health from treated and untreated wastewater and validate indicators of wastewater pollution in waterways, to inform the prioritisation of wastewater management interventions across the region.

Why this research is important

This project will improve our understanding of impacts to waterway health from treated and untreated wastewater and facilitate a more structured and strategic process for prioritising the investigation and management of different types of wastewater inputs e.g. wastewater treatment plant discharges, Emergency Relief Structure spills, septic tanks. The project will also consider potential impacts from a range of anticipated discharge scenarios (e.g., spill type, quality, volume, frequency and duration) to enhance planning capabilities and enable adaptive management strategies.

Contribution to Melbourne Water research priorities

This project addresses the HWS Key Research Area: Understanding and managing the impacts of treated and untreated wastewater discharges on waterway health.

Approach

Year 1 of this project will focus on synthesising knowledge from existing literature on the risks and impacts from contaminants in treated and untreated wastewater discharges on key environmental values, including identifying priorities for future research. Based on the review, sites will be selected across the Greater Melbourne Area for field-based investigations of ecological indicators of treated and untreated wastewater. This research will complement previous research by A3P that identified chemical indicators of treated and untreated wastewater in waterways.

Year 2 and beyond will be informed by the outcomes of Year 1 and will focus on applying chemical and biological indicators of wastewater inputs to support the prioritisation of wastewater management programs across the region.

Key outputs

A literature review that synthesises existing knowledge on the risks and impacts to environmental values from treated and untreated wastewater discharges. The literature review will identify research priorities for Year 2+.

Expected benefits

- Improved understanding of risks and impacts to environmental values from wastewater including key contaminants.
- Decision support for emergency releases of wastewater to waterways.
- Inform risk assessment of pollutants in wastewater discharges to waterways as outlined by EPA Victoria (Publication 1287, 2023).
- Inform HWS performance objectives and metrics for the next strategy.

Project teams

RMIT University: Erica Odell, Claudette Kellar, Kathryn Hassell, Monica Tewman & Vincent Pettigrove.
Melbourne Water: TBC.

For more information, contact Erica Odell, Erica Odell erica.odell@rmit.edu.au, or Claudette Kellar, claudette.kellar@rmit.edu.au, or see the full project proposal in the prospectus supporting document.

A5: Assessment of pollutant risks and the need for management interventions at environmentally sensitive sites across the region

Objective(s)

Determine the risk of pollution to environmentally sensitive sites within the Port Phillip and Westernport region, including Melbourne Water's Sites of Biodiversity Significance (SoBS) and Ramsar sites of international significance. Where pollution is a major threat to these sites identify the major sources of contamination to inform management priorities.

Why this research is important

Melbourne Water manages over 40 sites that are designated Sites of Biodiversity Significance (SoBS), as well as Ramsar sites of international significance such as Edithvale-Seaford Wetlands, Port Phillip (Western Shoreline, including the Western Treatment Plant) and Western Port. Management plans for SoBS are included in Melbourne Water's asset management system and five-yearly assessments of condition are conducted to guide protection. The potential threat of contaminants to values within these sites, however, has not been assessed for some of these sites. This project will assist Melbourne Water to identify sites where pollution is a major threat to environmental values and where applicable, identify major sources of contaminants to focus management efforts.

Contribution to Melbourne Water research priorities

This project addresses HWS Key Research Area: Understanding areas of high biodiversity significance (e.g., Melbourne Water's Sites of Biodiversity Significance, Ramsar) and appropriate management responses to manage key threats to environmental values.

Approach

This project is a continuation from A3P project B2.6, building on the same process, using the initial desktop risk assessments at all sites, which informed the order of systematic site assessment prioritization (Long *et al.*, 2019, 2020, 2022), to better understand potential contamination. Sediment, water and passive samplers will be used to measure a variety of contaminants. If results indicate contamination, a follow up investigation to clarify findings and identify the source and/or the risk of the contaminants to values will occur.

Initial site assessments will occur at 18 SoBS yet to be assessed, including The Inlets in Western Port; with 10 sites proposed for Year 1, pending steering committee agreement. Follow up sampling in conservation wetlands at the Western Treatment Plant (WTP) will also occur including sediment sampling and toxicity testing to assess the impact of elevated metals on macroinvertebrates. Additional follow-up studies are proposed to determine if metals (and potentially pesticides) pose a risk to birds through consumption of macroinvertebrates. This may include obtaining existing blood and feather samples collected by potential collaborators.

Key outputs

- Pollution data and risk assessment for all Melbourne Water SoBS for inclusion in management plans.
- Identification of the major sources of pollutants to SoBS and other sites of environmental significance to support targeted management interventions.

Expected benefits

- A greater understanding of the risks of pollution to SoBS and other sites of environmental significance in the region.
- Inform SoBS, WTP Risk Management and Monitoring Plan, biodiversity, management and Ramsar plans.

Project teams

RMIT University: Sara Long, Jackie Myers, Vincent Pettigrove, Monica Tewman, Hung Vu, Daniel MacMahon, Rebecca Reid, Michael Clark and Gina Mondschein. Melbourne Water: TBC.

For more information, contact Sara Long, sara.long@rmit.edu.au, or see the full project proposal in the prospectus supporting document.

A6: Understanding the major sources, pathways and waterway health impacts of chemicals of concern in waterways to inform risk assessments and management interventions

Objective(s)

To keep a watching brief on emerging chemicals of concern globally that pose a potential threat to aquatic ecosystems in the Melbourne Water region and to gather information about the presence of priority chemicals in waterways, likely impacts on environmental values and management options.

Why this research is important

Every year new chemicals appear in the market for a broad range of products ranging from pharmaceuticals, personal care products, disinfection by-products, pesticides, persistent organic chemicals, industrial chemicals and degradation products of all these substances. While many of these new products have little impact on the environment, there are many that may impact human or ecological health and may be poorly regulated i.e. new products can emerge in the environment with inadequate information to determine waterway health risk. In addition, not all chemicals can be measured in the environment. Therefore, decisions are needed to determine which chemicals should be given greatest attention for developing techniques for detecting and measuring their concentrations in the environment based on known chemical properties and emerging studies.

Contribution to Melbourne Water research priorities

HWS Performance Objective: RPO-23 The potential impacts of emerging contaminants of concern such as microplastics, pesticides and pharmaceuticals, and toxic chemicals are better understood and mechanisms to respond collaboratively developed.

Approach

We will conduct scans of emerging contaminants of concern in international literature, attend key conferences, and collaborate with relevant agencies to update priority lists of 'known' and 'emerging' chemicals of concern for management. Our partnership with the National Measurement Institute will continue to develop analytical methods for detection of new chemicals of interest, and we will explore options to enable quantitative passive sampling of chemicals of concern that typically occur intermittently or in low concentrations. Ongoing PhD projects will focus on the risk of emerging contaminants of concern to key environmental values.

Key outputs

- Inform Melbourne Water on priority chemicals of 'known' and 'emerging' concern
- Quantitative measurements of contaminants to better inform risk assessments
- Quantitative data on contaminants of concern for inclusion in Melbourne Water's contaminants framework and possible regional toxicant reporting 'dashboard'

Expected benefits

- Prioritisation of 'emerging' chemicals of concern to be the focus of future investigations of their presence and ecological impacts across the region
- Informs Melbourne Water's Contaminants Framework that supports General Environmental Duty obligations
- To provide specific information on 'known' chemicals of concern to help prioritisation of pollution management Performance Objectives in the next HWS

Project teams

RMIT University: Vincent Pettigrove, Sara Long, Claudette Kellar, Jackie Myers, Milanga Walpitagama, Monica Tewman, Daniel MacMahon. Melbourne Water: TBC.

For more information, contact Vin Pettigrove, vincent.pettigrove@rmit.edu.au, or see the full project proposal in the prospectus supporting document.

A7 Managing the impacts of toxicants in urban stormwater and wastewater treatment plant discharges on the health of estuaries and bays

Objective(s)

To understand the water quality in estuaries and bays across the region to support HWS target setting, performance objectives and prioritisation of management actions.

Why this research is important

HWS performance objectives are needed for toxicants in estuaries and bays to better inform risk-based management and protect biodiversity, amenity, and recreational values. Information on the occurrence and impacts of toxicants in estuaries and bays, in particular, has been identified as a research priority. This project will improve our understanding of what toxicants pose an ecological threat to the health of estuaries and bays and help establish clear goals for future catchment management activities.

Contribution to Melbourne Water research priorities

The project will contribute to the HWS Key Research Area: Developing improved monitoring, assessment and reporting methods to understand environmental conditions and values of wetlands and estuaries

Approach

To understand what toxicants pose a risk to the health of estuaries and bays, Year One of the project will consolidate existing data and collect new data to determine whether toxicants across the region occur at levels likely to impact estuarine and bay flora and fauna. The results of the knowledge synthesis will be used to inform priorities for data collection in subsequent stages of the project (i.e., Year Two and beyond). This may include:

- Undertaking ecotoxicological studies to determine whether observed toxicants concentrations can impact key environmental values.
- Collecting baseline data which will contribute towards environmental water quality performance target settings for bays and estuaries in the HWS 2028 renewal.

Key outputs

The key output expected from Year One is a knowledge synthesis of toxicants and toxicant impacts in estuary and bays. Outputs anticipated in future years of the project include estuary and bay toxicant and toxicology data.

Expected benefits

- Consolidation of existing knowledge about the levels and ecological risks posed by toxicants in bays and estuaries across the region.
- Identification of data gaps and other knowledge gaps required to underpin robust condition scores, management targets or Performance Objectives in the next HWS.
- Inform PPB and WP EMP and HWS condition metrics, targets and Performance Objectives.
- Supporting information for risk assessments regarding estuary and bay management e.g., estuary opening and dredging.

Project teams

RMIT University: Jackie Myers, Erica Odell, Vincent Pettigrove, Monica Tewman, Daniel MacMahon, Kathryn Hassell, Hung Vu. Melbourne Water: TBC. EPA: TBC. DEECA: TBC.

For more information, contact Jackie Myers, jackie.myers@rmit.edu.au, or see the full project proposal in the prospectus supporting document.

A8: Understanding ecological risks from pesticide spraying activities on or near waterways and suitable management alternatives

Objective(s)

To investigate risks and potential continuous improvement opportunities for vegetation management activities conducted by Melbourne Water on or near waterways.

Why this research is important

This project seeks to understand the environmental risks of chemicals used by Melbourne Water on or near waterways, as well as potential alternatives. Melbourne Water manages diverse and complex environments. Vegetation management in these areas is essential to protect local biodiversity and maintain assets. Herbicides, particularly glyphosate, are used in vegetation management globally, however, growing concern about the potential risks of glyphosate has led Melbourne Water to reassess the risks of glyphosate use and investigate reduction opportunities. This work will inform Melbourne Water's herbicide use policies and practices and support obligations under the EPA Act General Environmental Duty.

Contribution to Melbourne Water research priorities

HWS Key Research Area: Understanding the environmental impacts of pollutants, including contaminants of concern and litter, to inform risk-based management of waterways across the region.

Approach

This research will be delivered in two studies. Year 1 will focus predominantly on Study 1, with some initial data synthesis around spraying activities at WTP also undertaken for Study 2. Year 2 would then focus further on Study 2.

Study 1: Assessment of alternative instream vegetation management activities in Westernport

Complementary assessments of the impacts of alternative management practices, identified by Jacobs, to waterway health will be undertaken. Measurements may include chemical concentrations in water and sediments and assessments of biological measures e.g.: macroinvertebrates, functional bioindicators.

Study 2: Assessment of risks from herbicide spraying to waterway health and environmental values at WTP.

Key outputs

- Knowledge of potential waterway health impacts of alternative instream vegetation management strategies in Westernport
- Knowledge synthesis of spray activities undertaken at the Western Treatment Plant.
- Paper on reducing impacts to waterways from instream spraying for vegetation control.

Expected benefits

- Guidance on effective vegetation management practices to reduce risks to environmental values.
- Scientific foundation for use of certain instream vegetation management approaches in the Melbourne region to underpin Melbourne Water policy and practice documentation.
- Actions to support the Draft Growling Grass Frog Guideline for Species Management at Western Treatment Plant

Project teams

RMIT University: Jackie Myers, Sara Long, Claudette Kellar, Vincent Pettigrove, Monica Tewman, Hung Vu, Rebecca Reid, Daniel MacMahon, Michael Clark, James Oliver. Melbourne Water: TBC.

For more information, contact Jackie Myers, jackie.myers@rmit.edu.au, or see the full project proposal in the prospectus supporting document.

A9: Effective and affordable opportunities for the treatment of industrial pollutants in stormwater drains

Objective(s)

To determine the most effective ways to reduce pollution from industrial estates, including structural and non-structural pollution control options. It will also trial innovative assets that treat dry weather flows in stormwater drains and assess benefits for performance and maintenance of downstream stormwater treatment wetlands.

Why this research is important

Industrial areas can be major sources of pollution to local waterways and therefore, a significant risk to environmental values. The continued development of technologies to treat dry weather flows from industrial areas will increase confidence in our ability to effectively management pollution from industrial catchments, influence policy and planning and help to support the achievement of the HWS for Greater Melbourne. There is also potential for this project to influence urban stormwater management policy and for best practice control measures to be incorporated into standards and guidelines.

Contribution to Melbourne Water research priorities

HWS Key Research Area: Understanding the environmental impacts of pollutants, including contaminants of concern, to inform risk-based management of waterways across the region.

Approach

Online Treatment Solutions: Treatment Facility
Two programs within Melbourne Water are currently investigating building pilot online treatment facilities to reduce pollutants from industrial areas: Bayswater Industrial Online Treatment and Stony Creek Online Treatment. It is proposed that we will continue to support these programs by aiding in the scoping and designing of these online facilities.

Online Treatment Solutions: Pre sampling of online treatment facility (if approved)
Pre sampling of the receiving waterway will be conducted prior to the online treatment facility being built to obtain baseline data of the pollutants entering downstream waterways.

Assessment of Control Options – Synthesis document
Current practices in Victoria reviewed by A3P in 2020 will be revisited to understand if there have been improvements made towards better controls. Best practice management of pollutants from industrial areas will be refined and developed.

Research Note: Case studies of control options to manage pollutants from industrial estates
A research note will be developed for the benefits of implementing structural online treatment facilities to treat and reduce pollutants from industrial estates.

Assessment of built new online treatment facility
Assessing the performance of new online treatment facilities will be carried out before and after each asset has been built (future years of the project).

Key outputs

- Engagement to support design and construction of online treatment assets and assessment of the effectiveness of online treatment assets
- Synthesis of structural and non-structural industrial pollution control options

Expected benefits

- Stakeholders have awareness of industrial estate treatment options, enabling informed decision making.
- Increased confidence in the ability of online treatment assets to manage industrial pollution.
- Could be incorporated in best practice management guidelines for industrial runoff.

Project teams

RMIT University: Claudette Kellar, Jackie Myers, Vincent Pettigrove, Monica Tewman, Daniel MacMahon. Melbourne Water: TBC.

For more information, contact Claudette Kellar, claudette.kellar@rmit.edu.au, or see the full project proposal in the prospectus supporting document.

Appendix 1 – Melbourne Water participants in the June 2023 Melbourne Waterway Research-Practice Partnership project prioritisation workshop and those who provided subsequent feedback on shortlisted priorities*

Workshop Participants

Name	Team
Alison Kemp	Waterways Biodiversity and Environment
Alison Rickard	Service Enablement Healthy Waterways
Dan Green	Land Design and Community Planning
Felicity Kaufman	Waterway and Catchment Services
Grace Tjandraatmadja	Sustainable and Resilient Futures
Jared Polkinghorne	Waterway and Catchment Services
Joanna Mundy	Waterways and Catchment Operations
Jonno Cull	Environmental Services
Josie McGushin*	Service Strategy
Kelly Brooks	Sewerage Planning
Leonie Williams	Environmental and Management Systems
Lizzie Younger	Waterway and Catchment Services
Shane Haydon	Research and Modelling
Sharyn RossRakesh*	Waterways Biodiversity and Environment
Sophie Bourgues	Drinking Water Strategy and Policy
Suelin Haynes	Environmental and Management Systems
Teresa Mackintosh	Community Capacity Building
Trent Griffiths*	Waterways & Catchment Services
William Steele	Waterways Biodiversity and Environment
Yvonne Cabuang*	Community Capacity Building

* Provided input on priorities prior to the workshop

Individuals and/or Teams who Provided Feedback on the Shortlisted Projects from the Workshop

Name	Team
Al Danger	Service Enablement Catchments & Waterways
Alison Kemp	Waterways, Waterways, Biodiversity & Environment
Alison Rickard	Service Enablement Catchments & Waterways
Amanda Gunawardena	DSS Development Engineering & Planning Services
Cheryl Edwards	Sustainable Futures
Dan Green	Land Design & Community Planning
Dan Robertson	Waterways & Catchment Operations
Dana Grech	Waterways & Catchment Operations
David Galloway	Waterways & Catchment Operations
David Reginato*	DSS Strategic Engineering & Planning Services
Deborah Riley and Matilda Manning	Sustainable Futures
Grace Tjandraatmadja	Sustainable Futures
Josie McGushin*	Stormwater Policy Team
Josie McGushin*	IWM Team
Kathy Cinque	Research and Modelling
Leonie Williams	WTP Environment Compliance Officer
Louise Kerferd	Waterways & Catchment Operations
Michelle Ezzy	Sustainable Futures
Nino Polon*	DSS Strategic Engineering & Planning Services
Paul Rees*	Waterway and Catchment Operations
Priya Van Ryn*	Waterways, Waterways, Biodiversity & Environment
Rob Molloy	Yarra Strategic Plan
Sam Bradley	Waterway and Catchment Services
Shaun Corrigan	Catchment Partnerships
Suelin Haynes	Western Treatment Plant Environmental
William Steele	Waterways, Waterways, Biodiversity & Environment

* Provided joint input on priorities based on team discussions

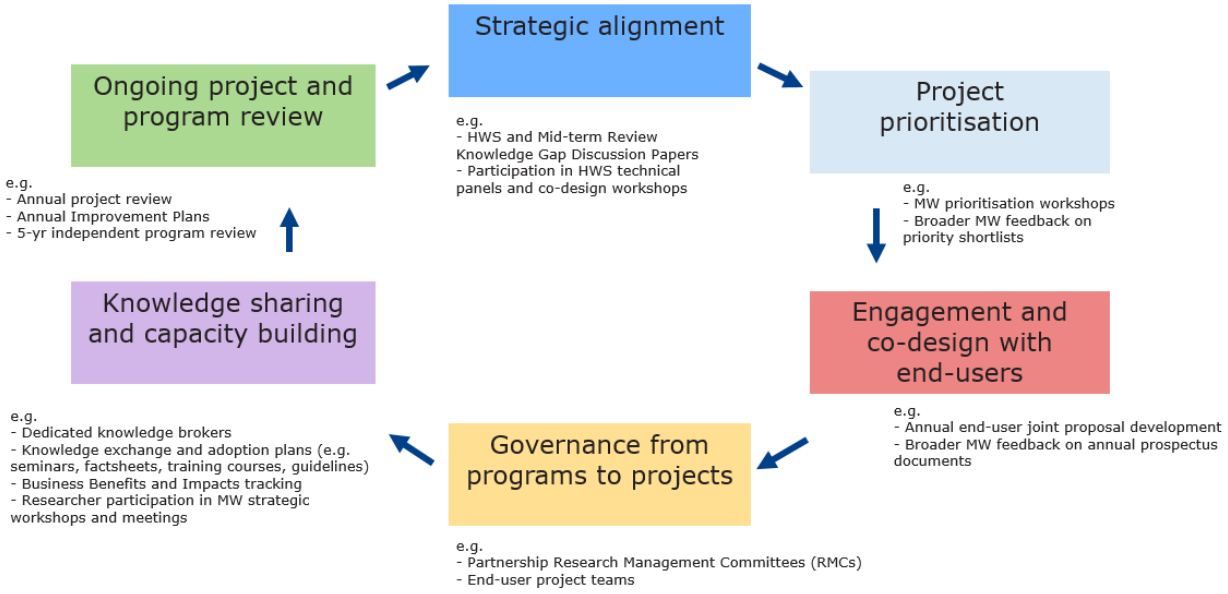
Appendix 2 – Background Information on the Waterways and Wetlands Research Program and the Aquatic Pollution Prevention Partnership 2023-2028

Melbourne Water's Waterways and Wetlands Research programs builds a knowledge base that informs and refines strategic decision-making and policy development and improves the efficiency of actions to protect and improve waterways and wetlands, monitor investment outcomes and respond to risks and opportunities. This extends to improving our understanding of the current and historical health of rivers and creeks, how to best manage specific river health issues, how to prioritise and practically implement on-ground activities, how to set meaningful natural resource management targets, the investment outcomes from particular waterway management activities and validity of critical waterway management assumptions. Development of this understanding is considered in the context of progressive urban growth, climate change and economic uncertainty.

Melbourne Water's Waterways and Wetlands research program outsources most of its projects through collaboration with researchers and key stakeholders e.g. DEECA, EPA, Parks Victoria, local government, water utilities. This approach gives Melbourne Water the flexibility to access a broad base of expertise, the capacity to undertake a higher volume of research across a diversity of research themes, greater agility to respond to future risks and opportunities, and opportunities for co-funding. Melbourne Water is able to address diverse knowledge gaps by investment both in large-scale research collaborations that focus on national priorities and industry direction (e.g. cooperative research centres [CRCs]), and in collaborations that can be more responsive to local research needs.

Over the past 10+ years, the Waterways and Wetlands Research program has evolved to strengthen its approach across key elements of research management cycle including 1) strategic alignment, 2) project prioritisation, 3) engagement and co-design with end users of the research, 4) project and program governance, 5) knowledge sharing and business/industry capacity building and 6) continuous improvement through ongoing project and program reviews (**Figure 2**).

Figure 2. Melbourne Water's Approach to Waterways and Wetlands Research



Since 2018, Melbourne Water has delivered over 50 research projects with our research partners. During the mid-term review of the Healthy Waterways Strategy these projects were mapped against the original 41 Key Research Areas and are summarised in **Appendix 2**. Two major research partnerships account for the majority of research projects, namely the Melbourne Waterway Research-Practice Partnership (MWRPP) with The University of Melbourne and the Aquatic Pollution Prevention Partnership (A3P) with RMIT University.

This document focusses on the Aquatic Pollution Prevention Partnership (A3P), that commenced in 2018 and is a dedicated waterway pollution management research program for the Port Phillip and Westernport region that

supports:

(i) applied research to underpin the improved management of waterway pollution and

(ii) knowledge exchange that integrates research findings and broader science with Melbourne Water activities (and with those of our stakeholders).

A3P focusses on understanding the types and levels of various pollutants in urban and rural waterways across the Port Phillip and Westernport region, the impacts of those pollutants on environmental and social values, the relative threat of pollutants, and efficient and effective approaches to pollution management. As well as helping to inform strategic planning, the research program is designed to be flexible and responsive so that it can also support Melbourne Water's day-to-day activities. This includes providing direct and easy access to expert advice for Melbourne Water, through regular formal and informal interaction opportunities between researchers and waterway managers. The A3P provides Melbourne Water with strong research capacity in waterway pollution and its management, and complements other key waterway research initiatives for which Melbourne Water is a collaborator.

The aims of A3P are to:

1. Undertake dedicated timely and relevant research to improve the efficiency and effectiveness of waterway pollution management in urban and rural waterways across the region
2. Develop formal strategies and activities to integrate findings from the research into Melbourne Water's policy and practice (and other stakeholders)
3. Develop formal opportunities for staff technical development and two-way exchange between Melbourne Water staff and University researchers, through secondments, exchange programs and student research projects.

In order to achieve these aims, the Partnership is founded on a collaborative research model of two-way knowledge exchange between researchers and practitioners at all stages – from research idea development through to changed business practices (**Figure 3**).

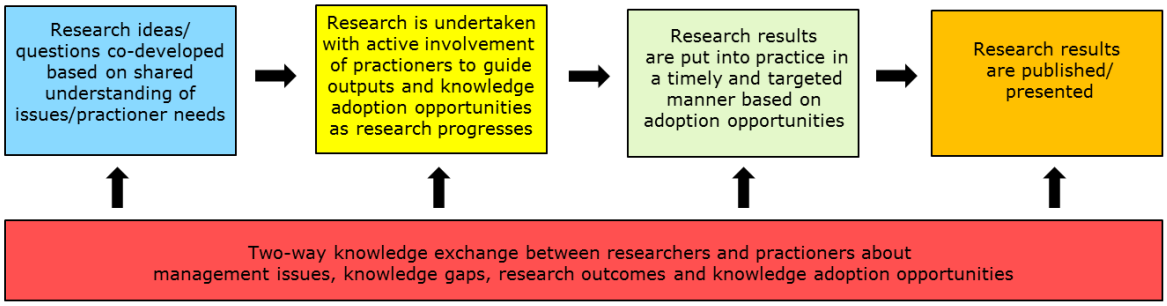


Figure 3. Aquatic Pollution Prevention Partnership collaborative research model

Partnership Governance

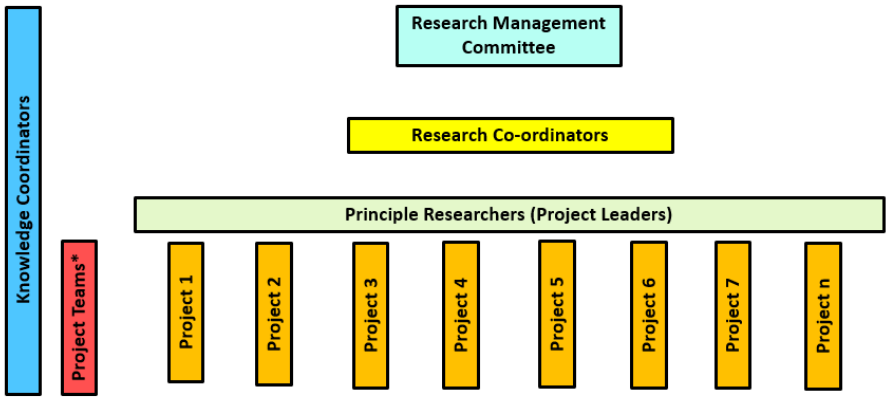
Formal governance of the Partnership as a whole occurs via the Research Management Committee (RMC) and includes representation from senior Melbourne Water managers from key waterway management related teams. The Research coordinators (Vin Pettigrove and Rhys Coleman) have responsibility for overseeing Partnership activities, while senior researchers (Claudette Kellar, Sara Long, Jackie Myers, Erica Odell) are responsible for co-ordination of projects and are also on the RMC. Melbourne Water senior managers on the RMC, representing a range of business areas, are Brett Anderson, Melita Stevens, Sophie Bourgues, Alison Rickard, Alison Kemp, and Trish Grant. The RMC also includes the Knowledge Brokers (Monica Tewman and Slobodanka Stojkovic) from RMIT University and Melbourne Water (**Figure 4**).

The RMC meets quarterly and amongst other things, approves the annual research program, discusses research progress, resourcing, future research opportunities, knowledge transfer initiatives and health and safety. The RMC also has the following responsibilities:

1. Ensuring the research aligns with Melbourne Water's strategic knowledge needs
2. Reviewing progress against milestones and performance targets
3. Tracking captured benefits for each project against Impact Domain adoption targets
4. Planning future knowledge exchange initiatives and activities
5. Identifying and resolving any issues affecting the performance of the Partnership, including considering and approving (or otherwise) any proposals by RMIT University to conduct work outside of the agreement
6. Actively overseeing the process of managing research by contributing to the development of, and tracking progress against, an Annual Improvement Plan that focusses on continual improvement.

At the project level, there are project teams comprising a research leader, researchers and Melbourne Water team members. The project teams are critical for helping shape the research projects, ensuring that research outputs are timely and relevant to Melbourne Water, providing management perspectives and insights, and supporting the transfer and adoption of knowledge. As part of establishing project teams, careful consideration of the 'Impact Domains' guides the composition of Melbourne Water participation i.e. those who are likely to be influenced by the research outcomes from planning to service delivery are represented on the team. The frequency of project team meetings with be project dependent, however, there should be 2-3 meetings per year.

Figure 3. Aquatic Pollution Prevention Partnership Governance



*Project teams = Research leader, key researchers and Melbourne Water stakeholders

Knowledge exchange

Knowledge exchange activities are led by a dedicated knowledge exchange officer at RMIT University (Monica Tewman) who works with Melbourne Water's Waterways and Wetlands Research Knowledge Broker (Slobodanka Stojkovic).

The purposes of knowledge exchange activities undertaken as part of the A3P are to: 1) promote the ways that the A3P can support better waterway management, 2) build awareness and understanding of research projects by potential users of the research, 3) encourage stakeholder engagement (including other agencies and research institutions), 4) establish a culture of knowledge sharing between researchers and practitioners, 5) generate a shared understanding of waterway management processes and context in which research will be adopted (including timeframes), 6) encourage integration of research findings into industry practice and 7) communicate the value of the research program in supporting Melbourne Water's operations.

Knowledge exchange is to be incorporated early in the research project development and implementation process. Whilst everyone in the A3P has a recognized role to play, knowledge exchange activities are planned and delivered with strategic oversight and coordination by the two knowledge brokers, who are also responsible for developing a Knowledge Exchange and Impact Framework (KEIF) that guides key activities on an annual basis. The KEIF provides a

framework for all communication activities undertaken as part of the A3P to ensure that knowledge exchange activities support the goals of the Partnership, in particular ensuring researchers and practitioners share and adopt knowledge.

The KEIF recognises that knowledge exchange activities are not simply the 'communication' or 'translation' of research ideas, but the active integration into policy and practice. To achieve this, the plan considers the development of formal strategies and activities to integrate findings from the research into Melbourne Water's policy and practice, and formal opportunities for staff development and exchange between Melbourne Water and University staff. The plan also provides a template for preparing communications briefs for each of the Partnership's research projects and identifies important dates for timely input into policy development and practices.

Importantly, the KEIF documents research outcomes and anticipated timelines. For each project, the KEIF identifies internal and external stakeholders across Impact Domains who need to be engaged at various stages and the appropriate forms of engagement. This includes consulting with teams relevant to the target Impact Domain(s) to agree on how to effectively engage with them throughout the life of the project. A range of mechanisms to deliver research outputs to suit different audiences will be explored through the KEIF and project Business Benefits and Impact Tables (BBITs).

The Partnership adopts an active approach to knowledge exchange, working collaboratively to develop (i) seminars (ii) practice notes (iii) guidelines for monitoring, modelling and the design of technologies. All of these communication activities will be underpinned by a focus on scientific excellence through peer-reviewed publication, to ensure that communications materials are credible and tested.

Knowledge exchange and research integration through the A3P will continue to be supported by:

1. Direct input to Melbourne Water committees: direct input from researchers to committees such as the Healthy Waterways Strategy Mid-term Review Evaluation Panel.
2. Technical advice and review of Melbourne Water documents: researchers from the Partnership are available to Melbourne Water staff to provide technical advice on Melbourne Water strategic projects, including review of key technical documents.
3. Melbourne Water exchange program: flexible opportunities for Melbourne Water staff to work within the Partnership in order to facilitate more efficient knowledge exchange. The form of such opportunities shall be agreed upon by both parties, but could include (for example), (i) part-time secondments or (ii) project-based secondments.
4. Research Higher Degree program: the Partnership provides the opportunity for Melbourne Water staff (subject to eligibility criteria) to undertake higher degree training within areas focused on Melbourne Water's needs.
5. Short courses: The Partnership conducts short courses with the aim of communicating research outcomes to Melbourne Water and the water industry more broadly. Examples of short courses that have been run during the Partnership include 'Aquatic Pollution 101'.

The Partnership website (www.rmit.edu.au/a3p) provides a central contact point for the partnership including a central repository for technical reports, list of all A3P research articles, updates on projects, and contact details for investigators.

Partnership Review 2022

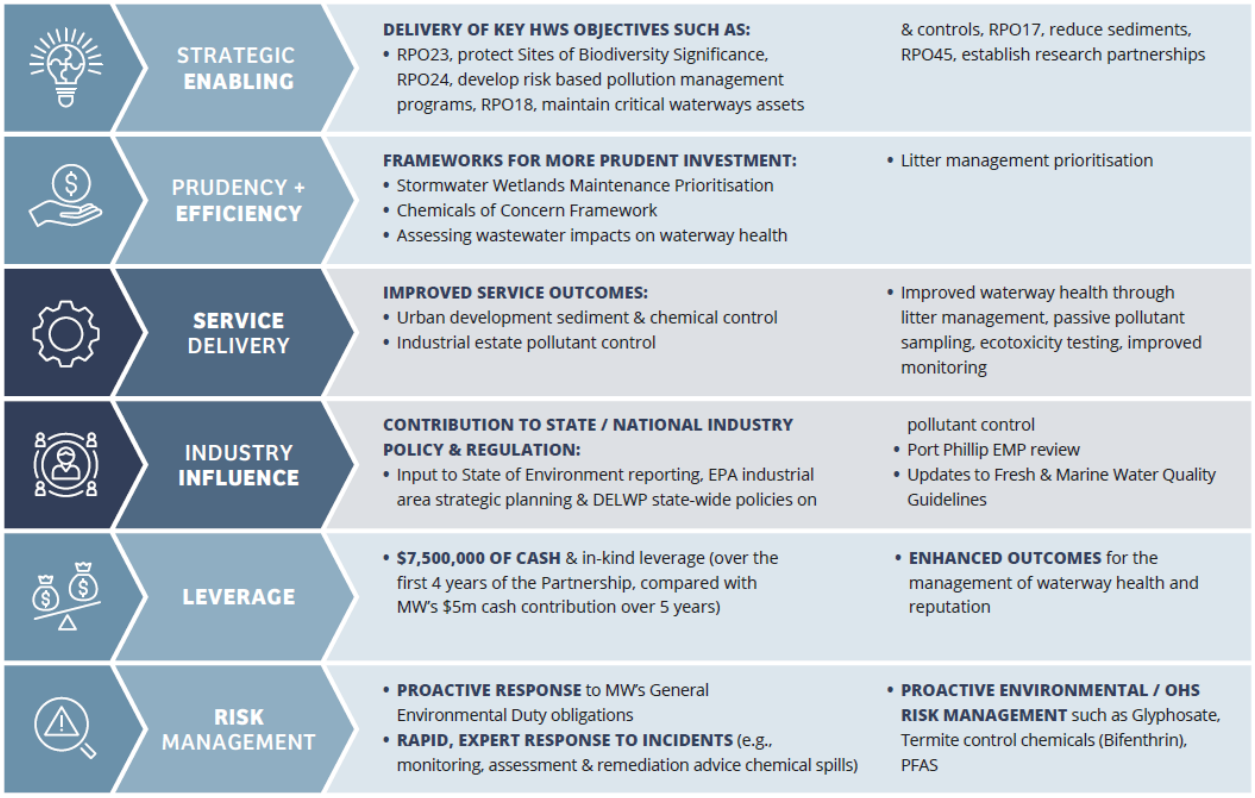
We recently signed a new 5-year Partnership agreement for the A3P from 1st July 2023 to 30th June2028. This renewal of the Partnership was supported by a formal review by Inxure Strategy Group in 2022 – with expertise in strategic water utility management, research program management and research adoption. The review had the following aims:

- To evaluate the benefits of the Partnership to Melbourne Water and our customers more broadly (e.g. DEWLP, EPA, Local Government).

- To identify the strengths of the Partnership (including structure, governance, project identification and prioritisation, performance of projects in terms of budget, timeliness and output, knowledge sharing and adoption, and publications); and
- To identify potential future improvements to the Partnership.

The review was founded on interviews and workshops with 50+ people (MW, Universities, Government organisations, consultants), with subsequent peer review by water industry experts. The review identified a broad range of substantial benefits to Melbourne Water and stakeholders (**Figure 5**) and recommended that the Partnerships continue along with a number of continuous improvement opportunities e.g. a more systematic approach to research benefits tracking.

Figure 5. Examples of the Types of Value Delivered by the Aquatic Pollution Prevention Partnership (A3P) identified by the Inxure Strategy Group Review



Research Prioritisation

Similar to the start of the last round of the A3P, a research planning workshop was held in June 2023 to reset and re-prioritise Partnership research projects (acknowledging that some committed projects would need to continue e.g. PhD projects) based on strategic knowledge gaps identified by the Healthy Waterways Strategy and the recent mid-term strategy review. This workshop was attended by both relevant Melbourne Water teams and research partners (**Appendix 1**) – with Melbourne Water staff determining knowledge gap priorities and researchers helping to facilitate discussions. The outcome of this workshop was a shortlist of research priorities (**Appendix 4**) that was subsequently circulated more broadly across Melbourne Water for feedback on projects considered as either a 'low', 'medium' or 'high' priority to particular teams. Participants were asked to prioritise projects in the context of the following considerations:

1. **Extent of existing research** i.e. knowledge sharing or a literature review may be sufficient where the knowledge gap has been adequately addressed.
2. **Importance** e.g.
   a. an area of high investment by the HWS but low confidence in management outcomes

   b. for delivering the current Healthy Waterways Strategy
   c. for developing the next strategy
   d. relates to a mid-term review major threat or substantial value decline
   e. provides benefits to multiple strategies e.g. IWM, flooding, Regional Catchment Strategy
3. **Feasibility** e.g.
   a. research can be delivered within the life of the strategy
   b. could be delivered by one of the existing Partnerships (either with the current expertise, or through a collaboration with known researcher from another institution)
4. **Cost** e.g.
   a. low cost relative to benefit
   b. substantial leverage of funds is likely or known to be possible
   c. synergies or dependencies with other projects can reduce costs

The prioritisation ratings from both the June workshop and subsequent business feedback helped identify projects that would be taken forward to research proposal development. Prior to drafting proposals, project scoping meetings were held with Melbourne Water representatives that showed an interest in certain projects. These staff members also provided feedback on draft proposals prior to inclusion of the proposal in this prospectus document. The direction and proposed outputs of each project will be reviewed annually as part of subsequent prospectus documents for Melbourne Water.

The highest priority projects, including those previously committed, that form the basis of the year 1 prospectus are:

- Decision support framework to prioritise water quality management actions
- Threat of climate change to water quality to inform mitigation opportunities
- Impact of toxicants on waterway and wetland function
- Ecological risks of treated and untreated wastewater discharges to waterways
- Pollutant risks to environmentally sensitive sites across the region
- Major sources, pathways and waterway health impacts of chemicals of concern
- Impacts of toxicants on the health of estuaries and bays
- Ecological risks from pesticide spraying on or near waterways and suitable alternatives
- Treatment of industrial pollutants in stormwater drains

Appendix 3 – Summary of Healthy Waterways Strategy research themes, Key Research Areas, collaborative research outcomes since 2018 and additional research knowledge gaps identified during the mid-term review

Research Theme (recently updated wording underlined)	**Research Outcomes 2018-2023** (Some research outcomes span multiple research themes but are only listed once)	**Additional mid-term review research gaps** (Will be prioritised alongside original HWS research gaps)
Riparian Vegetation and Instream Habitat 1. Understand the potential impacts of climate change on riparian vegetation communities and opportunities to effectively build resilience or transition vegetation communities 2. Understand the impact and effective management of pest plants and animals on riparian vegetation and instream habitat 3. Develop decision support tools to support improved investment in riparian and instream habitat activities and locations 4. Identify critical constraints to revegetation success and opportunities to improve vegetation outcomes 5. Improved understanding of instream habitat conditions, threats (including climate change) and processes across the region to inform works planning **Proposed New Key Research Area** 6. Develop remote sensing monitoring methods to better understand changes in vegetation condition and extent across the entire region	**Improved Habitat Suitability Models for instream values** – Developed improved stream network and associated environmental prediction information, including acquiring new vegetation and impervious surface data, to support the refinement of instream Habitat Suitability Models (HSMs) for aquatic macroinvertebrates, fish and platypus **Benefits of works-to-date and under climate change** – Used new climate change information for the region (e.g. VCP19 projections), data on works-to-date and proposed works through the HWS, and the instream HSMs to understand the potential implications for key environmental values across the region. **Climate resilient revegetation** – Modelled the risk of climate change to 31 key revegetation species to inform MW revegetation guidelines under a changing climate **Outcomes from riparian revegetation** – Developed and trialled a method for assessing the outcomes of riparian revegetation projects (ROMP) and has been adopted by the HWS MERI Framework **Remote sensing of vegetation extent and condition** – Investigated the ability of remote sensing monitoring methods to better understand changes in vegetation condition and extent across the region to complement more intensive field-based vegetation condition assessments that cannot be practically conducted across all 25,000km of waterways in the region **Species-level macroinvertebrate data** – Developing cost effective genetic approaches to identify aquatic macroinvertebrates to a species-level (as opposed to family level) for our aquatic macroinvertebrate MERI programs, that enable a deeper understanding of biodiversity patterns across the region and enable potentially more informative species-level Habitat Suitability Models **Managing deer impacts on vegetation and water quality** – Developed models to predict the distribution, density and vegetation impacts from deer across the region to support prioritisation of management interventions. Also reviewed options for non-lethal management of deer and assessed the success of particular control efforts	**Improved Habitat Suitability Models for instream values** – Continue to develop and refine instream Habitat Suitability Models (HSMs) for aquatic macroinvertebrates, fish and platypus to support the identification of the most cost effective waterway management actions, strategic target setting, the MERI framework and stakeholder strategy co-design in future Healthy Waterways Strategies **Climate resilient revegetation** – Forecast climate change impacts on a broader suite of vegetation species (including remnant native vegetation, common revegetation species and weeds), validate climate resilient revegetation approaches through establishment of climate plots across climatic gradients in Melbourne and develop a new management framework that builds resilience and adaptation of riparian revegetation to projected future climatic conditions **Impacts of climate change on fishway design –** Understand how climate change could impact the function and design of fishways to ensure that they continue to provide passage for target fish species in future decades **Outcomes from riparian revegetation** – Gain a deeper understanding of the outcomes of our riparian revegetation practices (ROMP) as well as the benefits for other environmental values e.g. riparian birds **Remote sensing of vegetation extent and condition** – Continue to test and establish cost effective remote sensing monitoring methods to better understand changes in vegetation condition and extent across the region, including impacts of vegetation clearing and outcomes from revegetation **Value and protection of headwater streams** – Understanding implementation barriers for headwater stream and wetland protection, including quantification of their water quality, ecological, social and cultural benefits, historical rates of loss, and the development of guidelines for protection from urban development **Integrated vegetation management to reduce chemical use** – Trial integrated vegetation management practices (e.g. alternative herbicides, heat, mowing) to reduce reliance on chemical use along waterways

	Incorporating instream vegetation in our strategies – Conducting research on the relationships between flow, channel form and instream vegetation to inform opportunities to manage and project instream vegetation habitat in the next Healthy Waterways Strategy **Channel form and floodplain protection** – Conducting research on the relationships between flow, urbanisation, floodplain connection and channel form to inform opportunities to protect stream channels from urban growth. Automated tools to extract channel dimension data (e.g. width, depth, slope, top of bank) across the region using Lidar were also developed to support a number of needs across Melbourne Water for channel dimension data **Direct seeding as a complementary revegetation tool** – Evaluated direct seeding as a cost-effective revegetation technique and developed guidelines for Melbourne Water for its use **Propagation of key vegetation species** –Developed methods for the propagation of critical native plants (*Gahnia*, *Pteridium*, *Lepidosperma*) for riparian restoration programs that are now commercially available from nurseries **Instream channel features needed to fully realise revegetation benefits** – Better understand the importance of retentive structures (e.g. instream wood, rocks, vegetation) for the retention of vegetation matter to realise the ecological benefits of organic matter inputs from riparian vegetation **Value and protection of headwater streams** – Investigated the role of small headwater streams in urban, rural and forested catchments for supporting waterway health, including stream flow, water quality and biodiversity benefits to guide strategies for the protection of headwater streams across the region	**Incorporating instream vegetation in our strategies** – Continue research on the relationships between flow, channel form and instream vegetation to inform opportunities to manage and project instream vegetation habitat in the next Healthy Waterways Strategy
Stormwater management and flooding 1. Improve our understanding how system design to prevent flooding and protection of waterway health needs to alter to accommodate impacts of climate change 2. Improving the stormwater treatment performance and determine the optimal maintenance of WSUD systems 3. Understanding the costs and benefits of various stormwater management interventions for biodiversity, amenity and recreational outcomes 4. Develop improved technologies and systems to support stormwater harvesting and re-use 5. Identifying and addressing institutional and structural barriers to implementation of Integrated Water Management 6. Develop decision support tools to inform the most effective stormwater treatment systems and locations to protect waterway biodiversity, amenity and recreation	**'Smart' water storages for multiple benefits** – Implementing a distributed network of 'smart' rainwater tanks and urban lakes that enable real-time monitoring and control of water levels for multiple benefits – augmenting household non-potable water use, reducing the risk of localised flooding and environmental flows under a changing climate (Monbulk Creek Smart Water Network) **Measuring the performance of stormwater wetlands** – Includes developing efficient and effective indicators of performance, to support industry guidelines, improve future design and underpin asset maintenance prioritisation. More recent research is seeking to understand the treatment, harvesting, maintenance and environmental flow benefits of 'smart' stormwater wetlands that incorporate real-time monitoring and control of water levels and water quality **Ability of stormwater wetlands to remove microplastics** – Commenced research to understand to the performance of stormwater wetlands to	**Barriers to the management of urban stormwater** – Understanding the barriers to the implementation of HWS stormwater Performance Objectives (e.g. policy, guidance, capacity and funding, sector willingness) and identify opportunities to overcome critical barriers. **Implications of climate change for stormwater management** – Better understand how flow changes associated with climate change will influence the threat of urban stormwater (e.g. increased storm intensity) and identify suitable interventions to mitigate the increasing threat **Real-time monitoring and control of WSUD assets** – Continue to investigate opportunities for real-time monitoring and control of WSUD systems, including rainwater tanks, urban ponds and stormwater wetlands, to improve treatment performance, increase harvesting suitability, prevent vegetation loss and provide environmental water for downstream waterways (including Groundwater Dependent Ecosystems)

Proposed New Key Research Area: 7. Understanding and managing the threat of urbanisation to floodplain function, wetlands and headwater streams	remove microplastics prior to discharging water to downstream natural waterways to understand the risks from microplastics and potentially inform future constructed wetland design and maintenance **Passively irrigated street trees** – Understanding the stormwater treatment and urban greening benefits of passively irrigated street trees, including testing a range of designs in contrasting contexts e.g. carparks, residential streets, median strips on main roads. **Managing stormwater in existing and new urban areas** – Assessed the benefits to stream health of a large-scale retrofit of stormwater control measures (rainwater tanks, raingardens) in an existing urban area (the Little Stringybark Creek catchment), as well as establishing a large-scale assessment of the benefits of the Sunbury IWM project that aims to achieve the HWS stormwater targets and protect the health of Jacksons and Emu Creek in the Sunbury Growth Area **Benchmarking and transitioning 'water sensitivity' of cities** – Developed a method to benchmark cities in regards to 'water sensitivity', set visions with stakeholders and implement transition strategies **Economic evaluation of Integrated Water Management projects** – Developed a comprehensive economic evaluation framework for Integrated Water Management projects and programs to support business cases **Tools and products to support Integrated Water Management** – Guidance documents and other tools and products to support integrated urban and water planning in new ('greenfield development') and existing ('infill development') urban areas	**Passively irrigated street trees** – Demonstrate the stormwater capture and infiltration potential of a fully functional 'leaky' streetscape with passively irrigated street trees **Impacts of urbanisation on wetlands** – Undertake research to better understand the impacts of urbanisation on wetlands and to define appropriate buffer distances and the measures required to maintain and improve values **Waterway setbacks for multiple benefits** – Explore opportunities to develop site specific waterway setbacks that protect floodplain functioning, including reduced localised flood risks, in urbanising areas **Measuring the performance of stormwater wetlands** – Continue to improve our understanding of the treatment of toxicants by stormwater wetlands, including emerging contaminants of concern, as well as the effect of toxicants on wetland performance e.g. biofilms, sediment bacterial communities **Managing industrial pollution with structural solutions** – Further develop and trial dry weather toxicant treatment assets in stormwater drains draining industrial pollution hotspots **Upscaling and mainstream Integrated Water Management** – Identifying approaches and opportunities to upscale and mainstream Integrated Water Management practices across the region
Pollution 1. Understanding the environmental impacts of pollutants, including contaminants of concern and litter, to inform risk-based management of waterways across the region 2. Quantifying ecosystem services in waterways for improving water quality to better account for the benefits of healthy waterways 3. Develop improved water quality indicators and monitoring methods to better understand the impacts of pollutants on waterway health 4. Developing tools and approaches to assist in strategic planning of pollution management to protect biodiversity, amenity and recreation in waterways across the region 5. Understanding and managing public health risks from recreation along waterways in the region 6. Understanding the impact of climate change on water quality and management implications for the protection of aquatic biodiversity, amenity and recreation along waterways **Proposed New Key Research Area:**	**Climate change and water quality** – Used new climate change information and water quality modelling (Port Phillip and Westernport Source Model) to understand the potential impacts of climate change on water quality across the region **Synthesis of water quality issues and opportunities** – Summarised waterway pollution data across the region to understand key water contaminants, sources, pollution hotspots and management opportunities **Impacts of urban construction on sediment loads** – Quantified the amount and quality of sediment delivered to streams and wetlands during construction of urban residential areas in the South East of Melbourne to understand risks to waterway and bay health and opportunities for management **Emerging contaminants of concern** – Reviewed local and international literature and conducted risk assessments based on HWS key environmental values to identify potential emerging contaminants of concern, develop methods to sample and measure them across the region to identify priority pollutants for management	**Climate change and water quality** – Improve understanding of the likely implications of climate change (warming, drying, more intense rainfall events) on the levels and ecological impacts of contaminants in waterways **Quantitative passive sampling of contaminants** – Refine passive sampling methods for contaminants to enable assessments to move from presence/absence to quantitative assessments of chemicals **Low cost sensors for monitoring urban construction** – Development of low cost monitoring systems to increase the coverage and resolution of data to understand and manage the risk of sediments to waterways from urban construction e.g. construction sediment control, compliance monitoring, sediment pond maintenance **Chemical indicators of treated and untreated wastewater** – Validate chemical indicators of sewage and quantify risks to key environmental values from chemicals associated with wastewater, including recycled water and Emergency Relief Structure (ERS) overflows

7. Understanding and managing the impacts of treated and untreated wastewater on waterway health	**Impacts of treated and untreated wastewater** – Developed indicators of treated and untreated wastewater discharges to waterways to understand major sources of wastewater contamination to guide prioritisation of wastewater management activities across the region **Continuous improvement in chemical use** – Reviewed the chemicals frequently used by Melbourne Water on or near waterways and conducted an ecological and human health risk assessment and considered alternative chemicals or practices to reduce the ecological and human health risks of priority chemicals e.g. glyphosate used in vegetation management activities **Water quality benefits of gully revegetation and stock exclusion** – Tested the water quality benefits (sediments, nutrients, faecal microbes) of revegetation and stock exclusion along gullies on rural land in the Tarago River catchment **Managing industrial pollution** – Surveyed urban streams and drains in industrial areas across the region to characterise the types and concentrations of pollutants. Also tested the ability of different types of filter media to remove industrial pollutants from dry weather flows in stormwater drains e.g. Barry Road, Campbellfield. **Catchment studies to identify management priorities** – Developed and applied a range of complementary water and sediment quality survey methods (including passive samplers) as well as ecotoxicology tests to determine levels of pollution stress and diagnose priority pollutants for management in contrasting catchments (Kororoit Creek, Little Yarra River, Lang Lang River) **Low cost water quality sensors** – Developed and tested low cost water quality sensors (e.g. water level, salinity, temperature, turbidity) and modelling to isolate major sources of pollution in stormwater drains, including the Old Joes Creek (Bayswater) and Stony Creek (Yarraville) industrial catchments **Managing recreational public health risks along the Yarra River** – Conducted an assessment of the risks of different types of aquatic recreation along the Yarra River to inform opportunities to reduce public health risks **Managing the risk of bifenthrin use** – Understanding the levels and ecological effects of the synthetic pyrethroid Bifenthrin (e.g. used to control termites) on aquatic organisms in new urban estates to inform structural and non-structural mitigation measures	**Risks to waterways from recycled water use** – Understand risk to waterways from increased use of recycled water for environmental flow purposes and use in residential and agricultural areas. **Quantifying the benefits of rural land management** – Improved metrics used to estimate the effectiveness of site scale agricultural interventions to reduce sediment, nutrient and pesticide run-off to protect waterway health **Understanding the ecological threats from contaminants in rural areas** – Better understand threats from pesticides and other sediment contaminants for waterways where high values (e.g. macroinvertebrates, platypus) intersect with rural land use **Threat of litter entanglement to key environmental values** – Better understanding of the risk of entrapment from litter for environmental values beyond platypus (e.g. fish, birds) to inform priorities for litter management across the region **Non-structural tools for managing industrial pollution** – Investigate the benefits of non-structural strategies (education and enforcement) to manage pollution from industrial areas **Toxicant risk assessment framework** – Further develop and apply the A3P toxicant risk assessment framework to assist in the prioritisation of management actions to reduce impacts on key environmental values, including continuing to undertake a systematic approach for screening and managing pollutants at sites of environmental significance **Catchment studies to identify management priorities** – Continue to develop assessment tools (e.g. eDNA, metabolomics, habitat, hydrology) to strengthen the multiple lines of evidence framework to understand major stressors in subcatchments where key environmental values are declining e.g. Lang Lang River aquatic macroinvertebrates, River Blackfish in the Plenty River **Continuous improvement in chemical use** – Continue to review and refine chemicals used by Melbourne Water on or near waterways (e.g. wash down and pathogen control procedures, herbicides along waterways and drains) to reduce impacts to the aquatic environment and human health **Litter management prioritisation** – Develop a litter management prioritisation framework to guide litter management interventions e.g. litter trap installation, routine clean-ups
Hydrology and Environmental Flows 1. Developing improved approaches to flow data collection and data management to support flow management decisions 2. Understanding and mitigating climate change effects on the hydrology of waterways, estuaries and wetlands	**Climate change and stream flows** – Used new climate change information for the region (e.g. VCP19 projections) and water quality modelling (i.e. Port Phillip and Westernport Source Model) to understand the potential impacts of climate change on flow across the region	**Climate change and stream flows** – Improve understanding of the likely ecological implications of climate change (warming, drying, more intense rainfall events) on the hydrology of waterways across the region

3. Improving our understanding of the responses of key environmental values to flow regimes to refine our environmental flow objectives 4. Developing tools and frameworks to assist improved decision-making in the management of flows to meet environmental flow objectives 5. Investigate opportunities for managing stream flows in urban catchments to protect and improve aquatic biodiversity, amenity, recreation and reduce flooding 6. Improved understanding of the hydrology of floodplains, wetlands and estuaries, including groundwater-surface water interactions to protect and improve aquatic biodiversity 7. Improved understanding of the flow requirements of estuaries to develop and refine environmental flow objectives 8. Explore opportunities to integrate methods for determining ecological flows objectives in urban and rural streams to improve approaches to objective setting across both stream types	**Benefits of billabong watering along the lower Yarra River** – Worked with the Wurundjeri Woiwurrung Narrap team to assess the vegetation and broader ecological benefits of watering billabongs along the lower Birrarung (Yarra River) to inform environmental watering regimes **Benefits of watering regimes in the Yellingbo Conservation Nature Reserve** – Assessed the vegetation and broader ecological benefits of watering regimes in the Yellingbo Conservation Nature Reserve that supports threatened species including the helmeted honeyeater and Leadbeater's possum **Upstream migration of threatened Australian grayling** – Assessed the relationship between the upstream migration of the threatened Australian Grayling and environmental conditions, including flows in the Bunyip River catchment **Fate of infiltrated stormwater from biofiltration systems** – Measured the volume and underground flow path of water infiltrated by the Wicks Reserve (The Basin) biofiltration system to understand the potential for this asset type to restore dry weather flows to adjacent waterways	**Incorporation of flow stress predictors in our Habitat Suitability Models** – Incorporate further hydrological predictors to refine instream Habitat Suitability Models e.g. farm dam flow stress metric **Multi-species interactions associated with environmental flows** – Better understand the benefits of environmental flows when multi-species interactions (meta-community perspective) are accounted for in environmental flow plans **Traditional Owner-led billabong management** – Further investigate historical wetting and drying cycles, vegetation communities and fire regimes to enhance future Wurundjeri-led management of Birrarung's billabongs
Liveability, community engagement, and social research 1. Refining our conceptual models and developing tools to support investment in waterway works for recreation and amenity 2. Defining public health and wellbeing benefits of waterway, stormwater and urban cooling programs to support investment decisions 3. Understanding the compatibility between social and environmental values and whether management actions are required to balance potentially competing objectives 4. Understanding demographics, preferences, values and water awareness of our customers to inform waterway works planning and delivery 5. Understanding, involving and supporting volunteers in waterway management to facilitate shared waterway objectives 6. Increasing community awareness and connection to waterways so we have informed, engaged partners 7. Understanding aboriginal cultural values of waterways and establish a framework to better integrate these values in waterway management decision-making	**Litter monitoring methods** – Developed and tested new litter monitoring methods to identify litter hotspots, understand major types and sources of litter, prioritise areas for management, and in future Healthy Waterway Strategies to set strategic targets and track progress towards those targets **Community engagement with waterways before, during and after Covid-19 restrictions** – Used a combination of community surveys and mobile phone human movement data to understand the levels of community engagement with and perceptions of, Melbourne's 'blue' and 'green' spaces (e.g. waterways, local parks) before, during and after the Covid-19 pandemic. **Managing WSUD on private land** – Assessing the performance, levels of maintenance and household perspectives of water sensitive urban design (WSUD) assets (e.g. rainwater tanks and raingardens) on private land, using contrasting management scenarios e.g. Aquarevo, Little Stringybark Creek catchment, Coburg Hill. **Impact of digital technology for citizen science** – Surveyed citizen scientists involved in the Frog Census and Birdlife Australia programs in the region to understand reasons for their involved in these programs, the pros and cons of using digital technology to participate in these programs (e.g. Frog Census App) and opportunities to increase participation, retention rates and participant satisfaction **Knowledge sharing with Traditional Owners** – Drafted knowledge sharing protocols between Melbourne Water and three Traditional Owner (TO) groups in the region, to support TO-led research and waterway management capacity building	**Human wellbeing and wetland health as a potential new social value in the next Healthy Waterways Strategy**– Better understand the relationship between human wellbeing and wetland health to inform the potential adoption of wellbeing as a social value in future Healthy Waterways Strategies **Strengthening our understanding of the links between social conditions and values** – Undertake further investigations to better understand these causal links between conditions (e.g. litter and access) and how that impacts social values (perceptions and realities) to improve Healthy Waterways Strategy conceptual models that underpin prioritisation of actions to increase social values across the region **Threat of recreational access to key environmental values** – Better understand the threat of recreational access to waterways on key environmental values, including riparian birds to better balance social and environmental values protection across the region

	Indigenous-led approaches to urban water design – Commenced research led by the Boon Wurrung Foundation and Monash University to learn about ways to repair urban landscapes for their cultural values	
Wetlands and Estuaries 1. Developing strategic decision-making tools and frameworks for the prioritisation of management interventions for wetlands and estuaries 2. Improving our understanding of management techniques that are most effective for protecting and improving the ecological health of wetlands and estuaries 3. Developing improved monitoring, assessment and reporting methods to understand environmental conditions and values of wetlands and estuaries **Proposed New Key Research Areas:** 4. Understanding the potential impacts of climate change on wetland health and mitigation options 5. Develop remote sensing monitoring methods to better understand changes in wetland condition across the region	**Habitat Suitability Models for wetland values** – Developed improved waterbodies spatial information layer and associated environmental prediction information to support the development of wetland Habitat Suitability Models for frogs, fish and birds that will enable predictions of current condition, condition under future urban growth and climate change and setting environmental value targets for wetland assets in future Healthy Waterways Strategies (equivalent to how the instream HSMs were applied in the current HWS) **Developing environmental DNA (eDNA) methods for aquatic biodiversity monitoring** – Further developed and applied eDNA monitoring methods to support the HWS MERI framework, including protocols for detecting frogs, birds and aquatic plants in wetlands and for detecting threatened or invasive species (e.g. threatened invertebrates, freshwater mussels, Australian mudfish, smooth newt)	**Habitat Suitability Models for wetland values** – Continue to develop and refine wetland Habitat Suitability Models for frogs, fish and birds that will enable predictions of current condition, condition under future urban growth and climate change, and develop decision support tools like zonation to aid in prioritisation of management scenarios for wetlands and setting environmental value targets for wetland assets in future Healthy Waterways Strategies. Further develop the environmental data library to include wetland Habitat Suitability Model predictors we expect to be influential, such as measures of impervious cover within the catchment areas of waterbodies. **Remote sensing of wetland loss and condition** – Continue to investigate cost effective remote sensing data collection techniques for wetland extent and condition assessments (e.g. inundation, vegetation cover) to support Habitat Suitability Model development and final strategy evaluation of wetland condition and loss. Further develop the wetland remote sensing change detection methodology to determine its accuracy and applicability to flag wetlands where substantial changes in open water may have occurred and could be subject to follow up investigations **Predicting climate change impacts on wetlands** – Consider other approaches to assessing potential climate change impacts on wetlands (e.g. extreme events such as fire, heatwaves, 'rain bombs', floods, and storm surges) that complement the wetland Habitat Suitability Models **Review our suite of regionally significant wetlands** – Once the wetland Habitat Suitability Models are finalised, conduct further analysis of regionally significant wetland representativeness across the region with respect to key environmental values, as well as investigating the potential for waterbodies or regions to be refuge areas for particular species during dry conditions **Managing the impacts of invasive fish species** – Identify opportunities for reducing the risk of invasive fish such as carp and mosquito fish in areas of high environmental value
Other Aquatic Biodiversity 1. Improving our understanding of critical ecological processes and ecology of key species to improve our conceptual and quantitative models 2. Understanding the unintended consequences of our management activities on aquatic biodiversity to inform works planning and programming to reduce impacts on environmental values 3. Understanding areas of high biodiversity significance (e.g. Melbourne Water's Sites of Biodiversity Significance, Ramsar)	**Risk of pollution to sites of environmental sensitivity** – Conducted risk assessments and screened for pollutants at 40+ environmentally sensitive waterways sites in the region, to understand the threat of aquatic pollution and identify priorities for management **Status of threatened aquatic macroinvertebrates** – Used a combination of traditional and eDNA survey methods to assess the current status of threatened aquatic macroinvertebrates in the region, including the Donna Buang and Kallista stoneflies and the Dandenong and Sherbrooke amphipods	**Waterway function as a new key environmental value in the next Healthy Waterways Strategy** – Investigate and develop monitoring methods and metrics to enable the inclusion of waterway function as a key environmental value in future waterway strategies, as well as helping to prioritise waterway management interventions and setting of strategic targets that can be part of the HWS MERI Framework **Status of threatened aquatic macroinvertebrates** – Increase our understanding of the distribution of threatened aquatic

and appropriate management responses to manage key threats to environmental values **Proposed New Key Research Areas:** 4. Understanding the impacts of barriers to dispersal across the landscape on key values 5. Developing methods, metrics and strategic management frameworks for waterway function as a key environmental value	**Status and management opportunities for less understood aquatic life** – Reviewed ecological, distribution, threats and management opportunities information for aquatic fauna where information was lacking, including river blackfish, freshwater mussels and freshwater crayfish	macroinvertebrates, including clarifying taxonomic uncertainty of the amphipods **Water quality, hydrology and riparian birds** – Strengthen our understanding of the relationship between water quality, hydrology and riparian birds to help update our conceptual models and prioritisation of management interventions **Increasing our knowledge to protect threatened platypus** – Investigate the relationship between platypus populations, water quality and macroinvertebrate communities (abundance and diversity), as well as increasing our understanding of the carrying capacity and minimum habitat patch size required to support a self-sustaining platypus population. **Potential risks from anti-microbial resistance to waterway health** – Understanding the risk of Antimicrobial Resistance (AMR) to waterway health from agricultural sources to inform the need for management interventions **Barriers to the dispersal of key environmental values** – Understanding the impacts of barriers to dispersal across the landscape on key values (including under a changing climate and following disturbances) to evaluate the need for interventions that increase population connectivity (e.g. barrier removal, road underpasses, translocations)
Port Phillip and Western Port 1. Undertake priority research projects identified in the Port Phillip Environmental Management Plan 2. Undertake priority research projects identified in the Western Port Environment Science Review and synthesis report 3. Undertake priority research projects identified in the Ramsar management plans for the Port Phillip and Westernport region	**Amounts and sources of sediment to Western Port** – Measured and modelled the amounts and major sources of sediment to Western Port to understand the locations and types of management interventions (e.g. riparian revegetation, rural land management, coastal protection), that are most likely to protect and improve critical seagrass habitats in Western Port **Restoration of seagrass meadows** – Developing and trialling methods for seagrass propagation and planting, along with tools to predict locations where seagrass restoration is likely to be most effective, to accelerate recovery of critical seagrass habitats in Western Port **Restoration of mangroves** – Developing and trialling methods for mangrove propagation and planting across Western Port and Port Phillip to restore critical mangrove habitats to support ecosystem health and coastal protection **Restoration of coastal vegetation under a changing climate** – Mapping past, present and predicted future distribution of coastal vegetation (mangroves, saltmarsh) across Western Port, to identify opportunities to protect coastal vegetation under sea level rise **Risks from and major sources of toxicants to Western Port** – Screened waterways, including stormwater wetlands, across Western Port to understand the types and concentrations of toxicants and evaluate the risks	**Amounts and sources of sediment to Western Port** – Increasing our understanding of the amounts and major sources of sediment to Western Port to support the prioritisation of interventions to reduce sediment loads to Western Port under urban growth and climate change and to meet the SEPP sediment target **Restoration of seagrass meadows** – Refining propagation and planting methods to support scaling-up and mainstreaming of seagrass meadow restoration in Western Port and Port Phillip **Risks from and major sources of toxicants to Western Port** – Complete the development of locally relevant tests to assess toxicity of priority pollutants (based on a risk assessment of chemicals detected across Westernport streams and wetlands) to early life stages of fish **Amounts and major sources of microplastics to Western Port** – Complete research to understand the levels and major sources of microplastics discharged from waterways into Western Port to evaluate the risks from microplastics to the health of the bay

	to waterway and bay health – including the development of locally relevant tests to assess toxicity to early life stages of fish **Amounts and major sources of microplastics to Western Port** – Commenced research to understand the levels and major sources of microplastics discharged from waterways into Western Port to evaluate the risks from microplastics to the health of the bay **Using environmental DNA (eDNA) to survey benthic biodiversity in Western Port** – Sampled sediment across >100 sites across Western Port and used eDNA techniques to determine spatial patterns in benthic biodiversity (microbial and invertebrate)	

Appendix 4 – Short list of projects identified by Melbourne Water teams during the June 2023 Aquatic Pollution Prevention Partnership workshop

Project ID	Title	Description
A3P_1	A decision support framework to help prioritise water quality management actions across the region, set management targets and assess management effectiveness	This project is expected to support water quality management priorities in the next Healthy Waterways Strategy, including predicting the benefits of interventions, setting management targets and supporting the HWS MERI Framework. This project would further develop and apply the A3P toxicant risk assessment framework and continue to develop assessment tools (e.g. eDNA, metabolomics, habitat, hydrology) to strengthen the multiple lines of evidence framework to understand major stressors in subcatchments where key environmental values are declining e.g. Lang Lang River aquatic macroinvertebrates, River Blackfish in the Plenty River. This information will assist in the prioritisation of management interventions, including consideration of landuse types and point and non-point source pollution, to reduce pollution impacts on waterway health, as well as the development of techniques to assess the effectiveness of management interventions e.g. remote sensing technologies, ecological, hydrological, geomorphological and chemical indicators of health. It is dependent on other research projects involving pollution data collection and ecosystem health assessments to inform the framework and action prioritisation.
A3P_2	Understanding the ecological risks of treated and untreated wastewater discharges to waterways	Previous research from A3P has focussed on identifying chemical indicators of treated and untreated (e.g. septics, Emergency Relief Structure spills) wastewater in waterways. The proposed next phase of this research is to undertake risk assessments of wastewater to key environmental values, including validation of the wastewater indicators, that will aid in the identification of waterways where wastewater impacts (e.g. nutrients, pharmaceuticals and personal care products, microplastics) on waterway health are greatest, major sources of wastewater and opportunities for management.
A3P_3	Understanding ecological risks from pesticide spraying activities on or near waterways and suitable management alternatives	This project would consider focus on Melbourne Water use of chemicals on or near waterways (e.g. wash down and pathogen control procedures, herbicides along waterways and drains) and potentially broaden the scope to use by other stakeholders. In the first instance it can draw on A3P chemical stocktake and risk assessment undertaken for Melbourne Water across drinking water, wastewater and waterway activities. In previous years, A3P has focussed on glyphosate use and effectiveness of alternative chemicals or practices to reduce ecological and human health risks. Would include assessments of toxicity of current and alternative pesticides to waterway values (e.g. vegetation, frogs, riparian birds).
A3P_4	Understanding the major sources, pathways and waterway health impacts of chemicals of concern in waterways to inform risk assessments and management interventions	Involved ongoing review of local and international literature and ecological risk assessments based on Healthy Waterways Strategy key environmental values to identify potential emerging contaminants of concern, develop methods to sample and measure them across the region, and determine critical ecological thresholds, to identify priority pollutants for management. This research project is important to demonstrate Melbourne Water's responsibilities as a waterway manager under the General Environmental Duty and links to Melbourne Water's Emerging Contaminants Framework.

Project ID	Title	Description
A3P_5	Managing the impacts of toxicants in urban stormwater and wastewater treatment plant discharges on the health of estuaries and bays	Would consider the impacts of toxicants in both Port Phillip and Western Port, as well as estuaries across the region. Would evaluate existing knowledge of water and sediment quality, including existing hydrodynamic models for both bays, as well as priorities identified in the Port Phillip Environmental Management Plan and Western Port Environment science review. The collection of pollutant data for estuaries would fill a key knowledge gap.
A3P_6	Effective and affordable opportunities for the treatment of industrial pollutants (e.g. heavy metals, hydrocarbons) in stormwater drains	This project will explore alternative filtration media and innovative designs to trial assets that treat dry weather flows in stormwater drains within industrial catchments known to be pollution hotspots. Previous A3P research has focussed on the performance of a trial asset in the Barry Road drain, Campbellfield where certain combinations of filter media are showing promising results. Future research could trial other designs in both old (e.g. Old Joes Creek in Bayswater, Stony Creek in Yarraville) and new industrial areas (e.g. Emu Creek, Sunbury). Trials would assess the treatment performance of these assets as well as maintenance frequency, costs, and potentially recycling options for accumulated waste.
A3P_7	Characterising chemicals of concern in urban stormwater to inform risk assessments, treatment options and IWM strategies	This project will determine the quality of stormwater across the region, including holistic assessment of chemicals (e.g. potential presence of emerging chemicals), spatial and temporal variability in quality, identification of effective treatment options and determination of potential impacts on re-use options.
A3P_8	Quantitative assessments of chemicals of concern using new passive sampling approaches	Many contaminants of concern are difficult to detect in waterways with traditional 'grab' water sampling methods. Passive sampling approaches have been successfully applied by A3P to detect chemicals in waterways that may occur intermittently or in concentrations below standard laboratory detection methods. At present these passive sampling methods have only been able to detect the presence of contaminants of concern. While useful, in order to understand relative concentrations of chemical of concern between waterways and likely risks to waterway health, quantitative passive sampling methods are needed. This project will develop and trial quantitative passive sampling methods for contaminants of concern to inform ecological risk assessments and the prioritisation of management interventions.
A3P_9	Understanding the threat of groundwater pollutants to high value waterways	This project will seek to understand levels of pollutants in groundwater across the region and identification of waterways most at risk to inform the need for targeted management inventions (e.g. WTP, ETP, Edithvale-Seaford)
A3P_10	Assessment of pollutant risks and the need for management interventions at environmentally sensitive sites across the region	This project extents previous A3P research and likely has only 2-3 years remaining to adequately screen all priority environmentally significant sites across the region. Sites screened in any particular year will be informed by Melbourne Water's Sites of Biodiversity Significance renewal schedule. The project will incorporate multiple lines of evidence, to ensure all contaminant risks are considered and assessed and consequently, management actions can be put forward to sustain and improve the condition of these sites.
A3P_11	Evaluating opportunities for the use of alternative water sources to meet the ecological flow requirements of key environmental values in flow stressed systems	This research would consider the costs, risks and the potential benefits of stormwater and treated wastewater inputs to flow stressed waterways under a changing climate.

Project ID	Title	Description
A3P_12	Understanding whether Melbourne Water assets are potential 'ecological traps'	Ecological traps occur in landscapes where animals are attracted to sites but those sites result in either mortality of animals or reduced fitness. Previous research by Melbourne Water ad The University of Melbourne has identified stormwater wetlands as potential ecological traps for some frogs and fish. This research project would evaluate a range of Melbourne Water management activities, whether they have the potential to cause unexpected impacts on environmental values, and identify potential design, maintenance or planning controls to remove ecological traps.
A3P_13	Threats from pesticides and other sediment contaminants to key environmental values in rural areas	This project will focus on understanding threats from pesticides and other sediment contaminants for waterways where high values (e.g. macroinvertebrates, platypus) intersect with rural land use. It could also consider improved metrics used to estimate the effectiveness of site scale agricultural interventions to reduce sediment, nutrient and pesticide run-off to protect waterway health.
A3P_14	Prioritisation framework to guide litter management interventions	This project would build on existing A3P research to develop a prioritisation framework to guide litter management interventions e.g. litter trap installation, routine clean-ups. It is likely a 1-2 year project to identify a range of useful datasets (litter monitoring data, landuse, drainage areas, human movement data) and indicators that could be summarised and combined to determine litter management priorities and set management targets. This project will focus on the design of the tool, with tool software development likely to be delivered by IT specialists.
A3P_15	Quantifying risks from industrial activities and associated impacts on water quality within waterways	This research project will assess the types, levels and major sources of pollutants in industrial areas across the region to identify pollution hotspots and priority pollutants and options for management. Will inform priority areas for project A3P_6.
A3P_MWRPP_1	Develop methods, metrics and strategic management frameworks for waterway function as a key environmental value	Investigate and develop monitoring methods and metrics to enable the inclusion of waterway function as a key environmental value (e.g. nutrient and carbon processing) in future waterway strategies, as well as helping to prioritise waterway management interventions and setting of strategic targets that can be part of the HWS MERI Framework. One aspect that A3P could incorporate is the threat of toxicants to waterway function.
A3P_MWRPP_2	Measuring pollutant treatment performance of Water Sensitive Urban Design (WSUD) assets	In addition to stormwater wetland performance project above, this project aims to develop efficient and effective indicators and approaches to monitor the pollutant treatment performance of other WSUD assets (e.g. biofilters, green roofs, raingardens, passively irrigated street trees) to inform improved designs, appropriate maintenance regimes and long-term sustainability.
A3P_MWRPP_3	Understanding the treatment of toxicants by stormwater wetlands as well as the effect of toxicants on wetland performance	Includes developing efficient and effective indicators of performance, to support industry guidelines, improve future design and underpin asset maintenance prioritisation. Research will be based on contaminants that Melbourne Water are most concerned about (e.g. zinc, pesticides, microplastics), extent to which these chemicals are removed by wetlands, implications for maintenance and disposal costs, and wetland treatment performance (e.g. biofilms, sediment bacterial communities). Includes economic, social and environmental risk assessment of pollutant accumulation.
A3P_MWRPP_4	Understanding the threat of climate change to water quality in waterways to inform mitigation opportunities	This project will seek to understand the threat of climate change to water quality in waterways and key environmental values most vulnerable to changes in water quality. In particular, it will look to determine critical thresholds for relevant species, in response to changes to temperature, dissolved oxygen, salinity and flow. This information could be combined with modelling approaches to predict impacts of climate change across the region and likely benefits of management interventions.