



Ferry Operations Development Application

METRONET on Swan Ferry Service Expansion

Public Transport Authority of Western Australia

Prepared by:

SLR Consulting Australia Pty Ltd

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Basis of Report

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Public Transport Authority of Western Australia (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid. SLR may have used AI in the preparation of this document.

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Executive Summary

The Public Transport Authority of Western Australia (PTA) is seeking development approval for the operation of the METRONET on Swan Ferry Service Expansion (MOSFSE), a major public transport initiative that will expand ferry services on the Swan River through the introduction of five new electric ferries operating between Elizabeth Quay, Matilda Bay and Applecross. This application relates only to the operation of ferry services on the river. The new and upgraded ferry terminals required to support the service have already been approved through separate planning processes.

The project has been developed to improve cross-river connectivity, provide additional public transport choices, support growing riverside communities and activity centres, reduce pressure on the road and rail network, and enhance public access to the Swan River. The expanded service will connect key destinations including the Perth CBD, the University of Western Australia, the Queen Elizabeth II Medical Centre precinct and Applecross. The service is also expected to support tourism and provide more opportunities for people to enjoy and experience the Swan River.

Proposed Ferry Operations

The proposed service will utilise five fully electric ferries designed and constructed in Western Australia. The vessels will accommodate up to 100 passengers, provide accessible facilities, bicycle storage and onboard amenities, and operate using zero-emission electric propulsion technology. Compared with conventional diesel-powered ferries, the vessels are expected to generate lower noise levels, eliminate fuel emissions during operation, and reduce risks to marine fauna through the use of waterjet propulsion systems rather than propellers.

From a public transport perspective, the PTA's objective is to provide the highest service frequency that is reasonably practicable, recognising that frequency is a key driver of patronage, convenience, and network competitiveness.

The proposed ferry route has been developed through extensive consultation with river user groups, government agencies and technical specialists. A primary operating route is proposed together with alternative route options that provide flexibility to respond to changing river conditions, special events, marine wildlife presence, safety requirements and other operational considerations. Final route alignments and operating parameters will be refined through ongoing consultation, vessel testing and regulatory approvals before the service commences.

Subject to speed exemptions being granted, the PTA intends to operate ferries approximately every 25 minutes between 6:00 am and midnight, providing a regular and reliable cross-river public transport connection. Project timetables will be finalised upon confirmation of operational speeds, completion of sea trials, and finalisation of the charging strategy. Travel times between Elizabeth Quay and Matilda Bay, and between Matilda Bay and Applecross are expected to be around 15 minutes. A full return loop between Elizabeth Quay, Matilda Bay and Applecross is expected to take approximately one hour and 15 minutes.

Four vessels are proposed to berth overnight at Barrack Street Jetty, with one vessel berthed at Matilda Bay.

Speed Exemption Process

The PTA intends to seek several speed exemptions from the Department of Transport and Major Infrastructure (DTMI) to support service reliability and operational efficiency. The proposed speed exemptions seek to improve travel times, service reliability and provide a



competitive ferry service whilst considering the appropriate controls for social and environmental impacts. These include an exemption to permit ferry operations above the standard 10-knot night-time speed restriction in open-water areas and potential exemptions in selected 8-knot speed restriction areas where additional speed may be required to maintain timetable reliability and improve travel times.

Any proposed speed exemptions will be subject to separate assessment by DTMI through an Aquatic Use Review process that considers navigational safety, existing recreational and commercial river activities, environmental impacts and community feedback.

Regardless of any exemptions granted, ferry operators will remain subject to all marine safety obligations, including collision avoidance requirements and safe navigation practices. This application assesses a range of operating scenarios and service frequencies, recognising that changes in vessel speed and service frequency may influence the nature and extent of potential impacts considered under the Swan and Canning Rivers Management Act (SCRM Act).

Supporting Documents

Extensive studies have been undertaken to understand the environmental, social, cultural and operational implications of the proposed ferry operations. These investigations include a Ferry Wake Shoreline Impact Assessment, an Operational Noise Assessment and a comprehensive Environmental Assessment Report. Together, these studies conclude that the ferry service can operate while maintaining the environmental, recreational and cultural values of the Swan-Canning river system, provided the recommended management measures are implemented.

Environmental assessments identified that most sections of the proposed ferry route are already influenced by natural wind-driven waves and existing river activities, and that ferry wake impacts are generally expected to be low. Some shoreline locations may experience modest increases in wave energy under higher-speed operating scenarios, particularly at sections of the Perth foreshore, Mill Point, and parts of the Como shoreline and Pelican Point (under speed exemption scenarios). However, these locations are already subject to ongoing erosion processes and management requirements. Ongoing shoreline and wake monitoring during initial operations is proposed to identify trends and to implement further shoreline management measures if necessary.

Water quality, seagrass habitat, marine fauna and conservation areas were also assessed. The preferred ferry route has been designed to avoid sensitive habitats wherever possible, and operations will incorporate measures to minimise sediment disturbance, shoreline erosion, waste generation and pollution risks. The assessment found that potential impacts to water quality, benthic habitats, fish, dolphins and other aquatic species are expected to be localised and minor. Importantly, the ferries will not operate within the Swan Estuary Marine Park and will maintain separation distances from sensitive environmental areas.

Noise assessments concluded that underwater noise generated by ferry operations is expected to remain well below thresholds associated with injury to marine mammals and fish. Predicted impacts are limited primarily to minor, short-term behavioural responses in the immediate vicinity of a vessel and are not expected to result in significant ecological effects.

The project has incorporated extensive stakeholder consultation throughout its planning and design. Since 2024, engagement has been undertaken with local governments, river user groups, community representatives and other stakeholders. A dedicated Waterways Stakeholder Reference Group comprising representatives from 21 water-based organisations has played an important role in refining ferry routes, identifying safety



considerations and helping to minimise conflicts with existing river uses. Ongoing consultation will continue during implementation and operation of the service.

The PTA has also undertaken dedicated engagement with the Whadjuk Noongar community. A Whadjuk Cultural Advisory Working Group has been established to share cultural knowledge, provide advice, and contribute to enhancing the cultural outcomes of the Project. Separate Aboriginal heritage approvals have been obtained, and cultural heritage management measures will continue to guide project implementation.

A draft Operational Plan has been prepared and included with this application. It is anticipated the Operational Plan, and an Operation Environmental Management Plan will be finalised in consultation with the Department of Biodiversity, Conservation and Attractions (DBCA) prior to commencement of operations.

Planning Assessment

This development application has been assessed against the requirements of the *Swan and Canning Rivers Management Act 2006*, relevant DBCA policies, locality plans and State Planning Policies. The assessment concludes that the proposal is consistent with these frameworks and aligns with broader State objectives for sustainable transport, environmental stewardship, community access and long-term river management.

Overall, the MOSFSE represents a significant investment in sustainable public transport infrastructure for Perth. The project will provide new travel choices, improve river accessibility, support economic activity and tourism, and contribute to the activation of riverfront precincts while incorporating measures to protect the environmental, cultural and recreational values of the Swan River. Subject to the implementation of the proposed management and monitoring measures, the assessment concludes that the ferry operations can proceed with no significant adverse impacts on the Swan-Canning river system and should be supported.



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Acronyms and Abbreviations

AHA Act	<i>Aboriginal Heritage Act 1972</i>
ALS	Aboriginal Land Services
AUR	Aquatic Use Review
BCH	Benthic Communities and Habitat
CALM Act	<i>Conservation and Land Management Act 1984</i>
CCW	Conservation Category Wetland
CD	Chart Datum
CPRS	Central Perth Redevelopment Scheme
CPS 42	Corporate Policy Statement No. 42: Planning for Land Use, Development and Permitting Affecting the Swan Canning Development Control Area
CPS 52	Corporate Policy Statement 52: Planning for Localities along the Swan Canning Development Control Area
CTP	Continuous Turbidity Profilers
DBCA	Department of Biodiversity, Conservation and Attractions
DFES	Department of Fire and Emergency Services
DTMI	Department of Transport and Major Infrastructure
DWER	Department of Water and Environmental Regulation
EPA	Environmental Protection Authority
EP Act	<i>Environmental Protection Act 1986</i>
ESA	Environmentally Sensitive Area
HCWA	Heritage Council of Western Australia
LAT	Lowest Astronomical Tide
MOSFSE	METRONET on Swan Ferry Service Expansion
MRA Act	<i>Metropolitan Redevelopment Authority Act 2011</i>
MRS	Metropolitan Region Scheme
OEMP	Operation Environmental Management Plan
ONA	Operational Noise Assessment
PMST	Protected Matters Search Tool
PTA	Public Transport Authority of Western Australia
PSP	Principal Shared Path
SCDCA	Swan Canning Development Control Area
SCRM Act	<i>Swan and Canning Rivers Management Act 2006</i>
SIA	Shoreline Impact Assessment
SRT	Swan River Trust
SPP 2.0	State Planning Policy 2.0 – Environment and Natural Resources Policy
SPP 2.6	State Planning Policy 2.6 – Coastal Planning



SPP 2.9	State Planning Policy 2.9 – Water
SWALSC	South West Aboriginal Land and Sea Council
TPAE	Transport Portfolio Aboriginal Engagement
UWA	University of Western Australia
WAPC	Western Australian Planning Commission
WAC	Whadjuk Aboriginal Corporation
WSRG	Waterways Stakeholder Reference Group



1.0 Introduction

This report has been prepared by SLR Consulting (SLR) on behalf of the Public Transport Authority of Western Australia (PTA) in support of a development application for the ferry operations which are proposed to be carried out on the Swan River as part of the State Government's METRONET on Swan Ferry Service Expansion (MOSFSE). The MOSFSE includes the procurement of five (5) new electric ferries which will be operated by Transperth on the expanded route.

The expansion of the ferry service on the Swan River is designed to meet the needs of a growing city, supporting the densification and activation of riverside precincts and increasing accessibility across the river. In this regard, the Swan River represents a significant natural barrier which segments Perth's regions, with limited river crossings in place to facilitate cross river movements. Whilst the city's train and road-based networks are vital components of Perth's transportation system, these modes frequently encounter capacity constraints during peak periods. In response, the MOSFSE is proposed to:

- Improve accessibility across the river, thereby facilitating urban revitalisation and densification at river nodes.
- Facilitate efficient transit across the natural divide of the river.
- Provide a sustainable adjunct to the existing transportation network, with the capacity to mitigate infrastructure strain and enhance overall mobility.
- Provide expeditious and sustainable travel alternatives for both commuters and tourists.
- Capitalise on the inherent aesthetic and recreational value of the Swan River, enhancing tourism opportunities and associated economic growth around river nodes.
- Support inner-city development in areas such as Applecross and Crawley through improved connectivity and network capacity.
- Provide an affordable opportunity for the community to experience the Swan River.

This report has been prepared to provide an overview of the Swan and Canning river context and the ferry service proposal, as well as an assessment against relevant planning framework requirements and an examination of the merits of the proposal. The application is also accompanied by a range of detailed plans and technical documents, as discussed throughout this report.

This application seeks approval for the operation of five electric public ferry vessels on the Swan River. The proposed ferry service will operate between terminals at Matilda Bay, Applecross and Elizabeth Quay, with overnight berthing occurring at the Barrack Street jetties and the Matilda Bay terminal. The proposal, including the route, vessel, timetable, operations and safety, and overnight berthing, are described in greater detail at section 4.0 of this report.

Development applications for two (2) new ferry terminals at Matilda Bay and Applecross and upgrades to the terminal at Elizabeth Quay have recently been approved by the Western Australian Planning Commission (WAPC) and DevelopmentWA respectively. As such, this proposal does not include any physical works or landside operations and relates to the ferry operations on the Swan River only.



1.1 Project Team

The MOSFSE is a State Government initiative. The PTA is leading the process to obtain the development approval for the on-river ferry operations on behalf of the State.

The PTA has engaged a highly qualified specialist consultant team to progress this development application submission, as detailed in Table 1 below.

Table 1: Technical Consultant Team

Consultancy	Project Role
SLR	Planning; Acoustic Engineering
AECOM	Environmental Impact Assessment
Seashore Engineering	Coastal Engineering

1.2 Development Approval Pathway

The area of ferry operations is wholly contained within the Swan Canning Development Control Area (SCDCA). Therefore, in accordance with Clause 69(1) of the *Swan and Canning Rivers Management Act 2006* (SCRM Act), development approval is required under Part 5 of the SCRM Act.

Whilst commercial activities carried out in the SCDCA (i.e. charters and tours) require a Commercial Activities Permit from DBCA, this process is not applicable to the MOSFSE because it is not a commercial activity.

1.3 Related Approval Processes

The PTA has separately progressed or, is continuing to progress, a range of related approvals for the proposal. This includes approvals required pursuant to:

- Part 10, Clause 27 of the Metropolitan Region Scheme (MRS) for development undertaken on reserved land and pursuant to Clause 45 of the MRS, for development located partially within the SCDCA.
- The Matilda Bay and Applecross Ferry Terminal development applications were lodged in September 2025, with the Western Australian Planning Commission (WAPC) approving the Matilda Bay and Applecross Ferry Terminals at its meeting held on 11 December 2025.
- Part 6 of the *Metropolitan Redevelopment Authority 2011* (MRA Act), which requires development approval for development in a redevelopment area.
- A development application for the proposed new works at Elizabeth Quay, including a new floating pontoon and an additional passenger boarding area was lodged with Development WA in October 2025. A development approval was issued for these works in December 2025.
- Section 18 of the *Aboriginal Heritage Act 1972* (AHA Act), to address the intersection of the project with registered Aboriginal Cultural Heritage Site 3536: Swan River.
- The PTA received Section 18 consent pursuant to the AHA Act in March 2026. The Section 18 consent requires that works are undertaken in accordance with the METRONET on Swan Ferry Service Expansion: Perth to Applecross Cultural Heritage Management Plan (PTA 2025) which outlines measures for the survey and protection of Aboriginal Cultural Heritage.



- Section 38 (Part IV) of the *Environmental Protection Act 1986* (EP Act) for consideration of the potential for significant environmental impacts.
- The MOSFE, including the proposed ferry operations, was referred to the Environmental Protection Authority (EPA) under Section 38 (Part IV) of the EP Act on 19 September 2025. On 24 October 2025, the EPA published the decision not to assess the MOSFE proposal on the basis that the likely environmental effects of the proposal are not so significant or unmitigated as to warrant formal assessment under Part IV of the EP Act.
- Part V Division 2 of the EP Act relating to the clearing of native vegetation.
- The PTA submitted a Native Vegetation Clearing Permit (NVCP) to seek approval to disturb up to 0.63ha of seagrass and macroalgae for the construction and installation of new jetty and ferry terminal infrastructure at the Matilda Bay and Applecross sites. The NVCP was granted in February 2026.
- The *Conservation and Land Management Act 1984* (CALM Act), which identifies the Swan and Canning Rivers (R 48325 and R 48327) vested with the Swan River Trust for the purpose of protecting and enhancing the environment and community amenity value.

These matters are subject to separate legislative frameworks and hence are being progressed separately and in parallel to the approval requirements for on river ferry operations under Part 5 of the SCRM Act.

2.0 Project Overview

2.1 Background

Historically, the Perth ferry service dates back to 1831, when a boat first connected Guildford and Fremantle. By 1836, a more regular service had been established between Fremantle and Perth, and in 1897, the Swan River Ferry Company commenced operations, thereby rendering ferries an integral component of transport on routes to South Perth, Applecross, and Como.

In 1912, the Western Australian Government assumed control of the ferry service, although the subsequent emergence of alternative transport modes led to periods of decline in ridership.

The current ferry service operates between Elizabeth Quay and South Perth (Mends Street) with a one-way journey time of approximately eight minutes, which is considerably shorter than the fifteen minutes typically required by road during peak hours. This efficient service highlights the potential of ferries as an effective alternative that reduces travel time and alleviates pressure on overextended road networks.

Of note, patronage on the existing ferry service in 2024–25 exceeded 935,000 boardings, the highest level of usage on record, compared to approximately 561,000 in 2019–20, with a 140% increase over the last decade.

The expansion of a ferry service in Perth's river system has been the subject of interest and study for several decades, involving multiple governmental departments and local councils. This reflects the long history of successful multi-destination ferry network operations in other Australian cities, including on Sydney Harbour and the Brisbane River. Previous work examining the potential expansion of Perth's ferry network has included:

- Swan and Canning Rivers Ferry Study (1990) which suggested a ferry service between Nedlands, Como, Applecross and Barrack Square.



- Feasibility Study of Ferry Services on the Swan River (1993) which suggested three (3) routes: Point Walter to Applecross to Perth; Point Walter to Claremont; and Crawley to Applecross to Canning Bridge to Como.
- Additional Ferry Services on the Swan and Canning Rivers (2000) which investigated the feasibility of extending ferry services on the Swan and Canning rivers (seven routes).
- Additional Swan River Ferry Service (2013) which assessed the patronage potential of a proposed new ferry service between Canning Bridge, the University of Western Australia (UWA) and Barrack Square. It suggested both actual and perceived travel times would be quicker by ferry than by the current train/bus or bus/bus. The ferry would therefore have the potential to capture a significant percentage of the public transport patronage to UWA.
- Perth's Ferry Services – Current Status and Future Use (2019):
 - Suggested 56 ferry terminals along the Swan and Canning Rivers, such as Canning Bridge, Applecross Raffles and Crawley.
 - Highlighted the dual nature of Perth's ferry services, including government-operated routes primarily for commuters and commercially operated services targeting tourists.
 - Highlighted the positive public perception of ferries as a comfortable mode of transport, being especially appealing to tourists.
- In 2022-24, the PTA and WA Transport Portfolio Strategic Office developed:
 - A high-level feasibility study and strategic business case confirming the viability of the MOSFSE. It documented environmental, social, and economic benefits, along with the ease of implementation of an expanded service.
 - An expression of interest was released by the PTA in 2024 to understand from the local industry the capability and capacity to deliver electric or hybrid vessels that would be suitable to deliver the expanded services. In line with the WA State Government's climate policy and ambitions to achieve a net-zero public transport network by 2050, electric vessels were nominated in the strategic business case.

2.2 Ferry Service Expansion

The MOSFSE is being jointly funded by the State and Federal Governments, with the State Government announcing their commitment to the project in January 2025 and the Federal Government confirming their support for the project in April 2025.

The MOSFSE will provide more public transport options on the Swan River to meet the needs of a growing city, improving cross river connectivity, supporting the densification and activation of riverside precincts and improving efficient multimodal integration. In addition, the MOSFSE will increase mode choices for visitors and enhance tourism related economic development opportunities at tourism nodes.

The MOSFSE will include new ferry terminals at Matilda Bay and Applecross (approved by the WAPC in December 2025) and expanded capacity at the existing Elizabeth Quay ferry terminal (approved by Development WA in December 2025), which services the current South Perth ferry service.

The new Matilda Bay ferry service will service UWA, which is projected to increase from 28,000 staff and students in 2021 to 45,000 in 2051, as well as the Queen Elizabeth II Medical Centre (QEII) Precinct, which is recognised as a specialised activity centre in the



State Planning Framework and is acknowledged as having significant potential for employment, economic development and housing growth.

The new Applecross ferry service has been selected due to its proximity to existing high density development that has occurred in this area, the planned additional development that is yet to occur, along with its location proximate to existing retail development on Canning Highway, the riverside Principal Shared Path (PSP) which facilitates active transport use and bus services on Canning Highway.

The MOSFSE includes five (5) new electric ferries which will run from Elizabeth Quay to Matilda Bay and then Applecross, prior to returning to Matilda Bay and then Elizabeth Quay, as shown in Figure 1. This full loop is estimated to take approximately one (1) hour and 15 minutes. In late 2025, the WA Government awarded a \$66 million contract to Henderson-based ship building company, Echo Marine Group to design and construct the five (5) new electric ferries.

Ferry patronage modelling has been undertaken by DTMI in their Strategic Transport Evaluation Model (STEM) model (used for all major projects in WA) to estimate annual passenger trips at both existing and proposed ferry terminals. This modelling indicates that ferry patronage is expected to grow year on year.

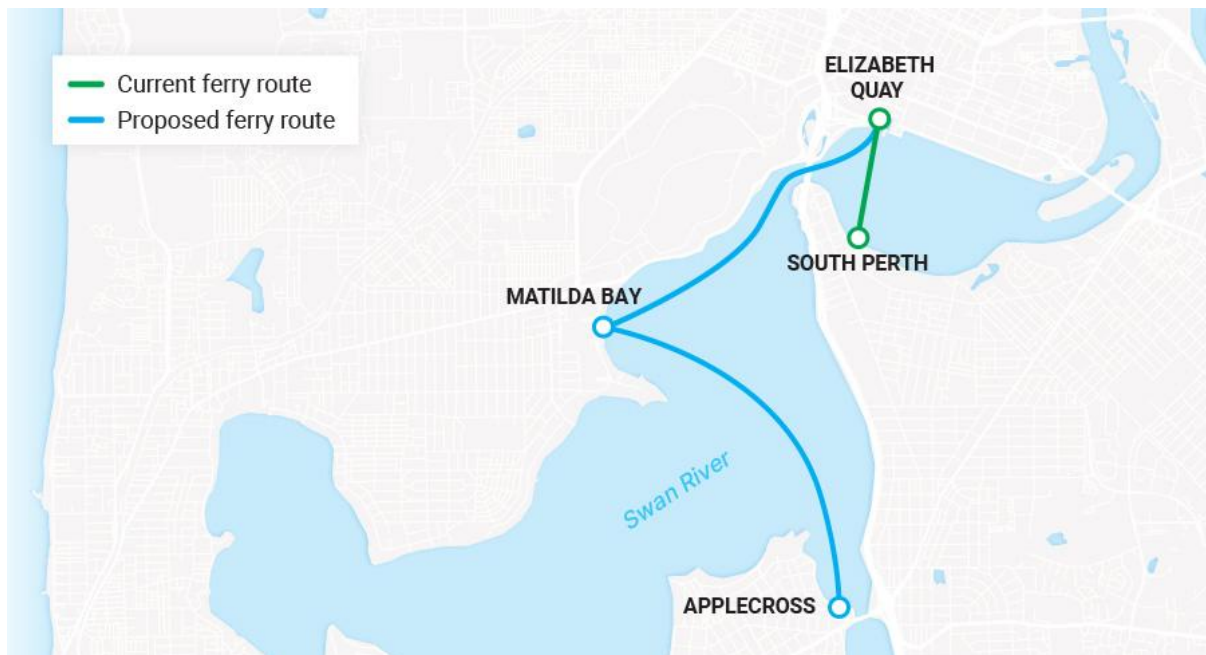


Figure 1: Ferry Expansion Project – Stylised ferry route between Elizabeth Quay, Matilda Bay and Applecross, in addition to the existing South Perth ferry route

The METRONET on Swan Ferry Service Eastern Expansion is also under early investigation, with the Western Australian Government committing \$10 million towards planning of an extension of the ferry service to key riverside locations such as Point Fraser, Burswood, Optus Stadium, Claisebrook, Belmont, Rivervale and Maylands. The DTMI and the PTA are completing various related technical studies, including environmental, planning, patronage and existing water-use investigations. These investigations will inform future delivery funding considerations. The Eastern Expansion of the ferry service does not form part of this application.



2.3 Approved Ferry Terminals

As outlined at section 1.3, the PTA has separately progressed, in parallel, a number of other related approvals that are required to support the MOSFSE under separate legislation. This has included three (3) separate development applications for new and/or expanded ferry terminal facilities including:

- A new Matilda Bay ferry terminal and associated public realm and road network upgrades.
- The new Applecross ferry terminal and associated public realm works.
- The expanded ferry terminal facilities at Elizabeth Quay.

The Elizabeth Quay, Matilda Bay and Applecross terminal works are scheduled for completion in time for the expanded ferry service to commence operations at the end of 2027.

It is noted that up to four (4) of the new electric ferries will be berthed overnight at the existing facilities at Barrack Street Jetty, which is managed by DTMI. Any infrastructure modifications that may be necessary at Barrack Street Jetty will be subject to a separate permit or approval (if and as required). Any approvals that may be required at Barrack Street Jetty, are excluded from this development application.

2.4 DTMI Speed Exemptions

The Swan and Canning Rivers are subject to gazetted speed restrictions in a number of areas, discussed further in section 3.2. Should alternative speeds be proposed, DTMI must approve an 'exemption' from marine safety legislation requirements (including speed) under the *Western Australian Marine Act 1982* to allow an activity to operate outside normal marine safety rules in specific circumstances, where the need is justified and risks are managed.

PTA intends to apply to DTMI's Navigational Safety team for an exemption from *Navigable Waters Regulations 1958* regulation 19A, which requires operating speeds to not exceed 10 knots from sunset to sunrise to accommodate a consistent ferry operation at nighttime.

Additional exemptions are proposed to be sought within the 8 knot speed restriction areas (see Figure 4) to improve the reliability of ferry operations by allowing vessels to meet the scheduled timetable after needing to slow or vary the ferry route in response to safety considerations or inclement weather. Importantly, the proposed 30-minute scheduled ferry timetable does not rely on the proposed additional speed exemptions.

If granted, an exemption would also require the ferry and ferry operator to adhere to any related conditions applied by DTMI.

Exemptions and associated conditions will be informed by the outcomes of an Aquatic Use Review (AUR) to be conducted by DTMI along with the findings of any other relevant studies, including wake and wave modelling. The AUR is a formal assessment carried out by DTMI to examine how a waterway is currently used and how it should be managed into the future, including to address identified safety, access or use issues. These reviews are informed by consultation with government agencies, stakeholders and the public, with proposed changes refined based on feedback received in these referrals before being implemented. It considers existing activities, safety risks, and competing uses of the water (e.g. boating, swimming, water-skiing). An AUR may recommend updates such as:

- Changes to speed zones or exclusion areas
- Adjustments to activity zones (e.g. water--skiing areas)
- Introduction of new safety controls or navigational aids



- Updated access arrangements for different vessel types

It is noted that whilst an exemption granted under the *Western Australian Marine Act 1982* provides a conditional departure from specific statutory requirements, it does not displace the overarching application of the *Collision Regulations (Prevention of Collisions in State Waters Regulations 1983 (WA))* and the fundamental obligation for all vessel operators to take all necessary action to avoid a collision.

Any speed exemption granted from the DTMI Maritime is applied to a specific vessel (or class of vessels) and its operator under an instrument of exemption. It does not grant a blanket waiver for any boat or operating agency. The speed exemption application will not be submitted until the new vessels have undertaken sea trials and acceptance through Australian Maritime Safety Authority (AMSA) survey. This will occur after the development application process for this Part 5 SCRM Act application has been completed. Therefore, the final route, speed and other operational matters related to the ferries, as outlined in this development application may be subject to change, pending the outcome of the AUR and speed exemption application processes.

If this occurs subsequent to a development approval being issued for the ferry operations, and the change has a consequential impact on the assessment of the application, PTA is aware that an application for a minor amendment to the relevant development approval may be required.

2.5 Stakeholder engagement

Effective stakeholder engagement is critical to the successful delivery of the MOSFSE.

Early stakeholder engagement has been conducted from October 2024. This has been carried out by the PTA and DTMI Maritime's communications and engagement teams, in conjunction with PTA's Project Managers and DTMI's Manager Navigational Safety.

Feedback received through the Waterways Stakeholder Reference Group (WSRG) from water user groups and representative bodies has been considered when developing the planned ferry operations.

Further stakeholder engagement via the WSRG will be undertaken in the lead up, during, and beyond the statutory advertising period for this development application. Additionally, it will provide a dedicated forum to facilitate feedback during the initial operations.

A Stakeholder Engagement Summary is attached as Appendix F and a Communications Action Plan for this application is attached as Appendix G.

2.5.1 Early engagement

Early stakeholder engagement focussed on introducing the proposed ferry service and gathering feedback during the feasibility and preliminary planning stages. The engagement targeted tier one stakeholders, including river user groups, localised land-based organisations and local governments through face-to-face briefings, information sessions, workshops, and follow-up communications, culminating in the announcement of the ferry service as an election commitment and the specific terminal locations for Matilda Bay and Applecross being announced.

During this early engagement, stakeholders raised concerns about safety, environmental impacts, and the usability of highly activated areas such as Matilda Bay. Many river-user groups in the Matilda Bay area expressed concern about collision risks with other watercraft and the disruption of on-water activities for existing clubs and water users. Residents in the Applecross area near the proposed terminal raised issues about visual amenity, noise, and security.



There were also several opportunities for the public to attend pop-up information sessions on the terminals and ferry service at Matilda Bay and Applecross as part of the ferry terminal; development application advertising period in October 2025. The feedback received during early engagement has been carefully considered and, where feasible, incorporated into project planning and design, helping to inform key project decisions.

This initial consultation process established a foundation for ongoing collaboration as the project progresses.

2.5.2 Waterways Stakeholder Reference Group

Following early engagement, DTMI and PTA established a WSRG in mid-2025 to provide an ongoing forum for engagement with water user groups. The WSRG comprises representatives from 21 water-based organisations and peak bodies, with eight meetings held to date, supplemented by targeted discussions with individual stakeholder groups where required.

The WSRG facilitates collaboration on navigational safety, operational matters and equitable access to the river, enabling water user groups to identify concerns, provide advice and contribute to the development of appropriate management measures.

A key focus of the group's work has been the identification and refinement of a preferred ferry route, whereby water user groups developed and evaluated route options based on their operational knowledge and local conditions, supported by navigational expertise and bathymetric data provided by DTMI.

The WSRG preferred route generally aligns with the route proposed as part of this development application at Appendix C.

More details about the WSRG process and route development, including group members and preferred route key considerations, are included in the Stakeholder Engagement Summary at Appendix F.

The preferred ferry route continues to be refined through ongoing consultation and negotiation with WSRG members, with the objective of achieving a balanced outcome that supports the safe and continued use of the river by all users whilst considering operational and environmental impacts. Through this process, members will contribute their collective river experience and considerations to help inform the assessment of the route options.

The WSRG will remain active throughout project development and the introduction of ferry operations, providing a mechanism for ongoing stakeholder input into safety measures, operational procedures and risk mitigation strategies.

2.5.3 Development application public comment

During assessment of this application, the DBCA will make the application and associated documents available for public viewing and feedback on two separate occasions.

The Communications Action Plan (Appendix G) sets out the PTA and DTMI approach to communicate with the public and stakeholders to support the development application process and ensure communications are coordinated and effective.

Actions to support the application's public comment processes are as follows:

- Direct interested parties to the DBCA online feedback portal that will be live on the opening day of the public comment period for a period of approximately four weeks.
- Information and Frequently Asked Questions on the PTA website.
- Newspaper advertisements.



- Electronic direct mail to project subscribers.
- Targeted emails to established key stakeholders.
- Information on the Building for Tomorrow website and social media.
- Briefing sessions with the relevant local Governments.

2.6 Whadjuk Noongar Community Engagement

The PTA, with support from the Transport Portfolio Aboriginal Engagement (TPAE) team, has prioritised culturally appropriate engagement with the Whadjuk Noongar community as a key part of this project.

To support this, PTA has engaged Aboriginal Land Services (ALS) to lead the development and facilitation of a dedicated Whadjuk Cultural Advisory Working Group. This group provides strategic cultural, heritage, and community-based advice to inform the project's direction.

In preparation for this, the PTA, working closely with ALS, has undertaken the following steps:

- Confirmed the importance of early Traditional Owner involvement as part of the project's planning and feasibility phase.
- Initiated discussions with the South West Aboriginal Land and Sea Council (SWALSC) and the Whadjuk Aboriginal Corporation (WAC) to ensure engagement is aligned with recognised cultural governance processes.
- Reviewed cultural advisory models used in other infrastructure projects to identify a fit-for-purpose structure for the MOSFSE.
- Endorsed the proposed engagement approach and supported the development of a Cultural Advisory Working Group.

ALS have established the working group, which comprises senior Whadjuk Traditional Owners identified in consultation with SWALSC and WAC. ALS has managed group formation, provided a draft terms of reference, and coordinated regular meetings over an initial six-month period.

Beyond group facilitation, ALS will offer strategic advice to the PTA as required, supporting broader Aboriginal engagement objectives, including input on placemaking, employment pathways, and procurement strategies.

3.0 Site Description and Context

3.1 Site Description

The proposed ferry will operate on the Swan River within the City of Perth municipal boundary and adjacent to the City of South Perth and City of Melville, between approved terminals at Matilda Bay and Applecross and the existing terminal at Elizabeth Quay. Overnight berthing will be at jetties at No.1 Barrack Square and at Matilda Bay terminal.

The proposed use extends across portions of the land parcels identified in Table 2 below. Certificates of Title for the affected parcels (where relevant) are provided at Appendix A.



Table 2: Certificate of Title Details

Lot	Deposited Plan	Volume	Folio	Street Address	Primary Interest Holder	Responsible Agency
300	047450	LR3151	547	26 Riverside Road, East Fremantle 6158	Swan River Trust	DBCA
301	047451	LR3151	548	171 Riverside Drive, Perth 6000	Swan River Trust	DBCA
310	047439	LR3151	540	N/A	Swan River Trust	DBCA
13017	193785	LR3026	703	N/A	Swan River Trust	DBCA
504	408106	LR3166	579	1 Barrack Square, Perth	Swan River Trust	DBCA

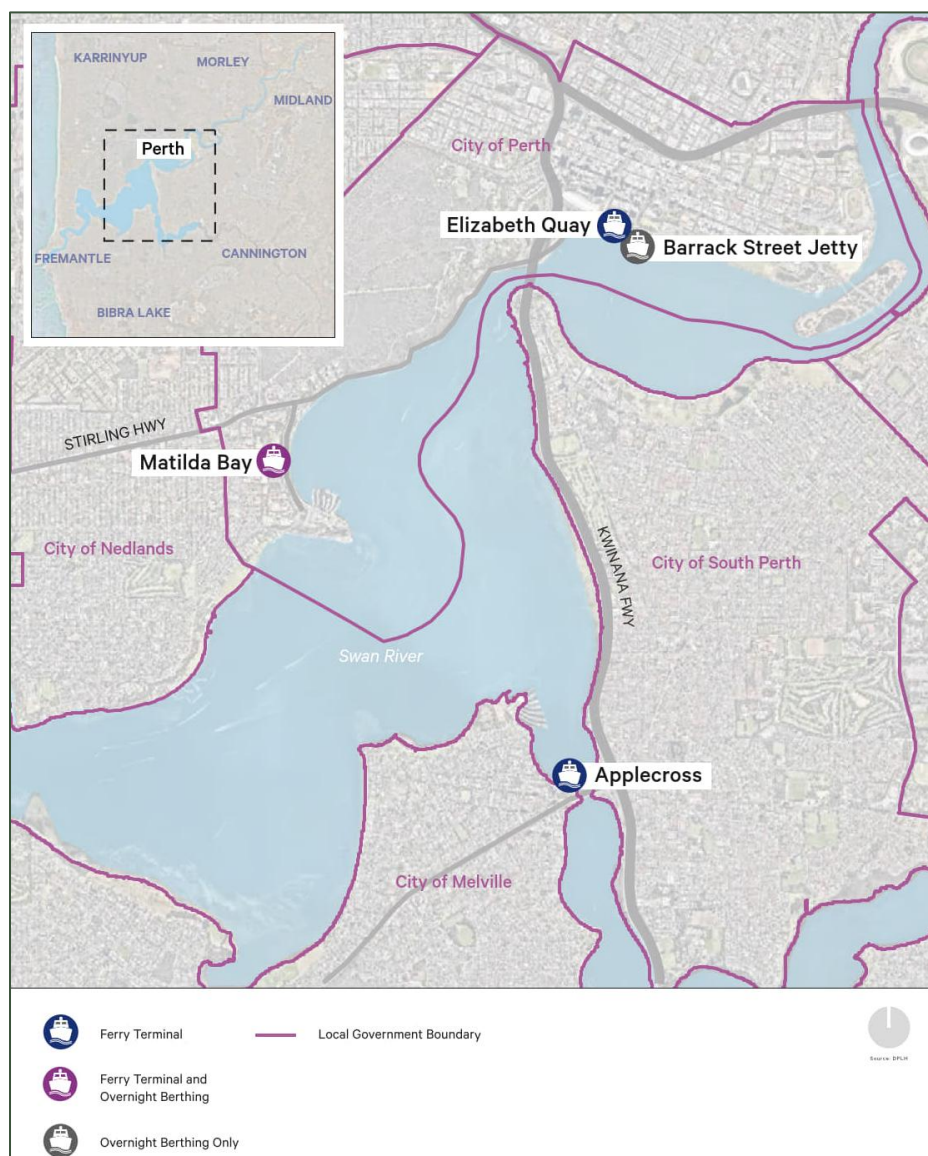


Figure 2: Local Context Plan



Lots 300, 301, 13017 and 504, comprising the waterways of the Swan River, are vested in the Department of Biodiversity, Conservation and Attractions (DBCA) in accordance with Crown Reserve 48325, for the purpose of protecting and enhancing the environment and community amenity value of the Swan and Canning Rivers.

Lot 310, comprising the waterway of the Canning River, is vested in the DBCA in accordance with Crown Reserve 48327, also for the purpose of protecting and enhancing the environment and community amenity value of the Swan and Canning Rivers.

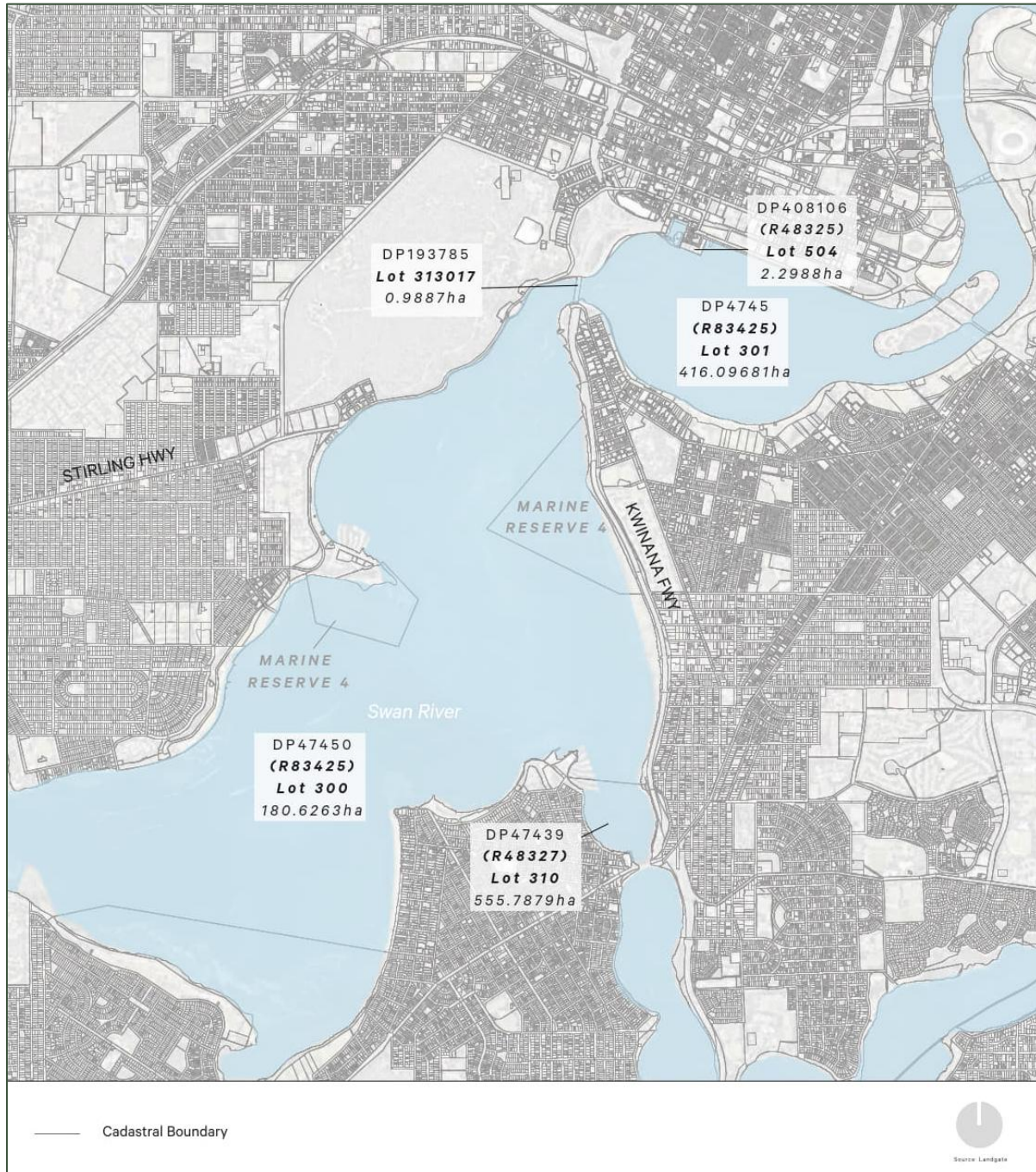


Figure 3: Cadastral Plan



Ferry operations within Elizabeth Quay are excluded from this application. This is because Elizabeth Quay is excluded from the SCDCA and is included in a Metropolitan Redevelopment Area and on this basis development approval is not required to operate ferries within Elizabeth Quay.

3.2 Site Context

The portion of the Swan River subject to this application lies immediately south-west of the Perth CBD and is bordered by the established urban centres of Perth, South Perth, Como, Nedlands and Applecross.

The river corridor is a significant natural system and environmental feature that contributes to the ecological, recreational, and cultural values of the Perth Metropolitan Region.

The surrounding context is characterised by a mixture of urban development, open space, foreshore and marine reserves, recreational facilities, and transport infrastructure. Notable adjoining features include the Elizabeth Quay entertainment precinct, Kings Park, Matilda Bay Reserve, the University of Western Australia, Mounts Bay Road, Kwinana Freeway, and the Applecross foreshore.

The river is used for passive and active recreation, including boating, sailing, rowing, swimming, fishing, and windsurfing, alongside its important role as an ecological and landscape resource.

The proposed routes have been developed with careful consideration of feedback received from existing waterway users. Where practicable, the routes utilise the existing navigational channel between Matilda Bay and Fremantle, while taking into account vessel movements towards the CBD through the Narrows, the effects of frequent ferry operations, including both direct wake and rebounding wave impacts, and local bathymetric conditions. Consideration has also been given to the influence of shallow water depths on wake generation and propagation, as well as potential environmental impacts associated with vessel operations.

The PTA acknowledges that certain aquatic events may require temporary modifications to, or suspension of, normal ferry operations. As standard practice such circumstances will be managed through the Department of Transport Maritime's aquatic event approval process, which assesses and coordinates events that may affect the safe and efficient navigation of vessels on the waterway.

The Swan Canning Riverpark is regulated through a range of navigational and safety management measures, including designated 8-knot speed restriction areas, recreational activity zones (such as personal watercraft freestyling areas) and synchronised navigation markers. These are illustrated in Figure 4.

The locality is highly accessible, benefitting from proximity to major road networks, including Stirling Highway, Mounts Bay Road, Canning Highway and Kwinana Freeway, as well as pedestrian and cycling connections.

The existing public transport network is shown in Figure 5. Elizabeth Quay terminal has good public transport connections, with an existing ferry service to South Perth and access to both train and bus services at the Elizabeth Quay Train and Bus Stations. Applecross is currently underserved, with no train connections other than via Canning Bridge Station on the Mandurah line and a congested traffic network that can impact bus timetables. The Mandurah line is also the busiest in the train network and close to reaching capacity. Matilda Bay similarly has no train connections, relying on buses. Therefore, the proposal will complement the existing public transport network.

Overall, the proposal's location within the central metropolitan area positions it as a key link between major employment, residential, educational, health and recreational destinations.





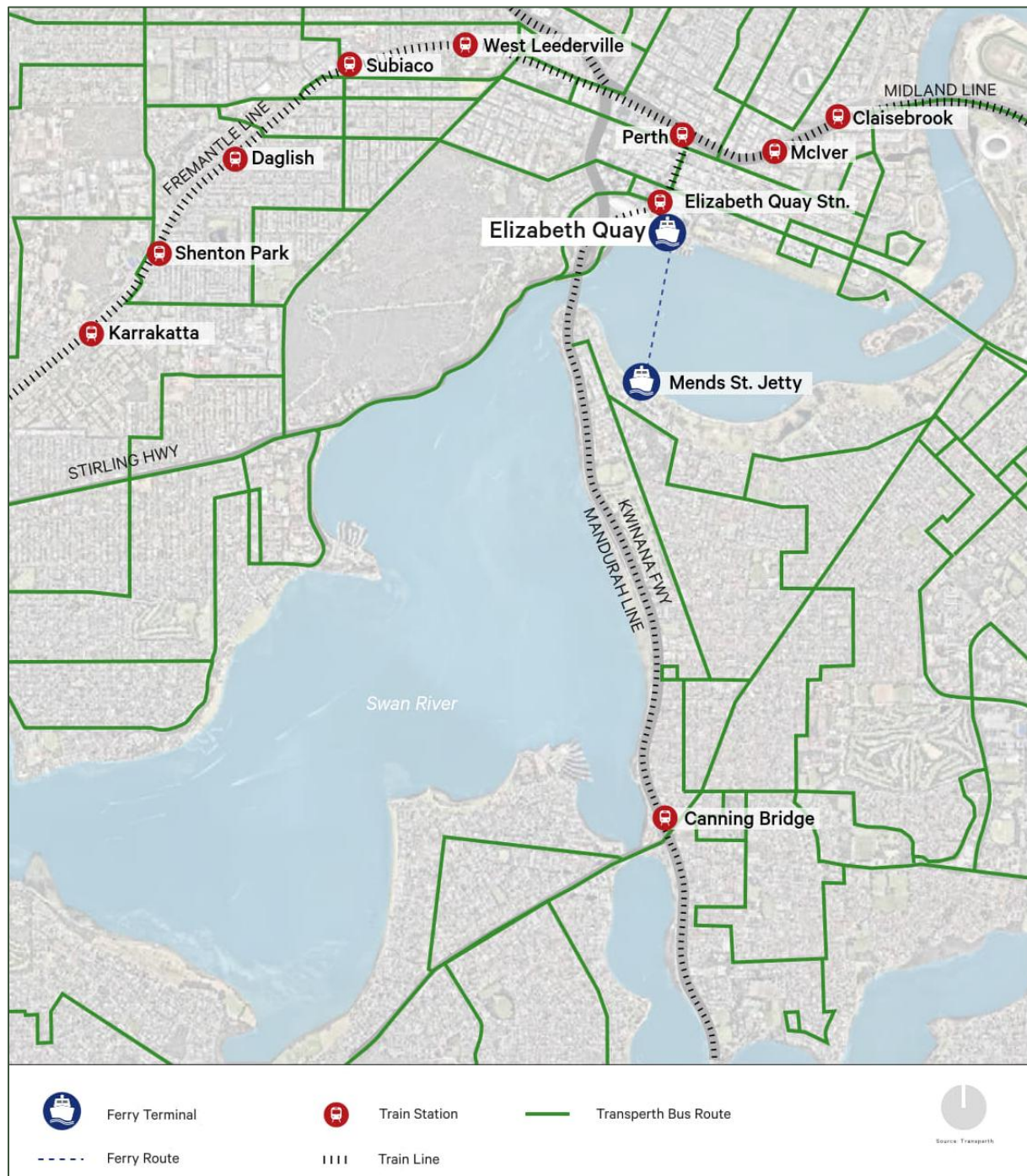
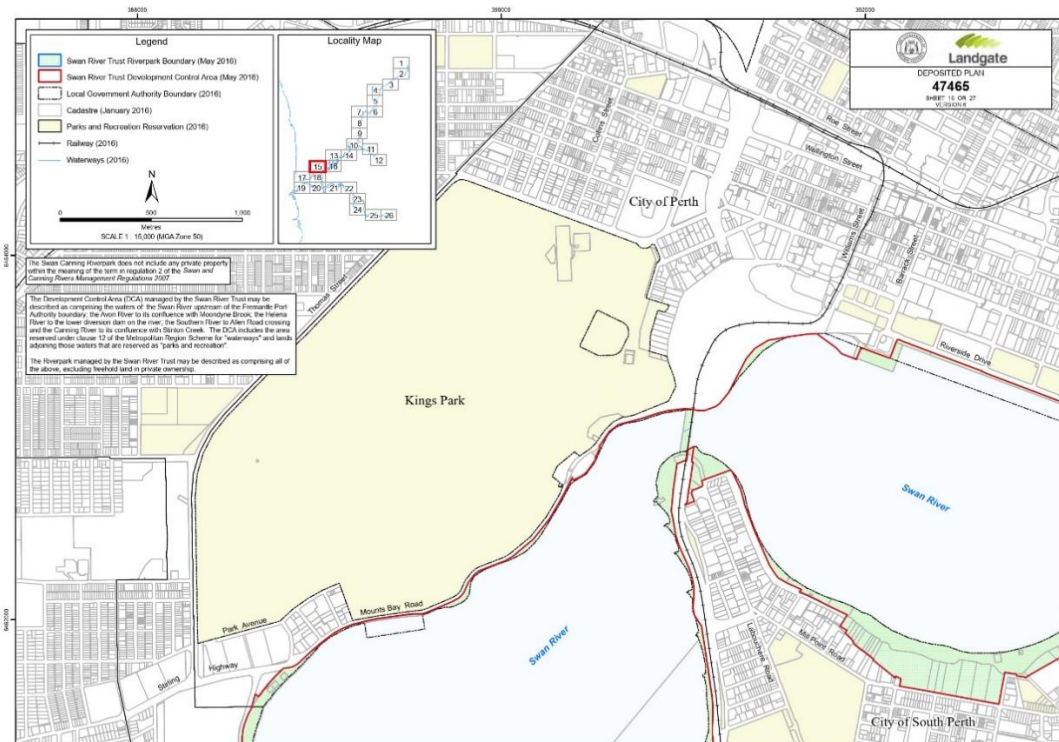


Figure 5: Existing Public Transport Network

3.3 Swan and Canning DCA

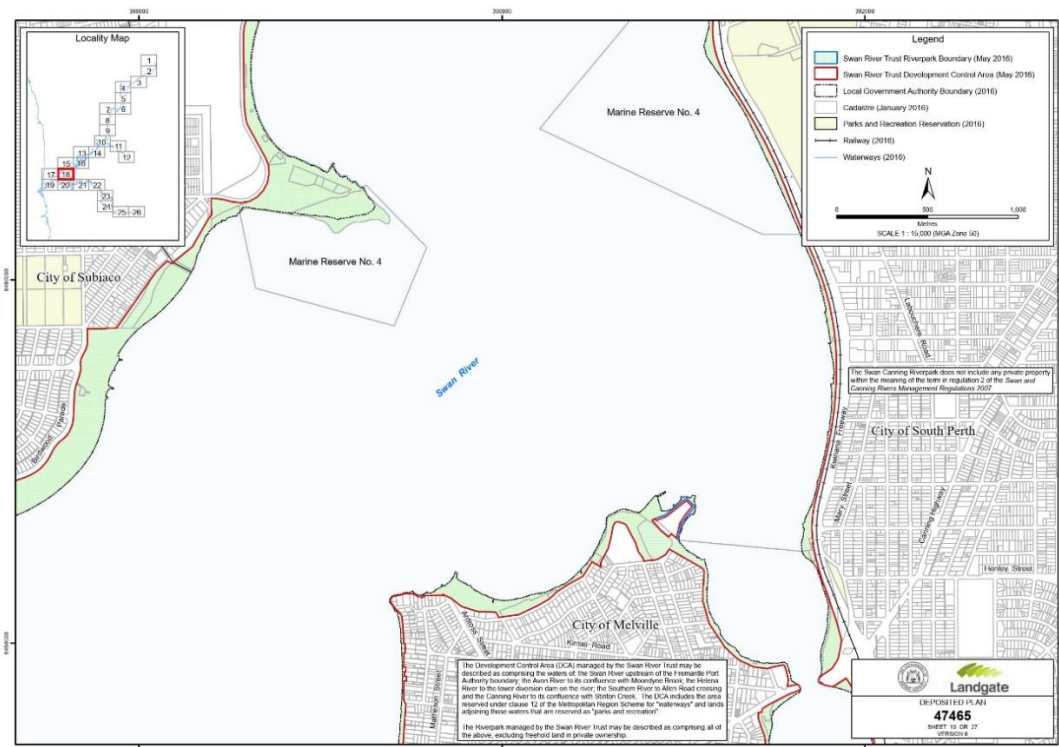
The area of ferry operations is located entirely within the Swan Canning Development Control Area (SCDCA), as shown on DCBA Maps 15 (East Perth, Perth, South Perth, Kings Park and Crawley) and 18 (South Perth, Crawley, Nedlands, Dalkeith, Como, Mount Pleasant and Applecross).





Development Control Area and Riverpark Map 15

Figure 6: Swan Canning DCA Map 15



Development Control Area and Riverpark Map 18

Figure 7: Swan Canning DCA Map 18



3.4 Heritage Considerations

The proposed use intersects with the mapping of a number of registered Aboriginal Cultural Heritage Sites, including:

- 3536: Swan River
- 3703: Spring Street
- 3704: Kings Park Waugal
- 3787: Mounts Bay Road
- 29278: Midgegooroo's Execution and Burial

The EAR (Appendix K) details the project's approach to managing Aboriginal Heritage impacts. This includes:

- Carrying out an Aboriginal Ethnographic and Archaeological Survey, which was undertaken by AHA Logic (2025). On the basis of historical disturbance, the archaeological potential of the project area was assessed as very low.
- Whadjuk Noongar representatives agreed that monitoring of any ground-disturbing activity within the boundaries of Aboriginal site ID 3536 would be an appropriate measure to ensure that any cultural or archaeological material, if present, is identified and protected.
- Ongoing consultation will continue prior to development and operation of the terminals and ferries. This process will inform the necessary approvals under the *Aboriginal Heritage Act 1972* (AH Act) and guide the management of potential impacts to ACH.
- The PTA received Section 18 consent pursuant to the AH Act in March 2026. The consent requires that works are undertaken in accordance with the PTA's *METRONET on Swan Ferry Service Expansion: Perth to Applecross Cultural Heritage Management Plan* (2025) which outlines measures for the surveying and protection of Aboriginal Cultural Heritage.



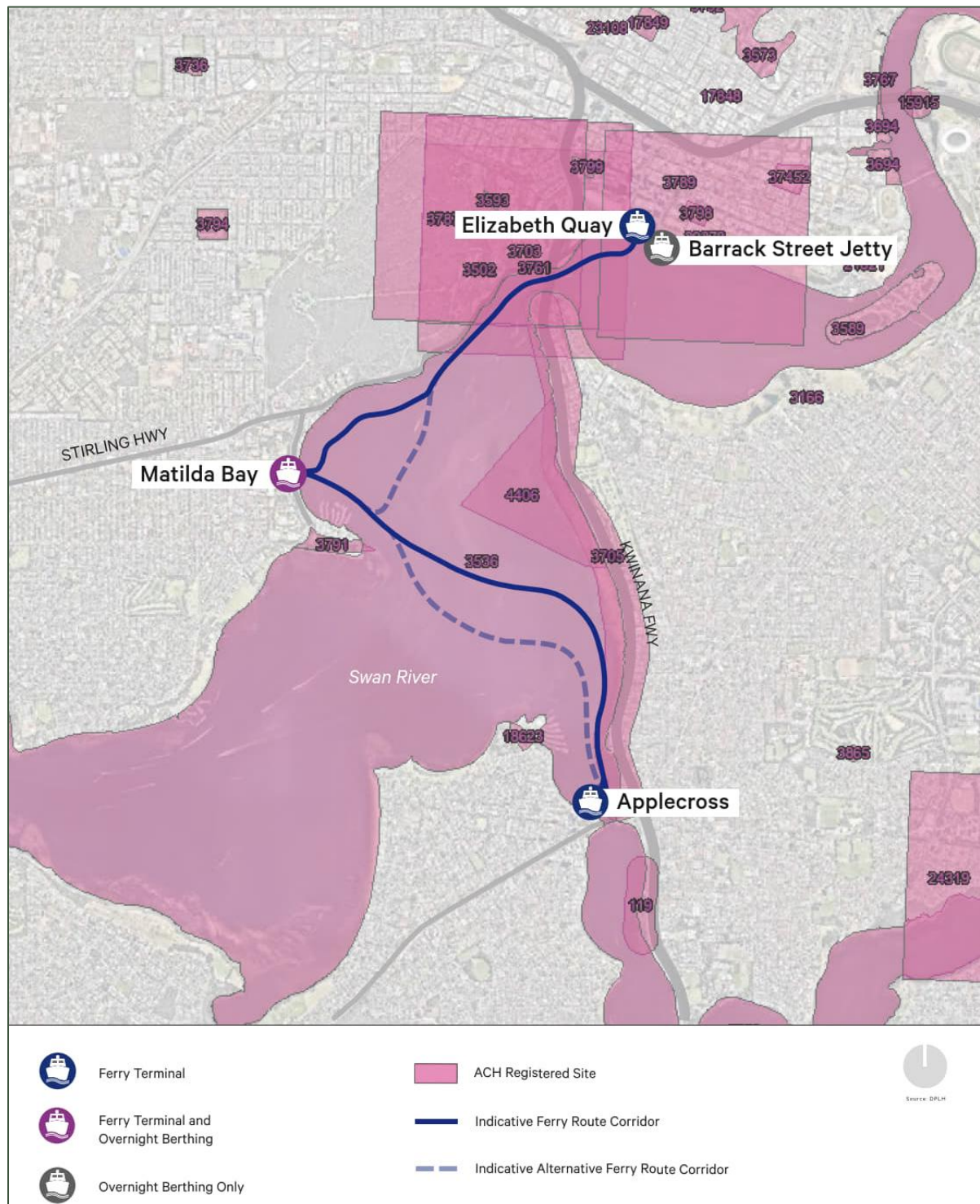


Figure 8: Aboriginal Cultural Heritage Registered Sites



- Swan and Canning Rivers (Swan Canning Riverpark) – Heritage Place No. 18987 (not a State Registered Place)
- Narrows Bridge (Bridge No 953) – Heritage Place No. 4795 (State Registered Place)
- Barrack Square and Jetties, Perth (Barrack Square, Flagstaff Square, Harper Square, Union Jack Square) – Heritage Place No. 4031 (State Registered Place)

[illegible]

3.5 Environmental Considerations

3.5.1 Geology, Soils and Sediments

The Swan River environment geology, soils and sediments are described in the EAR (Appendix K). In summary:

- The sediments of the Swan River under the ferry route are described as well sorted, pale coloured quartz sand with shell debris in the shallower areas and dark grey and black silt with a high organic content in deeper parts. The dark grey and black silt has a hydrogen sulfide smell and may be associated with anoxic conditions.
- Apart from Elizabeth Quay (which does not form part of this application), there are no known contaminated sites along the shoreline in the vicinity of the proposed ferry operations.
- Marine sediment sampling has been undertaken throughout the Swan-Canning Estuary across a number of surveys, including in 2009, 2022 and 2025. Results are discussed in the EAR (Appendix K), highlighting varied chemical concentrations, particle sizes, and environmental risks across the surveyed areas.

3.5.2 Hydrology, Water Quality and Bathymetry

The Swan River's hydrology and water quality are described in the EAR (Appendix K). In summary:

- The Swan-Canning Estuary is approximately 50 km long and covers an area of approximately 55 km². It is a microtidal system supplied with freshwater from the Swan and Canning rivers, while marine water is supplied from a narrow entrance channel at Fremantle that opens into two basins (Melville Water and Perth Water). During summer months, a salt wedge extends upstream 29 km from Melville Water into the Swan River and 13 km into the Canning River.
- Water quality sampling surveys of the relevant parts of the Swan River commenced in April 2025 and will be undertaken monthly until September 2026, to assist in determining baseline data for comparison monitoring during and post development. Results from April to September 2025 indicate that while most parameters remained within adopted assessment criteria, several nutrients and metals showed elevated concentrations during specific periods, largely associated with catchment runoff in the wetter months. The identified exceedances of metals and nutrients are typical of waterbodies that receive urban runoff.
- Water depths along the proposed route vary, ranging from approximately 2.15 m to 7.85 m Chart Datum (CD), approximately Lowest Astronomical Tide (LAT). The depths at the terminals in which the ferries will berth while passengers embark / disembark are approximately 4 m CD at Matilda Bay and approximately -3 m CD at Applecross.
- A series of hydrographic charts and riverbed feature maps (mosaics) have been produced, identifying several seabed feature types including debris, raised features (natural and manmade), boulders and scour.

3.5.3 Wetlands

DBCA mapping of Geomorphic Wetlands of the Swan Coastal Plain identifies the Swan River Estuary (including the Canning River) as a Conservation Category Wetland (CCW), listed as a basin landform and estuary-waterbody wetland type. CCWs are those that support a high level of attributes and functions.



The Swan-Canning Estuary (WA091) is also listed in the Directory of Important Wetlands in Australia. This is a large database that encompasses a number of important elements and aims to identify important wetlands across Australia to provide a substantial knowledge base on what defines wetlands and their variety and dependence on them of many flora and fauna species.

3.5.4 Conservation Reserves

The proposed route intersects the Swan-Canning River system which is identified as a DBCA legislated reserve (R48325 and R48327) for the purpose of protecting and enhancing the environment and community amenity value of the Swan and Canning Rivers.

The approved Matilda Bay terminal is located within the Matilda Bay Reserve (R17375), listed as an 'A Class' reserve for the purpose of public recreation and vested with the DBCA. The proposed ferry operations will not enter this reserve.

The Swan Estuary Marine Park is a Class A Marine Reserve encompassing three biologically important areas within the Swan Canning estuary near the area of ferry operations: Alfred Cove, Pelican Point and Milyu. As discussed in the EAR (Appendix K), these locations are considered biologically important areas because they have diverse ecosystems, are culturally significant and provide recreational opportunities. These sites hold significant cultural, mythological, and historical significance for the Whadjuk people and provide recreational opportunities, including swimming, fishing and boating. Restrictions are in place for recreational activities to ensure protection of the environment. The proposed ferry operations will not enter this reserve.

3.5.5 Vegetation, Benthic Habitat and Fauna Habitat

The EAR (Appendix K) maps the surveyed benthic communities and habitat at/near the relevant parts of the Swan River, showing a large extent of sand in the vicinity of Elizabeth Quay and patches of moderate to dense seagrass and macroalgae associated with the shallow areas of Matilda Bay and Applecross respectively. Vegetation and habitat are discussed in the EAR and summarised as follows:

- The marine environment in the area provides foraging and refuge for a range of endemic fish and crustacea species, particularly where seagrass is present. The majority of the selected route has been located in areas without seagrass, as confirmed in the EAR.
- The marine reserve areas are likely to be the most sensitive receptors that maintain ecosystem function in the river, due to their persistent populations of seagrass and use by waterbirds and juvenile fishes.
- The Swan-Canning Estuary is a dynamic system that is prone to substantial changes in species richness and diversity naturally.
- While the proposed route and terminal locations at Elizabeth Quay, Matilda Bay and Applecross are not considered to be part of nearby Biologically Important Areas under State legislation, they are known to provide brief foraging and refuge habitats for a range of endemic fish and crustacea.
- The region is also utilised by marine mammal species such as Indo-Pacific bottlenose dolphins, who are known to periodically hunt in the area.
- Due to the existing high levels of recreational activities, dense infrastructure, elevated noise and artificial lighting, there is a reduced likelihood of these parts of the Swan River supporting permanent or breeding populations or serving as significant foraging areas.



3.5.6 Fauna

The Swan River is an open water habitat home to a variety of species, many of which are of social, cultural, conservation, recreational and commercial importance.

Marine species specifically considered in the EAR (Appendix K) are as follows:

- Indo-Pacific bottlenose dolphin
- Estuarine cobbler
- Bull sharks
- Other fish and marine species

Threatened shark and turtle species identified using the Protected Matters Search Tool (PMST) are not expected to be present within the proposed route due to a lack of suitable habitat for these species.

The EAR confirms that migratory shore birds may pass through the operational route temporarily while travelling to more suitable habitat. The Swan-Canning Estuary is not expected to support permanent or continuous breeding populations of migratory birds, or significant foraging areas, due to frequent recreational activities, dense infrastructure and existing noise and artificial light. However, seagrass beds, particularly the Swan Estuary Marine Park, may offer occasional foraging locations for migratory birds.

3.5.7 Environmentally Sensitive Area

The relevant parts of the Swan River are located within and adjacent to a number of Environmentally Sensitive Areas (ESA). No native vegetation clearance is proposed as part of the ferry operations. Therefore, no further consideration of ESAs is required.

3.5.8 Shoreline and Foreshore

The EAR (Appendix K) maps the type of shoreline surrounding the ferry route, identifying built foreshore, rocky shore, sedimentary (beach and embankment) and vegetated (sedges). Descriptions of the shoreline and foreshore in the EAR are summarised as follows:

- The Elizabeth Quay terminal site is within a constructed quay that has no natural shoreline or foreshore, and instead has hard edge constructed elements interfacing with the water's edge. There are some planted natives in areas of landscaping. Constructed hard edges also occur along Mounts Bay Road and much of Kwinana Freeway.
- The foreshore areas at Matilda Bay and Applecross are well established recreational spaces for residents, visitors and tourists and contain riparian vegetation identified as wetland/shorebank vegetation.
- The broader Matilda Bay foreshore has undergone historic reclamation, followed by progressive erosion and installation of erosion protection measures such as limestone block walling.

Sections of the foreshore are detailed in the Ferry Wake Shoreline Impact Assessment Report (SIA) (Appendix I) where they are more likely to experience notable increases in wake energy. Refer to Appendix I for details of:

- Perth foreshore between the Narrows and Elizabeth Quay, with a focus on approximately 200m of beach along Birdiya Drive
- Mill Point Reserve artificial beach
- Northern Matilda Bay



- North side of Pelican Point
- Western Como foreshore, capturing Preston Street to the Scout Hall
- Approach to Applecross Terminal

3.5.9 Contamination

A desktop search of the Department of Water and Environmental Regulation's (DWER) Contaminated Sites Database indicates that the relevant parts of the Swan River are not identified as being contaminated.

3.5.10 Acid Sulfate Soils

A desktop search of DWER's Acid Sulfate Soil (ASS) Risk Map indicates that the area of ferry operations is as high to moderate risk of ASS. This has been considered in the EAR but no works are proposed as part of the application that would potentially mobilise ASS (Appendix K).

4.0 Proposal

4.1 Overview of the proposal

To support the delivery of the MOSFE, this application seeks approval for the operation of five (5) public ferry vessels on the Swan River. The proposed ferry service will operate between terminals at Matilda Bay, Applecross and Elizabeth Quay, with overnight berthing occurring at the Barrack Street Jetties and the Matilda Bay terminal.

The proposed route, vessel, timetable, operations and safety, and overnight berthing arrangements, are outlined in the following sections.

4.2 Route

The proposed ferry routes are shown in Figure 10 and Appendix C as a 50-metre wide corridor. A primary operating route is proposed for day-to-day services, with alternative route options identified to provide operational flexibility where temporary re-routing may be required primarily due to the usage of the river environment by existing water users at certain times or other unusual environmental factors. This may occur in response to special events, such as public fireworks displays, or where environmental considerations, including the presence of marine wildlife or prevailing weather conditions, necessitate route adjustments.

The proposed route corridors have been developed in consultation with the WSRG and informed by a broad range of technical investigations and design considerations. These include environmental studies and approvals, geotechnical, civil and marine investigations, associated infrastructure and built form requirements, and passenger journey and accessibility outcomes.

The proposed route alignments and operating speeds presented within this application are indicative and remain subject to ongoing refinement. Route planning has been iterative throughout the project development and will continue to be informed by technical assessments and ongoing stakeholder engagement. Final route alignments and operational speeds cannot be confirmed until in-water testing of the ferry vessels has been undertaken following the receipt of all relevant approvals.

Ultimate determination of the final route corridor and operating speeds rests with DTMI's Navigational Safety Team. A condition of approval is volunteered requiring the final route



corridor to be confirmed with DBCA following completion of in-water testing and approval by the Navigational Safety Team.

Notwithstanding the approved route corridors, the vessel master will retain discretion to vary routes during operation where necessary to ensure safe navigation consistent with applicable legislative and regulatory requirements, or in response to planned on-water events. Real-time operational decisions may be required in response to changing conditions on the water, and the master's judgement will take precedence over fixed routes.



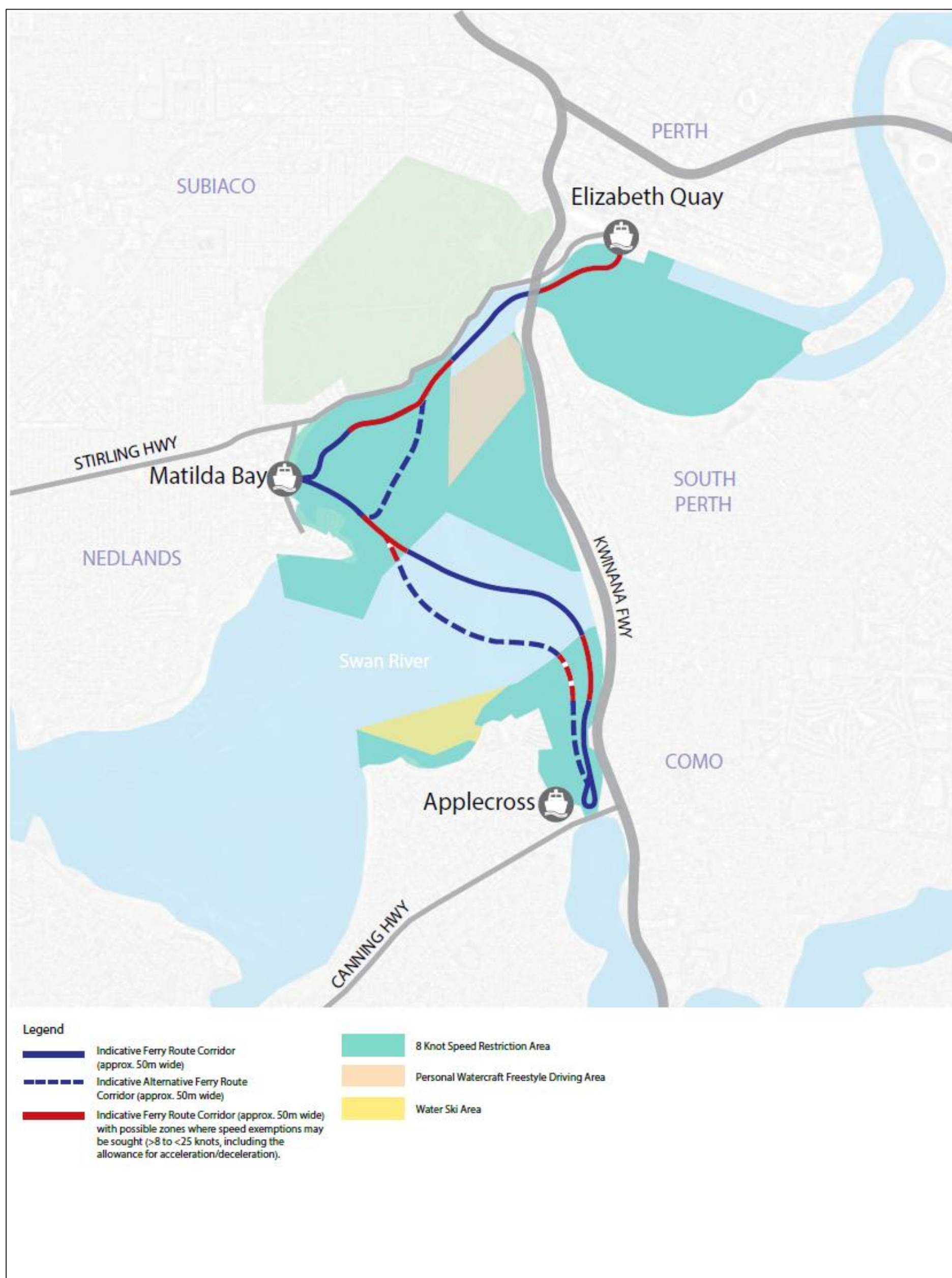


Figure 10: Indicative Ferry Route (Day)



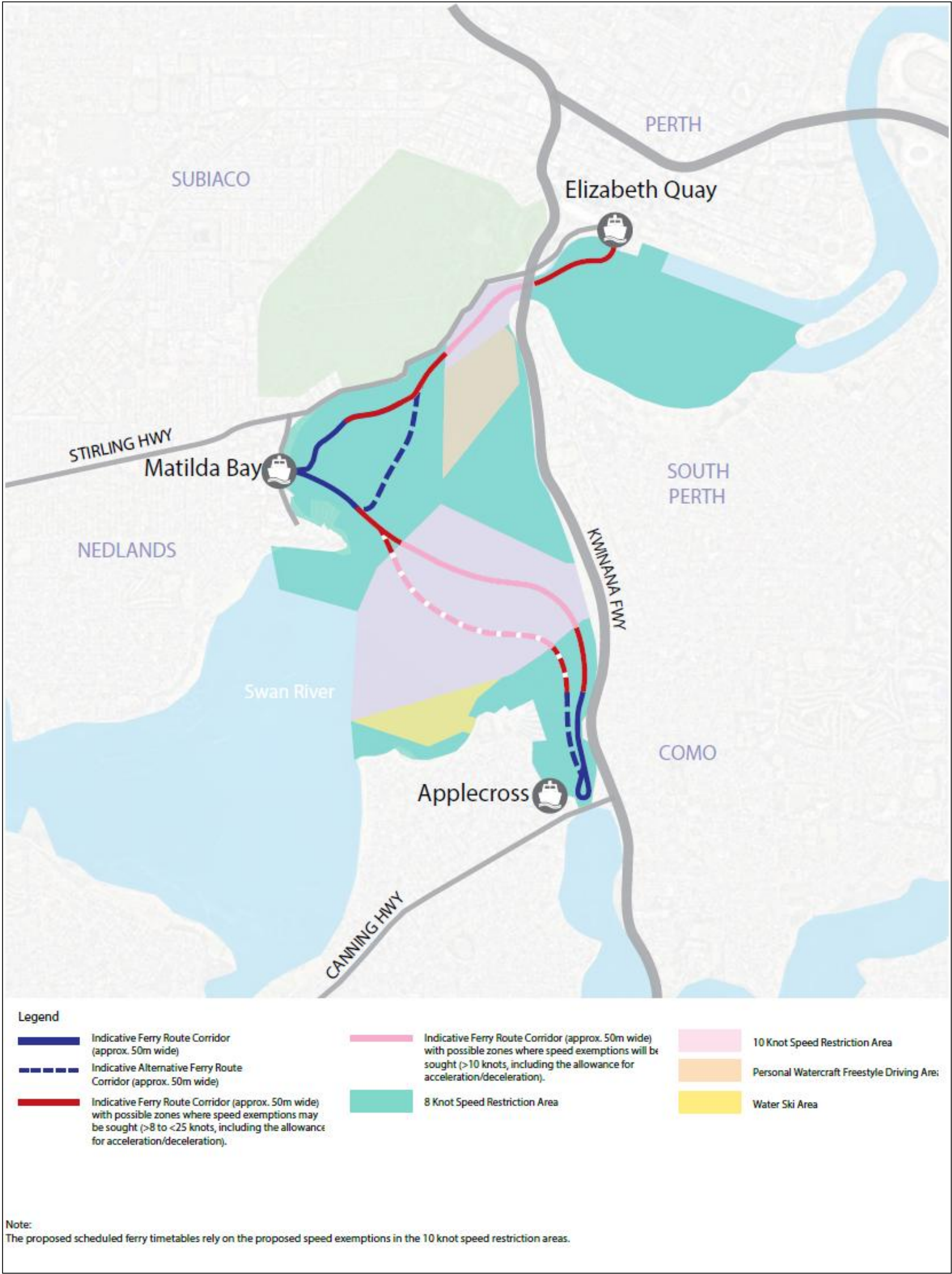


Figure 11: Indicative Ferry Route (Night)



4.3 Ferry Vessels

Designed and constructed by Echo Marine Group, the proposed electric ferry vessels are catamarans at 23.99m in length with capacity for 100 passengers and 2 crew members.

They will incorporate an indoor seating area, rear outdoor covered seating, two bathrooms, and designated space for bikes, wheelchairs and prams.

The vessels will operate using fully electric propulsion and energy storage systems.

As a novel vessel under AMSA's regulatory framework, the vessel will be required to remain in survey throughout its operational life. This includes periodic surveys and inspections by a recognised organisation/classification society to verify the ongoing integrity of the vessel, its systems, and safety-critical equipment. As part of this regime, an annual survey is expected to be undertaken to demonstrate continued compliance with the applicable classification and certification requirements, ensuring the vessel remains fit for service and maintains its Certificate of Survey.

A render of the proposed ferry vessel is shown in Figure 12 and vessel general arrangement is attached as Appendix D.



Figure 12: Proposed Ferry Vessel

The ferries have been designed to minimise potential impacts to the Swan-Canning Estuary environment by:

- Operating electric vessels with zero fuel storage and emissions.
- Using efficient hull design to minimise wave wake and wash, reducing the risk of erosion.
- Reducing noise when compared to conventional diesel-powered vessels.
- Utilising waterjet propulsion, thereby removing the potential for damage associated with propellers, including injury to marine fauna.

In addition to the measures outlined above, the vessel design incorporates a range of navigational safety features, including:



- Two 180-degree radar systems (forward and aft) to support situational awareness, particularly given the vessel's low air draft profile.
- External CCTV coverage around the vessel to assist with monitoring of the surrounding operating environment.
- A forward and centrally located wheelhouse with large windows, providing enhanced visibility for the vessel master.
- Standard vessel chart plotter and depth sounder.

Additional technologies that may further support navigational safety, such as camera-based systems for detecting marine features and hazards, will also be considered as the design progresses. While these systems can enhance situational awareness, they are intended to complement, rather than replace, the vessel master's responsibility to navigate safely and operate the vessel in accordance with the International Regulations for Preventing Collisions at Sea.

4.3.1 Lighting

The vessel will be equipped with standard, compliant marine navigation lights, including red port, green starboard, and white all-round lights, providing safe nighttime visibility on the Swan River. This arrangement is consistent with the existing vessel fleet.

It is not anticipated any additional lights will be required for the night speed exemption. Should this requirement change, the PTA will provide supplementary information to DBCA assessing light spill.

However, it is noted that the vessels will be fitted with forward facing headlights. These headlights are not intended for routine use during nighttime operations. Instead, they serve as a contingency measure, allowing the vessel Master to illuminate and verify potential hazards or objects observed ahead when additional visual confirmation is required. Their use would generally be limited to extreme circumstances where onboard night-vision camera systems are unable to provide a sufficiently clear image.

4.3.2 Vessel wake

The vessel has been specifically designed to minimise wake generation through a combination of hull form, slenderness ratio, low displacement relative to length, and efficient operating speeds. The PTA has undertaken several wake assessments and will continue to refine and validate the analysis as the final route alignment, operating profile and vessel speeds are confirmed through the planning and approvals process.

The findings of the wake investigations completed to date indicate that wake energy is lowest at operating speeds of approximately 5 to 10 knots, increases significantly between 12 and 15 knots, and then decreases again at higher operating speeds of 20 to 25 knots. The highest wake energy occurs within the 12 to 15 knot range, which corresponds to the vessel's hump-speed and critical/trans-critical depth conditions in shallow water. This is illustrated in Figure 13.

Importantly, the modelling undertaken to date concludes that the proposed ferry can operate on the Swan River without exceeding existing wind-wave conditions or vessel-wake benchmarks at sensitive locations, provided operations are managed to remain below 10 knots in constrained areas, and the vessel accelerates efficiently through the 12 to 16 knot range and operates at 20 to 25 knots where appropriate. The studies indicate that the greatest wake impacts occur at intermediate speeds in shallow water, rather than at the vessel's maximum operating speed.



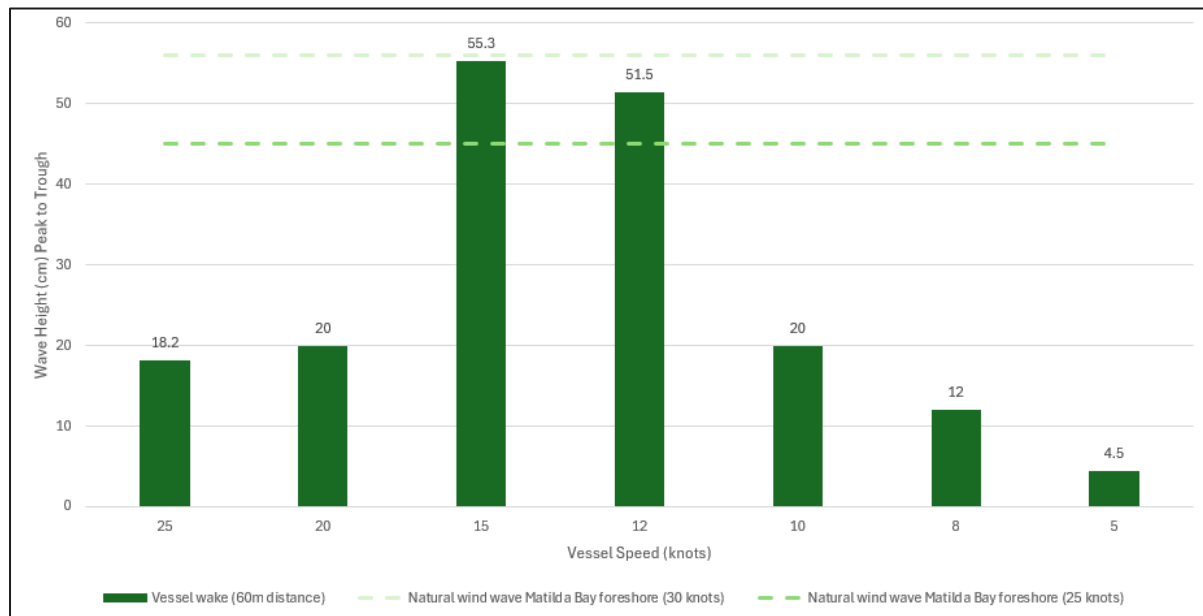


Figure 13: Vessel Wake and Wind Wave Height Comparison (Source: Wake Wave Analysis report)

In response to these findings, the PTA intends to minimise the time spent operating within the trans-critical speed range wherever practicable through route planning, vessel operating procedures and speed management measures. It is noted the preferred 25-minute timetabled scenario (Scenario 2) reduces the need to operate at 12 knots as a cruising speed.

Wake modelling is an iterative process that evolves alongside the vessel and is refined as additional site, operational, and performance data becomes available. Additionally, on-water sea trials will be critical to validate the modelling outputs by comparing predicted wake characteristics with actual wake measurements collected along the final operating route under representative operating conditions. This comparison will enable the model assumptions to be verified and refined where necessary, ensuring the final wake assessment accurately reflects the vessel's operational performance and demonstrates compliance with the applicable environmental and contractual requirements. In recognition of this, the PTA is committed to providing an updated wake assessment following on-water sea trials.

4.4 Timetable

From a public transport perspective, the PTA's objective is to provide the highest service frequency that is reasonably practicable, recognising that frequency is a key driver of patronage, convenience, and network competitiveness.

The PTA intends to seek several speed exemptions from DTMI to support service reliability and operational efficiency, as discussed in section 2.4. The proposed speed exemptions will seek to improve travel times, service reliability and provide a competitive ferry service whilst considering the appropriate controls for social and environmental impacts.

Areas where speed exemptions may be sought for daytime operations are identified in Figure 10. Exemptions will also be sought for nighttime ferry speeds to exceed the gazetted 10 knots in open water areas. Nighttime exemptions have been shown on the proposed route in Figure 11. Any nighttime exemptions will be carefully considered through the exemption process with the relevant navigational safety and environmental controls.



It should also be noted that whilst maximum speeds are identified as part of the exemption process, ferries will only utilise increased speeds, if approved, to the extent necessary to meet timetable requirements, and will carefully manage both acceleration and deceleration in a safe manner having regard to the safety of other river users, including other vessels, and the potential for environmental impacts on the river and shoreline environments. Any speed exemption granted by DTMI does not relieve the Master of their responsibility to safely manoeuvre and navigate the vessel. The Master remains responsible for exercising appropriate judgement in prevailing conditions and for complying with all applicable requirements of the International Regulations for Preventing Collisions at Sea.

Subject to speed exemptions being granted, the PTA intends to operate ferries approximately every 25 minutes between 6:00 am and midnight, providing a regular and reliable cross-river public transport connection. Project timetables will be finalized upon confirmation of operational speeds, completion of sea trials, and finalisation of the charging strategy. Travel times between Elizabeth Quay and Matilda Bay, and between Matilda Bay and Applecross are expected to be around 15 minutes. A full return loop between Elizabeth Quay, Matilda Bay and Applecross is expected to take approximately one hour and 15 minutes.

This is reflected in the draft timetables attached at Appendix E, and accompanying technical reports provided, which have been developed to demonstrate the impacts of the various speed exemption scenarios.

4.4.1 Ferry vessel speed scenarios

The draft timetables (Appendix E) and accompanying technical reports have considered the following four scenarios:

- **Scenario 1: 30 mins** – Gazetted speeds and up to 25 knots in open water areas.
- **Scenario 2: 25 mins** – Speed exemptions of up to 25 knots in all areas noted on the proposed route plan (Appendix C), but only up to 12 knots at Elizabeth Quay as per the existing ferry (South Perth) exemption.
- **Scenario 2a: 25 mins** – Speed exemptions of up to 25 knots in a reduced area from that on the proposed route plan (Appendix C), but only up to 12 knots at Elizabeth Quay as per the existing ferry (South Perth) exemption.
- **Scenario 3: 30 mins** – Speed exemption of 12 knots in all areas noted on the proposed route plan (Appendix C).

The rationale, benefits and risks of each scenario have been discussed in the following sections.

4.4.1.1 30-minute Scenarios

Scenario 1 looks at providing the service to existing gazetted speeds. This allows for a 30-minute frequency, but with limited operational headway for timetable recovery.

Operating the service at the existing gazetted speed limits while maintaining a 30-minute service frequency presents several operational challenges. The reduced transit speeds and increase overall journey times, leaving limited allowance within the timetable for recovery from routine operational variations such as passenger boarding, adverse weather, vessel manoeuvring, or charging activities. Consequently, while a 30-minute frequency may be achievable in principle under the existing gazetted speeds, the limited headway means the service would be less likely to consistently operate on schedule and would be more susceptible to ongoing operational delays. This could impact service reliability, operational efficiency, and passenger experience.



Scenario 3 introduces a restricted speed exemption of 12 knots in selected portions of the river that are 8 knot zones. This enables a 30-minute service frequency to be delivered with increased operational headway.

By increasing vessel operating speeds in selected sections of the route, additional time can be incorporated into the schedule. This additional headway provides greater flexibility to absorb minor delays associated with boarding activities, weather conditions, vessel manoeuvring, and charging operations, thereby improving timetable resilience and overall service reliability. Notably, this exemption option requires the vessel to travel for extending periods at the intermediate 'hump' speed associated with elevated wake generation, resulting in greater potential shoreline impacts while delivering limited operational benefit.

4.4.1.2 25-minute Scenario

Scenario 2A seeks an increased speed exemption of 25-knots in selected portions of river that are 8-knot zones. This would enable the delivery of a 25-minute service frequency, but with limited operational headway for timetable recovery.

A 25-minute service frequency provides a more competitive and attractive public transport offering through reduced passenger waiting times and improved network connectivity.

However, similar to Scenario 1, the timetable developed under a 25-knot operating scenario remains relatively tight and provides limited operational headway. While the service frequency is achievable, there is insufficient recovery time within the timetable to accommodate routine operational variability, such as delays associated with passenger boarding, weather conditions, vessel manoeuvring, or charging activities.

Scenario 2 further extends the speed exemption of 25-knot in selected portions of river that are 8 knot zones. This enables a 25-minute service frequency to be delivered with increased operational headway.

Unlike the more constrained scenarios, the reduced voyage time creates additional schedule flexibility, enabling recovery time to be built into the operating cycle without compromising service frequency. The increased headway improves timetable resilience by providing greater capacity to absorb routine operational variations, including passenger boarding and alighting, weather-related impacts, vessel manoeuvring, and charging activities. This reduces the likelihood of minor delays propagating through the service and improves the ability of the operation to maintain timetable adherence throughout the day.

From an operational perspective, this scenario offers a more sustainable balance between service frequency and reliability. Passengers benefit from a highly competitive 25-minute frequency, while operators gain sufficient schedule margin to support consistent and dependable service delivery. The improved travel times may also reduce the duration spent operating within intermediate "hump speed" ranges, where wake generation can be greatest. By enabling vessels to transition more efficiently through these speed bands, the extended exemption has the potential to deliver operational benefits while reducing the exposure to peak wake-producing conditions.

4.4.1.3 Preferred scenario

Overall, the 25-minute service frequency achievable under Scenario 2 represents the most effective outcome from a service planning perspective, supporting PTA's objective of delivering a frequent, reliable, and competitive ferry service while providing adequate operational headway and improved timetable robustness.



4.4.2 Hours of Operation

The proposed ferry service will operate with the first weekday departure from Applecross at approximately 6:00 am and arrival at Elizabeth Quay just before 7:00 am. The final weekday departure from Elizabeth Quay is proposed at approximately 9:00 pm, with the last service arriving back at Elizabeth Quay around 10:30 pm. Slightly reduced operating hours are proposed on weekends. To facilitate the first scheduled service, the first vessel will depart its overnight berth at around 5:40 am to arrive at the Applecross terminal before passenger boarding commences. These timings may vary slightly, as reflected in the conceptual timetables, pending confirmation of the applicable vessel speed exemptions.

The final timetable will be confirmed through ongoing operational planning and in-water vessel testing. The indicative timetables are provided in Appendix E. Table 3 summarises the operational parameters for scenario 2.

The anticipated travel time between Elizabeth Quay and Matilda Bay, and between Matilda Bay and Applecross terminals is approximately 15 minutes, providing a direct and efficient cross-river public transport connection. Travel times may vary slightly depending on a number of factors, including final approved operating speeds and navigational requirements.

The indicative timetables provided as Appendix E are all contingent upon approval of the proposed night-time speed exemption. Should the exemption not be approved, notwithstanding the establishment of relevant safety and environmental controls, the PTA would implement an hourly after-dark service frequency, with separate summer and winter timetable arrangements. This will increase the anticipated travel times between terminals after dark to approximately 20 minutes.

Table 3: Scenario 2 Indicative Ferry Service Timetable Summary

	Elizabeth Quay	Matilda Bay	Applecross
First weekday departure	6:30am	6.36am	6.17am
Last weekday departure	9.05pm	10.01pm	9:42pm
First weekend departure	7:20am	7.26am	7.08am
Last weekend departure	9.05pm	10.01pm	9:42pm

Of the five (5) electric vessels in the fleet, three (3) will be in active service at any given time. One (1) other vessel will be stationed at Matilda Bay whilst it undergoes a designated "long charge" cycle. To ensure all vessels operate within their battery performance parameters, this vessel will be rotated into service at regular intervals, with vessels exchanged throughout the operating day as part of the fleet management strategy.

Consistent with the current diesel ferry operation between Elizabeth Quay and Mends Street, the remaining vessel will be berthed at Barrack Square as an operational spare. This vessel will provide contingency capacity to maintain service continuity in the event of unplanned maintenance, vessel breakdowns, or other service disruptions.

4.5 Operations and safety

The ferry service will be operated in accordance with a comprehensive Operational Management Plan (OMP), a draft of which is provided at Appendix H. The OMP has been prepared to guide the safe, efficient operation of the ferry service and outlines the operational procedures, safety management measures, and monitoring requirements associated with the operation of the ferry service.

The OMP will support the implementation of ferry operations across all terminals and provides a framework for managing key operational elements including routes, schedules,



vessel speeds, berthing and passenger handling, charging operations, waste management, and interaction with other waterway users, including other commercial vessel operators. It also establishes protocols to minimise risks to passenger and crew safety, protect environmental values, and ensure compliance with relevant regulatory requirements.

It is noted the OMP does not detail environmental management controls, this is proposed to be managed through an Operation Environmental Management Plan (OEMP) which directly links back to the broader PTA Environmental Management System (EMS). The OEMP will be developed with DBCA prior to operations.

Key operational activities associated with the ferry service include berthing/mooring and departure from Matilda Bay, Applecross, and Elizabeth Quay terminals, and passenger embarkation and disembarkation.

Operational procedures also address the passenger verification process to ensure crew can account for all persons on board at any time, together with the use of onboard communication systems, including the Crestron/PA system to facilitate passenger announcements and safety briefings during boarding and arrival.

The OMP also addresses vessel operations in restricted visibility conditions, vessel start-up and shut-down procedures, charging operations, waste management, servicing and maintenance requirements, and emergency response procedures.

Charging infrastructure will comprise trickle-feed charging at Barrack Square, Applecross and Elizabeth Quay, together with high-capacity charging infrastructure at Matilda Bay, which have been approved separately under the relevant terminal's development approval. The trickle charging system will comprise a simple shore power arrangement, incorporating 63A connection points at overnight berthing locations. This system will provide a low-level continuous power supply to support essential vessel systems while berthed, ensuring operational and monitoring systems remain active overnight without drawing on the vessel's main battery reserves.

Power will be supplied through a standard service pillar located at the berth. The infrastructure required is minimal and consistent with conventional marina servicing arrangements, resulting in a low-impact installation with straightforward operational and maintenance requirements.

Waste management procedures include the management of onboard toilets and sewage systems and the handling and storage of rubbish, recycling and operational waste.

Sullage will be managed through the existing vacuum disposal infrastructure. Vessel connections will incorporate camlock fittings on disposal hoses to provide a secure transfer system and prevent leakage or spillage during pumping operations.

All waste generated during operations and maintenance will be removed from site and disposed of at approved offsite facilities in accordance with the OMP. Minor servicing activities may also include the replacement of enclosed internal fluids, such as steering oil. These fluids are stored, handled, and transported in sealed containers, minimising the risk of spills and environmental contamination. Further details of maintenance procedures and environmental controls will be provided in the Vessel Maintenance Plan following acceptance of the vessel as a PTA asset.

An EV Fire Risk Assessment has also been provided at Appendix L, which outlines the risks introduced by the provision of electric ferries and supporting charging facilities and provides recommendations for inclusions in the facility and ferry designs. The fire safety recommendations in this assessment will be incorporated into the proposal and associated development at the terminals.



Routine maintenance and operational servicing will be undertaken at Barrack Square in conjunction with vessel operations, including sillage disposal, waste management, trickle charging, and routine cleaning activities. The use of electric vessels significantly reduces overall maintenance requirements compared to conventional vessels; however, periodic replacement of components such as seating, windows, and damaged internal fittings will still be required. These activities are typically undertaken using a mobile service vehicle.

External vessel cleaning will be undertaken using fresh water and routine wash-down procedures to maintain vessel presentation and cleanliness. Each vessel is anticipated to undergo dry docking on an annual basis to facilitate statutory and class surveys, inspections, hull cleaning and polishing, preventative maintenance, repairs, and any other works necessary to maintain vessel safety, compliance, performance, and operational readiness. Dry docking activities will be conducted in Fremantle and/or Henderson.. The polished hull finish reduces the accumulation of fouling and other contaminants, minimising ongoing cleaning requirements and improving maintenance efficiency. Cleaning activities will not require hazardous chemicals, with routine wash-downs limited to fresh water only, resulting in minimal environmental impact.

PTA is continuing to review the required office and staff facilities that will be needed at Barrack Street Jetty to support ferry operations. These will be subject to a separate, future permit or application as required.

Detailed onboard operational and emergency procedures cannot be finalised at this stage, as they are inherently dependent on the final vessel configuration, systems, and equipment. These technical aspects can only be confirmed following vessel completion and delivery. Accordingly, the detailed standard operating procedures and emergency procedures for the vessels will be developed and submitted following vessel delivery, sea trialling period and following the operators' familiarity with the vessel.

4.6 Overnight Berthing

Primary overnight vessel berthing will occur at Barrack Street Jetty 2 as per Figure 14.

PTA and DTMI are working closely to managing the works that may be required at Jetty 2 and Barrack Square to accommodate the ferry operator and overnight berthing. These works will be subject to a separate future permit or application as required. Supporting infrastructure at Barrack Street Jetty 2 may include fencing, lighting, CCTV, building automation for access control, and new electrical supply routed from the site's main switchboard to support four 60kW EV charging stations for vessels. All required approvals (heritage, environmental, development, and land tenure) will be managed separately by DTMI.

Matilda Bay is intended to accommodate one (1) vessel berthed overnight. However, it does have capacity for up to four (4) vessels as future needs necessitate.



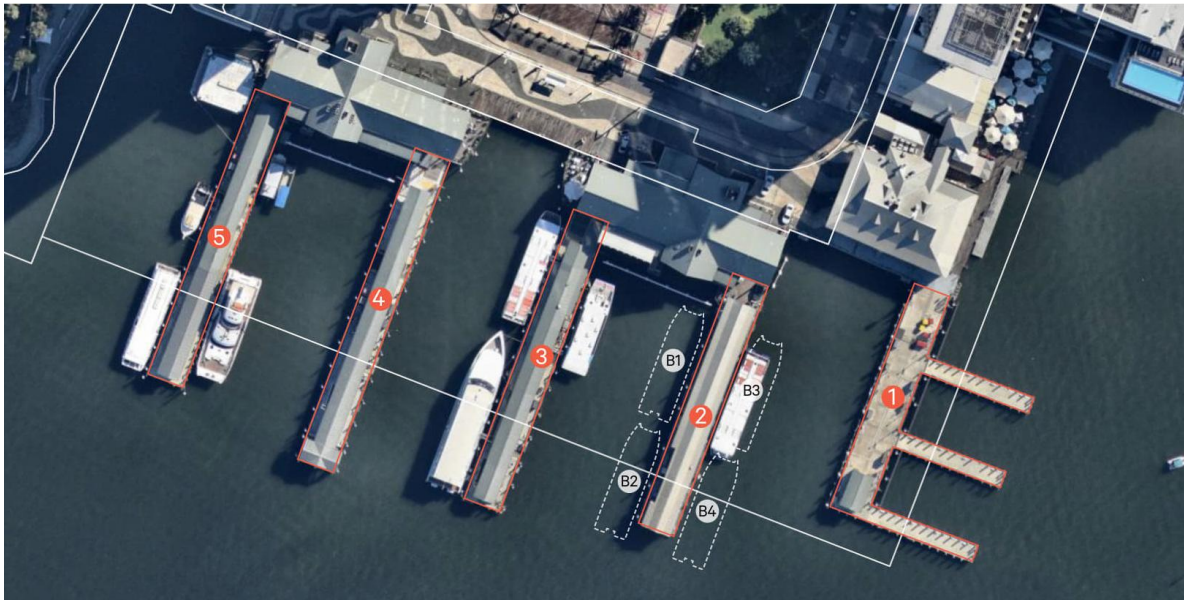


Figure 14: Barrack Street Jetties – Jetty 2 Overnight Berthing (Four Vessels)

5.0 Accompanying Technical Reports

As noted previously, this application is accompanied by the following supporting technical reports:

- Ferry Wake Shoreline Impact Assessment by Seashore Engineering (Appendix I)
- Operational Noise Assessment by SLR Consulting (Appendix J)
- Environmental Assessment Report by AECOM (Appendix K)

Key matters arising from these reports are discussed in the following sections.

Given final operating speeds are subject to final on-water testing and safety approvals, the technical reports assessed the four ferry vessel speed scenarios outlined in section 4.4.1 of this report.

5.1 Ferry Wake Shoreline Impact Assessment

The Ferry Wake SIA by Seashore Engineering characterises the potential for increased shoreline wave energy associated with the proposed ferry operations and outlines implications for shoreline erosion and management.

Results of the Ferry Wake SIA find that, for most of the shore along the proposed route, existing cumulative annual wind-wave energy and maximum wind-wave conditions substantially exceed the corresponding ferry wake conditions, indicating that the relative influence of the proposed ferry operations is generally small.

However, the potential for localised wake impacts increases under the higher-speed scenarios which take into consideration potential speed exemptions. The following locations have been identified where proposed operating scenarios may have implications for future shoreline management:

- Perth Foreshore (Birdiya Drive)
- Mill Point Reserve artificial beach
- Northern Matilda Bay



- North-facing Pelican Point
- Como – Cale Street to Scout Hall

The evaluation undertaken for each of these locations indicated that they are generally already affected by erosion and presently require management, rather than being locations where the proposed ferry wakes will introduce new erosion mechanisms or shoreline management issues.

Shoreline management considerations are set out in Table 4.

Table 4: Shoreline Management Considerations (source: Seashore Engineering)

Location	Management Considerations from Wake Influence	Applicable Scenario
Perth Foreshore (Birdiya Drive)	• Potential for enhanced offshore sediment transfer, increasing future beach nourishment requirements and the potential for further undermining of the limestone crest wall footing adjacent to the northern headland. • Should the southern section of the beach narrow, there may be greater reliance on the rock toe protection to protect the foreshore vegetation, with an increased potential for movement of smaller limestone spalls under vessel wake loading.	2, 2a and 3
Mill Point Reserve Artificial Beach	• Potential for increased offshore sediment transfer, reducing the available beach width for recreation and potentially increasing future beach renourishment requirements. • Potential for enhanced shoreline rotation towards the northwest, with greater sediment redistribution to the eastern beach. • Potential for a marginal increase in sediment transfer across the easternmost headland, resulting in gradual net sediment loss. • For Case 1, consider reducing the 25-knot operating limit slightly further west (e.g. more than 100m west of the Narrows Bridge) to substantially reduce wake impacts on this shoreline.	1, 2, 2a and 3
Northern Matilda Bay	• Significant existing scarping, with ongoing erosion trend and limited setback to the shared path and road across a 50m section mean this foreshore already warrants management. The relative minor increase in wave energy under Case 2 should be considered as part of any future management. • Consider truncating the 25-knot operating zone slightly further north to locally reduce wake energy over the 50m, scarped section.	2
North-facing Pelican Point	• Given Pelican Point forms part of the Class A Pelican Point Nature Reserve, the potential influence of Case 2 and 3 on sediment dynamics and the associated environmental values of the reserve and Sea Scout foreshore should be further investigated before implementation.	2, 3
Como Cale Street to Scout Hall	• Ongoing southward migration of erosion means this foreshore already warrants management. The potential increase in wake energy under Cases 2, 2a and 3, and its potential to locally exacerbate this issue should be considered as part of any future management. • Consider truncating the 12-knot and 25-knot operating zones slightly further north so that the additional wake energy is largely confined to the revetment-protected foreshore.	2, 2a and 3



The Ferry Wake SIA acknowledges that the simulation of boat wakes involves use of modelling systems and assumptions, which introduce a level of uncertainty when inferring likely shoreline impacts. Should the proposed operating scenarios be implemented, the Ferry Wake SIA recommends ongoing monitoring of the identified shoreline sections and a program for measurement of boat wakes to confirm shoreline response and inform management.

Therefore, PTA proposes to validate the Ferry Wake SIA assessment through monitoring to be undertaken during sea trials for the ferry vessels, allowing actual shoreline impacts to be assessed and any necessary additional management measures directly associated with ferry operations to be confirmed.

5.2 Noise

The Operational Noise Assessment (ONA) by SLR (Appendix J) assesses the potential noise and vibration impacts from the proposed ferry operations on the terrestrial marine environment.

It excludes any assessment of the landside development and operations (such as construction or EV charging infrastructure) as these have already been assessed as part of the relevant terminal development approvals.

Aquatic noise emissions during operations from ferry movements have been modelled and assessed against the relevant criteria.

Aquatic sensitive receptors of concern include marine mammals, particularly Swan River Dolphins (i.e. Indo-Pacific bottlenose dolphins), fish species and human divers/swimmers.

The threshold levels of Permanent Hearing Threshold Shift (PTS) (where noise exposure exceeds critical sound energy levels and hearing loss is permanent) and Temporary Hearing Threshold Shift (TTS) (where noise exposure is below a critical sound energy level and hearing loss is temporary) are not reached for marine mammals.

Modelled levels remain more than 20 dB below the relevant injury thresholds, representing a substantial margin of compliance.

Noise from ferry operations is considered to have very low physiological impacts (both mortality, recovery injury and TTS) on fish with swim bladders involved in hearing as the threshold levels are not reached.

Potential behavioural disturbance from the non-impulsive noise emissions from ferry operations is predicted to occur within 10 metres from the assessed ferry routes for marine mammals of all hearing groups, human divers and swimmers. For other groups, the threshold levels are not reached.

The ONA recommends that, while underwater noise impacts are predicted to be low, operational environmental management should include vessel operator awareness measures regarding dolphin interactions and monitoring of any future changes in ferry frequency or vessel characteristics that may alter underwater noise emissions. The ONA recommendations will be included in the OMP.

5.3 Environmental Assessment Report

The EAR by AECOM (Appendix K) identifies the environmental and social/heritage values of the Swan-Canning Estuary and assesses the potential impacts of the operation of ferry services on these values.

A summary of the potential operational impacts and management measures is presented in Table 5: Environmental Assessment Report – Summary of Potential Operational Impacts



(AECOM, 2026). The EAR concludes that, with appropriate management, the impacts are anticipated to be minor and not cause a significant impact to the environment of the Swan-Canning Estuary.

A condition of approval is volunteered requiring all operations to be undertaken in accordance with an OMP and OEMP as approved by the DBCA. More detailed recommendations for inclusion in the OMP and OEMP are stated throughout the EAR.

Table 5: Environmental Assessment Report – Summary of Potential Operational Impacts (AECOM, 2026)

Environmental factor	Potential impacts	Anticipated impact and management
Foreshore erosion	- Potential erosion of beaches and embankments. - Reduction in ecological values and public amenities.	Impact is anticipated to be low due to minimisation of wave wake through control of operating speeds and hull design. This impact has been modelled for confirmation as part of a wake prediction assessment report, revised report provided by Seashore Engineering (2026).
Water and sediment quality	- Direct impacts to water and sediment quality due to spills, leaks or debris / litter from the ferries. - Increased turbidity due to mobilisation of sediment due to vessel interaction with riverbed (propulsion turbulence). - Indirect impacts to water quality due to existing poor quality sediments being disturbed and mixing with the water column. - Risk of battery and fire retardant chemicals entering the water column in the unlikely event of a battery fire.	Impact anticipated to be highly localised, managed through good housekeeping and maintaining low speeds in shallow water to minimise sediment disturbance. Baseline water and sediment quality sampling is currently being undertaken to understand existing conditions. Design of ferry and associated fire suppression system will minimise the risk of battery fire. The PTA commits to monitoring water quality for 12-months following initial operations. This will also include the installation of Continuous Turbidity Profilers (CTPs) at the terminal site to monitor turbidity levels.
Benthic habitat	- Erosion (scour) of benthic habitat due to propulsion turbulence and wake wash. - Mobilisation of sediments causing decreased light availability and smothering of Benthic Communities and Habitat (BCH) (seagrasses). - Mobilisation of sediment causing changes to water quality through elevated nutrient concentrations in the water column, leading to algal blooms, decreased light availability and smothering of BCH.	The proposed main ferry route intersects a very small area of sparse to medium seagrass near the Kwinana Freeway and thus is more likely to impact seagrass. The proposed alternative route does not intersect any seagrass. The ferries will maintain low speeds in shallow water to minimise sediment disturbance. Orientation of waterjet nozzle and use of stern deflectors as much as practicably possible to reduce scour in shallow environments.



Environmental factor	Potential impacts	Anticipated impact and management
Marine fauna	- Vessel strike of marine fauna. - Erosion / scour causing physical removal of infauna and epifauna species (affecting food source of larger species). - Vessel noise creating behavioural response and impacting foraging / breeding (Indo-Pacific dolphins) and causing a response behaviour in other species. - Fauna death due to entanglement in or ingestion of ferry waste (including passenger litter). - Artificial lighting impacting predator / prey relationship.	Proposed ferry route avoids benthic habitat outside of immediate terminal areas. The ferries will maintain low speeds in shallow water to minimise benthic disturbance for infauna and epifauna. Ferry noise is not anticipated to cause impacts at distances greater than 10m from the ferry. Ferry waste will be minimised through use of litter bins with lids, signage and regular emptying of bins. Limited light use (particularly blue / green) and use of shielding in accordance with navigation and safety requirements. With these measures, impacts are anticipated to be localised and low.
Conservation reserves	- Potential impact to water quality in the Swan Estuary Marine Park. - Potential impacts to benthic habitat within the Swan Estuary Marine Park through erosion and loss of habitat. - Vessel strike of fauna.	The ferry will not traverse the Swan Estuary Marine Park and a minimum distance of 100m from the Marine Park will be maintained. Potential impacts to the Marine Park will be indirect and are anticipated to be limited to minor erosion (noting this is increased with the various increased speed scenarios) and vessel strike of mobile fauna species outside the Marine Park itself (noting this is considered low risk).

6.0 Planning Assessment

The proposal requires approval under Part 5 of the SCRM Act for a material change in use of waters within the SCDCA.

The development application is seeking approval for the use described in Section 4.0 of this report. The relevant provisions of the applicable planning frameworks are addressed below.

6.1 Swan and Canning Rivers Management Act 2006

The SCRM Act makes provision for the protection of the Swan and Canning Rivers and associated land to ensure the maintenance of ecological and community benefits and amenity.

Under the SCRM Act, the relevant planning considerations include the objectives of the Act and the principles to which regard needs to be given. These are assessed in Table 6. In summary, the proposal is consistent with the objectives and principles of the SCRM Act.



Table 6: SCRM Act 2006 Objectives and Principles Assessment

Matter	Compliance
Objectives	
a) To provide for the restoration and protection of the development control area and Riverpark.	The proposed ferry operations have been designed with a strong focus on protecting the SCDCA, as demonstrated in the Ferry Wake SIA (Appendix I), ONA (Appendix J) and EAR (Appendix K). These assessments confirm that the ferry route has been strategically developed and incorporates appropriate mitigation and management measures, to be detailed in the final OMP and OEMP as a condition of approval. Monitoring of the foreshore locations at potential risk of erosion during sea trials and initial operations, as identified in the Ferry Wake SIA, will enable actual erosion impacts to be identified and any necessary additional management measures directly associated with ferry operations to be confirmed. Monitoring of the water quality and installation of CTP's will ensure that environmental conditions remain consistent with those predicted during the assessment process.
b) To provide for the management of activities that affect the ecological and community benefits and amenity of the development control area and the Riverpark.	The proposal includes a comprehensive management framework, supported by the Preliminary OMP (Appendix H) and recommendations of the Ferry Wake SIA (Appendix I), ONA (Appendix J) and EAR (Appendix K). These establish clear measures to manage operational impacts on ecological values, community benefits, and the amenity of the SCDCA.
c) To provide for the needs of future generations in relation to the ecological and community benefits and amenity of the development control area and the Riverpark.	The proposal adopts a precautionary and impact-minimisation approach, ensuring that ecological values, community benefits and amenity are maintained over the long term, and preserved for future generations.
d) To recognise the interests of the Nyungah community and other people in the community with an association with the development control area or the Riverpark and to provide for their participation in the management of those areas and the management of activities affecting the ecological and community benefits and amenity of those areas.	As discussed in section 2.6 of this report, the PTA and TPAE team have prioritised culturally appropriate engagement with the Whadjuk Noongar community. This has included engaging ALS to facilitate a dedicated Whadjuk Cultural Advisory Working Group comprising Whadjuk Noongar Traditional Owners and Custodians. The PTA received Section 18 consent pursuant to the AH Act in March 2026. The consent requires that works are undertaken in accordance with the PTA's <i>METRONET on Swan Ferry Service Expansion: Perth to Applecross Cultural Heritage Management</i>



Matter	Compliance	
	<i>Plan</i> (2025) which outlines measures for the survey and protection of Aboriginal Cultural Heritage.	
e) To promote and facilitate the good management of the catchment area to meet the objectives referred to in paragraph (a) to (d).	The proposed ferry operations will be managed in accordance with the Preliminary OMP (Appendix H) and recommendations of the Ferry Wake SIA, ONA and EAR (Appendices I to– K). These documents collectively establish a robust management and monitoring regime that ensures alignment with and delivery of objectives (a) to (d).	✓
Principle 1 – Sustainability principles		
(1) Sound environmental practices and procedures should be adopted as a basis for sustainability for the benefit of all human beings and the environment today, while considering the environmental, social and economic needs of future generations.	The proposed ferry operations adopt sound environmental practices through a collaborative evidenced-based approach, supported by stakeholder engagement (Appendix F), Ferry Wake SIA, ONA, and EAR (Appendices I to K).	✓
(2) Environmental, social and economic factors should be considered in decision-making, with the objective of improving community well-being and the benefit to future generations.	The route selection, vessel operation parameters and mitigation measures will minimise impacts on river processes, ecological values, and community amenity. Monitoring of the foreshore locations at potential risk of erosion during sea trials and initial operations, as identified in the Ferry Wake SIA, will enable actual erosion impacts to be identified and any necessary additional management measures directly associated with ferry operations to be confirmed. Monitoring of the water quality and installation of CTP's will ensure that environmental conditions remain consistent with those predicted during the assessment process. These measures, together with ongoing management through the OMP (Appendix H) ensure the proposal supports environmental sustainability while managing the social and economic needs of existing river users. The proposal also supports positive social and economic outcomes through the provision of high-quality, functional, efficient public transport infrastructure that will benefit both current and future generations.	✓
(3) Environmental practices and procedures should be cost-effective and in proportion to the significance of the environmental risks and consequences being addressed.	The proposed environmental management measures are proportionate to the scale and risk profile of the proposed ferry operations and are informed by detailed technical investigations. Mitigation strategies, such as speed management, route optimisation, and operational controls, are targeted, practical, and cost-effective in addressing potential environmental risks and consequences.	✓



Matter	Compliance	
Principle 2 – Precautionary principle		
(1) Where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.	The proposal adopts a precautionary approach by using detailed technical assessments (see appendices) to inform route design and determine mitigation measures required to avoid the risk of serious or irreversible damage to the environment.	✓
(2) In the application of the precautionary principle, decision-making should be guided by: a) a careful evaluation to avoid serious or irreversible damage to the environment wherever possible; and b) an assessment of the risk-weighted consequences of the options.	Development of the proposal has been guided by a thorough evaluation of environmental and social risks.	✓
Principle 3 – Intergenerational equity		
The present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.	The proposal demonstrates consideration of intergenerational equity by integrating environmental protection measures into the ferry design and operations, informed by robust stakeholder engagement (Appendix F) and detailed technical assessments (Appendices I – K). These measures minimise impacts on ecological values, river processes, community amenity and equitable use, ensuring that the health, diversity and productivity of the Riverpark environment are paramount and maintained while enabling sustainable transport outcomes for both current and future generations.	✓
Principle 4 – Biodiversity and ecological integrity		
Biodiversity and ecological integrity should be maintained or enhanced as part of the irreplaceable life support systems upon which the earth depends.	The proposal supports the maintenance of biodiversity and ecological integrity through an evidence-based design and operational approach, informed by a detailed EAR (Appendix K). Potential impacts to ecological values have been avoided where possible and minimised through route optimisation, vessel design, and operational controls detailed in the EAR. These measures, together with ongoing management and monitoring, will ensure biodiversity and ecological integrity of the Riverpark are maintained while enabling sustainable public transport outcomes.	✓
Principle 5 – Shared responsibility		
Protection of the environment is a responsibility shared by Government, industry, business, the community and the people of the State.	The PTA acknowledge they share responsibility with other government, industry, business and community stakeholders. They are committed to protection of the environment and collaboration with other responsible stakeholders, as demonstrated	✓



Matter	Compliance	
	throughout the delivery of the project as detailed in this report.	
Principle 6 – Best practice		
When designing policies, systems, procedures or technologies, the best practicable measures available at the time should be used.	The proposal and accompanying technical reports have been developed in accordance with the best practicable measures available.	✓
Principle 7 – Continuous improvement		
Implementation of natural resource management should aim for continuous improvement and extend beyond compliance with relevant laws and requirements.	The environmental performance of the ferry operations will be monitored to identify opportunities for continuous improvement in relation to the avoidance and management of environmental impacts.	✓
Principle 8 – Accountability and transparency		
(1) Members of the community should be given: a) access to reliable and relevant information; and b) opportunities to participate in policy and programme development.	Members of the community have been given, and will continue to be given, access to reliable and relevant project related information through community engagement efforts and media releases. Stakeholders with a particular interest in the proposal (e.g. water users, neighbours) have been given, and will continue to be given, opportunities to participate in the development and design of the project. Refer to the Stakeholder Engagement Summary at Appendix F.	✓
(2) Decisions should be made in a transparent manner and be made public.	Decision making for the project has and will continue to be made in a transparent manner in accordance with the SCRM Act decision-making process, including public advertising and notification.	✓

6.2 DBCA Policies and Strategies

6.2.1 Corporate Policy Statement 42: Planning for Land Use, Development and Permitting Affecting the Swan Canning Development Control Area

The DBCA's Corporate Policy Statement 42: Planning for Land Use, Development and Permitting Affecting the Swan Canning Development Control Area (CPS 42) seeks to ensure land use, development and other permitted works, acts and activities in or affecting the SCDCA:

- Maintain and enhance the ecological health, community benefits and amenity of the Swan-Canning river system;
- Make suitable provisions for foreshore areas that can be reserved and protected under planning schemes and acquired as public land; and
- Do not create obstructions to the flow of flood waters of the river system and that appropriate provisions are made to minimise property damage by major flood flows.

A response to the key matters raised in CPS 42 is provided in Table 7 below.



Table 7: DBCA Corporate Policy Statement 42 Assessment

Policy	Compliance
Ecological Health	
5.1 Provide support, advice and decisions which protect and enhance the Swan Canning river system's ecological health. This includes maintaining tributary and stream habitats and their natural drainage functions, reducing nutrient enriched and polluted water inputs from adjacent land uses, minimising erosion of stream banks and protecting wetland ecosystems and associated wildlife habitats.	The proposal supports the Swan Canning river system's ecological health through an evidence-based design and operational approach, informed by a detailed Ferry Wake SIA (Appendix I) and EAR (Appendix K). Potential impacts have been avoided where possible and minimised through route optimisation, vessel design and operational controls, as detailed in the Ferry Wake SIA and EAR. ✓
5.2 Prioritise the protection of threatened flora and fauna and threatened ecological communities.	Regarding matters 5.1, 5.2 and 5.4, the EAR states: ✓
5.3 Promote the maintenance and restoration of natural vegetation and encourage proponents to retain existing native vegetation as a means of protecting linkages and natural vegetation corridors. Proposals should avoid the removal or fragmentation of native vegetation, where possible. As a guide, any vegetation removed within the DCA will likely be required to be replanted at a minimum ratio of 3 to 1 with appropriate local native species.	- No direct impacts to Conservation Reserves and BCH are proposed. - No threatened flora or fauna or ecological communities have been identified during the development of this Project. - An OMP and OEMP will be prepared and implemented in consultation with DBCA conditions of development approval. These will ensure construction activities do not result in any erosion and/or discharge of pollutants into the river system and that adjacent and nearby fauna, conservation reserves and wildlife habitats are protected during operation. ✓
5.4 Maintain a presumption against proposals which may, either directly or indirectly, unacceptably degrade shallow river flats, foreshore vegetation, fringing wetlands, saltmarshes or tributaries associated with the Swan Canning river system.	✓
5.5 Where necessary, require the preparation and implementation of a Construction Environmental Management Plan, as a condition of approval, to manage environmental impacts associated with a land use or development.	A preliminary OMP has been prepared (Appendix H) and it is expected that a final OMP and OEMP will be required as conditions of development approval. These will manage environment impacts associated with the proposed use. No construction is proposed, so a Construction Environmental Management Plan (CEMP) is not considered to be relevant. ✓
5.6 Where a proposal has the potential to contribute long term impacts on the Swan Canning river system, consider the need for a proponent to prepare and implement, as a condition of approval, an Environmental Management System to minimise any potential ongoing environmental impacts of development and use.	A preliminary OMP has been prepared (Appendix H) and it is expected that a final OMP and OEMP will be required as conditions of development approval. These will set out measures to minimise any potential ongoing environmental impacts of the proposed use. ✓
5.7 Have due regard for the provisions of relevant international and national agreements, State environment and planning legislation, policy, plans and strategies when	Relevant State Planning Policies are assessed in section 6.3 of this report. ✓



Policy	Compliance	
assessing proposals affecting the ecological health of the Swan Canning river system.		
Landscape Protection		
5.8 Have due regard for the provisions of the <i>Visual Landscape Planning in Western Australia: A manual for evaluation, assessment, siting and design</i> when considering a proposal's impact on the landscape. Proposals should enhance and protect the character and landscape setting of the Swan Canning river system. Typically, proposals should protect treelines and not dominate or overshadow public areas and views. Proponents will likely be required to provide a schedule of colours, materials and finishes as part of the development application process. For proposals that are likely to have a significant impact on the landscape, the department will require proponents to undertake a comprehensive landscape analysis in accordance with the manual.	As the proposal is limited to on water ferry operations, visual impacts are inherently low and transient in nature. Vessel design, scale and operation have been considered to ensure the ferry does not dominate or unduly intrude into river views or views from public spaces and will be compatible with the existing character and landscape setting of the Swan Canning river system, which is utilised by many small to medium private and commercial vessels. The ferry operations will not obstruct or detract from significant landmarks, views or vistas due to their low-profile, mobile nature.	✓
5.9 Consider, protect, and where appropriate, enhance significant landmarks, views and vistas.		✓
Recreation opportunities and public access		
5.11 Make provisions for public access and enjoyment of the Swan Canning river system including its foreshores in a manner that is consistent with the multiple use of the DCA and the preservation of the values of the land itself. The environment must be able to sustain the development and use proposed.	The proposal will enhance public access and enjoyment of the Swan Canning river system, allowing locals to incorporate the river into their everyday commute and tourists to experience the river environment first hand. Preservation of the river's environmental and social values has been ensured through the Preliminary OMP (Appendix H) and Ferry Wake SIA, Noise and Environmental Impact Assessments (Appendices I to K).	✓
5.12 Encourage a range of tourism and recreation facilities to be provided for in a local and regional context thereby providing visitors to the Swan Canning river system with a choice of recreation activities and experiences.	Multiple use of the SCDCA has been managed through stakeholder engagement and the WSRG, providing other river users with the opportunity to contribute to project design and pre-emptively resolving potential conflicts, including safety.	✓
5.15 Ensure proposals do not impair other forms of acceptable use or jeopardise the safety of others utilising the Swan Canning river system and its foreshores. Where potential conflict with other forms of acceptable use may occur as a result of proposal, the proponent will be required to demonstrate how the conflict can be resolved to the satisfaction of the department. This may require the redesign of the proposal to prevent or limit conflicts or the provision or relocation of facilities and uses to a more appropriate place. The department may refuse or recommend refusal of a proposal if it is not	The safety of other river users will also be considered through the OMP (Appendix H) including its improvement following approval and on-water vessel testing. The safety of other river users will also be thoroughly assessed through the decision-making process of DTMI's Navigational Safety team as set out at section 2.4.	✓



Policy	Compliance
satisfied that the potential conflicts have been adequately addressed.	
Heritage	
5.33 Encourage proponents to consult with local Aboriginal people as it recognises that the Swan and Canning rivers hold particular spiritual and mythological cultural significance for them. Proponents are to ensure they comply with the requirements of the <i>Aboriginal Heritage Act 1972</i> and the <i>Native Title Act 1993</i> .	As discussed in sections 2.6 and 3.4, the project team has engaged with Traditional Owners early in the process, establishing a Whadjuk Cultural Advisory Working Group. The Project has obtained the necessary approvals under the AH Act for project implementation separately to this application. ✓
5.34 Support the protection of cultural heritage places including the built environment, natural resources and sites of significance to both Aboriginal and non-Aboriginal people. The department will consider the impact that proposals may have on heritage places within its DCA and may seek advice from other relevant agencies or bodies.	✓
5.35 Consider the provisions of the Australian ICOMOS charter (more commonly known as <i>The Burra Charter</i>) for the conservation of places of cultural heritage significance or other heritage documents and legislation when assessing proposals within the DCA.	✓

In accordance with the above, the proposed ferry operations present an appropriate proposal in the Swan and Canning river system, enhancing broader public access to the river environment while maintaining environmental and social values, in a manner that is consistent with CPS 42.

6.2.2 Corporate Policy Statement 52: Planning for Localities along the Swan Canning Development Control Area

Corporate Policy Statement 52: Planning for Localities along the Swan Canning Development Control Area (CPS 52) seeks to ensure that land use, development and other permitted works, acts and activities within or affecting the SCDCA:

- Protect and enhance the ecological health, community benefits and amenity of the SCDCA; and
- Achieve consistent and integrated planning, decision-making and management outcomes in relation to the Swan Canning river system.

A response to the key matters raised in CPS 52 is provided in Table 8 below.

Table 8: DBCA Corporate Policy Statement 52 Assessment

Policy	Compliance
5.1 Protect and restore the river system	
5.1.1 Respect the river system, its waters and floodplains, local vegetation, wetlands, and habitats as a dynamic natural system, by designing land use and development to protect	The proposal respects and maintains the river system's ecological and landscape values through an evidence-based design and operational approach, informed by a detailed ✓



Policy	Compliance	
ecological and landscape values and be responsive to natural processes and the environment.	Ferry Wake SIA (Appendix I) and EAR (Appendix K).	
5.1.2 Maintain and progressively restore ecological function, the landscape, habitat and water quality, and improve degraded areas of the river system, including waterways, floodplains, wetlands, and bushlands. This applies to both the aquatic and terrestrial environments.	Wetlands and fauna habitats (including seagrass habitats) have been addressed in the EAR. Potential impacts have been avoided where possible and minimised through route optimisation, vessel design and operational controls, as detailed in the Ferry Wake SIA and EAR.	✓
5.1.3 Establish and maintain buffers between significant wetlands and other land uses.		✓
5.1.4 Protect and restore habitats that support local fauna, including protecting seagrass habitats and considering habitat enhancements.		✓
5.2 Protect and restore foreshore vegetation		
5.2.1 Protect areas of local vegetation associated with waterways (including the floodplain) to ensure that the river landscape and its values are maintained. Vegetation that is within and fringes waterways serve an important environmental, stabilisation, biological, and amenity function, adding value to the river system landscape for water-dependent ecosystems, wildlife and community enjoyment. Foreshore vegetation should not be removed, unless there is a demonstrated problem, such as weed invasion. Foreshore vegetation should not be altered to facilitate development outside of the foreshore reserve, including for bushfire management purposes or to enhance private views.	The EAR (Appendix K) has assessed the potential impacts to vegetation, including foreshore vegetation and benthic communities, noting that the proposed ferry operations have the potential to adversely impact coastal erosion processes, and subsequently the integrity of surrounding foreshore environments including associated habitats and benthic communities, due to the high silt and clay riverbed composition being susceptible to scour and sediment resuspension. Any impacts on local vegetation can be appropriately mitigated through vessel design, speed restrictions, and inclusion of measures to control impacts associated with sediment mobilisation and shoreline erosion in the OEMP.	✓
5.6 Retain and conserve cultural significance and heritage values		
5.6.1 Retain and conserve the Derbal Yirragan (Swan), Djarlgarro (Canning) and Mandoon (Helena) rivers, and other Aboriginal heritage sites, places and protected areas. All Aboriginal heritage sites, places and protected areas are protected under the <i>Aboriginal Heritage Act 1972</i> , including sites and places that are not registered. Registered Aboriginal sites are listed in the Aboriginal Cultural Heritage Register. The rivers have intrinsic value due to their natural attributes and spiritual and cultural significance. Features and landscapes that commonly contain Aboriginal heritage include springs, river pools, important trees, and middens. Whadjuk Noongar culture and knowledge of the river system should inform decision-making.	As discussed in sections 2.6 and 3.4, the project team has engaged with Traditional Owners early in the process, establishing a Whadjuk Cultural Advisory Working Group. The Project has obtained the necessary approvals under the AH Act separately to this application.	✓



Policy	Compliance	
5.6.2 Retain and conserve places of historic heritage significance associated within the rivers, in accordance with the <i>Heritage Act 2018</i> , including places entered on the State Register of Heritage Places or under consideration for the Register. The 'Swan and Canning Rivers' itself is acknowledged as a significant Western Australian landmark that is under consideration for the Register.		✓
5.6.3 Retain and conserve natural heritage places, including protected sites in the Aboriginal Cultural Heritage Directory and places of natural heritage value in the National Heritage List established under the <i>Environment Protection and Biodiversity Conservation Act 1999</i> .		✓
5.7 Maintain the rivers and their foreshores as a community asset		
5.7.1 Recognise the rivers and foreshores as a public asset that should be available to the whole community. Proposals should enhance the amenity of and consider the public's ongoing use and enjoyment of the rivers and foreshores. Development within the DCA is to enhance the river experience, be pertinent to the river, and demonstrate a benefit to the wider community.	The proposal supports, and is supported by, the rivers and foreshores as a public asset that is available to the whole community. Efficient, reliable public transport will enhance the public's ongoing use and enjoyment of the river and provide a benefit to the wider community. The proposed high-quality vessel and robust operational management measures as proposed will ensure high levels of amenity and enhance the river experience.	✓
5.9 Secure public access to the rivers and their foreshores		
5.9.1 Provide public access to the rivers and foreshores for recreation and to increase opportunities for people to connect with nature, subject to protecting ecological health and public amenity.	The proposal provides public access to the river as a public transport modality, enabling the public to equitably access and travel on the river for a low cost. The proposed ferry route and operations respond to the environmental, cultural and heritage values, existing river users, and the amenity of the river, as discussed throughout this report.	✓
5.9.2 Establish continuous public access along or adjacent to the foreshore, whichever is appropriate to local conditions. Respond to the environmental values, terrain, cultural and heritage values, existing land uses, amenity of the site and opportunities to connect adjacent activity centres when locating and designing accessways. Consider passive and active transport and assess access in relation to safety and functional requirements.	The terminals at Elizabeth Quay, Matilda Bay and Applecross (approved separately) are strategically located to provide connections to adjacent activity centres. Safety and functional requirements have informed the proposed route and future operation of the ferry service. These are outlined in the Preliminary Operational Management Plan (Appendix H).	✓
5.10 Provide opportunities for water transport		
5.10.1 Recognise and account for potential commuter water transport opportunities,	This proposal is for commuter water transport in the form of a public ferry service. The various ferry vessel speed scenarios assessed have intended to balance operational	✓



Policy	Compliance	
including by private operators, where practical and appropriate.	performance and service reliability with social and environmental considerations.	
5.10.2 Minimise potential wash and wake impacts, including to riverbank stability, built infrastructure, the ecology of the area, and the safety of other river users. Lower carbon transport options are encouraged.	Potential wash and wake impacts have been assessed in the Ferry Wake SIA (Appendix I). Monitoring of the foreshore locations at potential risk of erosion during sea trials, as identified in the Ferry Wake SIA, will enable actual erosion impacts to be identified and any necessary additional management measures directly associated with ferry operations to be confirmed. Monitoring of the water quality and installation of CTP's at the terminal site during initial operations will ensure that environmental conditions remain consistent with those predicted during the assessment process. The proposed electric ferry service is considered to be a lower carbon transport option.	✓
5.14 Implement Locality Plans		
5.14.1 Apply the locality-specific policy statements contained within adopted locality plans to the respective part of the river system. The following locality plans are to be read in conjunction with this policy: 2. Dootanboro (Melville Water) Locality Plan (March 2026) 3. Perth Water <i>Buneenboro</i> Locality Plan (August 2021)	The relevant locality plans have been considered and assessed in sections 6.2.3 and 6.2.4 of this report.	✓

In accordance with the above, the proposed ferry operations present an appropriate proposal in the Swan and Canning river system in a manner that is consistent with CPS 52.

6.2.3 Dootanboro (Melville Water) Locality Plan and Action Plan

The Dootanboro (Melville Water) Locality Plan (March 2026) contains locality-specific policy statements to ensure that land use, design and development approaches respond to the environmental, cultural, heritage and social values of the Dootanboro (Melville Water) section of the river system. The Plan also brings together 'on' and 'off' water considerations to direct appropriate protection, restoration and activation of the river and its foreshores.

The Locality Plan captures the portion of the proposed ferry route between Applecross, Matilda Bay, and the Narrows Bridge.

The Locality Plan acknowledges that the Melville Water river and foreshore areas are intensively used for commercial, recreational, transport and water-based activities, and that access and enjoyment of this part of the river by the public is paramount. It also notes the ecological importance of the locality, including some of the most important waterbird habitats in WA and important fish nurseries and feeding areas.

Relevant locality-specific Policy Statements are assessed in Table 9 below.



Table 9: Dootanboro (Melville Water) Locality-Specific Policy Statement Assessment

Policy Statement	Compliance
Protect and restore the river system	
2.1 Ensure the natural conservation values of nature reserves and marine parks are protected and enhanced, including Alfred Cove, Pelican Point, Milyu and Matilda Bay, particularly bird nesting, feeding and roosting areas and habitat for migratory birds and threatened species.	The EAR (Appendix K) has assessed the potential impacts to Swan Estuary Marine Park, concluding that the ferry will not traverse the Marine Park and that a minimum distance of 100m from the Marine Park will be maintained. Potential impacts to the Marine Park will be indirect and are anticipated to be limited to very minor erosion (noting this is increased with various increased speed scenarios) and potential vessel strike of mobile fauna species outside the Marine Park itself (noting that this is considered low risk). ✓
Retain and conserve cultural significance and heritage values	
2.18 Retain and conserve elements of heritage significance that contribute to the landscape setting of the river, including places entered on the State Register of Heritage Places or in the Local Government Heritage List or Local Heritage Survey, such as Sunset Hospital and Heathcote Hospital precinct.	As discussed in sections 2.6 and 3.4, the project team has engaged with Traditional Owners early in the process, establishing a Whadjuk Cultural Advisory Working Group and obtaining any necessary approvals under the AH Act separately to this application. No works are proposed, so historic heritage will not be impacted by the ferry operations. ✓
Maintain the rivers and their foreshores as a community asset	
2.23 Ensure that in-river uses are appropriate to the gazetted marine safety restrictions, complement the abutting land uses and comply with any established carrying capacities.	DTMI's Navigational Safety team will thoroughly assess the safety of the proposal, including any applications for an exemption to gazetted speeds (refer to section 2.4). Stakeholder engagement and the WSRG have provided other river users with the opportunity to contribute to project design and to pre-emptively resolve potential conflicts, as detailed in Appendix F. ✓
Maintain a sense of place	
2.24 Enhance recognition of the values of the nature reserves and marine parks.	The proposed ferry service will enhance recognition of the values of nearby nature reserves and marine parks by increasing exposure to the river environment, fostering community appreciation. ✓
2.25 Enhance connections to the river and foreshore, such as through wayfinding, from nearby community or activity centres. Particular attention should be given to Moreau Mews (Applecross) and Broadway (Nedlands).	The proposed ferry service will provide an enhanced connection to the river by providing an accessible recognisable public transport link that integrates with surrounding activity centres. ✓
Provide opportunities for water transport	
2.30 Recognise the importance of the river for commuting, recreation, tourism and leisure, as well as its conservation and amenity values. New jetties are to be a sensitive	The proposal supports the use of the river for commuting and tourism without adversely impacting existing recreation, leisure or tourism activities or conservation and amenity values. ✓



Policy Statement	Compliance	
design and built form to complement the river landscape, and link to the public access path network.		
Establish linkages and ecological corridors		
2.31 Protect foreshore vegetation and enhance the corridor of vegetation that abuts the river with local plant species, including sedge banks and habitat trees, to create a continuous vegetated corridor through the locality.	The EAR (Appendix K) has assessed the potential impacts to vegetation and fauna, concluding that these can be managed through vessel design, speed restrictions, and the OEMP, with specific measures recommended to be included in the OEMP to protect foreshore vegetation and marine fauna.	✓
2.32 Enhance or create ecological linkages and strategic connections for local fauna between natural areas.		✓
Complement the river landscape through sensitive design and built form		
2.38 Protect riverbanks in their natural state, maintaining and restoring the shoreline to conserve its ecological values. Where riverbank stabilisation is necessary, soft foreshore stabilisation approaches should be used. Avoid installing revetments and river walls, where possible. Rock material used for foreshore works is to be limestone.	The Ferry Wake SIA (Appendix I) concludes that, where erosion might occur, this will be in areas already affected by erosion and presently requiring management, rather than being locations where the proposed ferry wakes will introduce new erosion mechanisms or shoreline management issues. The Ferry Wake SIA will be validated through monitoring undertaken during sea trials, allowing actual shoreline impacts to be assessed and any necessary additional management measures directly associated with ferry operations to be confirmed.	✓
Activate the foreshores		
2.43 Applicants are to prepare an overarching context analysis to support proposed new or expanded commercial development that considers the broader foreshore and river uses to ensure a diversity of public facilities and experiences.	The WSRG has enabled PTA and DTMI to thoroughly understand the existing river context, ensuring the proposed route aligns with the requirements of existing foreshore and river uses, as detailed in Appendix F.	✓

Overall, the proposal is consistent with DBCA's intent for the Dootanboro (Melville Water) Locality. Importantly, the Locality Plan seeks to provide opportunities for water transport, recognising the importance of the river for commuting and tourism.

6.2.4 Perth Water Buneenboro Locality Plan and Action Plan

The proposed ferry route traverses the Perth Water Buneenboro locality between the Narrows Bridge, Elizabeth Quay and the Barrack Street jetties. The Perth Water Buneenboro Locality Plan (August 2021) establishes a vision for this locality and contains locality-specific objectives to achieve the vision.

The Locality Plan states that Buneenboro is defined by a network of lively activity nodes, expansive green spaces and open water that is visually and physically accessible to all. It notes it is an integral part of the local lifestyle, with generations of Western Australians recounting memories of boating, fishing, swimming and connecting with family and friends. It also describes the locality as the capital city's "front garden".



The Locality Plan acknowledges that new ‘on-water’ activities and growing infrastructure demands from commercial and entertainment uses have brought new challenges in managing the balance between the river’s unique environment and health, while also optimising significant tourism, recreation and economic development potential.

The five themes of the Locality Plan, supported by objectives and development outcomes, are assessed in Table 10 (as relevant to the proposal) below.

Table 10: Perth Water Buneenboro Locality Plan Assessment

Matter	Compliance
a) Culture, tourism and recreation	
Objectives	
1.1 Whadjuk-Noongar spirituality and connection to country is recognised and acknowledged throughout Perth Water <i>Buneenboro</i> .	As discussed in section 2.6 and 3.4 of this report, the PTA and TPAE team have prioritised culturally appropriate engagement with the Whadjuk Noongar community. This has included engaging ALS to facilitate a dedicated Whadjuk Cultural Advisory Working Group comprising Whadjuk Noongar Traditional Owners and Custodians. Consultation with Traditional Owner representatives will continue to inform the operation of the project. The PTA received Section 18 consent pursuant to the AH Act in March 2026. The consent requires that works are undertaken in accordance with the PTA’s <i>METRONET on Swan Ferry Service Expansion: Perth to Applecross Cultural Heritage Management Plan</i> (2025) which outlines measures for survey and protection of Aboriginal Cultural Heritage. ✓
1.2 The cultural landscape, including sites of Aboriginal and non-Aboriginal heritage significance and song lines are conserved and celebrated.	As discussed in sections 2.6 and 3.4, the project team has engaged with Traditional Owners early in the process, establishing a Whadjuk Cultural Advisory Working Group and obtaining any necessary approvals under the AH Act separately to this application. No works are proposed, so historic heritage will not be impacted by ferry operations. ✓
1.3 The local and tourist visitor experience reflects the locality’s role as a primary city destination, including Perth’s authentic character, environment and natural setting.	The proposed ferry route provides a key public transport connection between Elizabeth Quay (as the primary city destination) and other activity centres for locals and tourists. ✓
1.4 Perth Water <i>Buneenboro</i> remains actively used as a space for community celebration and relaxation.	<i>Buneenboro</i> will still be able to remain actively used as a space for community celebration and relaxation, with route design considering other river users through stakeholder engagement such as the WSRG. ✓
1.6 Views from public spaces are protected and enhanced.	As the proposal is limited to ferry operations, with buildings and infrastructure addressed in ✓



Matter	Compliance	
	separate application, visual impacts are inherently low and transient in nature. Vessel design, scale and operation will be compatible with the existing character and landscape setting which is utilised by many small to medium private and commercial vessels.	
1.7 Development complements the natural landforms and provides opportunities for public access to and enjoyment of the river.	The proposal provides an opportunity for the public to access and enjoy the river.	✓
Development Outcomes		
1(a) The Whadjuk-Noongar community is actively engaged on significant development proposals at planning inception.	As discussed in sections 2.6 and 3.4 of this report, the PTA and TPAE team have prioritised culturally appropriate engagement with the Whadjuk Noongar community. This has included engaging ALS to facilitate a dedicated Whadjuk Cultural Advisory Working Group comprising Whadjuk Noongar Traditional Owners and Custodians. Consultation with Traditional Owner representatives will continue to inform the operation of the project and, if required, separate approvals will be sought under the AH Act.	✓
1(c) The activity nodes described in Section 3 are to be the primary focus for new and upgraded community and recreation facilities and amenities.	Elizabeth Quay is identified in Section 3. This proposal will service Elizabeth Quay with new public transport services, providing a key community service.	✓
1(e) Development does not prejudice the: - cultural or heritage value of Perth Water <i>Buneenboro</i> or the larger Swan and Canning rivers; - ability of the community to access and enjoy the locality; and - availability of sufficient open space for large community events, sport and recreation activities.	As discussed in sections 2.6 and 3.4 of this report, engagement with Traditional Owners and obtaining any relevant approvals under the AH Act will ensure cultural heritage values are retained. No works are proposed, so historic heritage values will not be impacted by the ferry operations. Community access to the river will be enhanced by the proposal. The proposal will not preclude the use of open space for large community events, sport and recreation activities. This is ensured by the proposed alternative route which enables flexibility when such events take place.	✓
1(f) Development complements the visual amenity of the locality	Vessel design, scale and operation will be compatible with the existing visual amenity of the locality which is utilised by many small to medium private and commercial vessels.	✓
1(g) New development on public land complements and enhances the river environment and contributes to the capital city experience.	The proposal will complement the river environment and contribute to the capital city experience by providing a high-quality, reliable, efficient public transport service.	✓



Matter	Compliance
1(h) Development will achieve the community and cultural features, and aspirations identified in Figure 4. - Elizabeth Quay: Continued evolution into a flagship mixed use destination featuring tourism, commercial and residential uses, cultural and civic events, and celebrations. - Barrack Square: Primary port access to Perth CBD to be enhanced with a richer array of retail, dining, recreational tourism and civic experiences.	This proposal will provide Elizabeth Quay with new public transport infrastructure, supporting its evolution into a flagship mixed use destination. Overnight berthing at Barrack Square is consistent with its value as a primary port access to the Perth CBD. ✓
Natural values and resilience	
Objectives	
2.1 Enhance the river's natural fluvial and estuarine processes and protecting and restoring the natural ecology of the river and the foreshore.	The EAR (Appendix K) assessed the potential impacts to the river's natural fluvial and estuarine processes, the ecology of the river and foreshore, and natural habitat values. ✓
2.3 Recognise and expand the natural habitat values of the locality.	The recommended management and mitigation measures have been adopted as part of the proposal and will be incorporated into the final OEMP. ✓
2.7 Contamination to be managed and remediated where possible to mitigate adverse environmental outcomes with a specific focus on improvement in water quality entering the river.	Potential contamination from operations, such as from waste or sillage will be managed through the OMP and OEMP (Appendix H). ✓
2.8 Minimise adverse environmental impacts including to adjacent areas.	Environmental impacts of the proposal have been assessed in the Ferry Wake SIA (Appendix I) and EAR (Appendix K). The recommended management and mitigation measures have been adopted as part of the proposal and will be incorporated into the final OEMP. Monitoring of the foreshore locations at potential risk of erosion during sea trials, as identified in the Ferry Wake SIA, will enable actual erosion impacts to be identified and any necessary additional management measures directly associated with ferry operations to be confirmed. Monitoring of the water quality and installation of CTP's at the terminal site during initial operations will ensure that environmental conditions remain consistent with those predicted during the assessment process. ✓
2.9 Informed by research excellence conducted by relevant land managers, the principles of climate resilience are applied to planning and management of the river and foreshore.	The proposed ferry service is powered by electricity and provides an alternative transport modality to the private vehicle, supporting the principles of climate resilience. ✓



Matter	Compliance
Development Outcomes	
2e) Development addresses site specific considerations such as geotechnical and groundwater conditions and is designed to mitigate adverse environmental impacts.	Site specific considerations have been assessed in the Ferry Wake SIA (Appendix I) and EAR (Appendix K). The recommended management and mitigation measures have been adopted as part of the proposal and will be incorporated into the final OEMP. Monitoring of the foreshore locations at potential risk of erosion during sea trials, as identified in the Ferry Wake SIA, will enable actual erosion impacts to be identified and any necessary additional management measures directly associated with ferry operations to be confirmed.
2f) Potential adverse environmental and amenity impacts are mitigated. Examples that require focused consideration include noise pollution, clearing of vegetation, waste management, acid sulfate soils, soil and/or water contamination, light pollution, potential impacts to aquatic fauna and flora, hydrodynamic processes and erosion/deposition processes.	Adverse environmental and amenity impacts will be appropriately mitigated, as detailed throughout this report and the accompanying technical documents. The ONA (Appendix J) confirms that noise impacts will be acceptable. Waste management and light management will be detailed in the final OMP, with initial measures attached at Appendix H. Potential impacts to vegetation, ASS, aquatic flora and fauna and the potential for soil/water contamination have been assessed and appropriate mitigation identified in the EAR (Appendix K). Monitoring of the foreshore locations at potential risk of erosion during sea trials, as identified in the Ferry Wake SIA, will enable actual erosion impacts to be identified and any necessary additional management measures directly associated with ferry operations to be confirmed.
2(u) Any proposal to modify the interface with the river maximises access to and amenity of the river by: Mitigating impacts, such as erosion and deposition processes, on adjacent foreshore.	Erosion and deposition processes have been assessed in the Ferry Wake SIA (Appendix I) and EAR (Appendix K). Monitoring of the foreshore locations at potential risk of erosion during sea trials, as identified in the Ferry Wake SIA, will enable actual erosion impacts to be identified and any necessary additional management measures directly associated with ferry operations to be confirmed. Monitoring of the water quality and installation of CTP's at the terminal site during initial operations will ensure that environmental conditions remain consistent with those predicted during the assessment process.



Matter	Compliance
On-water activities	
Objectives	
4.1 The river is universally accessible for all users.	The proposed ferry service will enhance universal access to the river by providing a public transport option for a wide range of users. ✓
4.2 To protect and enhance the amenity of the river and the ability of the community to use, enjoy and safely access the river.	The proposal protects river amenity and safe use through low-impact operations informed by stakeholder engagement, operational controls (e.g. speed) and technical assessments addressing wake and noise. ✓
4.4 On-water activities preserve the environmental and cultural value of the river.	The proposal preserves environmental and cultural values through a design and operational approach that is informed by a Ferry Wake SIA (Appendix I), Environmental Impact Assessment (Appendix K) and engagement with Traditional Owners. ✓
4.5 Provision is made for a diverse range of activities (e.g. sea plane landing areas, helipad facilities, powered water sports activities, informal activities relying on equipment hire and entertainment activities).	Other river users have informed the proposed ferry route and operations design, particularly through the WSRG. The ferry operations are proposed to operate compatibly alongside the diverse range of activities that already use the river. ✓
4.7 The cumulative impact of on-water activities is considered.	The Ferry Wake SIA (Appendix I) and Environmental Impact Assessment (Appendix K) consider the impacts of the proposed ferry operations alongside the impacts of existing users to consider the cumulative impact of on-water activities. ✓
4.8 Synergies between on and off water uses are created.	The proposed ferry connects into the wider public transport system, as discussed in section 3.2 of this report. ✓
Development Outcomes	
4(b) Development applications proposing on-water activities are to be accompanied by a Transport and Infrastructure Access and Impact Statement detailing: - Bathymetry of the surrounding river channel; - Expected usage/patronage levels; - Operational details; - Public availability; - Access and servicing arrangements; - Strategies to mitigate impacts (environment, amenity, infrastructure); - Hours of operation; and - Event management plans (where applicable).	Although a standalone Transport and Infrastructure Access and Impact Statement has not been provided, the required information is presented across the submitted documents, including this report and appendices, and within associated development approvals for the terminals. ✓
4(d) All on-water development: Demonstrates safe and sustainable servicing (e.g. goods delivery, fuel supply, parking,	A range of studies over a number of decades (refer to section 2.1) have demonstrated the opportunities for and desirability of water- ✓



Matter	Compliance	
access to electricity, reticulated water and waste management); - On water development should demonstrate a need to be water-based rather than on land. Development should be prioritised on land, with new buildings or permanent structures within the river discouraged. - Provides appropriate sewage management (in that regard, direct connection to reticulated sewerage is preferred in an effort to minimise environmental risk); - Mitigates any adverse environmental impacts for example noise, light spill and pollution; and - Demonstrates that the activity can be undertaken safely.	based public transport infrastructure, in conjunction with land-based modalities. Safe and sustainable servicing, sillage management and safety measures have been detailed in the OMP (Appendix H). Additional details can be included following approval if required. Environmental impacts will be appropriately mitigated, as detailed in the Ferry Wake SIA (Appendix I) ONA (Appendix J) and EAR (Appendix K).	
4(e) Where necessary, development is serviced by land based infrastructure such as car parking, jetties and boat ramps to support on-water uses and activities. This may require upgrade of services and infrastructure at the cost of the proponent. Where the upgrade or delivery of infrastructure within the public realm is required, that infrastructure remains available for use and access by the community.	The relevant land-based infrastructure developments and upgrades are addressed in the development approvals issued for the Matilda Bay, Applecross and Elizabeth Quay ferry terminals in 2025. PTA and DTMI are managing any land-based infrastructure works required at Barrack Street jetties and any approval requirements for these will be addressed separately.	✓
Circulation and movement		
Objectives		
5.1 Efficient, convenient and accessible public transport networks and services connect activity nodes.	The proposed ferry service will provide an efficient, convenient, and accessible public transport link between key riverfront activity nodes.	✓
5.2 Connections to and around Perth Water <i>Buneenboro</i> strengthen its relationship with surrounding local communities.	By linking destinations around Perth Water <i>Buneenboro</i>, the proposed ferry will enhance connections between the surrounding communities and the river.	✓
5.5 Scenic loops for the enjoyment of tourists and locals with views to Perth Water <i>Buneenboro</i> are prioritised.	Tourists and locals alike will experience scenic river views throughout the ferry journey.	✓
Development Outcomes		
5(a) Development provides: - Infrastructure that supports and encourages active transport between activity nodes; - Access to public amenities such as public toilets, parents' rooms and universal access facilities; - A visually permeable and easy to navigate environment; - Appropriate interpretive signage; - Access to drinking water;	Patrons can bring bicycles on board, ensuring the ferry complements and enables active transport networks at either end of the journey. Toilets will be available to ferry passengers on board each of the ferries. Additional public toilets have been approved at the Matilda Bay Ferry Terminal (subject to a separate development approval). The ferry terminals (which are subject to separate development approvals) will include signage and wayfinding to direct passengers	✓



Matter	Compliance	
- Pet facilities (e.g. water bowls, tethering points, waste bags); - Consistency in the look, feel and treatment of access and infrastructure elements tailored to the locality's setting; and - Connections to the surrounding area.	to the ferry terminals and direct boarding requirements. The proposed vessels will include signage as required to direct passengers on board and provide relevant information regarding ferry routes etc. The functional design of the ferries also supports intuitive wayfinding. Announcements via the vessel's PA system will assist with patrons' navigation and interpretation of the vessel. Drinking water and pet facilities do not form part of this proposal. The proposed vessel will have Transperth branding and will be consistent with the look and feel of other public transport vehicles and supporting infrastructure throughout the City, ensuring familiarity for patrons. The proposed ferry service will enhance connections to the surrounding area by providing a direct and accessible transport link between Elizabeth Quay, Applecross, and Matilda Bay.	
5(c) Universal access is provided in accordance with the requirements of the <i>Disability Discrimination Act 1992</i> and relevant Australian Standards.	The ferries will be designed to meet the relevant requirements for universal access under the <i>Disability Discrimination Act 1992</i>.	✓

Figure 9 in the Locality Plan (refer to Figure 15 below) identifies the following outcomes for on-water activity in the vicinity of the proposed ferry route:

- Elizabeth Quay: Continued role as priority location for public ferry services, courtesy moorings and commercial river craft including water taxis.
- Barrack Street Jetties: Expanded jetty infrastructure and facilities at key nodes based on approved Department of Transport (DoT) criteria (vessel size, use, times etc.).
- Commercial watersports area (horizontal blue lines): High-speed designated area for approved operators (e.g. wakeboarding, jet boats).
- Anchor: Expanded mooring buoy capacity by reconfiguring existing and introducing new courtesy mooring buoys adjacent key activity nodes.

The proposed ferry service will utilise the Elizabeth Quay ferry terminal for public pick-up/drop-off and overnight berthing will occur at Barrack Street jetties and at the Matilda Bay terminal in accordance with the on-water outcomes identified for these locations.





Figure 15: Excerpt of Perth Water Buneenboro Locality Plan Figure 9 – Desired outcomes for on-water activity

Figure 10 in the Locality Plan (Desired outcomes for circulation and movement) identifies an expanded public ferry route to the east of the existing route between Elizabeth Quay and South Perth. This is currently being explored by PTA and DTMI, as discussed earlier in this report.

The Action Plan which accompanies the Locality Plan includes the following action:

5.3 Expand bus and ferry services

Explore opportunities for improved public transport services within the local areas:

- c) *Subject to demand, review previous studies (such as Perth's Ferry Services – Current Status and Future Use' report) and investigate the viability of the potential for new ferry routes and vessels, to increase cross river connections.*

This proposal is consistent with Action 5.3(c), being underpinned by a number of feasibility assessments (refer to section 2.1) and increasing demand for cross river connections.

Accordingly, the proposal is consistent with DBCA's intent for the Perth Water *Buneenboro* Locality. Importantly, the Locality Plan seeks to provide opportunities for efficient, convenient



and accessible public transport networks that strengthen the locality's relationship with surrounding communities and provides scenic loops for the enjoyment of tourists and locals. Elizabeth Quay and Barrack Street Jetties are also identified as priority locations for public ferry services and jetty infrastructure respectively.

6.3 State Planning Policies

6.3.1 State Planning Policy 2.0 – Environment and natural resources policy

State Planning Policy 2.0 – Environment and Natural Resources Policy (SPP 2.0) defines the principles and considerations that represent good and responsible planning in terms of environment and natural resource issues within the framework of the State Planning Strategy.

A response to the relevant matters raised in SPP 2.0 is provided below.

- General Measures
 - The accompanying EAR at Appendix K details how the project will be managed to avoid any unacceptable environmental damage and protect significant natural and indigenous cultural features, including consideration of key matters related to coastal erosion and foreshore, water quality, benthic habitat, marine fauna, waste and hazardous materials, and heritage.
- Water Resources
 - The project incorporates measures to protect, manage and conserve the Swan and Canning rivers as detailed in the EAR (Appendix K). The EAR identifies that the proposed ferries and ferry routes have been designed to minimise impacts to benthic habitats and marine fauna, as well as reducing wave wake. An OEMP will be prepared to minimise the impacts of operation.
- Air Quality
 - The project increases availability and accessibility to public transport, supporting sustainable urban development patterns such as emerging higher density activity centre nodes.
- Biodiversity
 - The project will minimise any adverse impacts on areas of high biodiversity or conservation value as detailed in the EAR (Appendix K). In particular, the ferry will not traverse the Swan Estuary Marine Park and a minimum distance of 100m from the Marine Park will be maintained. Potential impacts to the Marine Park will be indirect and are anticipated to be limited to very minor erosion and vessel strike of mobile fauna species outside the Marine Park itself. The risk of strike of mobile fauna is anticipated to be low however will also be appropriately managed through vessel design, speed restrictions and the OEMP.
- Marine Resources and Aquaculture
 - The proposed route has been selected to minimise impacts on existing recreational water users.
- Greenhouse Gas Emissions and Energy Efficiency
 - The proposal will enhance access to high-quality public transport that connects inner city activity centre precincts.



- The proposed ferry vessels are electric to support reduced greenhouse gas emissions associated with the new ferry service.

In accordance with the above, an appropriate operational management framework is being implemented for managing environmental considerations for the project, as detailed in the accompanying EAR at Appendix K.

SPP 2.0 is supplemented by more detailed SPPs on particular environmental matters, such as coastal and water planning. These are addressed below.

6.3.2 State Planning Policy 2.6 – Coastal Planning

The purpose of State Planning Policy 2.6 – Coastal Planning (SPP 2.6) is to provide guidance for decision-making within the coastal zone, including managing land use change. SPP 2.6 applies to the coast throughout WA including 'tidal reaches of inland waters' such as the Swan River.

The objectives of SPP 2.6 include an intent to:

- ensure that development and the location of coastal facilities take into account coastal processes, landform stability, coastal hazards, climate change and biophysical criteria;
- ensure the identification of appropriate areas for the sustainable use of the coast for housing, tourism, recreation, ocean access, maritime industry, commercial and other activities;
- provide for public coastal foreshore reserves and access to them on the coast; and
- protect, conserve and enhance coastal zone values, particularly in areas of landscape, biodiversity and ecosystem integrity, indigenous and cultural significance.

A response to the relevant matters raised in SPP 2.6 is provided below.

- Development and settlement
 - The proposed ferry route has been determined with regard to infrastructure capacity, with the recent approval of two new terminals at Applecross and Matilda Bay and an upgrade of existing facilities at Elizabeth Quay.
 - The proposed ferry route is in a suitable area, determined by stakeholder engagement (Appendix F), Ferry Wake SIA (Appendix I), ONA (Appendix J), and EAR (Appendix K).
 - Significant and permanent negative impacts on the environment will be avoided, as demonstrated by the Ferry Wake SIA (Appendix I), ONA (Appendix J), and EAR (Appendix K).
- Public interest
 - Community consultation and engagement strategies, including the WSRG, have enabled informed community input into project decision-making (Appendix F).
 - The project will support continued public access to the Matilda Bay and Applecross foreshores and create enhanced opportunities for increased public enjoyment of the Swan River environment.
- Coastal foreshore reserve
 - The project will support the established public recreation function of the Matilda Bay Reserve (R17375), offering enhanced public transport access to this area for foreshore and river users.



- Coastal strategies and management plans
 - Foreshore Management Plans have been included as a conditional requirement in the relevant approvals for the new ferry terminals at Matilda Bay and Applecross, consistent with the requirements of the Coastal Planning Policy Guidelines.
- Precautionary principle
 - The accompanying Ferry Wake SIA (Appendix I), ONA (Appendix J), and EAR (Appendix K) demonstrate that there are no threats of serious or irreversible environmental damage associated with the proposal, and that associated environmental considerations can be appropriately addressed through an OEMP.

6.3.3 State Planning Policy 2.9 – Water

State Planning Policy 2.9 – Water (SPP 2.9) ensures that planning and development considers water resource management, applying appropriate measures to protect water quality and quantity and ensuring the delivery of sustainable outcomes for both water resources and development.

Relevant policy outcomes are as follows:

- 6.1 Planning and development maintains or enhances water quality and hydrological regimes to protect public health and support healthy ecosystems through the:
 - i. protection of sensitive water resources and other important environments;
 - ii. protection of existing vegetation and/or restoration of cleared or degraded vegetation, preferably with endemic species;
 - iii. appropriate siting and management of land uses; and
 - iv. maintenance of natural flows in waterways, groundwater levels and inundation of wetlands to sustain aquatic and terrestrial habitats through the delivery of appropriate stormwater and groundwater management systems.
- 6.3 Aboriginal heritage values in relation to water resources are identified and protected consistent with the *Aboriginal Heritage Act 1972*.
- 6.4 Historic heritage values in relation to water resources are protected consistent with the *Heritage Act 2018*.
- 6.5 Planning and development maintains and enhances public access to water resources where appropriate.
- 6.6 Planning and development enhances amenity and sense of place associated with water resources, which in turn protect public health and increase the resilience of the community.

An assessment of the relevant policy measures is provided in Table 11 below.

Table 11: State Planning Policy 2.9 Assessment

Policy Measure	Compliance
7.1 General Measures	
a) All relevant water-related matters should be considered at the earliest possible stage of the planning process	Water-related matters have been considered as part of early project planning, as demonstrated through the stakeholder engagement summary ✓



Policy Measure	Compliance	
and all subsequent stages in accordance with the Guidelines.	(Appendix F), Ferry Wake SIA (Appendix I), ONA (Appendix J) and EAR (Appendix K).	
b) Proposals are to be accompanied by sufficient information in accordance with the Guidelines, which specify instances where a Water Management Report is required and what it must contain.	N/A - A Water Management Report is not necessary to support the proposed ferry operations as there will be no impacts on water resources, flooding stormwater management, wastewater servicing, groundwater, or drinking water source protection. The impacts of the ferry operations on the water of the Swan River have been assessed in the EAR (Appendix K).	
7.2 Environmental, social and cultural values		
Wetlands and waterways Proposals should, in accordance with the Guidelines:	The accompanying EAR at Appendix K identifies and describes the Swan and Canning river context's wetlands, waterways foreshore areas and reserves.	✓
a) identify wetlands and their buffers and waterways and their foreshore areas and/or reserves;		
d) where possible, maintain and restore ecological linkages;	The EAR (Appendix K) details how the project will be managed to maintain ecological linkages and sensitive water resources with regard to the foreshore environment, benthic habitat and marine fauna.	✓
f) identify and protect sensitive water resources;		✓
g) where possible, protect and enhance vegetation within sensitive water resource areas, in particular endemic species;		✓
Water quality Proposals should, in accordance with the Guidelines:	The EAR (Appendix K) details how the project will mitigate impacts to water quality, stating that the OEMP will include measures to manage impacts, including:	✓
h) minimise export of nutrient and all other contaminants, including sediment, entering water resources;	- Ferry route and speeds - Pollution controls – it is expected that possible sources of toxicants will be limited to ballast (pending system requirements), antifoulant and ferry cooling / anticorrosion systems and public toilets.	✓
i) avoid adverse effects on the natural and built environment and/or human health when undertaking subdivision and development of land containing acid sulfate soils or contaminated sites;	- Integrated waste management procedures - Wastewater and litter management and servicing requirements - Fire management - Correct storage of hazardous materials (as applicable).	✓
j) demonstrate that infrastructure and site management practices are in place to manage nutrient and all other contaminants, including sediment, particularly within sensitive water resource areas and public drinking water source areas, and adjacent to other important environments.	Water quality in the Swan and Canning Estuary is routinely monitored by DBCA. These reports will likely provide a long-term data set from which to compare changes over time. Additionally, monitoring of the water quality and installation of CTP's at the terminal site during initial operations will ensure that environmental conditions remain consistent with those predicted during the assessment process.	✓



Policy Measure	Compliance	
	Ferries are to operate in accordance with relevant State, Commonwealth and International legislative requirements for the safe operation of the vessels including the International Convention for the Prevention of Pollution from Ships (MARPOL) management planning. Uncontrolled releases will be reported immediately.	
Social Proposals should, in accordance with the Guidelines: n) maintain or enhance safe public access to water resources, except where at the detriment of ecosystem health and/or public drinking water source protection; and	The proposal will enhance safe public access to the river through the provision of accessible, water-based public transport. Maintaining existing safe public access to the river has been managed through stakeholder engagement and the WSRG, providing other river users the opportunity to contribute to project design and pre-emptively resolving potential conflicts.	✓
Cultural Proposals should, in accordance with the Guidelines: o) identify Aboriginal heritage and use best endeavours to protect, avoid or minimise harm consistent with the <i>Aboriginal Heritage Act 1972</i> ; and	As discussed in sections 2.6 and 3.4 of this report, engagement with Traditional Owners and obtaining any relevant approvals under the AH Act will ensure cultural heritage values are retained. No works are proposed, so historic heritage values will not be impacted by the ferry operations.	✓
p) identify, conserve and protect historic heritage places and values.		✓
7.7 Specific area measures: Swan Canning river system		
a) maintain and enhance the ecological and hydrological functions of the river system, and demonstrate detrimental impacts have been prevented	The ecological and hydrological functions of the river system will be maintained, as detailed in the Ferry Wake SIA (Appendix I), ONA (Appendix J), and EAR (Appendix K). These reports demonstrate that detrimental impacts can be prevented. Measures required to ensure this will be included in the OEMP (Appendix H). Monitoring of the foreshore locations at potential risk of erosion during sea trials, as identified in the Ferry Wake SIA, will enable actual erosion impacts to be identified and any necessary additional management measures directly associated with ferry operations to be confirmed. Monitoring of the water quality and installation of CTP's at the terminal site during initial operations will ensure that environmental conditions remain consistent with those predicted during the assessment process.	✓
b) demonstrate a benefit to the community and a functional need to be located within the river and/or foreshore reserves, where the proposal is located on public land;	A range of studies over a number of decades (refer to section 2.1) have demonstrated the opportunities for and desirability of water-based public transport infrastructure, in conjunction with land-based modalities.	✓



Policy Measure	Compliance	
c) maintain and enhance public access to and along the rivers and its foreshores, including through the establishment of foreshore reserves;	The proposal will enhance safe public access to the river through the provision of accessible, water-based public transport. Maintaining existing safe public access to the river has been managed through stakeholder engagement and the WSRG, providing other river users the opportunity to contribute to project design and pre-emptively resolving potential conflicts.	✓
d) consider the importance of the river as a strategic water transport network for commercial and recreational use;	The proposal will enhance Perth's strategic water based public transport network.	✓
e) maintain and enhance the natural landscape character and sense of place of the river system;	Vessel design, scale and operation will maintain the existing character of the river system which is utilised by many small to medium private and commercial vessels.	✓
f) maintain and enhance views of the Swan Canning river system from public places;	As the proposal is limited to ferry operations, with buildings and infrastructure addressed in separate application, visual impacts are inherently low and transient in nature.	✓
g) identify Whadjuk Noongar Aboriginal heritage and use best endeavours to protect, avoid or minimise harm consistent with the <i>Aboriginal Heritage Act 1972</i> ;	As discussed in sections 2.6 and 3.4 of this report, engagement with Traditional Owners and obtaining any relevant approvals under the AH Act will ensure cultural heritage values are retained.	✓
h) protect, maintain or increase vegetation coverage (preferably with endemic species); and	Protection of vegetation has been considered in the EAR (Appendix K), particularly in relation to the effects of erosion and sediment mobilisation on benthic species such as seagrass. The EAR confirms that vessel design and speed restrictions will minimise these effects.	✓
i) maintain or establish ecological and public open space linkages to the Swan Canning river system for wildlife habitat and movement and natural water flows	Ecological and public open spaces linkages to the Swan Canning river system will not be impacted by the proposal due to the on water nature of the proposed ferry service.	✓

The project therefore represents a positive contribution to the Swan River estuarine environment that is consistent with the objectives, intentions and provisions of SPP 2.9.

7.0 Planning Merit

In addition to the assessment and justification provided in the preceding sections of this report, the principles of orderly and proper planning require that new development is a logical and efficient extension of existing development in the locality, and that it is consistent with the planning vision for the area. The key points regarding the proposal are as follows:

- The proposal is consistent with the objectives and principles of the SCRM Act, which include sustainability, the precautionary principle, intergenerational equity, biodiversity and ecological integrity, shared responsibility, best practice, continuous improvement, and accountability and transparency.



- The proposal is consistent with the policy framework for the Swan Canning DCA, which supports commuter water-based transport where the ecological health, community benefits and amenity of the river system are maintained.
- The delivery of the MOSFE is consistent with key State level planning policies and strategies as detailed throughout this report and aligns with the State Government's METRONET Strategy.
- The proposal represents an appropriate use of Crown Reserves 48325 and 48327 for water-based transport that will enhance access to the river, contributing to the community amenity value of the river while protecting the environment.
- The proposal will provide a new public transport mode between key locations including the Perth CBD, UWA and high density mixed use and residential areas, reducing car dependence, supporting affordable and accessible transport options, and providing connections between active transport networks. The proposal will provide social benefits to the community by facilitating enhanced river transport services for residents, workers, tourists and recreational users.
- The proposal will facilitate an affordable way for recreational enjoyment of the Swan River by those community members who cannot typically afford those types of on river experiences. This is a positive social and recreational benefit of the MOSFE.
- Vessel design and bulk will be contextually sensitive and minimal, and on this basis compatible with the existing riverine environment.
- Existing river users have been comprehensively engaged with through the WSRG and have directly contributed to the proposed preferred ferry route. This will continue until the route is finalised and operations have commenced. The WSRG is a key mechanism for reducing conflict with existing river users and enhancing the safety and accessibility of the river.
- Ferry operations will be appropriately managed through an OMP, with a preliminary OMP attached at Appendix H to which further details will be included as required prior to operations commencing. This will ensure safety, servicing, and other operational requirements are implemented to a high standard.
- The PTA and TPAE team have prioritised culturally appropriate engagement with the Whadjuk Noongar community. This has included engaging ALS to facilitate a dedicated Whadjuk Cultural Advisory Working Group comprising Whadjuk Noongar Traditional Owners and Custodians. Consultation with Traditional Owner representatives will continue to inform the operation of the project and, if required, separate approvals will be sought under the AH Act.
- The proposal has been designed to minimise impact on the natural environment, as assessed in the Ferry Wake SIA (Appendix I), ONA (Appendix J) and EAR (Appendix K), with all recommendations from these reports to be included in the final OEMP.
- The proposed electric vessels contribute to the State Government's net zero emissions target for 2050.

The proposed development is therefore consistent with the principles of orderly and proper planning and has significant planning merit.



8.0 Conclusion

This report has been prepared by SLR, on behalf of the PTA, in support of a development application for the delivery of the proposed ferry operations, which represents an integral component of the State Government's MOSFSE.

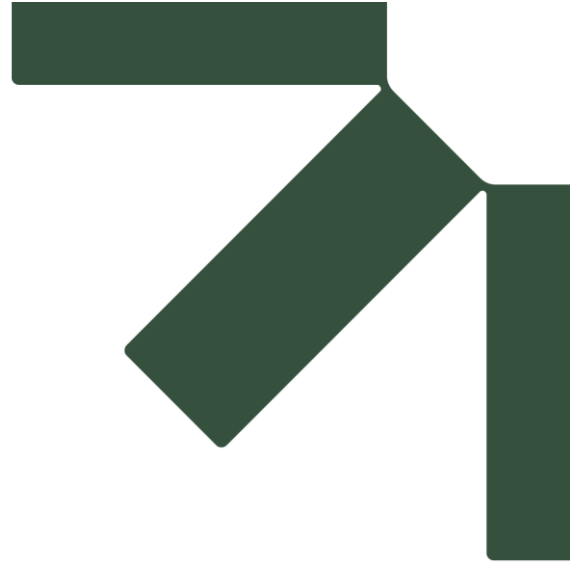
The MOSFSE represents a significant investment in an expanded ferry network to significantly improve accessibility across the Swan River, provide an expeditious and sustainable travel alternative for both commuters and tourists, capitalise on the inherent aesthetic and recreational value of the rivers and support economic growth, urban revitalisation and densification around river nodes. This report sets out the development approval framework, project area description, proposed land use and planning framework applicable to the proposal.

Based on the assessment set out in this report, it is considered that the proposed development will meet the objectives and principles of the SCRM Act and associated policy framework and will also achieve appropriate outcomes with respect to environmental and heritage matters. The proposal has also been informed by stakeholder feedback from both river users and river interface users, and agency stakeholders.

For these reasons, and the demonstrated consistency with the applicable planning framework, the proposed ferry operations are consistent with the principles of orderly and proper planning, and warrant approval accordingly. We therefore respectfully request the support of the DBCA, SRT, City of Perth, City of South Perth and City of Melville, and we look forward to the favourable consideration of this application by the Minister.

To assist with the timely implementation of this important State Government infrastructure project, we respectfully request the assistance of all key stakeholders in processing this development application through to conditional approval as quickly as reasonably possible.





Appendix A Certificates of Title

Ferry Operations Development Application

METRONET on Swan Ferry Service Expansion

Public Transport Authority of Western Australia

SLR Project No.: 675.V25085.00EA1

21 August 2026

WESTERN



AUSTRALIA

TITLE NUMBER

Volume Folio

LR3166 579

**RECORD OF CERTIFICATE
OF
CROWN LAND TITLE**
UNDER THE TRANSFER OF LAND ACT 1893
AND THE LAND ADMINISTRATION ACT 1997

The undermentioned land is Crown land in the name of the STATE OF WESTERN AUSTRALIA, subject to the interests and Status Orders shown in the first schedule which are in turn subject to the limitations, interests, encumbrances and notifications shown in the second schedule.

BGRoberts
REGISTRAR OF TITLES



LAND DESCRIPTION:

LOT 504 ON DEPOSITED PLAN 408106

STATUS ORDER AND PRIMARY INTEREST HOLDER:
(FIRST SCHEDULE)

STATUS ORDER/INTEREST: RESERVE VESTED UNDER STATUTE

PRIMARY INTEREST HOLDER: SWAN RIVER TRUST OF PO BOX 6740, EAST PERTH
(XE K668071) REGISTERED 28/7/2008

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)

1. H267244 MEMORIAL. HERITAGE OF WESTERN AUSTRALIA ACT 1990. LODGED 1/11/1999.
2. J964173 LEASE TO OLD PERTH PORT PTY LTD OF LUCKY SHAG WATERFRONT BAR MEZZANINE 1 GF OLD PERTH PORT, BARRACK SQUARE, PERTH. EXPIRES: SEE LEASE. AS TO PORTION ONLY. REGISTERED 25/10/2006.
 - O199316 EXTENSION OF LEASE J964173. REGISTERED 23/7/2019.
 - O199319 VARIATION OF LEASE J964173 REGISTERED 23/7/2019.
 - O199352 SUB-LEASE OF LEASE J964173 TO SKS WATERFRONT PTY LTD OF UNIT 1 28 THOROGOOD STREET BURSWOOD WA 6100 EXPIRES: SEE SUB LEASE. REGISTERED 23/7/2019.
 - O659264 EXTENSION OF SUB LEASE. REGISTERED 3/3/2021.
 - O898194 SUB LEASE. SUB LESSEE SKS WATERFRONT HOTEL PTY LTD OF UNIT 1 28 THOROGOOD STREET BURSWOOD WA 6100 AS TO PORTION ONLY REGISTERED 7/10/2021.
 - O898193 EXTENSION OF SUB LEASE. REGISTERED 7/10/2021.
 - O504398 EXTENSION OF LEASE. J964173 REGISTERED 22/9/2020.
3. N361112 RESERVE 48325 FOR THE PURPOSE OF PROTECTION AND ENHANCEMENT OF THE ECOLOGICAL AND COMMUNITY BENEFITS AND AMENITY OF THE SWAN AND CANNING RIVERS REGISTERED 22/6/2016.
4. K668071 CARE, CONTROL AND MANAGEMENT PURSUANT TO SECTION 11(7) OF THE SWAN AND CANNING RIVERS MANAGEMENT ACT 2006. REGISTERED 28/7/2008.

END OF PAGE 1 - CONTINUED OVER

ORIGINAL CERTIFICATE OF CROWN LAND TITLE

REGISTER NUMBER: 504/DP408106

VOLUME/FOLIO: LR3166-579

PAGE 2

- O199315 THE CORRECT ADDRESS OF THE PRIMARY INTEREST HOLDER IS NOW LOCKED BAG 104 BENTLEY DELIVERY CENTRE WA REGISTERED 23/7/2019.
5. L152867 MEMORIAL. CONTAMINATED SITES ACT 2003 REGISTERED 26/11/2009.
6. L441612 LEASE TO OLD PERTH PORT PTY LTD OF P.O. BOX 7925, CLOISTERS SQUARE, PERTH. EXPIRES: SEE LEASE. AS TO PORTION ONLY. REGISTERED 30/9/2010.
- L772041 MORTGAGE OF LEASE L441612 TO AUSTRALIA AND NEW ZEALAND BANKING GROUP LTD REGISTERED 1/11/2011.
- L772041 THE CORRECT ADDRESS OF THE LESSEE IS NOW LUCKY SHAG WATERFRONT BAR, OLD PERTH PORT UNIT M01 GROUND FLOOR, BARRACK SQUARE, PERTH. REGISTERED 1/11/2011.
- O199323 CHANGE OF ADDRESS. THE PROPRIETORSHIP IS NOW OLD PERTH PORT PTY LTD OF LUCKY SHAG WATERFRONT BAR MEZZANINE 1 GF OLD PERTH PORT BARRACK SQUARE PERTH REGISTERED 23/7/2019.
- O199323 EXTENSION OF LEASE L441612. REGISTERED 23/7/2019.
- O199324 VARIATION OF LEASE L441612 REGISTERED 23/7/2019.
- O504390 VARIATION OF LEASE. L441612 REGISTERED 22/9/2020.
- O504391 EXTENSION OF LEASE. L441612 REGISTERED 22/9/2020.
7. O199315 LEASE TO OLD PERTH PORT PTY LTD OF LUCKY SHAG WATERFRONT BAR MEZZANINE 1 GF OLD PERTH PORT BARRACK SQUARE PERTH EXPIRES: SEE LEASE. AS TO PORTION ONLY REGISTERED 23/7/2019.
- O199317 EXTENSION OF LEASE O199315. REGISTERED 23/7/2019.
- O199320 VARIATION OF LEASE O199315 REGISTERED 23/7/2019.
- O199354 SUB-LEASE OF LEASE O199315 TO SKS WATERFRONT PTY LTD OF UNIT 1 28 THOROGOOD STREET BURSWOOD WA 6100 EXPIRES: SEE SUB LEASE. REGISTERED 23/7/2019.
- O659264 EXTENSION OF SUB LEASE. REGISTERED 3/3/2021.
- O898194 SUB LEASE. SUB LESSEE SKS WATERFRONT HOTEL PTY LTD OF UNIT 1 28 THOROGOOD STREET BURSWOOD WA 6100 AS TO PORTION ONLY REGISTERED 7/10/2021.
- O898193 EXTENSION OF SUB LEASE. REGISTERED 7/10/2021.
8. O199318 LEASE TO OLD PERTH PORT PTY LTD OF LUCKY SHAG WATERFRONT BAR MEZZANINE 1 GF OLD PERTH PORT BARRACK SQUARE PERTH EXPIRES: SEE LEASE. AS TO PORTION ONLY REGISTERED 23/7/2019.
- O199321 VARIATION OF LEASE O199318 REGISTERED 23/7/2019.
- O199353 SUB-LEASE OF LEASE O199318 TO SKS WATERFRONT PTY LTD OF UNIT 1 28 THOROGOOD STREET BURSWOOD WA 6100 EXPIRES: SEE SUB LEASE. REGISTERED 23/7/2019.
- O659264 EXTENSION OF SUB LEASE. REGISTERED 3/3/2021.
- O898194 SUB LEASE. SUB LESSEE SKS WATERFRONT HOTEL PTY LTD OF UNIT 1 28 THOROGOOD STREET BURSWOOD WA 6100 AS TO PORTION ONLY REGISTERED 7/10/2021.
- O898193 EXTENSION OF SUB LEASE. REGISTERED 7/10/2021.
9. O199322 LEASE TO OLD PERTH PORT PTY LTD OF LUCKY SHAG WATERFRONT BAR MEZZANINE 1 GF OLD PERTH PORT BARRACK SQUARE PERTH EXPIRES: SEE LEASE. AS TO PORTION ONLY REGISTERED 23/7/2019.
- O199325 VARIATION OF LEASE O199322 REGISTERED 23/7/2019.
10. O420026 NOTIFICATION CONTAINS FACTORS AFFECTING THE WITHIN LAND. LODGED 4/6/2020.
11. O885761 NOTIFICATION. HERITAGE ACT 2018. SEE DEPOSITED PLAN 421827 LODGED 28/9/2021.

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
 Lot as described in the land description may be a lot or location.

-----END OF CERTIFICATE OF CROWN LAND TITLE-----

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ORIGINAL CERTIFICATE OF CROWN LAND TITLE

REGISTER NUMBER: 504/DP408106

VOLUME/FOLIO: LR3166-579

PAGE 3

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND:	DP408106
PREVIOUS TITLE:	LR3153-419
PROPERTY STREET ADDRESS:	1 BARRACK SQ, PERTH.
LOCAL GOVERNMENT AUTHORITY:	CITY OF PERTH
RESPONSIBLE AGENCY:	DEPARTMENT OF BIODIVERSITY, CONSERVATION AND ATTRACTIONS (SCLM)

NOTE 1:	L675050	SECTION 138D TLA APPLIES TO CAVEAT K115422.
NOTE 2:	L688857	SECTION 138D TLA APPLIES TO CAVEAT K777897.
NOTE 3:	N361111	CORRESPONDENCE FILE 00469-2010-01RO
NOTE 4:		SUBJECT TO SURVEY - NOT FOR ALIENATION PURPOSES

WESTERN



AUSTRALIA

TITLE NUMBER

Volume Folio

LR3151 548

RECORD OF QUALIFIED CERTIFICATE OF CROWN LAND TITLE

UNDER THE TRANSFER OF LAND ACT 1893
AND THE LAND ADMINISTRATION ACT 1997

The undermentioned land is Crown land in the name of the STATE OF WESTERN AUSTRALIA, subject to the interests and Status Orders shown in the first schedule which are in turn subject to the limitations, interests, encumbrances and notifications shown in the second schedule.

BGRoberts
REGISTRAR OF TITLES



LAND DESCRIPTION:

LOT 301 ON DEPOSITED PLAN 47451

STATUS ORDER AND PRIMARY INTEREST HOLDER: (FIRST SCHEDULE)

STATUS ORDER/INTEREST: RESERVE VESTED UNDER STATUTE

PRIMARY INTEREST HOLDER: SWAN RIVER TRUST OF PO BOX 6740, EAST PERTH
(XE K668071) REGISTERED 28/7/2008

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS: (SECOND SCHEDULE)

1. J964173 LEASE TO OLD PERTH PORT PTY LTD OF LUCKY SHAG WATERFRONT BAR MEZZANINE 1 GF OLD PERTH PORT, BARRACK SQUARE, PERTH. EXPIRES: SEE LEASE. AS TO PORTION ONLY. REGISTERED 25/10/2006.
 - O199316 EXTENSION OF LEASE J964173. REGISTERED 23/7/2019.
 - O199319 VARIATION OF LEASE J964173 REGISTERED 23/7/2019.
 - O199352 SUB-LEASE OF LEASE J964173 TO SKS WATERFRONT PTY LTD OF UNIT 1 28 THOROGOOD STREET BURSWOOD WA 6100 EXPIRES: SEE SUB LEASE. REGISTERED 23/7/2019.
 - O257727 SUB-LEASE OF SUB-LEASE O199352 TO OLD PERTH PORT PTY LTD OF LUCKY SHAG WATERFRONT BAR MEZZANINE 1 GF OLD PERTH PORT BARRACK SQUARE PERTH WA 6000 AS TO PORTION ONLY REGISTERED 14/10/2019.
 - O659264 EXTENSION OF SUB LEASE. REGISTERED 3/3/2021.
 - O898194 SUB LEASE. SUB LESSEE SKS WATERFRONT HOTEL PTY LTD OF UNIT 1 28 THOROGOOD STREET BURSWOOD WA 6100 AS TO PORTION ONLY REGISTERED 7/10/2021.
 - O898193 EXTENSION OF SUB LEASE. REGISTERED 7/10/2021.
 - O504398 EXTENSION OF LEASE. J964173 REGISTERED 22/9/2020.
2. K668067 RESERVE 48325 FOR THE PURPOSE OF PROTECTION AND ENHANCEMENT OF THE ECOLOGICAL AND COMMUNITY BENEFITS AND AMENITY OF THE SWAN AND CANNING RIVERS REGISTERED 28/7/2008.

END OF PAGE 1 - CONTINUED OVER

ORIGINAL CERTIFICATE OF CROWN LAND TITLE
QUALIFIED

REGISTER NUMBER: 301/DP47451

VOLUME/FOLIO: LR3151-548

PAGE 2

- N361112 AMENDMENT OF RESERVE. RESERVE AMENDED TO EXCLUDE THE PORTION
COMPRISED IN LOT 500 ON DP408106 ONLY. REGISTERED 22/6/2016.
- O511739 AMENDMENT OF RESERVE. RESERVE AMENDED. REGISTERED 30/9/2020.
3. K668071 CARE, CONTROL AND MANAGEMENT PURSUANT TO SECTION 11(7) OF THE SWAN AND
CANNING RIVERS MANAGEMENT ACT 2006. REGISTERED 28/7/2008.
4. L570597 MEMORIAL. HERITAGE OF WESTERN AUSTRALIA ACT 1990. AS TO PORTION ONLY - SEE
DEPOSITED PLAN 70488. LODGED 9/3/2011.
5. L991949 CAVEAT BY CITY FORESHORE INVESTMENTS PTY LTD AS TO PORTION ONLY. LODGED
13/7/2012.
6. N361111 PORTION COMPRISED IN LOT 500 ON DP408106 TO VOL 3166 FOL 578. REGISTERED 22/6/2016.
7. N666603 LEASE TO WEST AUSTRALIAN ROWING CLUB INC OF RIVERSIDE DRIVE PERTH WA
EXPIRES: SEE LEASE. AS TO PORTION ONLY REGISTERED 5/7/2017.
- N666604 SUB-LEASE OF LEASE N666603 TO CARRON MICHELLE WEIR OF 199 RAVENSCAR
STREET DOUBLEVIEW EXPIRES: SEE SUB LEASE. AS TO PORTION ONLY REGISTERED
5/7/2017.
- N666606 TRANSFER OF LEASE N666604, LESSEE NOW RUBRA COFFEE MERCHANTS PTY LTD
OF 33A BRICKNELL ROAD ATTADALE WA 6156 REGISTERED 5/7/2017.
- N666607 EXTENSION OF LEASE N666604. REGISTERED 5/7/2017.
- N666605 EXTENSION OF LEASE N666603. REGISTERED 5/7/2017.
8. O199318 LEASE TO OLD PERTH PORT PTY LTD OF LUCKY SHAG WATERFRONT BAR MEZZANINE 1
GF OLD PERTH PORT BARRACK SQUARE PERTH EXPIRES: SEE LEASE. AS TO PORTION
ONLY REGISTERED 23/7/2019.
- O199321 VARIATION OF LEASE O199318 REGISTERED 23/7/2019.
- O199353 SUB-LEASE OF LEASE O199318 TO SKS WATERFRONT PTY LTD OF UNIT 1 28
THOROGOOD STREET BURSWOOD WA 6100 EXPIRES: SEE SUB LEASE. REGISTERED
23/7/2019.
- O257727 SUB-LEASE OF SUB-LEASE O199353 TO OLD PERTH PORT PTY LTD OF LUCKY SHAG
WATERFRONT BAR MEZZANINE 1 GF OLD PERTH PORT BARRACK SQUARE PERTH
WA 6000 AS TO PORTION ONLY REGISTERED 14/10/2019.
- O659265 EXTENSION OF SUB LEASE. REGISTERED 3/3/2021.
- O659264 EXTENSION OF SUB LEASE. REGISTERED 3/3/2021.
- O898194 SUB LEASE. SUB LESSEE SKS WATERFRONT HOTEL PTY LTD OF UNIT 1 28
THOROGOOD STREET BURSWOOD WA 6100 AS TO PORTION ONLY REGISTERED
7/10/2021.
- O898193 EXTENSION OF SUB LEASE. REGISTERED 7/10/2021.
9. O199322 LEASE TO OLD PERTH PORT PTY LTD OF LUCKY SHAG WATERFRONT BAR MEZZANINE 1
GF OLD PERTH PORT BARRACK SQUARE PERTH EXPIRES: SEE LEASE. AS TO PORTION
ONLY REGISTERED 23/7/2019.
- O199325 VARIATION OF LEASE O199322 REGISTERED 23/7/2019.
10. O420026 NOTIFICATION CONTAINS FACTORS AFFECTING THE WITHIN LAND. LODGED 4/6/2020.
11. O511738 PORTION COMPRISED IN LOT 500 ON DEPOSITED PLAN 416700 TO VOL 3172 FOL 213
REGISTERED 30/9/2020.
12. O570716 LEASE TO OLD SALT PERTH PTY LTD OF 26 HOWE STREET OSBORNE PARK WA 6017
EXPIRES: SEE LEASE. AS TO PORTION ONLY REGISTERED 30/11/2020.
13. O885761 NOTIFICATION. HERITAGE ACT 2018. SEE DEPOSITED PLAN 421827 LODGED 28/9/2021.

- Warning: (1) A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
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- (2) The land and interests etc. shown hereon may be affected by interests etc. that can be, but are not, shown on the register.
- (3) The interests etc. shown hereon may have a different priority than shown.

-----END OF CERTIFICATE OF CROWN LAND TITLE-----

END OF PAGE 2 - CONTINUED OVER

ORIGINAL CERTIFICATE OF CROWN LAND TITLE
QUALIFIED

REGISTER NUMBER: 301/DP47451

VOLUME/FOLIO: LR3151-548

PAGE 3

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND: DP47451
PREVIOUS TITLE: LR3138-88
PROPERTY STREET ADDRESS: 171 RIVERSIDE DR, PERTH.
LOCAL GOVERNMENT AUTHORITY: CITY OF PERTH
RESPONSIBLE AGENCY: DEPARTMENT OF BIODIVERSITY, CONSERVATION AND
ATTRACTIONS (SCLM)

NOTE 1: K668049 CORRESPONDENCE FILE 01746-2005-01RO
NOTE 2: SUBJECT TO SURVEY - NOT FOR ALIENATION PURPOSES
NOTE 3: L675050 SECTION 138D TLA APPLIES TO CAVEAT K115422.
NOTE 4: L688857 SECTION 138D TLA APPLIES TO CAVEAT K777897.

WESTERN



AUSTRALIA

TITLE NUMBER

Volume Folio

LR3151 540

**RECORD OF QUALIFIED CERTIFICATE
OF
CROWN LAND TITLE**

**UNDER THE TRANSFER OF LAND ACT 1893
AND THE LAND ADMINISTRATION ACT 1997**

The undermentioned land is Crown land in the name of the STATE OF WESTERN AUSTRALIA, subject to the interests and Status Orders shown in the first schedule which are in turn subject to the limitations, interests, encumbrances and notifications shown in the second schedule.

BGRoberts
REGISTRAR OF TITLES



LAND DESCRIPTION:

LOT 310 ON DEPOSITED PLAN 47439

**STATUS ORDER AND PRIMARY INTEREST HOLDER:
(FIRST SCHEDULE)**

STATUS ORDER/INTEREST: RESERVE VESTED UNDER STATUTE

PRIMARY INTEREST HOLDER: SWAN RIVER TRUST OF PO BOX 6740, EAST PERTH
(XE K508133) REGISTERED 15/2/2008

**LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)**

1. K508129 RESERVE 48327 FOR THE PURPOSE OF PROTECTION AND ENHANCEMENT OF THE ECOLOGICAL AND COMMUNITY BENEFITS AND AMENITY OF THE SWAN AND CANNING RIVERS REGISTERED 15/2/2008.
2. K508133 CARE, CONTROL AND MANAGEMENT PURSUANT TO SECTION 11(7) OF THE SWAN AND CANNING RIVERS MANAGEMENT ACT 2006. REGISTERED 15/2/2008.
3. P733873 NOTIFICATION. HERITAGE ACT 2018. AS TO PORTION ONLY - SEE DEPOSITED PLAN 425438 LODGED 5/10/2023.

Warning: (1) A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
Lot as described in the land description may be a lot or location.
(2) The land and interests etc. shown hereon may be affected by interests etc. that can be, but are not, shown on the register.
(3) The interests etc. shown hereon may have a different priority than shown.

-----END OF CERTIFICATE OF CROWN LAND TITLE-----

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND: DP47439
PREVIOUS TITLE: LR3151-540

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ORIGINAL CERTIFICATE OF CROWN LAND TITLE
QUALIFIED

REGISTER NUMBER: 310/DP47439

VOLUME/FOLIO: LR3151-540

PAGE 2

PROPERTY STREET ADDRESS: NO STREET ADDRESS INFORMATION AVAILABLE.
LOCAL GOVERNMENT AUTHORITY: CITY OF CANNING
RESPONSIBLE AGENCY: DEPARTMENT OF BIODIVERSITY, CONSERVATION AND
ATTRACTIONS (SCLM)

NOTE 1: K508100 CORRESPONDENCE FILE 01746-2005-01RO
NOTE 2: SUBJECT TO SURVEY - NOT FOR ALIENATION PURPOSES

WESTERN



AUSTRALIA

TITLE NUMBER

Volume Folio

LR3026 703

**RECORD OF QUALIFIED CERTIFICATE
OF
CROWN LAND TITLE**

**UNDER THE TRANSFER OF LAND ACT 1893
AND THE LAND ADMINISTRATION ACT 1997**

The undermentioned land is Crown land in the name of the STATE OF WESTERN AUSTRALIA, subject to the interests and Status Orders shown in the first schedule which are in turn subject to the limitations, interests, encumbrances and notifications shown in the second schedule.

BGRoberts

REGISTRAR OF TITLES



LAND DESCRIPTION:

LOT 13017 ON DEPOSITED PLAN 193785

**STATUS ORDER AND PRIMARY INTEREST HOLDER:
(FIRST SCHEDULE)**

STATUS ORDER/INTEREST: RESERVE VESTED UNDER STATUTE

PRIMARY INTEREST HOLDER: SWAN RIVER TRUST OF PO BOX 6740, EAST PERTH
(XE K668071) REGISTERED 28/7/2008

**LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)**

1. H027859 TAKING ORDER. THE DESIGNATED PURPOSE OF CONSTRUCTION OF A PUBLIC ROAD BRIDGE AND ANCILLARY PURPOSES THERETO. REGISTERED 16/2/1999.
2. K668067 RESERVE 48325 FOR THE PURPOSE OF PROTECTION AND ENHANCEMENT OF THE ECOLOGICAL AND COMMUNITY BENEFITS AND AMENITY OF THE SWAN AND CANNING RIVERS REGISTERED 28/7/2008.
3. K668071 CARE, CONTROL AND MANAGEMENT PURSUANT TO SECTION 11(7) OF THE SWAN AND CANNING RIVERS MANAGEMENT ACT 2006. REGISTERED 28/7/2008.

Warning: (1) A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
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(2) The land and interests etc. shown hereon may be affected by interests etc. that can be, but are not, shown on the register.
(3) The interests etc. shown hereon may have a different priority than shown.

-----END OF CERTIFICATE OF CROWN LAND TITLE-----

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND: DP193785
PREVIOUS TITLE: LR3111-579

END OF PAGE 1 - CONTINUED OVER

ORIGINAL CERTIFICATE OF CROWN LAND TITLE
QUALIFIED

REGISTER NUMBER: 13017/DP193785

VOLUME/FOLIO: LR3026-703

PAGE 2

PROPERTY STREET ADDRESS: NO STREET ADDRESS INFORMATION AVAILABLE.
LOCAL GOVERNMENT AUTHORITY: CITY OF PERTH
RESPONSIBLE AGENCY: DEPARTMENT OF BIODIVERSITY, CONSERVATION AND
ATTRACTIONS (SCLM)

NOTE 1: A000001A CORRESPONDENCE FILE 1140/1998.
NOTE 2: SUBJECT TO SURVEY - NOT FOR ALIENATION PURPOSES
NOTE 3: LAND PARCEL IDENTIFIER OF SWAN LOCATION 13017 ON SUPERSEDED PAPER
CERTIFICATE OF CROWN LAND TITLE CHANGED TO LOT 13017 ON DEPOSITED PLAN
193785 ON 20-AUG-02 TO ENABLE ISSUE OF A DIGITAL CERTIFICATE OF TITLE.
NOTE 4: THE ABOVE NOTE MAY NOT BE SHOWN ON THE SUPERSEDED PAPER CERTIFICATE
OF TITLE.

WESTERN



AUSTRALIA

TITLE NUMBER

Volume Folio

LR3151 547

RECORD OF QUALIFIED CERTIFICATE OF CROWN LAND TITLE

UNDER THE TRANSFER OF LAND ACT 1893
AND THE LAND ADMINISTRATION ACT 1997

The undermentioned land is Crown land in the name of the STATE OF WESTERN AUSTRALIA, subject to the interests and Status Orders shown in the first schedule which are in turn subject to the limitations, interests, encumbrances and notifications shown in the second schedule.

BGRoberts
REGISTRAR OF TITLES



LAND DESCRIPTION:

LOT 300 ON DEPOSITED PLAN 47450

STATUS ORDER AND PRIMARY INTEREST HOLDER: (FIRST SCHEDULE)

STATUS ORDER/INTEREST: RESERVE VESTED UNDER STATUTE

PRIMARY INTEREST HOLDER: SWAN RIVER TRUST OF PO BOX 6740, EAST PERTH
(XE K668071) REGISTERED 28/7/2008

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS: (SECOND SCHEDULE)

1. K668067 RESERVE 48325 FOR THE PURPOSE OF PROTECTION AND ENHANCEMENT OF THE ECOLOGICAL AND COMMUNITY BENEFITS AND AMENITY OF THE SWAN AND CANNING RIVERS REGISTERED 28/7/2008.
2. K668071 CARE, CONTROL AND MANAGEMENT PURSUANT TO SECTION 11(7) OF THE SWAN AND CANNING RIVERS MANAGEMENT ACT 2006. REGISTERED 28/7/2008.
3. L720794 MEMORIAL. HERITAGE OF WESTERN AUSTRALIA ACT 1990. AS TO PORTION ONLY. SEE DEPOSITED PLAN 71474 LODGED 30/8/2011.
4. L969162 CAVEAT BY MINISTER FOR WORKS AS TO PORTION ONLY. LODGED 21/6/2012.
5. M700490 LEASE TO VIEWNORTH INVESTMENTS PTY LTD OF CARE OF JOE TOTARO, 71-73 DALY STREET, BELMONT EXPIRES: SEE LEASE. AS TO PORTION ONLY. REGISTERED 9/7/2014.
 M700491 VARIATION OF LEASE M700490 REGISTERED 9/7/2014.
 N102645 TRANSFER OF LEASE M700490, LESSEE NOW DOME COFFEES AUSTRALIA PTY LTD OF 219-221 RAILWAY PARADE MAYLANDS REGISTERED 25/8/2015.
 N193431 MORTGAGE OF LEASE M700490 TO WESTPAC BANKING CORPORATION REGISTERED 4/12/2015.
6. N231289 LEASE TO THE MINISTER FOR TRANSPORT OF CARE OF DEPARTMENT OF TRANSPORT 1 ESSEX STREET FREMANTLE WA EXPIRES: SEE LEASE. AS TO PORTION ONLY. REGISTERED 20/1/2016.
7. O510750 LEASE TO THE ROYAL PERTH YACHT CLUB OF WESTERN AUSTRALIA (INC) OF 6 AUSTRALIA II DRIVE CRAWLEY WA 6009 EXPIRES: SEE LEASE. AS TO PORTION ONLY

END OF PAGE 1 - CONTINUED OVER

ORIGINAL CERTIFICATE OF CROWN LAND TITLE
QUALIFIED

REGISTER NUMBER: 300/DP47450

VOLUME/FOLIO: LR3151-547

PAGE 2

REGISTERED 30/9/2020.

- O510751 MORTGAGE TO WESTPAC BANKING CORPORATION REGISTERED 30/9/2020.
8. Q171104 LEASE TO BOAT PENS PTY LTD OF 9 BISHOP STREET JOLIMONT WA 6014 EXPIRES: SEE
LEASE. AS TO PORTION ONLY REGISTERED 11/10/2024.
Q171105 MORTGAGE TO AUSTRALIA & NEW ZEALAND BANKING GROUP LTD REGISTERED
11/10/2024.
9. Q252506 MEMORIAL. CONTAMINATED SITES ACT 2003 REGISTERED 16/12/2024.

- Warning: (1) A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
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(2) The land and interests etc. shown hereon may be affected by interests etc. that can be, but are not, shown on the register.
(3) The interests etc. shown hereon may have a different priority than shown.

-----END OF CERTIFICATE OF CROWN LAND TITLE-----

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land
and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND: DP47450
PREVIOUS TITLE: LR3151-547
PROPERTY STREET ADDRESS: 26 RIVERSIDE RD, EAST FREMANTLE.
LOCAL GOVERNMENT AUTHORITY: TOWN OF EAST FREMANTLE, CITY OF PERTH
RESPONSIBLE AGENCY: DEPARTMENT OF BIODIVERSITY, CONSERVATION AND
ATTRACTIONS (SCLM)

- NOTE 1: K668046 CORRESPONDENCE FILE 01746-2005-01RO
NOTE 2: SUBJECT TO SURVEY - NOT FOR ALIENATION PURPOSES
NOTE 3: Q713461 DEPOSITED PLAN 425071 LODGED

Appendix B Application Forms and Landowner Consent

Ferry Operations Development Application

METRONET on Swan Ferry Service Expansion

Public Transport Authority of Western Australia

SLR Project No.: 675.V25085.00EA1

21 August 2026

Development Application Guidelines for Form 1

Under the Swan and Canning Rivers Management Act 2006 – Part 5 – section 72(1)

Important information for applicants

1. The Department of Biodiversity, Conservation and Attractions (the department) is responsible for assessment of development applications in the Swan Canning Development Control Area under section 72(1) of the *Swan and Canning Rivers Management Act 2006* (SCRM Act).
2. The original application Form 1 must be accompanied by sufficient information detailing the proposed works and a full set of scaled plans and specifications for the proposed development. Under section 72(7) of the SCRM Act, the department may also request further information relating to the development before considering the application to be valid and to enable proper consideration of the application.
3. The landowner(s) must consent to the application being made and must sign the application. The applicant is responsible for obtaining landowner(s) consent, except where the landowner is the department.
4. Where the applicant appoints an authorised agent to act on their behalf, the authorised agent must attach a copy of the written authority to the application.
5. The application is to be lodged with the local government or redevelopment authority in whose jurisdiction the proposed development is situated. If the proposed development is not within a local government or redevelopment authority area, the application is to be made direct to the department's Swan Canning Waterways Branch.
6. There are penalties for providing false information in the application, which may include a fine of up to \$10 000, under section 88 of the SCRM Act.
7. Please carefully read the information below when preparing your application. The application will not be considered valid and will be returned to the applicant if the application has not been signed by the owner(s) of the land, or is not accompanied by adequate detail, plans and specifications of the proposed development.

Planning Policies for development affecting the Swan Canning Development Control Area

Development proposals must be consistent with the purpose and objectives of the SCRM Act, which provides for the protection and enhancement of the ecological health, community benefits, amenity and heritage value of the Swan Canning river system. A range of planning policies have been created to guide land use and development and provide for consistent and integrated planning and decision making in relation to the Swan Canning Development Control Area.

The policies provide guidance regarding the issues that are considered when assessing an application. Where possible please address any relevant issues identified in the policies and include this supplementary information with the application.

Corporate Planning Policies for development affecting the Swan Canning Development Control Area

The department has a range of policies, guidelines and plans relevant to development affecting the Swan Canning Development Control Area, which are available on the [department's website](#).

These documents provide direction and guidance regarding how the department assesses development applications in accordance with the SCRM Act and Swan and Canning Rivers Management Regulations 2007.

State Planning Policy 2.9 Water (SPP 2.9)

State planning policies (SPPs) provide the highest level of planning policy control and guidance in Western Australia. SPPs are prepared under Part 3 of the *Planning and Development Act 2005*.

SPP 2.9 identifies issues for planning and decision making for the Swan Canning river system and is available on the Department of Planning, Lands and Heritage website: <https://www.planning.wa.gov.au/state-planning-policy-2.9-water>

Other relevant planning policies, guidelines and Australian Standards that address issues such as (but not limited to) design, lighting, wetlands, bushfire planning, visual impacts, stormwater, contaminated sites, acid sulphate soils, bushland conservation and water quality may also be considered during the assessment.

Application submission

Via email at: Rivers.planning@dbca.wa.gov.au

In person to:

Department of Biodiversity, Conservation and Attractions
17 Dick Perry Avenue
Technology Park, Western Precinct
KENSINGTON WA 6151

In post to:

Statutory Assessments – Swan Canning Waterways Branch
Department of Biodiversity, Conservations and Attractions
Locked Bag 104
BENTLEY DC WA 6983
Telephone enquiries: 9219 9000

Personal information

The Department of Biodiversity, Conservation and Attractions (DBCA) collects personal information in order to progress this application.

We may share this information with other organisations as required, in order to seek advice about the application in relation to the organisation's legislative responsibilities.

This information is required as a result of Part 5 of the Swan and Canning Rivers Management Act 2006.

Without this information we will be unable to progress this application.

For further details on how DBCA manage your personal information, you can read our Privacy Policy. If you have any questions about how your personal information will be handled, or if you would like to access your personal information, please contact DBCA by emailing privacy@dbca.wa.gov.au.

Checklist of information to include with a Form 1 application

To assist the efficient assessment of applications, please include the detail requested below and any other additional information relevant to the proposal.

Item	☒	N/A
Completed application form, including written consent of the landowner(s).	☒	
Additional information, including details of the proposed development (including the existing and proposed use of the site and proposed hours of operation) and addressing any relevant issues identified in the policies.	☒	
Plans and specifications of the proposed development showing: - current and proposed levels (contours at no greater than 1 metre intervals), including retaining structures and fill requirements - the location, metric dimensions, materials, finishes and type of all existing and proposed structures, including services - sections through the site - the nature and extent of any existing and proposed open space and landscaping - proposed external lighting and signage - any watercourse(s) flowing through the site - position and species of any large trees or on-site vegetation, clearly marking vegetation proposed to be retained and removed - the existing and proposed means of access and movement for pedestrians and vehicles.	☒	
Plans, elevations and sections of any building or structure proposed to be erected or altered and/or any building or structure to be retained.	☐	N/A
Site plan of the lot showing the development location in relation to: - adjacent roads - rivers, creeks, springs and wetlands - nearby conservation areas and/or Bush Forever sites - floodway and flood fringe boundaries - land reserved for Regional Open Space under the Metropolitan Region Scheme.	☒	
Information on the availability of drainage and sewer.	☒	
Information on any impacts to Aboriginal heritage sites and historic heritage sites and subsequent approvals (if required).	☒	☐
Information regarding potential acid sulphate soils and/or contamination. If the proposed development is likely to disturb potential and/or actual acid sulphate soils or a contaminated site, a preliminary investigation is required, and the results included with this application.	☒ ☐	☐ ☒
Detail of proposed construction methodologies.	☐	N/A
Geotechnical information.	☒	
Operational details (where relevant) e.g. for a proposed café.	☒	
Larger developments should also include:		
Photo montages showing the development in relation to the river and foreshore landscape.	☒	☐
Information on the impacts of parking, noise and traffic generated by the proposal.	☒	☐
Details of stormwater management incorporating water sensitive urban design principles.	☐	☒
Details of any dewatering proposed during construction, including the expected volumes, water quality, method of disposal and sampling regimes in accordance with DBCA's Policy 50 – Planning for Dewatering Affecting the Swan Canning Development Control Area.	☐	☒
Any specialist studies and/or management plans required to support the application, such as traffic, heritage, environmental, engineering, landscaping or urban design studies.	☒	☐



Department of Biodiversity,
Conservation and Attractions



SWAN CANNING
RIVERPARK

Form 1 – Application for Approval of Development

Swan and Canning Rivers Management Act 2006 – Part 5 – section 72(1)

1. Applicant details

The applicant is the person with whom the department, on behalf of the Chief Executive Officer, will correspond, unless an authorised agent has been appointed to act on behalf of the applicant, in which case correspondence will be sent direct to the agent.

Name	Alvin Prasad		
Position (if applicable)	Contract Manager - Infrastructure & Services		
Organisation (if applicable)	Public Transport Authority		
Contact person			
Postal address	Level 1, Public Transport Centre, West Parade		
Town/Suburb	Perth	State	WA Postcode 6000
Telephone	Work Perth	Mobile	0404 026 480
Email	alvin.prasad@pta.wa.gov.au		

I give authority for an agent (as identified at item No. 3) to act on my behalf during the assessment of the application

☒ YES ☐ NO

If 'YES', please provide Agent's details at item No. 3

Applicant signature

Date

27/07/26

2. Landowner details

All owner(s) of the land **must sign this application**. Where land is owned by the Crown or has a management order granted to a local government or other agency, this application must be signed by the relevant landowner or management body as required under section 72(5)(a) of the Act. If there are more than two landowners, please provide the additional information and signature(s) on a separate page.

Details of first landowner

Name	State of Western Australia (Management Authority - Swan River Trust)		
Position (if applicable)	Manager, Swan Canning Waterways Branch		
Organisation (if applicable)	Swan River Trust c/- Department of Biodiversity, Conservation and Attractions		
Contact person	Glen McLeod-Thorpe		
Postal address	17 Dick Perry Avenue		
Town/Suburb	Kensington	State	WA Postcode 6151

I consent to this application being made.

First landowner signature

Date

29/07/2026

Details of second landowner (if applicable)

Name			
Position (if applicable)			
Organisation (if applicable)			
Contact person			
Postal address			
Town/Suburb		State	
		Postcode	

I consent to this application being made.

Second landowner
signature

Date



3. Authorised agent details (if applicable)

The applicant must sign the form and tick the authorisation under item No. 1 to provide authority for an appointed authorised agent to act on their behalf.

Details of authorised agent

Name	Renee Young		
Position (if applicable)	Principal Consultant - Planning		
Company/agency (if applicable)	SLR Consulting		
ACN/ABN (if applicable)			
Postal address	Level 1, 500 Hay Street		
Town/Suburb	Subiaco	State	WA Postcode 6008
Telephone	Work 0429 102 079	Mobile	0429 102 079
Email	renee.young@slrconsulting.com		
Authorised Agent signature		Date	7/31/2026

4. Location of proposed development

Certificate of title information	Volume LR3151, LR3026, LR3166 Folio 547, 548, 540, 703, 579
	Diagram/plan/deposit plan no. 047450, 047451, 047439, 193785, 408106
Lot No.(s)	300, 301, 310, 13017, 504 (Refer to attached schedule)
Location	Swan and Canning Rivers
Reserve No.(s) (if applicable)	48325 & 48327
Street No.(s) and name	Refer to attached schedule
Town/Suburb	Refer to attached schedule
Nearest road intersection	

5. Details of proposed development

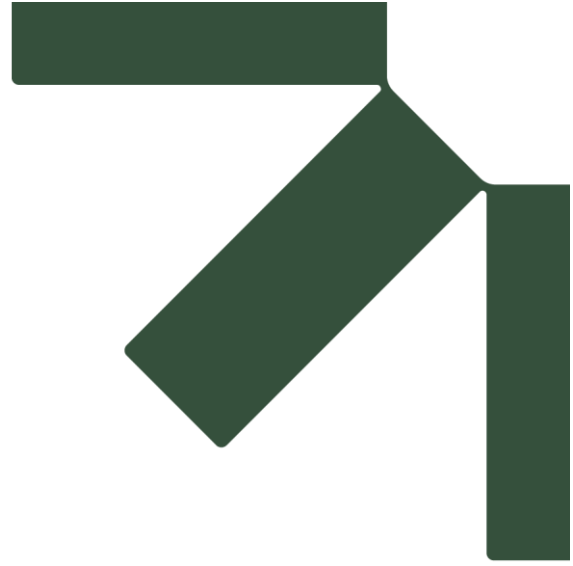
Please provide a written description of the proposed development (refer to the Development Application Guidelines for further details on what information to include in this section).

Estimated cost of development	\$N/A
Current use of land	Refer to attached Planning Report
Proposed development	Ferry operations - refer to attached Planning Report.

OFFICIAL

Ferry Operations Development Application – Property Details and Landowner Signature Table

Lot	Survey	Volume	Folio	Street Address	Owner	Reserve Number	Management Authority	Contact Details	Landowner Signatures
300	DP47450	LR3151	547	26 Riverside Road, East Fremantle (Swan River)	State of Western Australia	Reserve 48325	Swan River Trust	Department of Biodiversity, Conservation and Attractions (Swan River Trust) Locked Bag 104 Bentley Delivery Centre WA 6983	 Name: Glen McLeod-Thorpe Position: Manager, Swan Canning Waterways Branch
301	DP47451	LR3151	548	171 Riverside Drive, Perth (Swan River)		Reserve 38325			
310	DP47439	LR3151	540	N/A		Reserve 48327			
13017	DP193785	LR3026	703	N/A		Reserve 48325			
504	DP408106	LR3166	579	1 Barrack Square, Perth		Reserve 48325			



Appendix C Proposed Ferry Route

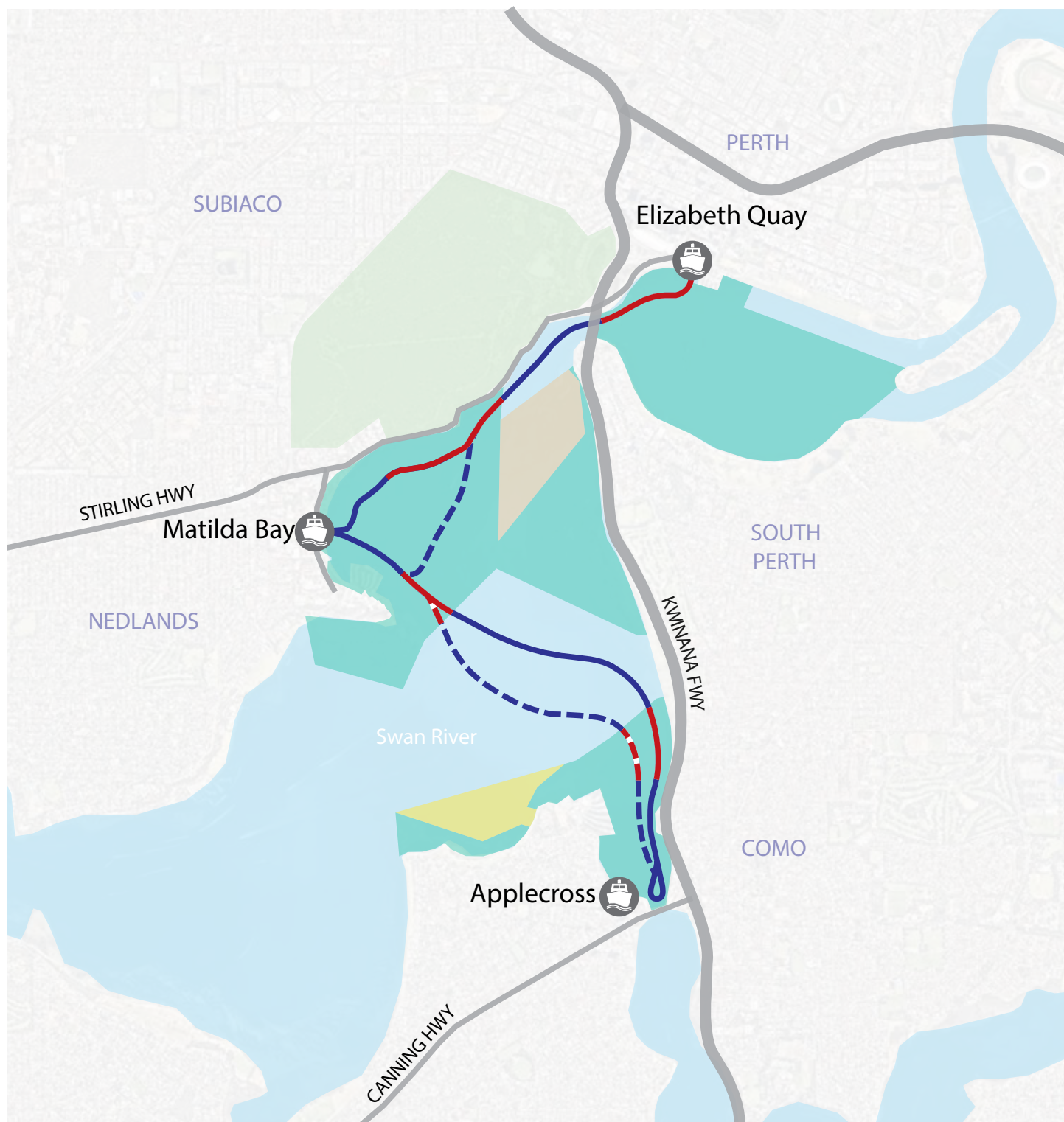
Ferry Operations Development Application

METRONET on Swan Ferry Service Expansion

Public Transport Authority of Western Australia

SLR Project No.: 675.V25085.00EA1

21 August 2026



Legend

- | | | | |
|--|---|---|--|
|  | Indicative Ferry Route Corridor (approx. 50m wide) |  | 8 Knot Speed Restriction Area |
|  | Indicative Alternative Ferry Route Corridor (approx. 50m wide) |  | Personal Watercraft Freestyle Driving Area |
|  | Indicative Ferry Route Corridor (approx. 50m wide) with possible zones where speed exemptions may be sought (>8 to <25 knots, including the allowance for acceleration/deceleration). |  | Water Ski Area |

Indicative Ferry Route Corridor Options Transperth Ferry Expansion

Date: 30 Jul 2026 Scale: NTS @ A4 File: 25-085 CP3-1 Staff: JK GW



element. | PART OF SLR

Level 1, 500 Hay Street, Subiaco, Western Australia 6008.
T. +61 8 9289 8300 E. hello@elementadvisory.com.au



Legend

- | | | | | | |
|--|---|---|--|---|--|
|  | Indicative Ferry Route Corridor (approx. 50m wide) |  | Indicative Ferry Route Corridor (approx. 50m wide) with possible zones where speed exemptions will be sought (>10 knots, including the allowance for acceleration/deceleration). |  | 10 Knot Speed Restriction Area |
|  | Indicative Alternative Ferry Route Corridor (approx. 50m wide) |  | 8 Knot Speed Restriction Area |  | Personal Watercraft Freestyle Driving Area |
|  | Indicative Ferry Route Corridor (approx. 50m wide) with possible zones where speed exemptions may be sought (>8 to <25 knots, including the allowance for acceleration/deceleration). |  | |  | Water Ski Area |

Note:

The proposed scheduled ferry timetables rely on the proposed speed exemptions in the 10 knot speed restriction areas.

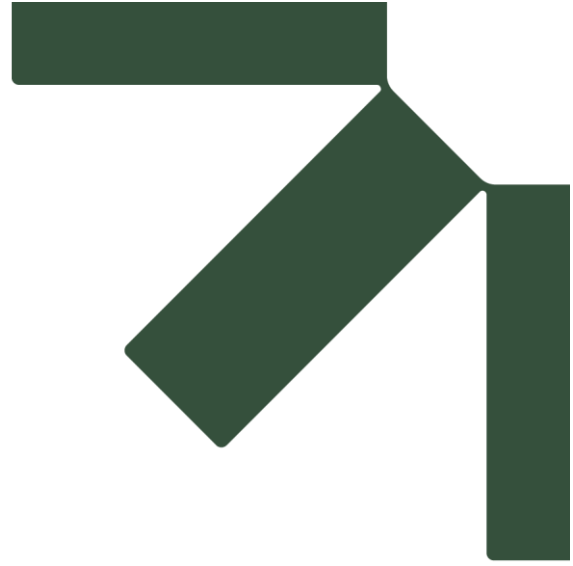
Indicative Ferry Route Corridor Options (Night time) Transperth Ferry Expansion



element. | PART OF SLR

Date: 30 Jul 2026 Scale: NTS @ A4 File: 25-085 CP3-2 Staff: JK GW

Level 1, 500 Hay Street, Subiaco, Western Australia 6008.
T: +61 8 9289 8300 E: hello@elementadvisory.com.au



Appendix D Vessel General Arrangement

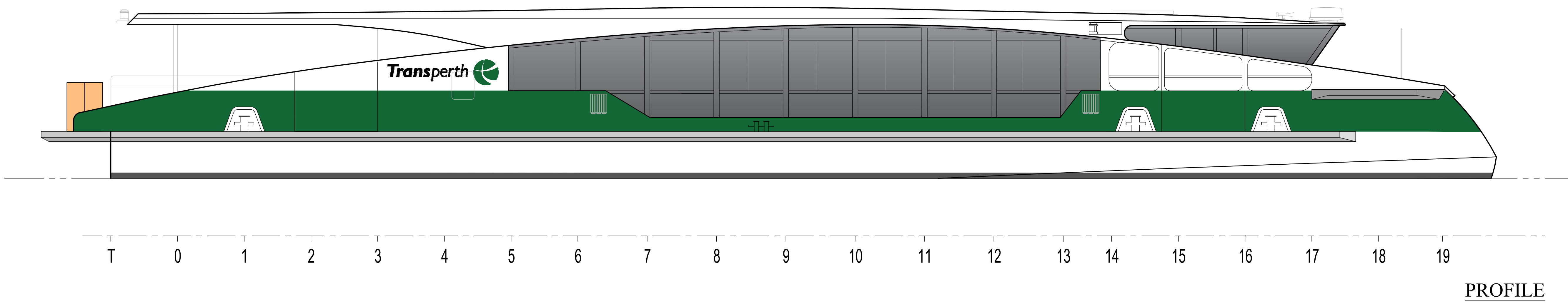
Ferry Operations Development Application

METRONET on Swan Ferry Service Expansion

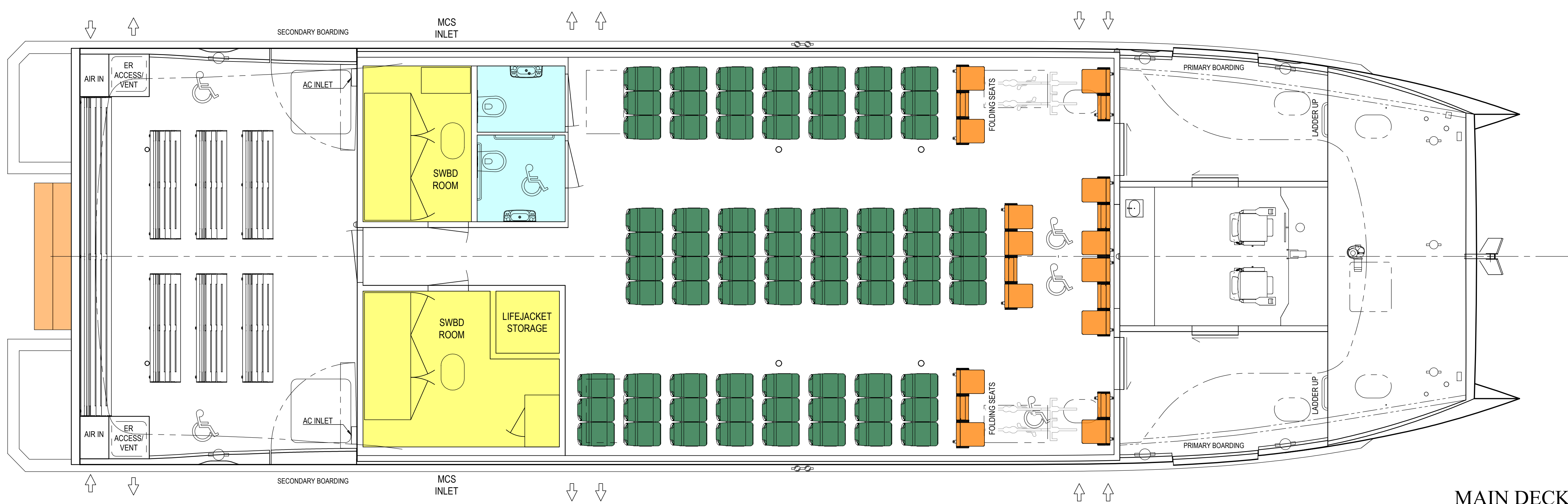
Public Transport Authority of Western Australia

SLR Project No.: 675.V25085.00EA1

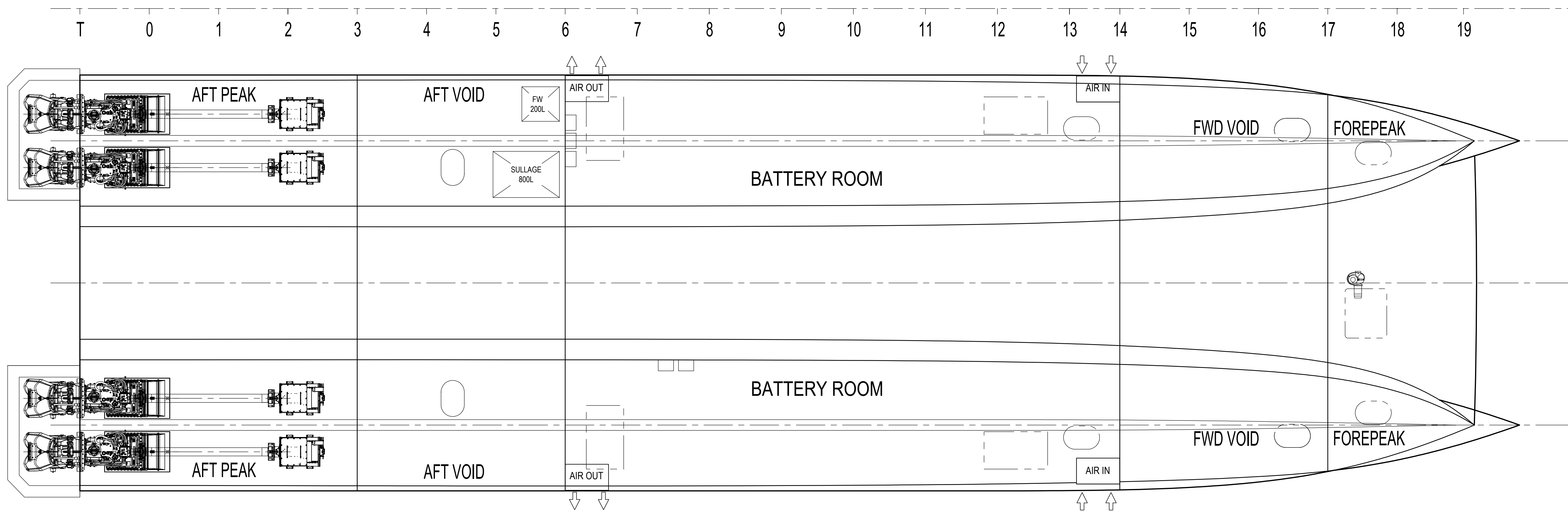
21 August 2026



PROFILE



MAIN DECK



BELOW DECKS

PRINCIPAL PARTICULARS

Length Measured	23.99 m
Beam (Excl. Sponsons)	7.20 m
Draft	1.00 m
Fresh Water	200 L
Sullage	800 L
Raised PAX Capacity	100
Crew	2
Class: LR +A1 SSC Passenger Catamaran G1 MCH	
Flag: AMSA 1E	

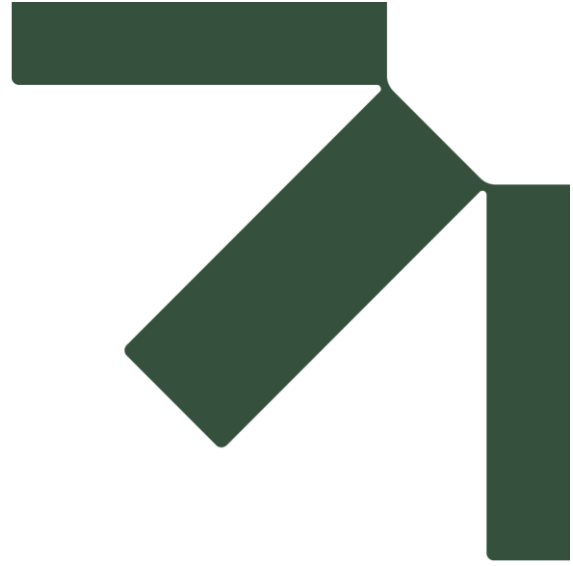
 ECHO MARINE GROUP 49 CLARENCE BEACH ROAD, HENDERSON, WESTERN AUSTRALIA	HULL NO: 102
	DRAWING REF: 102-100-001
	REVISION: C



24m LOW WASH FERRY - GENERAL ARRANGEMENT

11 MAY 2026

One 2 Three Pty Ltd | Suite 409, 56 Bowman St | Pymont | NSW | 2009 | Australia | Tel: +61-2-8574-0335 | design@one2three.com.au
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DRAWING # 24064-0001 REVISION C A3 SHEET SCALE: NTS



Appendix E Indicative Timetable

Ferry Operations Development Application

METRONET on Swan Ferry Service Expansion

Public Transport Authority of Western Australia

SLR Project No.: 675.V25085.00EA1

21 August 2026

Concept Public Facing Timetable

Scenario 1 - Speed exemptions at night only.

Elizabeth Quay	Matilda Bay	Applecross	Matilda Bay	Elizabeth Quay
Monday to Friday				
		6:15	6:37	6:55
		6:45	7:07	7:25
6:30	6:53	7:15	7:37	7:55
7:00	7:23	7:45	8:07	8:25
7:30	7:53	8:15	8:37	8:55
8:00	8:23	8:45	9:07	9:25
8:30	8:53	9:15	9:37	9:55
9:00	9:23	9:45	10:07	10:25
9:30	9:53	10:15	10:37	10:55
10:00	10:23	10:45	11:07	11:25
10:30	10:53	11:15	11:37	11:55
11:00	11:23	11:45	12:07	12:25
11:30	11:53	12:15	12:37	12:55
12:00	12:23	12:45	13:07	13:25
12:30	12:53	13:15	13:37	13:55
13:00	13:23	13:45	14:07	14:25
13:30	13:53	14:15	14:37	14:55
14:00	14:23	14:45	15:07	15:25
14:30	14:53	15:15	15:37	15:55
15:00	15:23	15:45	16:07	16:25
15:30	15:53	16:15	16:37	16:55
16:00	16:23	16:45	17:07	17:25
16:30	16:53	17:15	17:37	17:55
17:00	17:23	17:45	18:07	18:25
17:30	17:53	18:15	18:37	18:55
18:00	18:23	18:45	19:07	19:25
18:30	18:53	19:15	19:37	19:55
19:00	19:23	19:45	20:07	20:25
19:30	19:53	20:15	20:37	20:55
20:00	20:23	20:45	21:07	21:25
20:30	20:53	21:15	21:37	21:55
21:00	21:23	21:45	22:07	22:25

Elizabeth Quay	Matilda Bay	Applecross	Matilda Bay	Elizabeth Quay
Saturday & Sunday				
		7:15	7:37	7:55
		7:45	8:07	8:25
7:30	7:53	8:15	8:37	8:55
8:00	8:23	8:45	9:07	9:25
8:30	8:53	9:15	9:37	9:55
9:00	9:23	9:45	10:07	10:25
9:30	9:53	10:15	10:37	10:55
10:00	10:23	10:45	11:07	11:25
10:30	10:53	11:15	11:37	11:55
11:00	11:23	11:45	12:07	12:25
11:30	11:53	12:15	12:37	12:55
12:00	12:23	12:45	13:07	13:25
12:30	12:53	13:15	13:37	13:55
13:00	13:23	13:45	14:07	14:25
13:30	13:53	14:15	14:37	14:55
14:00	14:23	14:45	15:07	15:25
14:30	14:53	15:15	15:37	15:55
15:00	15:23	15:45	16:07	16:25
15:30	15:53	16:15	16:37	16:55
16:00	16:23	16:45	17:07	17:25
16:30	16:53	17:15	17:37	17:55
17:00	17:23	17:45	18:07	18:25
17:30	17:53	18:15	18:37	18:55
18:00	18:23	18:45	19:07	19:25
18:30	18:53	19:15	19:37	19:55
19:00	19:23	19:45	20:07	20:25
19:30	19:53	20:15	20:37	20:55
20:00	20:23	20:45	21:07	21:25
20:30	20:53	21:15	21:37	21:55
21:00	21:23	21:45	22:07	22:25

Span of Hours			
	Elizabeth Quay	Matilda Bay	Applecross
First weekday departure	6:30 AM	6:37 AM	6:15 AM
Last weekday departure	9:00 PM	10:07 PM	9:45 PM
First weekend departure	7:30 AM	7:37 AM	7:15 AM
Last weekend departure	9:00 PM	10:07 PM	9:45 PM

IMPORTANT - This is a concept timetable only, all timings are indicative and remain subject to operational testing

Notes:

- Timetabled to a 30-minute frequency.
- An application for exemption from Navigable Waters Regulations 1958 r.19A requirement to operate at speed exceeding 10 knots from sunset to sunrise will be sought from DTMI in order for the ferry to operate to scheduled timetables. If this were not approved, the service will operate at an hourly frequency from sunset to sunrise.
- Ferry operating hours is reflective of the existing Mends Street Summer timetable operating hours.
- The timetable may be adjusted for special events.

Concept Public Facing Timetable

Scenario 2 - Open speed areas extended

Elizabeth Quay	Matilda Bay	Applecross	Matilda Bay	Elizabeth Quay
Monday to Friday				
		6:17	6:36	6:48
		6:42	7:01	7:13
6:30	6:47	7:07	7:26	7:38
6:55	7:12	7:32	7:51	8:03
7:20	7:37	7:57	8:16	8:28
7:45	8:02	8:22	8:41	8:53
8:10	8:27	8:47	9:06	9:18
8:35	8:52	9:12	9:31	9:43
9:00	9:17	9:37	9:56	10:08
9:25	9:42	10:02	10:21	10:33
9:50	10:07	10:27	10:46	10:58
10:15	10:32	10:52	11:11	11:23
10:40	10:57	11:17	11:36	11:48
11:05	11:22	11:42	12:01	12:13
11:30	11:47	12:07	12:26	12:38
11:55	12:12	12:32	12:51	13:03
12:20	12:37	12:57	13:16	13:28
12:45	13:02	13:22	13:41	13:53
13:10	13:27	13:47	14:06	14:18
13:35	13:52	14:12	14:31	14:43
14:00	14:17	14:37	14:56	15:08
14:25	14:42	15:02	15:21	15:33
14:50	15:07	15:27	15:46	15:58
15:15	15:32	15:52	16:11	16:23
15:40	15:57	16:17	16:36	16:48
16:05	16:22	16:42	17:01	17:13
16:30	16:47	17:07	17:26	17:38
16:55	17:12	17:32	17:51	18:03
17:20	17:37	17:57	18:16	18:28
17:45	18:02	18:22	18:41	18:53
18:10	18:27	18:47	19:06	19:18
18:35	18:52	19:12	19:31	19:43
19:00	19:17	19:37	19:56	20:08
19:25	19:42	20:02	20:21	20:33
19:50	20:07	20:27	20:46	20:58
20:15	20:32	20:52	21:11	21:23
20:40	20:57	21:17	21:36	21:48
21:05	21:22	21:42	22:01	22:13

Elizabeth Quay	Matilda Bay	Applecross	Matilda Bay	Elizabeth Quay
Saturday to Sunday				
		7:07	7:26	7:38
		7:32	7:51	8:03
7:20	7:37	7:57	8:16	8:28
7:45	8:02	8:22	8:41	8:53
8:10	8:27	8:47	9:06	9:18
8:35	8:52	9:12	9:31	9:43
9:00	9:17	9:37	9:56	10:08
9:25	9:42	10:02	10:21	10:33
9:50	10:07	10:27	10:46	10:58
10:15	10:32	10:52	11:11	11:23
10:40	10:57	11:17	11:36	11:48
11:05	11:22	11:42	12:01	12:13
11:30	11:47	12:07	12:26	12:38
11:55	12:12	12:32	12:51	13:03
12:20	12:37	12:57	13:16	13:28
12:45	13:02	13:22	13:41	13:53
13:10	13:27	13:47	14:06	14:18
13:35	13:52	14:12	14:31	14:43
14:00	14:17	14:37	14:56	15:08
14:25	14:42	15:02	15:21	15:33
14:50	15:07	15:27	15:46	15:58
15:15	15:32	15:52	16:11	16:23
15:40	15:57	16:17	16:36	16:48
16:05	16:22	16:42	17:01	17:13
16:30	16:47	17:07	17:26	17:38
16:55	17:12	17:32	17:51	18:03
17:20	17:37	17:57	18:16	18:28
17:45	18:02	18:22	18:41	18:53
18:10	18:27	18:47	19:06	19:18
18:35	18:52	19:12	19:31	19:43
19:00	19:17	19:37	19:56	20:08
19:25	19:42	20:02	20:21	20:33
19:50	20:07	20:27	20:46	20:58
20:15	20:32	20:52	21:11	21:23
20:40	20:57	21:17	21:36	21:48
21:05	21:22	21:42	22:01	22:13

Span of Hours			
	Elizabeth Quay	Matilda Bay	Applecross
First weekday departure	6:30 AM	6:36 AM	6:17 AM
Last weekday departure	9:05 PM	10:01 PM	9:42 PM
First weekend departure	7:20 AM	7:26 AM	7:07 AM
Last weekend departure	9:05 PM	10:01 PM	9:42 PM

IMPORTANT - This is a concept timetable only, all timings are indicative and remain subject to operational testing

Notes:

- Timetabled to a 25-minute frequency, however can be scaled to a 30-minute frequency if required.
- This timetable requires an application for exemption from Navigable Waters Regulations 1958 r.19A requirement to operate at speed exceeding 10 knots from sunset to sunrise and an exemption from current 8 knot speed restricted waters.
- Ferry operating hours is reflective of the existing Mends Street Summer timetable operating hours.
- The timetable may be adjusted for special events.

Concept Public Facing Timetable

Scenario 2A - Open speed areas extended

Elizabeth Quay	Matilda Bay	Applecross	Matilda Bay	Elizabeth Quay
Monday to Friday				
		6:18	6:38	6:52
		6:43	7:03	7:17
6:30	6:49	7:08	7:28	7:42
6:55	7:14	7:33	7:53	8:07
7:20	7:39	7:58	8:18	8:32
7:45	8:04	8:23	8:43	8:57
8:10	8:29	8:48	9:08	9:22
8:35	8:54	9:13	9:33	9:47
9:00	9:19	9:38	9:58	10:12
9:25	9:44	10:03	10:23	10:37
9:50	10:09	10:28	10:48	11:02
10:15	10:34	10:53	11:13	11:27
10:40	10:59	11:18	11:38	11:52
11:05	11:24	11:43	12:03	12:17
11:30	11:49	12:08	12:28	12:42
11:55	12:14	12:33	12:53	13:07
12:20	12:39	12:58	13:18	13:32
12:45	13:04	13:23	13:43	13:57
13:10	13:29	13:48	14:08	14:22
13:35	13:54	14:13	14:33	14:47
14:00	14:19	14:38	14:58	15:12
14:25	14:44	15:03	15:23	15:37
14:50	15:09	15:28	15:48	16:02
15:15	15:34	15:53	16:13	16:27
15:40	15:59	16:18	16:38	16:52
16:05	16:24	16:43	17:03	17:17
16:30	16:49	17:08	17:28	17:42
16:55	17:14	17:33	17:53	18:07
17:20	17:39	17:58	18:18	18:32
17:45	18:04	18:23	18:43	18:57
18:10	18:29	18:48	19:08	19:22
18:35	18:54	19:13	19:33	19:47
19:00	19:19	19:38	19:58	20:12
19:25	19:44	20:03	20:23	20:37
19:50	20:09	20:28	20:48	21:02
20:15	20:34	20:53	21:13	21:27
20:40	20:59	21:18	21:38	21:52
21:05	21:24	21:43	22:03	22:17

Elizabeth Quay	Matilda Bay	Applecross	Matilda Bay	Elizabeth Quay
Saturday to Sunday				
		7:08	7:28	7:42
		7:33	7:53	8:07
7:20	7:39	7:58	8:18	8:32
7:45	8:04	8:23	8:43	8:57
8:10	8:29	8:48	9:08	9:22
8:35	8:54	9:13	9:33	9:47
9:00	9:19	9:38	9:58	10:12
9:25	9:44	10:03	10:23	10:37
9:50	10:09	10:28	10:48	11:02
10:15	10:34	10:53	11:13	11:27
10:40	10:59	11:18	11:38	11:52
11:05	11:24	11:43	12:03	12:17
11:30	11:49	12:08	12:28	12:42
11:55	12:14	12:33	12:53	13:07
12:20	12:39	12:58	13:18	13:32
12:45	13:04	13:23	13:43	13:57
13:10	13:29	13:48	14:08	14:22
13:35	13:54	14:13	14:33	14:47
14:00	14:19	14:38	14:58	15:12
14:25	14:44	15:03	15:23	15:37
14:50	15:09	15:28	15:48	16:02
15:15	15:34	15:53	16:13	16:27
15:40	15:59	16:18	16:38	16:52
16:05	16:24	16:43	17:03	17:17
16:30	16:49	17:08	17:28	17:42
16:55	17:14	17:33	17:53	18:07
17:20	17:39	17:58	18:18	18:32
17:45	18:04	18:23	18:43	18:57
18:10	18:29	18:48	19:08	19:22
18:35	18:54	19:13	19:33	19:47
19:00	19:19	19:38	19:58	20:12
19:25	19:44	20:03	20:23	20:37
19:50	20:09	20:28	20:48	21:02
20:15	20:34	20:53	21:13	21:27
20:40	20:59	21:18	21:38	21:52
21:05	21:24	21:43	22:03	22:17

Span of Hours			
	Elizabeth Quay	Matilda Bay	Applecross
First weekday departure	6:30 AM	6:38 AM	6:18 AM
Last weekday departure	9:05 PM	10:03 PM	9:43 PM
First weekend departure	7:20 AM	7:28 AM	7:08 AM
Last weekend departure	9:05 PM	10:03 PM	9:43 PM

IMPORTANT - This is a concept timetable only, all timings are indicative and remain subject to operational testing

Notes:

- Timetabled to a 25-minute frequency, however can be scaled to a 30-minute frequency if required.
- This timetable requires an application for exemption from Navigable Waters Regulations 1958 r.19A requirement to operate at speed exceeding 10 knots from sunset to sunrise and an exemption from current 8 knot speed restricted waters.
- Ferry operating hours is reflective of the existing Mends Street Summer timetable operating hours.
- The timetable may be adjusted for special events.

Concept Public Facing Timetable

Scenario 3 - Open speed areas extended with 12 knots

Elizabeth Quay	Matilda Bay	Applecross	Matilda Bay	Elizabeth Quay
Monday to Friday				
		6:11	6:31	6:46
		6:41	7:01	7:16
6:30	6:50	7:11	7:31	7:46
7:00	7:20	7:41	8:01	8:16
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21:00	21:20	21:41	22:01	22:16

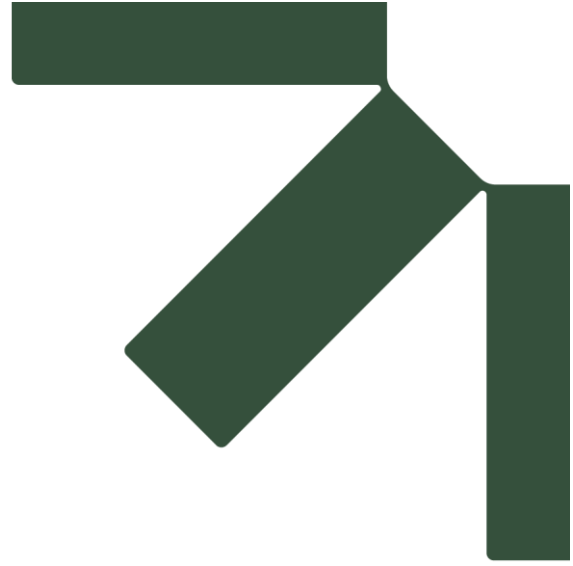
Elizabeth Quay	Matilda Bay	Applecross	Matilda Bay	Elizabeth Quay
Saturday & Sunday				
		7:11	7:31	7:46
		7:41	8:01	8:16
7:30	7:50	8:11	8:31	8:46
8:00	8:20	8:41	9:01	9:16
8:30	8:50	9:11	9:31	9:46
9:00	9:20	9:41	10:01	10:16
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20:00	20:20	20:41	21:01	21:16
20:30	20:50	21:11	21:31	21:46
21:00	21:20	21:41	22:01	22:16

Span of Hours			
	Elizabeth Quay	Matilda Bay	Applecross
First weekday departure	6:30 AM	6:31 AM	6:11 AM
Last weekday departure	9:00 PM	10:01 PM	9:41 PM
First weekend departure	7:30 AM	7:31 AM	7:11 AM
Last weekend departure	9:00 PM	10:01 PM	9:41 PM

IMPORTANT - This is a concept timetable only, all timings are indicative and remain subject to operational testing

Notes:

- Timetabled to a 30-minute frequency.
- This timetable requires an application for exemption from Navigable Waters Regulations 1958 r.19A requirement to operate at speed exceeding 10 knots from sunset to sunrise and an exemption from current 8 knot speed restricted waters.
- Ferry operating hours is reflective of the existing Mends Street Summer timetable operating hours.
- The timetable may be adjusted for special events.



Appendix F Stakeholder Consultation Summary

Ferry Operations Development Application

METRONET on Swan Ferry Service Expansion

Public Transport Authority of Western Australia

SLR Project No.: 675.V25085.00EA1

21 August 2026

METRONET on Swan Ferry Service Expansion Stakeholder Consultation

Summary Perth to Applecross consultation

Initially the stakeholder engagement for the Ferry Service Expansion Project (Perth to Applecross) focused on providing information about the proposed service and gathering feedback during the feasibility and early planning stages. The engagement targeted tier-one river-user groups, localised land-based organisations and local governments through face-to-face briefings, information sessions, workshops, and follow-up communications, culminating in the announcement of the ferry service as an election commitment and the specific terminal locations for Matilda Bay and Applecross being announced.

This included 20 group and solo stakeholder briefings and two stakeholder group workshop/information sessions.

During this initial engagement stakeholders raised concerns about safety, environmental impacts, and the usability of highly activated areas such as Matilda Bay. Many river-user groups in the Matilda Bay area expressed concern about collision risks with other watercraft and the disruption of on-water activities for existing clubs and water users. Residents in the Applecross area near the proposed terminal raised issues about visual amenity, noise, and security.

There were also several opportunities for the public to attend the six pop-up information sessions about the terminals and ferry service at Matilda Bay and Applecross as part of the Development Applications consultation period.

Following this it was identified that there was a need to create an ongoing channel of communication with water user groups to address their areas of concern and work collaboratively with them to ensure the safe, effective and equitable access to the river could continue.

A Waterways Stakeholder Reference Group (WSRG) was then established to assist the Department of Transport and Major Infrastructure (DTMI) Maritime and the Public Transport Authority (PTA) in ensuring the safe and effective operation of the ferry service and other waterways activities between terminals at Elizabeth Quay, Matilda Bay, and Applecross.

The WSRG provides a dedicated forum for identifying on-water safety concerns, providing advice and collaboratively developing appropriate controls and measures to ensure the river is shared safely and equitably by all users.

All relevant water user groups and representative bodies were offered the opportunity to nominate an individual to represent them on the WSRG through an Expression of Interest (EOI) process. A total of 21 water-based organisations and peak bodies are represented by the WSRG and seven meetings have been held to date.

WSRG Member Organisations are listed below

- Amazon Dragon Boat Racing
- Australian Sailing
- Boating Industry Association WA
- Boating Western Australia
- Claremont Masters Swimming Club

- Fishability Inc
- Hale School
- Mounts Bay Sailing Club
- Perth Dinghy Sailing Club
- Rowing WA
- Royal Perth Yacht Club
- Sailability WA
- Scouts WA
- Shenton College Rowing
- South of Perth Yacht Club
- SUP Central WA
- UWA Boat Club
- UWA Outdoor Club
- UWA Sport
- Windsurfing WA (WWA)
- Yachting WA

Additional out-of-session meetings with key members including Sailability, UWA Boat Club, South of Perth Yacht Club and Amazon Dragon Boat Racing have also occurred to address issues specific to their club and needs.

The WSRG meetings have addressed a broad range of topics, including the proposed terminal location, on-water safety concerns, risk assessment findings and key ferry service information.

Route development

A key focus of the WSRG to date has been the identification of a suitable ferry route. Rather than DTMI and PTA proposing a route for consultation, WSRG members were invited to identify and propose potential route alignments based on their operational knowledge, safety considerations and localised on-water activities.

This stakeholder-led process has enabled water user groups to develop, discuss and refine route options iteratively and collaboratively over a number of workshops. DTMI supported this process by gathering updated bathymetric data to understand water depths and providing navigational safety expertise.

This led to several alternative route options being identified and explored by the group as shown in Figure 1. Following this DTMI assessed each option against navigational safety requirements and provided feedback.

Current WSRG proposed Route

To date the WSRG has identified a more acceptable overall route shown in Figure 2, with the understanding that further refinements would be made as members considered the implications of the route with their members.

This potential route was preferred to alternatives as it met navigational safety requirements, minimised the number of times the ferry needed to pass any specific point and provided an equitable impact across the clubs in the area.

Key WSRG considerations influencing discussions for the proposed ferry route selection included:

- Aiming to minimise the potential impact or interactions on current water activities within the ferry route (*Route proposed and discussed collaboratively by WSRG members*).
- Maximising open water available for sailing in Matilda Bay, Melville Waters and the Lower Canning (*The route is aligned along the edges of large, contiguous sailing areas where it is safe to navigate to maximise the amount of open water not subject to regular ferry movements. Discussions also included the potential to relocate sailing buoys and navigational aids to assist*

this and the possible addition of a west cardinal marker near Como scouts are to mark shallow waters).

- Minimise potential backwash for rowers from the seawall adjacent to Mounts Bay Road, particularly nearby Quarry Point. *(The ferry route aligns with the recommended navigation track for larger vessels adjacent to Narrows waters gazetted for PWC use only. This route deviates east of the track close to Quarry Spit navigational aid to maximise distance from the Quarry Point seawall within this narrower section of the river).*
- Providing an adequate buffer between self-powered passive craft (rowing, dragon boats etc) from ferry movements and any potential wake and wash in Matilda Bay. *(A 200–250 metre buffer is maintained between the shoreline and the ferry route to provide separation for passive watercraft within Matilda Bay.)*
- Minimising ferry movements past any one location within Matilda Bay and providing longer intervals between ferry transits. *(The route transits around the perimeter of Matilda Bay, entering at one end and exiting at the other. Any east–west leg to Matilda Bay would require ferries to repeatedly use the same corridor for a single terminal service, increasing transit frequency and reducing the time available for water users to cross between ferry movements).*
- Ensuring that the ferry route would not cut the use of Matilda Bay in half in terms of activities either vertically (north-south) or horizontally (east-west) thereby minimising potential interaction of watercraft with the ferry. *(The route aligns the ferry route along the edge of Matilda Bay allowing a large, contiguous area for sail racing and minimising the times competitors have to cross the ferry route during a race. However, Sailability preferred an east–west approach to Matilda Bay, approximately 500 metres north of RPYC, as it would avoid the need for participants to cross the ferry route).*

Key WSRG considerations influencing ferry route speed profiles included:

- A preference for ferries to operate at existing gazetted speed limits to minimise wake impacts.
- DTMI's commitment that ferry speeds will not exceed eight knots (approximately 15 km/h) when transiting through Matilda Bay.

Discussions regarding a final preferred route remain ongoing with WSRG members working together to negotiate and refine a route that balances the needs, concerns and operational requirements of the diverse water user groups represented.

Given the diversity of vessel types, operating patterns and speeds represented within the WSRG, achieving unanimous agreement on a preferred route is challenging. Consequently, discussions have focused on route options that minimise impacts on existing river users while enabling clubs to progress towards identifying practical measures to mitigate on-water safety risks.

The final route will be a stakeholder-driven outcome, reflecting the collective efforts of water user groups to identify an equitable and workable solution for the wider waterway community. Members have considered impacts on other users, safety requirements and negotiated compromises.

This collaborative approach has encouraged shared ownership and constructive negotiation enabling members to shape a route that supports continued waterway activities with some adjustment that is broadly acceptable to the diverse river users represented on the WSRG. Through this process, members will ultimately determine an optimal route that reflects their collective operational needs.

WSRG meetings will continue for the duration of the project and the introduction of ferry operations. This will ensure safety measures and risk mitigations can be considered and worked through as the project progresses including processes to cross the ferry route safely alongside existing water activities.



Figure 1: Alternate Route Options

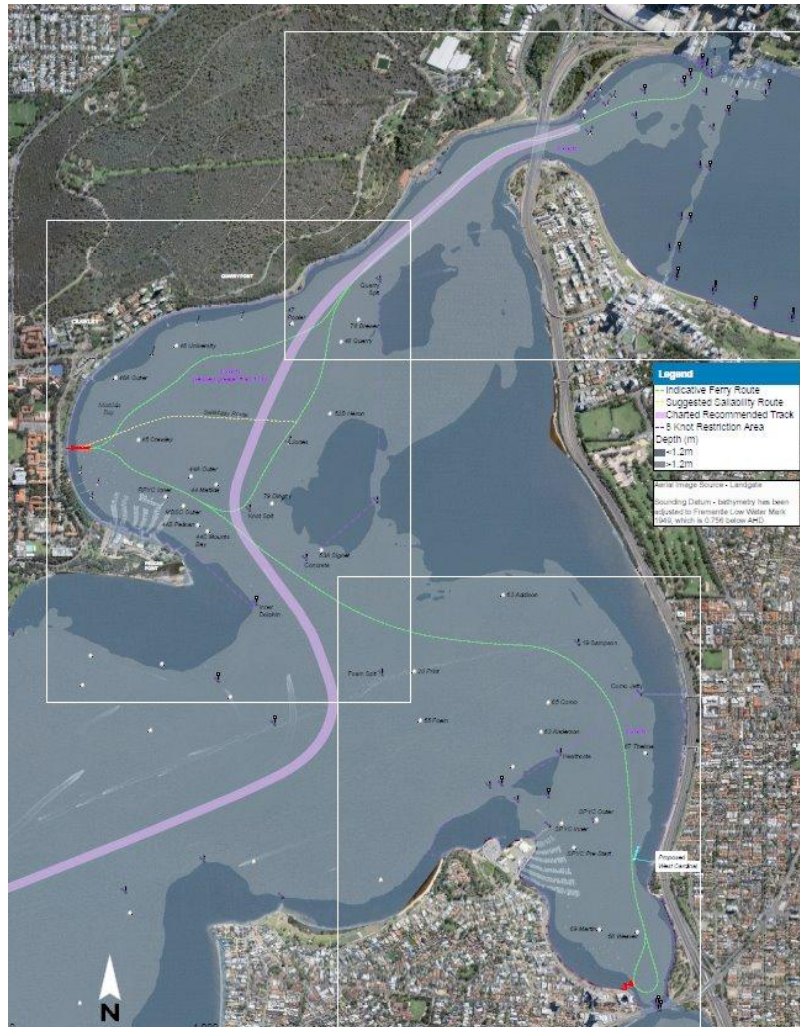
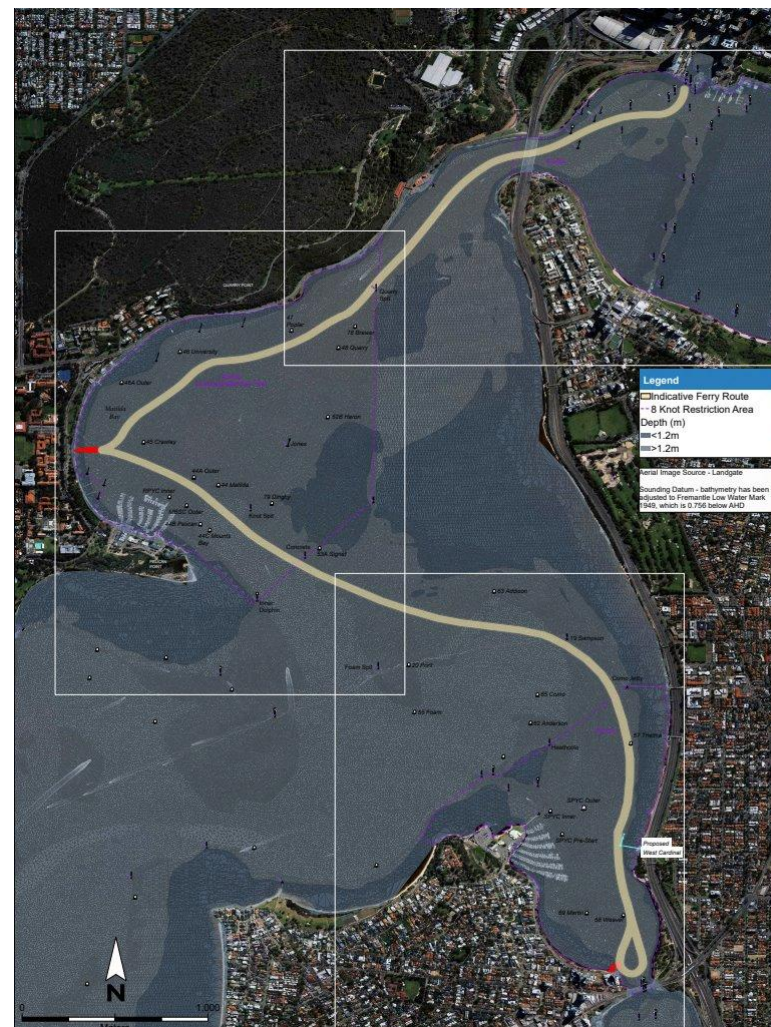


Figure 2: WSRG proposed route



The following table provides an overview of the stakeholder engagement to date, including with on-water users.

Engagement Types	Number of meetings held
Group and one-on-one project information briefings with key stakeholders	20
Stakeholder Group Workshops	1
Stakeholder Group Information Session	1
Public pop-information sessions	7
Waterways Stakeholder Reference Group meetings to date	7
Individual out of session meetings with WSRG members	4

Appendix G Communications Action Plan

Ferry Operations Development Application

METRONET on Swan Ferry Service Expansion

Public Transport Authority of Western Australia

SLR Project No.: 675.V25085.00EA1

21 August 2026

Ferry Service Expansion

Communications Action Plan

Promotion of Development Application public comment period for Ferry Operations on the river

Background

Before the Ferry Service Expansion project can transition into delivery, a Development Application (DA) for the ferry operations on the Swan River is required to be submitted to the assessing authority.

Development approvals have been previously issued for the Matilda Bay Ferry Terminal and the Applecross Ferry Terminal by the Western Australian Planning Commission and for the Elizabeth Quay Ferry Terminal by the Metropolitan Redevelopment Authority.

A DA pursuant to Part 5 of the *Swan and Canning Rivers Management Act 2006* (SCRM Act) will be lodged with the Department of Biodiversity, Conservation and Attractions (DBCA) for the proposed ferry service on the Swan River, between Applecross, Matilda Bay and Elizabeth Quay. Pursuant to section 74(2) of the SCRM Act, the proposed development is considered a matter of significant public interest due to the scale, location, and potential impact to the river and surrounding foreshore reserve.

As part of the assessment, DBCA will make the application and associated documents available for public viewing and feedback via an online portal.

A second public comment period will also be required before the application is decided, and it will occur after DBCA's draft report has been presented to the Swan River Trust for consideration. DBCA's draft report will be made publicly available for comment.

Feedback received by DBCA will be considered as part of their overall assessments of the DA.

This Communications Action Plan sets out the approach of the Public Transport Authority (PTA) and the Department of Transport and Major Infrastructure (DTMI) to communication with the public and stakeholders to support the DA process and ensure communications are coordinated and effective.

Purpose

- To raise awareness of the project in general.
- To raise awareness of the opportunity for affected stakeholders, particularly waterway users and groups on the public comment period to voice their concerns or support for the ferry operations.

Stakeholders

- People undertaking recreational activities on the Swan and Canning Rivers and in the vicinity of the proposed terminals and new ferry route.

Key points

- The WA Government is investing \$107 million to expand public transport options along the Swan River, helping to shape a more connected and vibrant Perth. Expanding ferry services is a natural step forward for our growing city.
- As part of this expansion, a new ferry route will connect the existing Elizabeth Quay terminal with two new terminals at Matilda Bay and Applecross.
- Services will run on a ~30-minute frequency between 6.00am to 12.30am.
- A Development Application for the proposed ferry operations on the Swan and Canning Rivers has been submitted to DBCA, and you are invited to have your say.
- Information can be viewed and feedback submitted via the Department of Biodiversity, Conservation and Attractions website.

Proposed ferry operations

- ~30-minute frequency
- ~15-minute trip between terminals
- Approximately 6.00am to 12.30am operations

Actions

- A feedback portal live on the opening day of public comment period
- Information and Frequently Asked Questions on PTA website
- Newspaper advertisements
- Electronic Direct Mail to project subscribers
- Targeted emails to established key stakeholders
- Information on the Building for Tomorrow website and social media
- Briefings sessions with City of Perth and City of Melville

Appendix H Operational Management Plan

Ferry Operations Development Application

METRONET on Swan Ferry Service Expansion

Public Transport Authority of Western Australia

SLR Project No.: 675.V25085.00EA1

21 August 2026



Operational Management Plan (Draft) Battery-Electric Ferries

METRONET on Swan River Ferry Expansion

June 2026

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**Public Transport
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Introduction

Purpose of the Report

This report has been prepared to support the Part 5 Development Application under the Swan and Canning Rivers Management Act for the operational aspects of the Project.

This Operational Management Plan (OMP) has been prepared to guide the safe and efficient operation of the EV ferry service. The plan outlines operational procedures, safety management measures, and monitoring requirements associated with the ongoing operation of the ferry service.

The OMP supports the implementation of ferry operations across all terminals and provides a framework for managing key operational elements including routes, schedules, vessel speeds, berthing and passenger handling, charging operations, waste management, and interaction with other waterway users. It also establishes protocols to minimise risks to passenger and crew safety, protect environmental values, and ensure compliance with relevant regulatory requirements.

This OMP should be read in conjunction with supporting technical and operational documents, including vessel specifications, safety studies, operation environmental management plans and systems, and terminal operation plans, which collectively inform the delivery of safe and effective ferry operations.

Structure of this Report

This report is structured as follows:

- **Section 1** provides operational aspects of the ferry service including waste management, berthing, charging and relevant daily operational procedures.
- **Section 2** covers emergency procedures including hazard and incident reporting procedures.
- **Section 3** covers servicing and maintenance requirements.

Consultation and Notification

To support the development of the Operational Management Plan (OMP) for the Transperth Ferry Expansion, expert input has been provided by SeaLink Operations, as represented by Harry Clarke, Marine Manager – Transperth Operations. This input is based on extensive industry experience in the commissioning and operational management of new build passenger vessels, including the development of Safety Management System (SMS) manuals and onboard procedures for passenger operations.

At the time of preparation, the battery-electric ferries associated with this expansion are still under construction. Consequently, detailed onboard operational and emergency procedures cannot yet be finalised, as these are inherently dependent on the final vessel configuration, systems, and equipment. These technical aspects can only be confirmed following vessel completion and delivery.

The vessels will operate using fully electric propulsion and energy storage systems, which introduce additional operational considerations. Vessel-specific training and technical documentation will be provided by EV Maritime and Echo Marine, as the vessel builder and battery system supplier respectively. The development of associated procedures will rely on this information, including defined operating parameters and system-specific emergency responses, which will be made available in conjunction with vessel delivery.

Consistent with established industry practice for commissioning new build vessels, existing operational procedures from comparable passenger ferry operations will form the baseline framework for the OMP. These procedures will be reviewed and adapted to reflect the unique characteristics, handling, and systems of the new vessels, ensuring both continuity with proven practices and alignment with vessel-specific requirements.

This adaptation process will be undertaken during the vessel delivery, sea trialling and Master familiarity phase. Sea trials are critical to verifying vessel performance and operational behaviours, and they provide the necessary data and practical experience to refine and finalise safe and effective onboard procedures.

Accordingly, the detailed standard operating procedures and emergency procedures for the battery-electric ferries will be developed and submitted following vessel delivery and during the sea trialling period. These procedures will be informed by existing operational frameworks, the marine experience of the proposed operations team, and the specialist training and technical guidance provided by the vessel delivery Contractor.

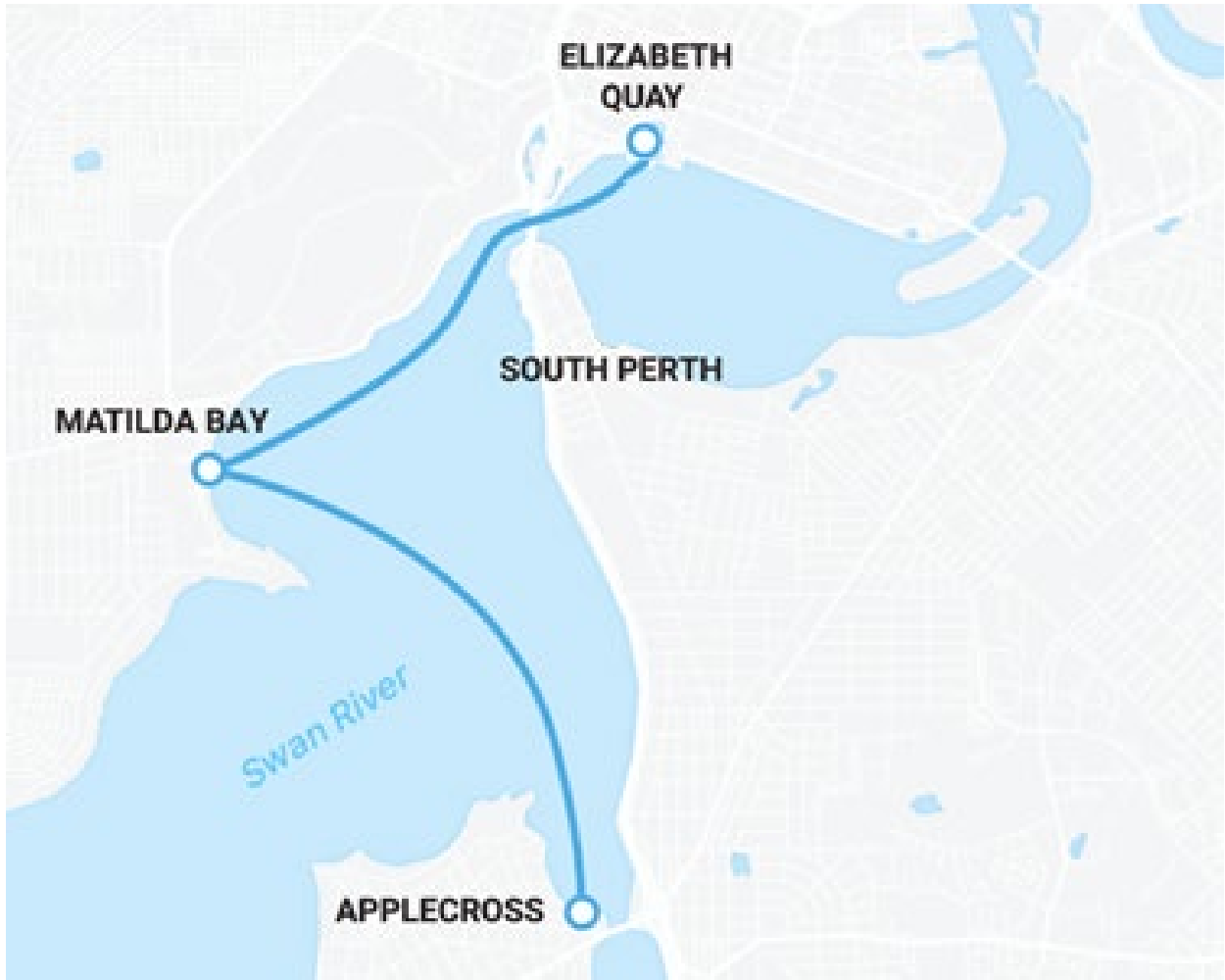
Project Background

The METRONET on Swan Ferry Expansion Project involves the introduction of a new ferry service operating across existing and newly developed ferry terminals within the river network. The project includes the use of electric-powered vessels to provide a sustainable and efficient transport service, operating from two existing terminals and two newly constructed terminals (Matilda Bay Terminal and Applecross Terminal) designed to support modern ferry operations.

The ferry operations are expected to be implemented progressively, aligned with the readiness of terminal infrastructure and supporting systems. This plan applies to all operational stages of the ferry service and will be updated as required to reflect operational changes, technological advancements, and outcomes from monitoring and review processes.

The map incorporates two 50-metre-wide navigation corridors that have been developed in consultation with relevant waterway stakeholders. While these corridors have been prepared to support the submission of an Operational Works Development Application, they are intended as guidance only and do not supersede the master's obligation to navigate the vessel safely and in accordance with prevailing conditions and maritime regulations (COLREGs).

One route and an alternative have been identified to accommodate varying patterns of waterway use throughout hours of the day/days of the week. The route selection has been informed by consideration of different user groups and anticipated traffic volumes during specific periods, with the objective of minimizing potential conflicts and promoting the safe and efficient shared use of the waterway.



SECTION 1 - Ferry Operational Procedures

Anchoring

Note that the following are to be reviewed and updated as required following vessel completion and delivery.

Purpose

To ensure a safe means of effectively deploying and retrieving the anchor, the below procedures are to be followed. Individual circumstances may make it necessary to modify the process; this is to be under the Master's instruction.

This procedure is applicable to staff who have been employed in the function of Vessel Master, or apart of vessel maintenance team. Persons who engage in this procedure must have completed a full vessel induction and company safety induction.

It is anticipated the anchoring system will not be used during scheduled operations and only put into practice during emergency or isolated events.

Responsibilities

It is the Master of the vessels' responsibility to be familiar with the anchoring arrangements and its equipment and to be competent in deploying and retrieving the vessels anchor and can safely carry out the duties within this procedure.

It is the responsibility of the Operations Manager to ensure the Master is allocated an appropriate period and resources to ensure competency and capability of carrying out the duties within this procedure.

Masters must ensure the correct PPE (Personal Protective Equipment) is available and utilised for all parties while carrying out their duties within this procedure. This includes use during training drills.

It is the responsibility of the Masters to adhere to and implement these procedures.

Master(s) may deviate from these instructions where they believe on reasonable grounds that a departure from this procedure will result in a safer outcome during an incident or to avoid a hazard.

Procedure

Note: Prior to anchoring, the direction and speed of the current or tidal stream and wind must be confirmed. Attempts should not, whenever possible, be made to anchor across the current, tidal stream or wind.

When all the way has been taken off the vessel, the vessel's head should be close to the direction of the tidal stream or wind, and the bow should not be swinging excessively.

Deploying Anchor (Manual Deployment)

1. Ensure all passengers are clear of the bow area and are inside the accommodation space.
2. Master manoeuvres vessel to a suitable anchorage and positions the bow of the vessel to the wind or tide, whichever has the greater effect.

3. *In the event of a main electrical plant failure / emergency, the anchor will be deployed immediately if the likelihood of collision is imminent.
4. Remove the anchor from its position and lace out the chain and rope ready for deployment, making sure there are no entanglements or obstructions.
5. Master to lower the anchor.
6. *Note: Stand well clear from the anchor chain/rope. The Anchor will free fall at speed.
7. Let the anchor chain/rope free spool, measuring how much you are letting out.
8. *Note: Scope ratio will depend upon conditions – 3:1 for smooth conditions, 5 or 6:1, if moderate seas and 8:1 or greater if conditions are rough. It is unlikely however that a scope of greater than 4 or 5:1 would ever be required in the Transperth operational area.
9. Manoeuvre the vessel slowly astern to lay out chain/Rope.
10. Once the vessel is in position and has sufficient swing room for wind veining, the rope attached to the anchor will then be secured to the starboard or port bollards.
11. Master checks the vessel has sufficient swing room for wind veining. Set up anchor watch using radar and GPS, together with landmarks. Display light and shapes for 'at anchor' as per Collision Regulations.
12. Monitor anchor dragging.
13. Inform Operations Manager and refer to Critical Incident Management Plan.

Weighing Anchor

1. Ensure all passengers are clear of the bow area and inside the accommodation space.
2. Master positions the Bow of the vessel to the wind or tide whichever has the greater effect.
3. Ensure anchor Rope/chain is clear of any visual obstructions.
4. Engage the anchor switch located at the Helm and turn to the On Position.
5. Check the foot switch at the fore deck has power and the capstan winch spins by pressing down on the foot switch. This will require assistance from another crew member. The anchor on the vessel will not be used unless in an emergency, therefore assistance must be sought from other crew, brought to the vessel.
6. Master may weigh anchor when ready by moving forward and creating sufficient slack in line to permit raising.
7. Once anchor is back on deck, the anchor may be securely stored in its original position.

Berthing and Mooring / Departure

Note that the following are to be reviewed and updated as required following vessel completion and delivery.

Purpose

To provide guidance for the safe berthing and departure operations of the EV vessels.

Information contained in this procedure refer to the final approach and actions required for safe mooring and departure from a wharf.

While every care has been taken to ensure that the information contained within is accurate, nothing in this procedure shall exonerate the Master from the consequences of any neglect to comply with the International Regulations for the Prevention of Collisions at Sea and National Law General Safety Duties.

This means a Master may make a departure from this procedure when using their professional judgement to make decisions that are in the interests of safe operation of the vessel, and to minimise and real or perceived risk to the vessel, its crew and passengers.

Scope

This procedure applies to all staff who have been employed in the function of Vessel Master.

It includes recommended actions to control and minimise risk for mooring and berthing activities.

The procedure specifies actions to take in normal conditions but does not include instructions for Masters to follow when conditions become highly unpredictable necessitating a dynamic risk assessment by Masters in order to determine the safest actions to berth.

Where conditions are not considered safe, Masters must not undertake a voyage in the first instance and must contact the Operations Manager.

Overnight berthing details are not part of this OMP. Refer to Overnight Berthing Details section of the Part 5 DA Planning Report.

Responsibilities

The Master has a duty of care and responsibility for the welfare and safety of all passengers, safe navigation and operation of the vessel. These responsibilities are directly imposed by the General Safety Duties under Part 3, Division 3, Section 16 of the National Law.

During times when the vessel is engaged in berthing/mooring and departure operations, the Master must be prepared and have a sound understanding of the departure and arrival procedures, including the vessel's limitations to manoeuvrability, risk and controls available associated with the operational environment. This includes working in and around fixed infrastructure, high traffic density areas and when there are significant lighting distractions.

Masters must remain vigilant, as lighting conditions may change rapidly.

All Masters are expected to follow this procedure to the best of their ability, however, nothing in this procedure shall prevent a Master from using their professional judgement to ensure the safe

operation and navigation of a vessel. This includes a departure from this procedure where the safe operation of the vessel requires such a departure.

The vessel shall be berthed using a low-speed, controlled approach that accounts for prevailing environmental conditions, vessel traffic, and berth configuration. The master shall maintain positive control of the vessel throughout the manoeuvre and ensure that all mooring operations are conducted in accordance with established safety procedures and the vessel's approved operating procedure.

Procedures

Berthing Preparedness:

- Master must have sound knowledge of the day's weather forecast. A summary of the forecast must be entered into the vessel's log, including wind strength and direction.

(*Note - Wind gusts can be 40% stronger than the forecast average wind speed).

- All mooring lines must be in good condition. Good condition means lack of visual abrasion, corrosion, pitting and any other obvious wear and tear that may limit the performance of the line.
- A check of mooring lines must be conducted by the Master at the commencement of each shift.
- Where a mooring line requires replacement or is suspected of being faulty, the Operations Manager must be contacted forthwith to organise replacement line(s) immediately.
- The Master must have a sound understanding of the vessel's manoeuvrability characteristics, limitations and stopping distances.
- The Master must not attempt berth unless certificated, and they have successfully completed internal training to establish competency, or where under the instruction of a Training Master.
- The Master and Deckhand shall maintain situational awareness of vessel traffic within the operating area, including commercial vessels, recreational craft, paddle craft, and other waterway users, and shall communicate any identified navigational risks to ensure safe passage and manoeuvring.

Berthing

1. Reduce speed as the vessel approaches the berthing location
2. Use jet propulsion system to manoeuvre into position using small, deliberate adjustments rather than large corrections
3. Once alongside, the deckhand is to secure appropriate mooring lines in accordance with the vessel's mooring plan. Establish control of the vessel before making final line adjustments.
4. Deckhand is to remain clear of snap-back zones and line bights.

Embarkation / Disembarkation

Purpose

To ensure a safe and effective means of embarking and disembarking passengers for EV vessels.

Scope

This procedure is applicable to all staff who have been employed in the function of Vessel Master. Persons who engage in this procedure must be appropriately qualified and must have completed a full vessel induction and company safety induction.

Procedure

1. Ensure vessel is safely secured to the jetty. Continually monitor the location of the ferry in relation to the jetty to ensure contact is maintained.
2. Open main entry door on the starboard side of the vessel.
3. Position the gangway on the vessels gunwale to bridge the gap between the jetty and vessel.
4. Prior to embarkation ensure that all passengers that wish to alight have disembarked the vessel.
5. Ensure that the next trip is programmed into the ETIM (Electronic Ticket Issuing Machine) prior to opening the jetty side boarding gates.
6. Master must ensure the passenger counter (clicker) is operational and ready for use.
7. When ready, the Master may open the jetty side boarding gate to allow passengers to board the vessel.
8. To be able to verify an accurate passenger count, the Master must use the passenger counter (clicker) and count every passenger including infants and children that boards the vessel.
9. Advise passengers to take care when embarking / disembarking.
10. The boarding gate may be closed on the scheduled departure time or up to 2 mins after.
11. Once the boarding gate has been closed, the Master can remove the gangway from the vessel placing it on the jetty side landing.
12. Once the gangway has been removed, the main entrance door is closed, and the Master can ready the vessel for departure.
13. As soon as reasonably practicable, the Master must record the passenger number into the ships logbook.

Passenger Numbers

If a ferry is already at capacity and cannot accommodate any further passengers, the passengers should be advised of the next scheduled service.

Boarding Standard Bicycles

- Standard bicycles can board with the passengers.
- The number of bicycles permitted is 8 standard bicycles per trip. Additional bicycles may be permitted, at the discretion of the Master, dependent upon space available after considering the quantity of wheelchairs, gophers and prams already on board.
- Further instruction is available in the Transperth Service Handbook – Policy and Procedures.

NOTE - BICYCLES ARE NOT PERMITTED TO BE STOWED BETWEEN THE SEATS.

Boarding of Wheelchairs and Prams

The number of wheelchairs, gophers or prams carried on board the ferry at any one time is at the discretion of the Master.

If the wheelchair areas are occupied by patrons not using wheelchairs, gophers or prams, then the Master must instruct these passengers to vacate their seats in preference to a wheelchair, gopher or pram.

Passenger Verification

Scope

This procedure is to be utilised to enable crew to account for all persons onboard at any time, especially in the event of an emergency.

This relates to operational periods when the vessel is underway or making way. The correct number of passengers must always be known by the Master.

If at any time there is doubt about the number of passengers on board, an additional headcount shall be carried out immediately.

Procedure

1. The Master must count the number of passengers getting on board the vessel during the boarding process.
2. The Master must use the clicker counter to facilitate the counting of the passengers.
3. The Master must record the passenger numbers in the log.
4. The Master must confirm the number of passengers on board before departure.

Voyage

During the voyage, the Master must monitor passengers and their behaviour during the transit and communicate any risk related activity to the Operations Manager or PTA as determined by the situation presented.

The Master must ensure they know the number of passengers on board at any time.

Crestron System / PA System for Safety Briefing

Note that this procedure will be provided following vessel completion and delivery.

One button for welcome onboard safety announcement and one button for safety arrival message.

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Operations in Restricted Visibility

Note that the following are to be reviewed and updated as required following vessel completion and delivery.

Objectives and Scope

To ensure the safe operation of the vessel when visibility is restricted.

Introduction

In the event of restricted visibility, the Master must make decisions in regard to passenger and crew safety. This procedure outlines the additional requirements to consider and to adopt when operating the vessels in restricted visibility.

Communication

Sound signals as per the collision regulations, handheld radio.

Lighting signals will be incorporated into the vessel design to warn existing water traffic of the incoming vessel during times of restricted visibility.

Procedure In Brief

The International Regulations for Preventing Collisions at Sea, Part B, Section 3, Rule 19 applies to the conduct of vessels in restricted visibility. Masters must be familiar with this rule and competent in its application.

1. Continuously determine position by sight and use of wheelhouse equipment (GPS, Radar).
2. Set the radar at an appropriate range for the area of operation.
3. Sound the appropriate signals on the vessel's horn.
4. Steam at a safe speed and keep a proper lookout.
5. Understand the limitations of radar in heavy rain.

Procedure In Detail

Vessels should use all available means to keep a proper lookout and where necessary slow down to ensure a safe speed is maintained.

Every vessel shall proceed at a safe speed appropriate to the prevailing circumstances and conditions. Early radio contact with other vessels and open lines of communication will help in avoiding any close quarters situations and the risk of collision.

- At all times, the Master should know their position by utilising their wheelhouse equipment designed to ensure the vessel's position may be determined at any time.
- Masters must know their compass courses to and from their destination.
- Where conditions dictate, slow to a safe speed to enable the vessel to stop safely when other vessels and structures are in close proximity. When determining a safe speed, the vessel should be able to be stopped in half the distance of the range of visibility, or less.

- The vessel's navigation lights should be turned on.
- Set plotter and radar to head up – although not compulsory, it is good seamanship to do so and easier to compare radar targets on plotter screen, to evaluate if the risk of collision is present. The Master may choose to view radar or GPS plotter depending on personal preference, however changing between both screens from time to time may be appropriate. The Master must use their professional judgement to make a determination.
- Ensure the range used on the plotter and radar is appropriate for the vessel speed, conditions and area of operation.
- If unsure where you are, stop the vessel and maintain your current position, until the vessel's position has been confirmed and safe course has been determined.
- Use known features and markers in the area to help determine vessel location on radar.
- If other vessels are detected but not in sight, sound signals shall be used.
- In the unlikely event of zero or near zero visibility, sound signals must be used.
- A power-driven vessel underway should sound 1 prolonged blast on the ships horn at intervals of not more than 2 minutes.
- A power-driven vessel underway, but not making way, should sound 2 prolonged blasts on the ships horn at intervals of not more than 2 minutes.

Start Up Procedure

Note that the following are to be reviewed and updated as required following vessel completion and delivery.

Purpose and Scope

This procedure specifies the duties that are required for vessel start up on all vessels at Transperth Operations.

Prior to departure, the Master shall verify that the battery systems, propulsion equipment, monitoring systems, navigation equipment, communications systems, and safety equipment are fully operational and free from faults. Following completion of pre-departure checks and crew briefing, the vessel may be energised and prepared for departure in accordance with the manufacturer's procedures and the vessel's Safety Management System.

Start Up Procedure for Business Operations

1. Pick up coin bag, mobile phone & PTA handheld 27 meg radio from office.
2. Check roster for vessel to be operated on your shift.
3. Open exit gate & lock open.
4. Unlock wheelhouse, main door & port side door.
5. Read previous days log entries.
6. Check ETIM has downloaded.

Start Up Procedure for Vessel Operations

1. Visually inspect hull for damage.
2. Inspect mooring lines for correct lengths, damage etc. Inform Operations Manager for immediate replacements if required.
3. Inspect lights, fixtures, fittings atop vessel – check operational status.
4. Check shore power – turn off and store.
5. Select appropriate battery bank on main switch board 1 or 2.
6. (Fridays only) duress button test contact security on 9326 3634 on the vessels mobile phone & enter into the logbook.
7. Engage engine batteries.
8. Check battery charge levels.
9. Check coolant levels.
10. Disconnect CCTV power cable & put with vacuum cleaner.
11. Hose down roof and windows to remove bird droppings.

12. Squeegee all outside windows.
13. Check coolant, battery levels, any evidence of leaks or oxidation.
14. Check seacocks open/check strainers.
15. Check vessel log for any matters that may affect start up or operations and address as required.
16. Startup vessel, check for correct operating temp.
17. Visually inspect electric equipment room and jet propulsion systems.
18. Test of propulsion, ensure engagement forward and aft.
19. Close hatch.
20. Fill in logbook.
21. Radio checks.
22. Confirm all battery management systems (BMS), monitoring systems, alarms, and displays are operational and indicate normal status.
23. Check operating temperatures, listen for unfamiliar sounds.
24. Sign onto your ETIM.
25. The Master and Deckhand shall complete a departure briefing, including weather conditions, route selection, anticipated traffic, emergency procedures, and assigned crew responsibilities.
26. Set gangway prior to opening boarding gate.

NOTE: *DURRESS BUTTON TEST MUST BE DONE EVERY FRIDAY AND LOGGED – Swan Transit Mount Claremont BASE via Digital Radio CH12 TP Ferries or CMR on 9326 3634 or 9326 3626 BEFORE PRESSING THE BUTTON.

Shut Down Procedure

Note that the following are to be reviewed and updated as required following vessel completion and delivery.

Purpose and Scope

This procedure specifies the duties that are required for vessel shut down on all vessels at Transperth Operations.

- Shut Down Procedure for Business Operations
- Place driver card onto ETIM & sign off
- Place driver report & driver card back into your coin bag
- Go to the office & place your driver's receipt & money night safe.
- Place mobile phone & PTA radio on charge.
- Coin bag must be left in your locker.
- Lock office door on the way out.

Shut Down Procedure

1. Disembark all passengers.
2. Secure vessel to jetty using all 4 lines – ensure lock offs on both sides off cleats. Ensure ropes are in good condition
3. Close all windows.
4. Pick up all paper tickets etc.
5. Clean all inside windows.
6. Wipe windowsills.
7. Vacuum floor.
8. Attach shore power cable and make sure power is on.
9. Open hatches visually inspect propulsion system and space.
10. Fill out the logbook and sign
11. Shut down systems.
12. Seacocks closed
13. Turn off main engine battery switches port and starboard.
14. Lock port side & wheelhouse doors.
15. Isolate all switches on 24-volt power board.

16. Turn off wheelhouse light.
17. Lock starboard main door.
18. Last shift to close gate and lock.

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Low Voltage Charging

Note that this procedure will be reviewed and updated as required following vessel completion and delivery.

Purpose

This procedure specifies the duties that are required for to engage low voltage charging on the Transperth electric ferries.

Procedure

1. Make sure you have read and understand the instructions of the vehicle to be charged.
 - a. The Charging process starts when the vehicle connector is correctly connected to the vehicle.
2. Attach the vehicle connector to the vehicle. Make sure that the vehicle connector is correctly connected. Listen for the vehicles lock-in sound.
3. When stopping charging remove connector. Leave cable neatly.

High Voltage Charging

Note that this procedure will be reviewed and updated as required following vessel completion and delivery.

Purpose

This procedure specifies the duties that are required for to engage high voltage charging on the Transperth electric ferries.

Procedure

1. Make sure you have read and understand the instructions of the vehicle to be charged.
 - a. The Charging process starts when the vehicle connector is correctly connected to the vehicle, when identification is complete (if required) and when the vehicle is in neutral.
2. Attach the vehicle connector to the vehicle. Make sure that the vehicle connector is correctly connected. Listen for the vehicles lock-in sound.
3. If identification is required, the charging unit asks for it when the vehicle connector is connected to the vehicle.
 - a. Use the suggested identification method.
4. Communication between the charging unit and the vehicle starts. Follow the progress on the screen display.
5. When charging starts the charging status is shown on the display screen and an indicator light turns on at the connection point.
6. Press stop on the display screen to end charging session.
7. Ensure MCS cable is left neatly.

Waste Management

Note that the following are to be reviewed and updated as required following vessel completion and delivery.

Purpose

To ensure all waste generated onboard ferry vessels is managed, collected, stored, and disposed of in a safe, hygienic, and environmentally compliant manner, in line with Australian maritime requirements and MARPOL Annex V obligations.

Scope

This procedure applies to all ferry crew, vessels, and terminals involved in passenger ferry operations.

Waste Categories

Waste generated onboard includes:

- General waste (packaging, paper, food waste)
- Recyclables (plastic bottles, cans, glass where applicable)
- Operational waste (cleaning materials)
- Any hazardous or regulated waste (if applicable)

Waste Storage and Handling

All waste must be placed in designated bins located onboard vessels.

Bins must:

- Be clearly labelled (general waste, recyclables if applicable)
- Be fitted with liners
- Remain secured to prevent spillage during transit

Waste must be contained at all times to prevent discharge into waterways.

Bin Emptying Schedule

Crew are responsible for routine waste removal as follows:

- Once daily at lunchtime (mid-service):
 - All onboard bins are to be checked and emptied as required.
 - Liners replaced where necessary.
- At the completion of services upon berthing:
 - All bins must be emptied regardless of fill level.

- Waste is to be transferred to approved shore-based waste facilities.
- Bins must be cleaned if required and reset for the next service.

This ensures hygiene standards are maintained and prevents accumulation of waste onboard.

Disposal Requirements

All collected waste must be disposed of using approved onshore waste facilities.

Disposal must comply with:

- Local council requirements
- Port/terminal waste management protocols

Under no circumstances is waste to be discharged directly into the water.

Crew Responsibilities

Crew must:

- Monitor bin usage throughout the voyage
- Prevent overfilling of bins
- Promptly clean any spills
- Follow the defined emptying schedule
- Report any waste management issues or equipment failures

Environmental Protection

Waste minimisation practices should be encouraged, including:

- Reducing single-use items where possible
- Promoting recycling

Effective waste handling reduces pollution risks and protects marine ecosystems.

Toilets

For the current fleet operating short-duration services, toilets are installed onboard but remain locked and are not available for passenger use. This approach is adopted due to the relatively short journey duration, as well as to support operational simplicity and reduce ongoing maintenance requirements. As a result, passengers are expected to use land-based toilet facilities prior to boarding.

For the future electric ferry fleet, toilets will be installed and available for passenger use, reflecting longer travel distances and increased journey times, as well as improved passenger comfort expectations. The new electric ferries in Perth are confirmed to include onboard toilet facilities as part of their design.

Sullage Management

To ensure safe and compliant operation, onboard toilets in the new fleet must be connected to holding tanks or approved sewage treatment systems and be regularly maintained to prevent odours, leaks, and blockages. Sewage generated onboard must not be discharged in restricted waters or in proximity to terminals, in accordance with Australian marine pollution regulations, and must instead be disposed of via appropriate shore-based pump-out facilities or approved systems.

In addition, new terminals supporting these longer routes should provide adequate onshore toilet facilities for passengers and include appropriate infrastructure to service onboard sewage systems where required. Operational planning should ensure clear communication to passengers regarding the availability of onboard versus onshore toilet facilities, and that routine servicing and maintenance schedules are established for all onboard sewage systems.

Sullage will be managed at end of operations through the Barrack Street Jetty 2 waste reception facilities. Vacuum pumps are provided on the jetty. The vessel will be fitted with a camlock hose fitting to ensure no risk of spillage.

The operator is to:

- Retain all waste onboard in holding tanks until it can be pumped out into the land-based mains system.
- Utilize secure, heavy-duty suction hoses with leak-proof deck fittings.
- Ensure zero discharge into the Swan River. It is an offense under the *Jetties Act 1926* and *Environmental Protection Act 1986* to bypass shore connection points and release any greywater (sullage) or blackwater into the river.

The operator must comply with all directions and restrictions as may be imposed by the Department of Transport Maritime in relation to the use, or operation, of the Sullage System.

SECTION 2 - Emergency Procedures

Adverse Weather

Purpose and Scope

This procedure contains instructions for the Master during adverse weather conditions.

In the event of adverse weather, the Master must make decisions regarding passenger and crew safety.

This procedure outlines the extra requirements to consider and to adopt when operating the vessels in adverse weather.

This procedure applies to all Transperth vessels.

Communication

Many mediums of communication will be used in this procedure – internet, free to air radio, VHF radio stations, phone and human senses (e.g. sight and sound).

Bureau of Meteorology (BOM) Definitions of Wind Warnings

The wind strengths associated with the category of wind warnings issued by the Bureau of Meteorology are set out in the table below. It is important to remember that these are averages and wind gusts may be up to 40% stronger than predicted.

Warning	Definition	Plus 40 %
Strong Wind Warning	Winds averaging from 26-33 knots	Up to 46 knots
Gale Wind Warning	Winds averaging from 34-47 knots	Up to 66 knots
Storm Force Wind Warning	Winds averaging from 48-63 knots	Up to 88 knots
Hurricane Wind Warning	Winds averaging from 64 + knots	Up to 90 knots

Masters Responsibility

The Master is responsible for making a final decision on whether the vessel sails or not.

In adverse weather conditions, it is important to have sound knowledge of the vessel and its limitations.

The Master must be sure that he is working within the conditions set out by the vessels survey, stability limitations, the PTA policy.

Passenger and crew safety is the most important thing to consider. Any doubt of safety being maintained would indicate that a delay in departure would be within the practice of good seamanship.

Procedure

- During periods of adverse weather, the Master must at the commencement of their shift ensure they have read the latest forecast reports and checked any weather warnings that apply to the area.
- The Master shall discuss the expected conditions and any expected changes needed

to normal operations with the crew at the beginning of shift.

- Before every departure, the Master should assess all prevailing conditions including but not limited to wind, tide, flooding, sea conditions (size and direction), visibility and traffic.
- As passengers aboard the vessel, all crew should be aware of the current conditions and position.
- The Master shall make additional announcements via the vessels PA system prior to departing the wharf. The announcement must explain to the passengers what weather conditions that are expected and advise passengers to remain seated and if they are moving around at all times to have “one hand for the vessel.”
- Crew shall offer any passenger assistance during times of adverse weather, provided it doesn’t present risk of injury to crew.
- The Master shall proceed at a safe speed considering prevailing conditions and circumstances. It may be necessary for the safety and comfort of passengers to deviate from the normal route, and Masters must achieve the safest and most comfortable voyage for passengers.
- To reduce the risk of collision with (possible) debris in the water an extra lookout should be posted when there is or could be a risk of this occurring.
- In rough weather conditions particularly in any following seas, vessel Masters are to hand steer the vessel to ensure they can react to wave conditions and to ensure the movement of the vessel is minimised in the prevailing conditions.
- Where weather conditions reduce visibility, vessel Masters must make use of all available means to operate the vessel safely including ensuring the navigation lights are on, all bridge equipment is tuned to the conditions, and an appropriate range and scale is used on plotters and radars. A crew member should also be posted as an extra lookout in the wheelhouse.

Master Incapacitated

Note that the following are to be reviewed and updated as required following vessel completion and delivery.

Purpose

This procedure encompasses instructions for the Deckhand or Passengers to control and manage a Master incapacitated situation.

Scope

This procedure is applicable to all staff who have been employed in the function of Vessel Master and Operations Manager, Commuter Ferry Division.

Responsibilities

It is the responsibility of the Master of the vessel to ensure they have participated in training to confirm they have the required competency and can safely carry out the duties within this procedure.

It is the responsibility of Operations Manager, Commuter Ferry Division to ensure the Master is allocated an appropriate period of time and resources to ensure competency and capability of carrying out the duties within this procedure.

The Operations Manager, Commuter Ferry Division must set realistic scenarios for drill training, oversee training drills and provide information and documented feedback to management.

Masters must ensure the correct PPE (Personal Protective Equipment) is available and utilized for their own safety while carrying out their duties. This includes use during training drills.

It is the responsibility of all marine crew to adhere to and implement these procedures.

Master(s) may deviate from these instructions where they believe on reasonable grounds that a departure from this procedure will result in a safer outcome during an incident or to avoid a hazard.

It is of great importance that the Master must report any symptoms of feeling unwell or not being in a fit state to operate the vessel safely.

Procedure

In the event of an emergency involving the vessel, the Master must take whatever immediate action is called for to secure the safety of the vessel and those on board, as is normal practice and in accordance with good seamanship using the developed Emergency Procedures.

During any passage, a Master who may feel as though they become incapacitated, the priority is that an attempt should be made to immediately engage the “Duress Button” and if possible, take the vessel out of gear.

In the unlikely event that a Master was to become incapacitated, the monitoring by CMR (Central Monitoring Room) and the activation of the Duress Button would bring alert to the CMR.

Communication may be given from CMR to the vessel using the LLPA (Long Line Public Address) system. There is also a Main Systems Emergency Stop button located under the VHF radio and is clearly visible.

In addition, there is a direction notice placed near the throttle control for any deckhand / passenger to immediately call the Designated Person Ashore (DPA) or contact VHF Ch 16. The immediate contact will direct the person / passenger to safely stop the vessel or steer into clear water.

Note: If circumstances permit the Master to leave the helm at any point to secure the safety of the vessel, they must ensure to engage the NUC light signals operated via the Oceanic PLC Screen.

1. If possible, activate “Duress Button” and take vessel out of gear.
2. CMR / Passenger/s observe the Master incapacitated.

Observation by CMR

1. If observed by CMR control room the Transperth Security Shift Supervisor will utilize the LLPA System to instruct a passenger to enter the wheelhouse and stop the vessel utilising the Main Systems Emergency Stop.
2. Advise the person / passenger to steer the vessel away from any danger or obstructions.
3. CMR will contact Water Police to advise of the situation.

Observation by Passenger/s

1. The response deemed reasonable for a Passenger/s would be to enter the cabin area and attend to the Master.
2. Whilst the vessel is underway a following response deemed reasonable would be to call for help or attempt to stop the vessel. Clearly visible on entry to the cabin area the Main Systems Emergency Stop button located under the VHF would need to be pressed/engaged.
3. In the event a passenger does not engage the Main Systems Emergency Stop, however does locate the throttle controls, there is a direction notice placed near the throttle control for any deckhand / passenger to immediately call the Designated Person Ashore (DP) (Number provided) or contact VHF Ch 16 (Water Police).
4. Operations Manager to advise the person / passenger to remain calm.
5. Operations Manager to advise the person / passenger to activate the “Duress Button”.
6. Operations Manager to advise the person / passenger to engage the Main Systems Emergency Stop button.
7. Operations Manager to advise the person / passenger to steer the vessel away from any danger or obstructions.
8. Operations Manager to advise the person / passenger to contact Water Police for assistance by VHF Ch 16.
9. Operations Manager to advise the person / passenger to stand by until assistance arrives.
10. When possible, must enter notes of the event in the vessel log as soon as possible after the event, while the facts of the event are still fresh in their memory.
11. As soon as practicable, the Master must complete the marine internal incident report and AMSA Form 19 report.

Personal or Medical Emergency

Note that the following are to be reviewed and updated as required following vessel completion and delivery.

Purpose

The purpose of this is to detail the response the Master will take in the event of first aid or medical incident on the vessel or from operation with the vessel. This may include third party assistance or responses to other vessel distress calls in the local operational area.

As each incident situation or injury or illness is different. This process is written as guidance material and allocates duties to crew roles.

Scope

The scope of this document relates to the Master's response who is trained in First Aid or passengers requested to assist crew who are suitably trained in medical treatment or for other appropriate assistance

Responsibilities

The Operations Manager is responsible for:

- For revision of this document and crew compliance.
- Monitoring the master's training requirement for currency and booking in crew to maintain qualifications.
- Monitoring drills are carried out regularly in line with the drill schedule.
- Monitoring the first aid kit and ensuring it is maintained and kept by the Master.

The Master is responsible for:

- For revision of this document and crew conformance to the prescribed process.
- Completing regular drills in medical response and minutes complete for the drill in line with the drill schedule.
- Treatment of injuries, on the vessel to the degree possible with experience and training, and with the assistance of other appropriate passengers.
- Reporting injuries in line with PTA hazard, injury near miss reporting procedure in a timely manner.
- Critical incidents are reported immediately to Operations Manager.

Process

First aid qualifications are held by the master through mandatory requirement for holding Marine qualifications under AMSA (Australian Maritime Safety Authority) legislation and internal company risk assessment.

The Master is First Aid qualified and will render assistance to the level of their competence, unless guided by the 000 operator or by a suitably qualified nurse or Doctor on the vessel at the time of the incident.

No master shall provide any treatment or care outside of 'First Aid' unless directly directed by a medical practitioner or 000 operator.

First Aid training is valid for 3 years whereby the crew will carry out refresher training prior to expiration of the 3-year currency.

First Aid Kit, Inspection and Maintenance

The vessel is fitted with workplace level first aid kit. The first aid items are stored in the wheelhouse, as signposted.

Masters Role

- Remain in the wheelhouse in control of the vessel and overall management of the vessel;
- Track the vessel to make the passage as comfortable as possible while treatment is underway;
- Delegate First Aid Treatment to available passengers as required or able;
- Call Emergency Services on 000 and shore management if injury or situation is outside of 'first aid' to arrange assistance at the nearest port;
- Turn vessel around towards Elizabeht Quay or Mends Street Jetty or continue to the nearest wharf in consultation with 000 operator - Emergency Services;
- Communicate with shore-based Management when practicable to report on the initial incident situation. Report any changes to the condition of the patient to allow updates to management and/or the emergency services on arrival;
- Check passengers for a Doctor (on board and determine if a public announcement is needed to assist crew in the treatment of the patient.
- Log all actions in the vessel log, post incident
- Reporting internal Incident reporting requirements as soon as possible following the event.

Engineer /Deckhand Role:

- Communicate patient status to Master as requested or when the condition of the patient changes;
- Administer first aid as required in line with training and directions given by 000 operator;
- Make Public announcement if nurse or doctor is needed for patient treatment;
- Assist Emergency Services to board upon their arrival;
- Manage passengers (keep calm and updated) including patients' family or friends.
- Remain with patient;
- Reassure patient where possible;

- Administer First Aid where possible;
- Assist Emergency Services once on board;
- Assist with patient transfer if requested by Emergency Services.
- Log all actions including time of incident/treatment and timeline of actions completed until ambulance handover;

Ambulance Handover

If the patient is needing an ambulance or hospital treatment the crew should provide a handover of information to the paramedics. The following is a guide for information that should be given:

- Time of incident, injury or illness;
- Symptoms and observations;
- History or medication information given by family members;
- Contact details person – if known;
- Company contact details – if requested;
- Any additional information requested from paramedics.

Treatment and Incident Records

Details should be written down during the treatment of the person. These notes should be handed over to the Ambulance staff, if requested.

All information for the initial incident causing the injury, or conditions leading to the injury or illness, should be well documented and reported using the hazard, Incident and Injury report form. The first aid section of the form should include all treatment information given and information/notes from the 000 operator, ambulance staff and the patient.

Closure or Review

Following the first aid or medical incident, a review of the incident and subsequent treatment should be undertaken to ensure no gaps in our response or treatment were evident. If there is 'room to improve', these improvements should be included on the reporting form with procedures and risk assessment updated accordingly.

Abandon Ship

Note that the following are to be reviewed and updated as required following vessel completion and delivery.

Purpose

This procedure encompasses instructions for the Master to control and manage an Abandon Ship Emergency Situation.

Scope

This procedure is applicable to all staff who have been employed in the function of Vessel Master.

Responsibilities

It is the responsibility of the Master of the vessel to ensure they have participated in training confirm they have the required competency and can safely carry out the duties within this procedure.

It is the responsibility of Operations Manager, Commuter Ferry Division to ensure the Master is allocated an appropriate period of time and resources to ensure competency and capability of carrying out the duties within this procedure.

The Operations Manager, Commuter Ferry Division must set realistic scenarios for drill training, oversee training drills and provide information and documented feedback to management.

Masters must ensure the correct PPE (Personal Protective Equipment) is available and utilized for their own safety while carrying out their duties. This includes use during training drills.

It is the responsibility of all marine crew to adhere to and implement these procedures.

Master(s) may deviate from these instructions where they believe on *reasonable grounds* that a departure from this procedure will result in a safer outcome during an incident or to avoid a hazard.

Procedure

In the event of an emergency involving the vessel or passengers the Master must take whatever immediate action is called for to secure the safety of the vessel and those on board, as is normal practice and in accordance with good seamanship using the developed Emergency Procedures.

Note: If circumstances permit the Master to leave the helm at any point to secure the safety of the vessel, they must ensure to engage the NUC light signals operated via the Oceanic PLC Screen.

1. Evaluate the emergency situation.
2. Ensure the duress button has been activated.
3. Consider situational awareness, tide, weather conditions and hazards that might further impact on this procedure i.e. if vessel requires anchoring.
4. Initiate "MAYDAY" distress call by VHF Radio (Channel 16).
5. Instruct passengers (through the Public Address System) to "Abandon Ship" and follow all instructions given to them. Instruct passengers to don their Life Jackets.

6. Consider reasonable measures to assist in abandoning ship i.e. It may be required to deploy the anchor, if possible, position the vessel favourably to the weather conditions, etc.
7. Master to assist passengers in disembarkation, ensuring headcount during abandoning ship in controlled manner.
8. Check the entire cabin area for any remaining Passengers.
9. Collect vessel Grab Bag/Kit, First Aid Kit and Ship's Log.
10. Should circumstances be such that passengers have entered the water without putting on a life jacket. The master should throw extra lifejackets into the water after he has put his own life jacket on before he abandons the vessel this will supply extra buoyancy devices.
11. Master to evacuate vessel.
12. Check with passengers for any that have sustained injuries. If so, take appropriate measures to stabilize that person until rescue parties arrive and to report to Security. Rescue Party must be made aware as soon as practicable of any injured persons so they can be removed, and treatment can be made available.

Collision

Note that the following are to be reviewed and updated as required following vessel completion and delivery.

Purpose

This procedure encompasses instructions for the Master in the event of:

- A collision with a wharf or object;
- A collision with another vessel;
- A collision with a person outside a vessel;
- A collision with marine fauna.

The procedure includes instructions for situations where the vessel is underway or making way while operating the vessel.

Scope

This procedure is applicable to all staff who have been employed in the function of Vessel Master.

Particular attention should be given during:

- Dawn and dusk periods.
- Low water visibility conditions.
- Periods of increased dolphin activity.
- Mating or migration seasons.

Responsibilities

It is the responsibility of the Master of the vessel to ensure they have participated in training confirm they have the required competency and can safely carry out the duties within this procedure.

It is the responsibility of Operations Manager, Commuter Ferry Division to ensure the Master is allocated an appropriate period of time and resources to ensure competency and capability of carrying out the duties within this procedure.

The Operations Manager, Commuter Ferry Division must set realistic scenarios for drill training, oversee training drills and provide information and documented feedback to management.

Masters must ensure the correct PPE (Personal Protective Equipment) is available and utilised for their own safety while carrying out their duties. This includes use during training drills.

It is the responsibility of all marine crew to adhere to and implement these procedures.

Master(s) may deviate from these instructions where they believe on reasonable grounds that a departure from this procedure will result in a safer outcome during an incident or to avoid a hazard.

It is the responsibility of the Master to ensure all relevant reporting is completed after the incident.

Procedure

In the event of an emergency involving the vessel, the Master must take whatever immediate action is called for to secure the safety of those on board and the vessel, as is normal practice and in accordance with good seamanship using the developed Emergency Procedures and in accordance with the International Regulations for Preventing Collisions at Sea (COLREGs).

Note: If circumstances permit the Master to leave the helm at any point to secure the safety of the vessel, they must ensure to engage the NUC light signals operated via the Oceanic PLC Screen.

Collision with a Wharf or Object

1. In the event of an imminent collision, immediately sound the alarm on the Public Address (PA) System by instructing passengers to “BRACE, BRACE, BRACE!”.
2. Instruct passengers to don lifejackets. This step must be done even if the vessel’s watertight integrity is still intact.
3. Stop vessel and ensure throttle controls are in neutral.
4. Activate duress button.
5. Promptly check all passengers for any injuries and offer assistance where possible.
6. Move passengers away from affected areas.
7. Assess if there is any damage to your own vessel and if there is any potential for escalation, i.e. hull damage, flooding, environmental damage etc.
8. Further consideration of action must be given if the hull is at risk of being breached or if it has been breached, it may be best practice to keep the vessel in position (this may be to reduce the risk of flooding). If the hull has been breached and vessel is at risk of flooding, proceed to Flooding Procedure.
9. Broadcast URGENCY Message on marine radio Channel 16 – Advise Perth Water Police Operations by Marine Radio. Include location, sea, & wind conditions + tidal direction.
10. Shut down all electrical circuits in affected areas.
11. Notify the Operations Manager of the onboard Emergency situation (as soon as reasonably practicable). Maintain regular communications to provide (SITREP).
12. If the watertight integrity has been confirmed and no flooding has occurred, then evaluate the emergency situation. If situation is controlled and deemed to be safe, proceed to the nearest jetty to safely disembark passengers.
13. Master must enter notes of the event in the vessel log as soon as possible after the event, while the facts of the event are still fresh in their memory.
14. As soon as practicable the Master must complete the marine internal incident report and AMSA Form 19 report.

Collision with Another Vessel

1. Where the collision is with another vessel the Master will follow all steps within this procedure.

2. When another vessel is involved, confirm that all passengers and crew are safe and have no serious injuries. Render assistance if/when possible, maintaining your OWN safety at all times.
3. The master must, as soon as reasonably practicable, call and provide SITREP to Water Police and the Operations Manager.

Collision with a Person Outside a Vessel or Craft

Applies To: All ferry masters, deck crew, and operational staff

Objective: To protect life, provide immediate assistance, and ensure effective emergency response following an actual or suspected collision with a swimmer or person in the water.

This procedure establishes the actions required when a ferry collides with, strikes, or is suspected of striking a swimmer, diver, surfer, paddler, or any person outside a vessel or watercraft.

Life safety is the highest priority.

1. Raise the alarm. Shout: 'person in the water – emergency'
2. The Master shall reduce speed immediately and stop propulsion if necessary to prevent further injury.
3. Assess the location of the person relative to the vessel. It is important a crew member maintain visual contact toward the casualty. Do not lose site of the person.
4. Assign crew to emergency response duties.
5. Deploy a lifebuoy or flotation aid if safe to do so.
6. Recover the casualty, and provide first aid and medical care as required. Notify emergency services and authorities.
7. Master must enter notes of the event in the vessel log as soon as possible after the event, while the facts of the event are still fresh in their memory.
8. As soon as practicable the Master must complete the marine internal incident report and AMSA Form 19 report.

Warning: Avoid sudden maneuvers that could place the casualty near water jets, or thrusters.

Collision with Marine Fauna

Applies To: All ferry masters, deck crew, and operational staff

Objective: To minimize the risk of collision with dolphins, and other marine fauna while maintaining safe vessel operations.

This procedure establishes the requirements for preventing collisions with marine fauna in the Swan River and ensuring compliance with environmental protection obligations.

The protection of wildlife shall be considered an integral part of safe navigation.

Master shall be responsible for:

- Safe navigation of the vessel.

- Ensuring proper lookout is maintained.
- Reducing speed when marine fauna are observed.
- Taking appropriate avoiding action.
- Reporting significant marine fauna strikes or near misses.

Pre-Departure Requirements:

- Review known wildlife activity areas and recent sightings.
- Confirm lookout responsibilities.
- Ensure navigation equipment is operational.
- Discuss environmental hazards during pre-departure briefings.

Any crew member observing marine fauna shall immediately report:

- Relative bearing.
- Distance.
- Direction of movement.
- Number of animals observed.

When Marine Fauna Are Observed

The Master shall:

1. Assess risk of collision.
2. Reduce speed where appropriate.
3. Alter course safely if sufficient clearance exists.
4. Maintain a predictable vessel movement.
5. Avoid sudden changes that may confuse animal movement patterns.

If Collision Appears Imminent

The Master shall:

1. Sound warning signals if appropriate.
2. Reduce speed immediately.

3. Stop propulsion where safe.
4. Alter course if safe and effective.
5. Avoid actions that create greater risk to passengers, crew, or other river users.

*Safety of life remains the overriding priority.

Suspected or Confirmed Marine Fauna Strike

If the vessel strikes or is suspected of striking marine fauna:

1. Reduce speed.
2. Stop if safe.
3. Determine whether the animal can be safely observed.
4. Record GPS position.
5. Note species if known.
6. Record time and environmental conditions.
7. As soon as practicable the Master must complete an incident report and notify Wildcare Helpline at (08) 9474 9055.

Critical Breakdown / Control Failure

Note that the following are to be reviewed and updated as required following vessel completion and delivery.

Purpose

This procedure encompasses instructions for the Master to control and manage a Critical Breakdown / Control Failure Emergency situation on the vessel Tricia.

Scope

This procedure is applicable to all Transperth staff who have been employed in the function of Vessel Master.

Responsibilities

It is the responsibility of the Master of the vessel to ensure they have participated in training confirm they have the required competency and can safely carry out the duties within this procedure.

It is the responsibility of Operations Manager, Commuter Ferry Division to ensure the Master is allocated an appropriate period of time and resources to ensure competency and capability of carrying out the duties within this procedure.

The Operations Manager, Commuter Ferry Division must set realistic scenarios for drill training, oversee training drills and provide information and documented feedback to management.

Masters must ensure the correct PPE (Personal Protective Equipment) is available and utilised for their own safety while carrying out their duties. This includes use during training drills.

It is the responsibility of all marine crew to adhere to and implement these procedures.

Master(s) may deviate from these instructions where they believe on reasonable grounds that a departure from this procedure will result in a safer outcome during an incident or to avoid a hazard.

Procedure

In the event of an emergency involving the ship, the Master must take whatever immediate action is called for to secure the safety of the ship and those onboard, as is normal practice and in accordance with good seamanship using the developed Emergency Procedures.

Note: If circumstances permit the Master to leave the helm at any point to secure the safety of the vessel, they must ensure to engage the NUC light signals operated via the Oceanic PLC Screen.

Steering Failure

1. Once the Master acknowledges that the vessel's primary steering system has failed the Master can engage the emergency steering system.
2. The Master will engage the Emergency Backup Steering breaker on the switchboard located in the wheelhouse.
3. The Master will turn the Emergency Steering control panel on which will engage the backup steering pump.

4. The Emergency Steering control panel shall ensure the vessel is operational until the vessel is safely secured alongside the wharf.

Critical Breakdown - Control / Systems Failure

1. In the event the Master acknowledges that the vessel's primary control has failed, proceed to emergency anchoring procedure if safe to do so.
2. If failure is only on one side, use of alternate engine to be used as primary control & use emergency steering if the Starboard engine is still operational.
3. Make an announcement over the Public Address System (PA) to inform all Passengers of the situation. Instruct passengers to remain seated.
4. Notify the Operations Manager of the onboard Emergency situation (as soon as reasonably practicable).
5. Ops Manager will instruct the Master to proceed to a safe location to disembark passengers.
6. Ops Manager to notify PTA as soon as reasonably practicable.
7. Factor in weather conditions and tidal influences and create an emergency docking plan prior to approaching the berth.
8. Vessel to remain at berth until shore-based engineers investigate the cause of the critical breakdown.
9. Master must enter notes of the event in the vessel log as soon as possible after the event, while the facts of the event are still fresh in their memory.
10. As soon as practicable the Master must complete the marine internal incident report.

Battery Room Fire

Note that the following are to be reviewed and updated as required following vessel completion and delivery.

Purpose

This procedure encompasses instructions for the Master to control and manage Battery Room Fire Emergency Situation.

Scope

This procedure is applicable to all staff who have been employed in the function of Vessel Master.

Responsibilities

It is the responsibility of the Master of the vessel to ensure they have participated in training confirm they have the required competency and can safely carry out the duties within this procedure.

It is the responsibility of Operations Manager, to ensure the Master is allocated an appropriate period of time and resources to ensure competency and capability of carrying out the duties within this procedure.

The Operations Manager, must set realistic scenarios for drill training, oversee training drills and provide information and documented feedback to management.

Masters must ensure the correct PPE (Personal Protective Equipment) is available and utilised for their own safety while carrying out their duties. This includes use during training drills.

It is the responsibility of all marine crew to adhere to and implement these procedures.

Master(s) may deviate from these instructions where they believe on reasonable grounds that a departure from this procedure will result in a safer outcome during an incident or to avoid a hazard.

Procedure

In the event of an emergency involving the vessel, passengers or the Master must take whatever immediate action is called for to secure the safety of the vessel and those onboard, as is normal practice and in accordance with good seamanship using the developed Emergency Procedures.

Note: If circumstances permit the Master to leave the helm at any point to secure the safety of the vessel, they must ensure to engage the NUC light signals operated via the Oceanic PLC Screen.

Battery Room Fire

1. When fire is evident or fire, smoke/heat alarms have sounded, verify specific location.
2. Once location verified, assess the situation to determine best course of action.
3. Activate duress button.
4. Immediately shut down all electrical equipment.
5. Make an announcement over the Public Address System (PA) to inform all Passengers of the situation. Instruct passengers to don lifejackets. This step must be done even if the vessel's watertight integrity is still intact.

6. Broadcast URGENCY Message on marine radio Channel 16 – Advise Perth Water Police Operations by Marine Radio. Include location, sea, & wind conditions + tidal direction.
7. Remove passengers from affected area and keep passageway clear.
8. Investigate severity of fire.
9. Once severity of emergency is established, determine whether fire can be extinguished by using portable fire extinguishers.
10. If the fire is deemed to be out of control, the system room hatches must remain closed.
11. If the cabin is being affected by smoke, you may open windows and doors to vent smoke out of cabin area.
12. The Master will while heading to the closest jetty activate:
 - Emergency Shut Off to required system.
 - Engage required Emergency Stop, this will close the fire dampers to that selected room.
 - Activate Fixed Fire Suppression System by press both selected buttons on the required Fire Detection & Activation System.
13. Notify the Operations Manager of the onboard Emergency situation (as soon as reasonably practicable). Maintain regular communications to provide Situation Report (SITREP).
14. Formulate a plan with the Operations Manager, Authorities and any relevant parties with regards to assistance required from external emergency services etc.
15. Evaluate the emergency situation. If situation is controlled and deemed to be safe, proceed to the nearest jetty to safely disembark passengers.
16. Master must enter notes of the event in the vessel log as soon as possible after the event, while the facts of the event are still fresh in their memory.
17. As soon as practicable the Master must complete the marine internal incident report and AMSA Form 19 report.

If the Fixed fire suppression system is released accidentally due to a non-fire related incident the Master must take the following steps:

Accidental Release of Fixed Fire Suppression

1. As soon as you're aware that the Fire Suppression system has been activated the engine void and immediate area must be evacuated.
2. Isolate the area using 'DANGER' isolation tape.
3. Contact the Operations Manager immediately, who will take charge of situation and give direction.
4. In the event that the suppression system has been activated accidentally during operations, the Master is to follow the vessel's 'Critical Breakdown / Control Failure' Procedure and return to the vessels permanent berth.

Additional Information

All fires must be attempted to be extinguished by the use of portable fire extinguishers depending on the severity. DO NOT PUT YOURSELF OR OTHERS IN DANGER.

Under no circumstance can any member open or enter the affected engine room space once the onboard fire suppression system has been activated. The space can only be deemed safe to enter once it has been inspected by the competent authority (Department of Fire and Emergency Services).

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Fire in Other Spaces

Note that the following are to be reviewed and updated as required following vessel completion and delivery.

Purpose

The purpose of this procedure is to give the Master instructions on how to control and manage a fire on board the vessels.

Scope

This procedure is applicable to all staff who have been employed in the function of Vessel Master.

Responsibilities

It is the responsibility of the Master of the vessel to ensure they have participated in training confirm they have the required competency and can safely carry out the duties within this procedure.

It is the responsibility of Operations Manager, Commuter Ferry Division to ensure the Master is allocated an appropriate period of time and resources to ensure competency and capability of carrying out the duties within this procedure.

The Operations Manager, Commuter Ferry Division must set realistic scenarios for drill training, oversee training drills and provide information and documented feedback to management.

Masters must ensure the correct PPE (Personal Protective Equipment) is available and utilised for their own safety while carrying out their duties. This includes use during training drills.

It is the responsibility of all marine crew to adhere to and implement these procedures.

Master(s) may deviate from these instructions where they believe on reasonable grounds that a departure from this procedure will result in a safer outcome during an incident or to avoid a hazard.

Procedure

In the event of an emergency involving the ship or passengers, the Master must take whatever immediate action is called for to secure the safety of the ship and those onboard, as is normal practice and in accordance with good seamanship using the developed Emergency Procedures. Note: If circumstances permit the Master to leave the helm at any point to secure the safety of the vessel, they must ensure to engage the NUC light signals operated via the Oceanic PLC Screen.

1. When fire is evident or fire, smoke/heat alarms have sounded, verify specific location of onboard emergency by crew visual inspection of the vessel.
2. Advise the passengers and ask them to remain calm & move away from fire. Isolate alarms to reduce panic.
3. Activate duress button.
4. Once severity of emergency is established, determine whether fire can be extinguished by using portable fire extinguishers. If possible collect relevant extinguishers and extinguish fire immediately.
5. If the fire is deemed to be out of control, the Master must immediately and isolate the area and evaluate whether to engage in abandoning ship procedure.

6. Evaluate the emergency situation. If situation is controlled and deemed to be safe, proceed to the nearest jetty to safely disembark passengers.
7. Notify the Operations Manager of the onboard Emergency
8. situation (as soon as reasonably practicable). Maintain regular communications to provide (SITREP).
9. Formulate a plan with the Operations Manager, Authorities and any relevant parties with regards to assistance required from external emergency services etc.
10. The master shall oversee the orderly evacuation of all the passengers to a suitable location as far possible from the burning vessel.
11. If the fire occurs adjacent to the jetty, any passengers on-board shall be disembarked and again request that they remain calm.
12. Move all spectators away from the ferry.
13. Ask if there are any injuries and offer assistance where possible.
14. If the fire was suspicious ask for any witnesses and record the appropriate details.
15. Master must enter notes of the event in the vessel log as soon as possible after the event, while the facts of the event are still fresh in their memory.
16. As soon as practicable the Master must complete the marine internal incident report and AMSA Form 19 report.

Additional Information

Fires will not always be contained to electric rooms or compartments. If an electrical fire occurs, the first consideration should be to turn off/shut down all electrical service supplies.

Extinguish the fire with the appropriate extinguisher then isolate the power to the area:

All fires must be attempted to be extinguished by the use of portable fire extinguishers depending on the severity. DO NOT PUT YOURSELF OR OTHERS IN DANGER.

Flooding

Note that the following are to be reviewed and updated as required following vessel completion and delivery.

Purpose

This procedure encompasses instructions for the Master to control and manage a Grounding Emergency Situation.

Scope

This procedure is applicable to all Transperth staff who have been employed in the function of Vessel Master.

Responsibilities

It is the responsibility of the Master of the vessel to ensure they have participated in training confirm they have the required competency and can safely carry out the duties within this procedure.

It is the responsibility of Operations Manager, Commuter Ferry Division to ensure the Master is allocated an appropriate period of time and resources to ensure competency and capability of carrying out the duties within this procedure.

The Operations Manager, Commuter Ferry Division must set realistic scenarios for drill training, oversee training drills and provide information and documented feedback to management.

Masters must ensure the correct PPE (Personal Protective Equipment) is available and utilised for their own safety while carrying out their duties. This includes use during training drills.

It is the responsibility of all marine crew to adhere to and implement these procedures.

Master(s) may deviate from these instructions where they believe on reasonable grounds that a departure from this procedure will result in a safer outcome during an incident or to avoid a hazard.

Procedure

In the event of an emergency involving the ship the Master must take whatever immediate action is called for to secure the safety of the ship and those onboard, as is normal practice and in accordance with good seamanship using the developed Emergency Procedures.

Note: If circumstances permit the Master to leave the helm at any point to secure the safety of the vessel, they must ensure to engage the NUC light signals operated via the Oceanic PLC Screen.

1. To assess whether a Flooding situation has occurred, utilise all available equipment to ascertain location, severity and control methods.
2. The audible alarm on the helm station will sound when the float switch is raised in the affected void/s. Note* Each void is fitted with an automatic electric bilge pump, in the event the float switch is activated the electric bilge pump will engage in the affected void.
3. Ensure the duress button has been activated.
4. Make an announcement over the Public Address System (PA) to inform all Passengers of the situation. Instruct passengers to don lifejackets.

5. Move passengers away from affected areas (if necessary).
6. Broadcast URGENCY Message on marine radio Channel 16 – Advise Perth Water Police Operations by Marine Radio. Include location, sea, & wind conditions + tidal direction.
7. Monitor the affected void/s. If the affected void does not contain oil, fuel, sullage or any contaminant, start mechanical clutch bilge pump as required Note* Ensure bilge manifold has been set correctly. If affected void has any contaminant fluids, immediately return to a safe berth at SLOW speed to inspect and evaluate damage. DO NOT DISCHARGE CONTAMINANT FLUIDS OVERBOARD.
8. Notify the Operations Manager of the onboard Emergency situation (as soon as reasonably practicable). Maintain regular communications to provide (SITREP).
9. Evaluate the emergency situation. If situation is controlled and deemed to be safe, proceed to the nearest passenger loading/ unloading facility to safely disembark passengers.
10. Master must enter notes of the event in the vessel log as soon as possible after the event, while the facts of the event are still fresh in their memory.
11. As soon as practicable the Master must complete the marine internal incident report and AMSA Form 19 report.

Grounding

Note that the following are to be reviewed and updated as required following vessel completion and delivery.

Purpose

This procedure encompasses instructions for the Master to control and manage a Grounding Emergency Situation.

Scope

This procedure is applicable to all staff who have been employed in the function of Vessel Master.

Responsibilities

It is the responsibility of the Master of the vessel to ensure they have participated in training confirm they have the required competency and can safely carry out the duties within this procedure.

It is the responsibility of Operations Manager, Commuter Ferry Division to ensure the Master is allocated an appropriate period of time and resources to ensure competency and capability of carrying out the duties within this procedure.

The Operations Manager, Commuter Ferry Division must set realistic scenarios for drill training, oversee training drills and provide information and documented feedback to management.

Masters must ensure the correct PPE (Personal Protective Equipment) is available and utilised for their own safety while carrying out their duties. This includes use during training drills.

It is the responsibility of all marine crew to adhere to and implement these procedures.

Master(s) may deviate from these instructions where they believe on reasonable grounds that a departure from this procedure will result in a safer outcome during an incident or to avoid a hazard.

Procedure

In the event of an emergency involving the vessel, the Master must take whatever immediate action is called for to secure the safety of the vessel and those on board, as is normal practice and in accordance with good seamanship using the developed Emergency Procedures.

Note: If circumstances permit the Master to leave the helm at any point to secure the safety of the vessel, they must ensure to engage the NUC light signals operated via the Oceanic PLC Screen.

1. Stop vessel and ensure throttle controls are in neutral.
2. Activate duress button.
3. Make an announcement over the Public Address System (PA) to inform all Passengers of the situation. Instruct passengers to don lifejackets. This step must be done even if the vessel's water tight integrity is still intact.
4. Promptly check all passengers for any injuries and offer assistance where possible.
5. Move passengers away from affected areas (if necessary).

6. Assess if there is any damage to your own vessel and if there is any potential for escalation, i.e. hull damage, flooding, environmental damage etc.
7. Further consideration of action must be given if the hull is at risk of being breached, it may be best to stay grounded. If the hull has been breached and vessel is at risk of flooding, proceed to Flooding Procedure.
8. Consider reasonable measures to minimise risk of any potential escalation, i.e. Lower anchor to restrict the movement of vessel into further danger.
9. Broadcast URGENCY Message on marine radio Channel 16 – Advise Perth Water Police Operations by Marine Radio. Include location, sea, & wind conditions + tidal direction.
10. If the watertight integrity has been confirmed and no flooding has occurred, then evaluate the emergency situation, check tides and weather conditions prior to attempting to depart the area.
11. Notify the Operations Manager of the onboard Emergency situation (as soon as reasonably practicable). Maintain regular communications to provide (SITREP).
12. Formulate a plan with the Operations Manager, Authorities and any relevant parties that may assist in transferring passengers ashore.
13. Evaluate the emergency situation. Formulate a plan with the Operations Manager, Authorities and any relevant parties that may assist in removing vessel from grounding. i.e. Tug, Volunteer Sea Rescue etc.
14. Master must enter notes of the event in the vessel log as soon as possible after the event, while the facts of the event are still fresh in their memory.
15. As soon as practicable the Master must complete the marine internal incident report and AMSA Form 19 report.

Person Overboard

Note that the following are to be reviewed and updated as required following vessel completion and delivery.

Purpose

This procedure encompasses instructions for the Vessel Master in the event of:

- A person falling overboard
- A person jumping overboard in a deliberate act

The procedure includes instructions for situations where the vessel is underway or making way while operating the vessels.

Scope

This procedure is applicable to all staff who have been employed in the function of Vessel Master.

Responsibilities

It is the responsibility of the Master of the vessel to ensure they have participated in training confirming they have the required competency and can safely carry out the duties within this procedure.

It is the responsibility of Operations Manager, Commuter Ferry Division to ensure the Master is allocated an appropriate period of time and resources to ensure competency and capability of carrying out the duties within this procedure.

The Operations Manager, Commuter Ferry Division must set realistic scenarios for drill training, oversee training drills and provide information and documented feedback to management.

Masters must ensure the correct PPE (Personal Protective Equipment) is available and utilised for their own safety while carrying out their duties. This includes use during training drills.

It is the responsibility of all marine crew to adhere to and implement these procedures.

Master(s) may deviate from these instructions where they believe on reasonable grounds that a departure from this procedure will result in a safer outcome during an incident or to avoid a hazard.

Procedure

In the event of an emergency involving the ship the Master must take whatever immediate action is called for to secure the safety of the ship and those onboard, as is normal practice and in accordance with good seamanship using the developed Emergency Procedures.

Note: If circumstances permit the Master to leave the helm at any point to secure the safety of the vessel, they must ensure to engage the NUC light signals operated via the Oceanic PLC Screen.

Accidental Incident During Passage

1. Swing the stern of the boat away from the POB. This will reduce the danger to the person in the water by placing distance between the vessel's propeller and the POB.
2. Activate POB/MOB button and duress button.

3. Throw a lifesaving appliance to them as soon as possible even if they can swim. Care should be taken not to hit them.
4. Manoeuvre vessel and use appropriate sound signals where necessary.
5. Broadcast URGENCY Message on marine radio Channel 16 – Advise Perth Water Police Operations by Marine Radio. Include location, sea, & wind conditions + tidal direction. This step must be completed even if POB recovery appears imminent.
6. Keep the person in view at all times. If you have another person in the boat with you, ask them to act as a lookout. If it is night, direct the best available light on the person in the water.
7. Call other ferry in operation and provide brief situation report (SITREP) Master may request assistance if required.
8. Use lifejacket.
9. Locate rope ladder in wheelhouse, extract and secure to assist POB to return to the boat. Utilise another passenger to assist if the passenger is apparently willing and able. Do not obligate any person to assist.
10. Assess POB and apply first aid where necessary.
11. Where possible, record the names and contact details of the person involved, including eye witnesses.
12. If further assistance is required contact the Operation Manager or Transperth Security.
13. If no further assistance is required, provide SITREP to Operations Manager, Water Police and the other vessel in operation.
14. The Master must assess if the voyage may continue to original destination or not, based on the condition of the POB post incident.
15. Master must enter notes of the event in the vessel log as soon as possible after the event, while the facts of the event are still fresh in their memory.
16. As soon as practicable the Master must complete the marine internal incident report and AMSA Form 19 report.

Deliberate Act

1. Where a person deliberately jumps overboard, the Master will follow steps all POB steps within this procedure where possible and maintain observations.
2. The master must, as soon as is reasonably practicable, call water police operations and provide SITREP.
3. Where POB demonstrates a desire to return to the vessel and appears compliant, the Master may effect a recovery.
4. Where POB does not appear to wish to return the vessel, or is not, or may not be compliant, the Master must maintain safe observation of the POB until directed otherwise by Police.

Hazard and Incident Reporting Procedure

Purpose

The purpose of this Procedure is to describe the arrangements for the reporting of health, safety, environmental and marine Hazards and Incidents, including statutory reporting requirements.

Scope

This Procedure applies to the operation of the Transperth Ferry services.

Responsibilities

- Transperth Contract Manager is responsible for:
 - Ensuring this Procedure is implemented across all Transperth ferry services.
 - Ensuring operational managers are aware of their responsibilities in relation to Hazard and Incident reporting.
- Ferry Operator - Manager HSEQ is responsible for:
 - Managing Hazard and Incident reporting functionality in the HSE software system.
 - Providing advice and support to business units on Hazard and Incident reporting.
- Ferry Operator - General Managers are responsible for:
 - Ensuring the requirements of this Procedure are implemented within their business unit.
 - Promoting an environment that encourages open and honest communication about HSE issues.
 - Demonstrating and promoting leadership and commitment in line with a fair and just culture, by protecting Workers from reprisals when reporting Hazards and Incidents.
 - Ensuring a WHS Notifiable Incident site is not disturbed until an Inspector arrives at the site, or any earlier time that an Inspector directs.
- Ferry Operator - Operations Managers are responsible for:
 - Recording Hazards and Incidents in their area of responsibility.
 - Consulting with Health and Safety Representatives and HSE/Consultative Committee members in their area of responsibility.
 - Ensuring immediate contact is made with the Return-to-Work Coordinator if a Worker is injured.
 - Ensuring injured personnel receive appropriate first aid or medical treatment.
 - Ensuring a WHS Notifiable Incident site is not disturbed until an Inspector arrives at the site, or any earlier time that an Inspector directs.
 - Providing feedback to the originator of a Hazard or Incident report in their area of responsibility.

- HSEQ are responsible for:
 - Ensuring Notifiable Incidents are reported to relevant authorities.
 - Ensuring SafeConnect remains current and contains correct Hazard and Incident information.
 - Ensuring any Incident where damage is sustained to a vessel is reported to the Transperth Contract Manager as soon as reasonably practicable.
 - Ensuring any Incident where a customer or member of the public is injured within the business's control or in the proximity to where the business operates and there is risk of a potential claim for compensation, the Incident is reported to the Transperth Contract Manager as soon as reasonably practicable.
- Workers are responsible for:
 - Taking immediate action to make an area safe where reasonably practicable following an Incident and bringing Hazards to the attention of others in the area.
 - Photographing relevant aspects of a Hazard or Incident and submitting the report.
 - Reporting Hazards and Incidents to their supervisor or manager and reporting them as soon as reasonably practicable.
 - Not making comment or discussing an Incident in any detail with non-Transperth personnel; ensuring not to offer opinion on fault or discuss liability.

Hazard Reporting

In the event of a Hazard being identified:

- Workers must take reasonable steps to immediately eliminate or control the Hazard to reduce the risk of harm.
- Workers to notify others in the vicinity of an uncontrolled Hazard.
- The Hazard is to be reported by the Worker, or if this is not possible, by their manager as soon as practicable after it was identified and within 24 hours.
- If a Hazard has been immediately eliminated or controlled upon identifying, the Hazard is still to be reported by the Worker, or if this is not possible, by their supervisor or manager.
- Actions are to be managed in accordance with the Actions Management Procedure.
- Feedback is to be provided to the originator/s of a Hazard report to foster a positive reporting culture.

Incident Reporting

In the event of an Incident:

- Workers must take reasonable steps to immediately control any Hazards, prevent further escalation of sustained damage/loss or Injury, and notify others in the vicinity including their supervisor or manager.

- Where an Incident results in service disruption, environmental harm, serious injury, or serious Property Damage, the Worker is to notify their manager immediately, if they are uncontactable then HSEQ, if they are uncontactable then the General Manager. If outside of normal business hours, then the Duty Manager.
- The Incident is to be reported by the Worker/s involved, if this is not possible, by their manager as soon as practicable after it occurred and within 24 hours.
- The reporting of an Incident is not to make comment on fault.
- Any witnesses to an Incident are to be requested to provide their details for potential further discussion or statement of the Incident. Details to include full name, contact number/s, and email. A witness cannot be forced to provide this information however it is to be encouraged in a professional manner.
- Incidents to be reported include:
 - Near Misses
 - Worker Injuries
 - Customer Injuries
 - Worker Occupational Illness/Disease
 - Customer Illness
 - Behaviour Incidents
 - Environmental Incidents
 - Property Damage
 - Vehicle Damage
 - Vessel Incidents
 - Security Incidents
- Injury: If a Worker sustains an injury:
 - The Worker must advise their manager or Return to Work Coordinator immediately; and
 - The Worker or their manager must report the injury within 24 hours of it occurring.
- Asset Damage: Where an Incident results in damage to a vessel, marine infrastructure or building:
 - Photographs taken of the damage immediately after the Incident.
 - Equipment tagged out if required.
 - Maintenance notified by phone if repairs are high priority or critical damage requires repair.
- HSEQ to review incident details for accuracy and determine the incident classification and reporting details.

- Feedback is to be provided to the originator/s of an Incident report to foster a positive reporting culture.
- Actions are to be managed in accordance with the Actions Management Procedure.
- Contractual arrangements may require client notification.

Notifiable Incidents – WHS

The following Incidents are to be reported to the state/territory Work Health and Safety Regulator by HSEQ immediately after becoming aware of an occurrence:

Death of a Person

Serious Injury or Illness

- An injury or illness requiring the person to have:
 - Immediate Treatment as an in-patient in a hospital; or
 - Immediate Treatment for:
 - The amputation of any part of his or her body; or
 - A serious head injury; or
 - A serious eye injury; or
 - A serious burn; or
 - The separation of his or her skin from an underlying tissue (such as degloving or scalping); or
 - A spinal injury; or
 - The loss of a bodily function; or
 - Serious lacerations; or
 - Medical Treatment within 48 hours of exposure to a substance.

Dangerous Incident

An incident that exposes a Worker or any other person to a serious risk to a person's health or safety emanating from an immediate or imminent exposure to:

- An uncontrolled escape, spillage, or leakage of a substance.
- An uncontrolled implosion, explosion, or fire.
- An uncontrolled escape of gas or steam.
- An uncontrolled escape of a pressurised substance.

- Electric shock.
- The fall or release from a height of any plant, substance, or thing.
- The collapse, overturning, failure, or malfunction of, or damage to, any plant that is required to be authorised for use by the WHS Regulations.
- The collapse or partial collapse of a structure.
- The collapse or failure of an excavation or any shoring supporting an excavation.
- The inrush of water, mud, or gas in workings, in an underground excavation or tunnel.
- The interruption of the main system of ventilation in an underground excavation or tunnel.

Notifiable Incidents - Marine

The following Incidents must be reported to the Australian Maritime Safety Authority (AMSA) as soon as reasonably practical:

- Death of, or serious injury to, a person associated with the operation or navigation of a vessel.
- The loss or presumed loss of a vessel.
- The loss of a person from a vessel.
- Significant damage to a vessel.
- Collision of a vessel with another vessel.
- Collision by a vessel with an object.
- Collision with marine fauna.
- The grounding, sinking, flooding or capsizing of a vessel.
- Fire onboard a vessel.
- Loss of stability of a vessel that affects the safety of the vessel.
- The structural failure of a vessel.
- A close quarters situation.
- A dangerous occurrence, which is an occurrence that could have caused the death of, or serious personal injury to, any person on the vessel.
- An event that results in or could have resulted in a vessel becoming disabled and requiring assistance.
- The fouling or damaging by a vessel of any pipeline, submarine cable, or any aid to navigation.
- Any serious danger to navigation on or near the course of the vessel.

If there is any ambiguity as to whether an incident is reportable to AMSA, the Operations / Marine Manager or General Manager shall contact the National Designated Person or Deputy Designated Person for direction.

AMSA

- Form 19 to be submitted to AMSA by a member of the business unit management team, or by a vessel Master in consultation with the management team, within 72 hours of becoming aware of the incident.
- For serious incidents, or those which have the potential to become serious or attract attention by AMSA, media or other third parties, the business must seek advice from the Head of Marine Standards before a Form 19 submission.
- Reports must be submitted via email to reports@amsa.gov.au copying in the business unit Operations / Marine Manager and HSEQ, and the Head of Marine Standards.

Water Police

- A member of the business unit management team or vessel Master must notify their nearest Water Police operations unit by telephone for specified incidents.
- Refer to the Marine Incident Reporting Categories table on the following page for incidents that are to be notified to Water Police.

Marine Incident Reporting Categories

Incident Type	Detail	Reporting			Alcohol and Other Drug Testing	Investigation
		Transperth	AMSA	Water Police		
Serious Marine Incidents	Any death, serious injury, significant damage arising from collision, fire or grounding, loss of vessel, loss of person from a vessel.	Yes	Yes	Yes	Yes	ICAM
Collision (A): Damage to vessel/s	Damage to one or more vessels	Yes	Yes	Yes Major Damage	Yes	ICAM
Collision (B): No damage to vessel/s	Collision occurs of such a minor nature that no damage is caused to any vessel & there is no reasonable prospect of unseen damage going undetected.	Yes	No	No	GM Decision	Standard
Collision (C): Injury / Passenger Comfort	Any collision of any nature that causes or contributes to an injury, or adversely affects passenger comfort, due to the operation of a vessel.	Yes	Yes	Yes Serious Injury	Yes	ICAM
Collision (D): Vessel vs Fixed Object or Structure	Impact causes damage that is not Minor Damage.	Yes	Yes	Yes Major Damage	Yes	ICAM
Collision (E): Vessel vs Fixed Object or Structure	Impact causes Minor Damage.	Yes	No	No	GM Decision	Standard
Collision (F): Vessel collision with submerged object.	Impact causes or requires vessel to be taken out of service for any period, for inspection or repairs	Yes	Yes	No	GM Decision	Standard
Collision (G): Vessel collision with submerged object.	Impact does not require vessel to be taken out of service for any period for inspection or repairs	Yes	No	No	GM Decision	Standard
Grounding (A):	Vessel lightly touches the seabed (grounds) and continues making way, no damage or expectation of damage, no vibration, does not slow down, no passenger discomfort, no navigational, passage plan or COLREG errors.	Yes	Yes	No	GM Decision	Standard
Grounding (B):	Any other grounding that is not as described in Grounding (A) above.	Yes	Yes	GM Decision	Yes	ICAM
Flooding (A):	Unintended water ingress where the volume of water in the space is <2% of the Gross Register Tonnage, and/or where the volume of water is not reasonably believed to have affected vessel stability.	Yes	No	No	No	Not Required

Flooding (B):	Any other flooding that is not as described in Flooding (A).	Yes	Yes	GM Decision	GM Decision	ICAM
Technical Failure (A)	A failure of any part of the machinery that requires assistance externally of the vessel e.g. a tow. Includes power propulsion, steering systems, engineering systems, navigational equipment, communication equipment, access emergency equipment.	Yes	Yes	No	GM Decision	Determined by National Designated Person
Technical Failure (B)	Any other technical failure such as: Unplanned maintenance. Requires attendance of onshore maintenance team. Causes cancellation of service / vessel swap. Causes delay to scheduled service of 15 minutes or more. Damage to vessel outside of budget. Includes power propulsion, steering systems, engineering systems, navigational equipment, communication equipment, access, emergency equipment.	Yes	No	No	GM Decision	Standard
Other Incidents (A)	Other incidents where damage has been caused, occurrence which is or could be conceived to have occurred due to failure of crew competency or training.	Yes	No	No	GM Decision	Standard
Other Incidents (B)	Other incidents where there is an alarm by passengers, media attention, or a reasonable conclusion that AMSA should be aware of an incident.	Yes	Yes	GM Decision	GM Decision	GM Decision

Notifiable Incidents – Environment

- Business Units must ensure notifiable Environmental Incidents are understood and reported to the DBCA and DTMI Maritime as required.
- If there is a marine fauna suspected or confirmed strike an incident report shall be submitted detailing:
 - Date and time.
 - Position.
 - Species involved (if known).
 - Estimated size of animal.
 - Vessel speed.
 - Weather conditions.
 - Actions taken.
 - Witness details.

Securing An Incident Site

- The Manager or Master must ensure the incident site is secured if any of the following occurs:
 - The death of a person.
 - A serious injury or illness of a person.
 - A dangerous incident.
- Once notified of the Incident, the General Manager must ensure the site remains undisturbed until an Inspector arrives, or until an earlier time as directed by the Inspector.
- If any authority is given to mitigate further damage / prevent Injury that involves cost, record of this instruction is to be retained.
- The General Manager (or their delegate) is responsible for securing the incident site, which includes:
 - Taking appropriate action to make the area safe and prevent escalation of the situation.
 - Preserve the incident site whilst ensuring controls are implemented to prevent further incident.
 - Photograph/video the scene as soon as possible.
 - Ensure perishable evidence is preserved.
 - Carry out a preliminary assessment of the incident.
 - Document the emergency response actions for debrief and analysis.

- Ensuring that, where practicable, neither those involved nor other Workers take photographs or comment / post on social media regarding the incident.
- The above requirement does not prevent any action:
 - To assist an injured person;
 - To remove a deceased person;
 - That is essential to make the site safe or to minimise the risk of further incidents;
 - That is associated with a police investigation; or
 - For which an Inspector or Regulator has given permission.

Insurer Notification

- All Incidents involving damage to a vessel, infrastructure and/or serious Injury to customers or members of the public are to be reported to the Transperth Contract Manager within 24 hours via email.
- All captured and related information, including the report, regulator report, photographs etc are to be provided to the Transperth Contract Manager within 72 hours of initial notification. If this timeframe is not achievable, a definitive timeline is to be confirmed.
- An email notification will be sent to the relevant insurer by the Transperth Contract Manager.
- Workers are not to have direct contact brokers or insurers, unless instructed otherwise by the Transperth Contract Manager or Internal Legal.
- Rectification works or repair are not to commence without notifying the Transperth Contract Manager as it may be necessary to preserve the subject of the Incident until an assessment can be undertaken.

Records

Records associated with Hazard and Incident reports are to be stored in Objective and maintained as per the PTA Records Management Manual.

Definitions

AMSA	Australian Maritime Safety Authority
Behaviour	The unruly behaviour of a Worker, contractor, customer, visitor, or member of the public which places Workers, customers, or the operation at risk, e.g. aggressive behaviour, personal threats, refusal to pay passenger fare, alcohol or drug-related behaviour, and deliberate Property Damage.
Environmental Incident	An occurrence of air, water, noise, or land pollution or where an adverse environmental impact has occurred.
Hazard	Anything which has the potential to harm people, and the environment or cause damage to property.
Health and Safety Representative	A Worker who has been elected by their work group under the Work Health and Safety Act to represent them on health and safety matters.
Immediate Treatment	Urgent treatment would be required for a serious injury or illness. It includes treatment by a registered medical practitioner, a paramedic, or a registered nurse.
Incident	Any occurrence that has resulted in or has the potential to result in adverse consequences to people, the environment, property, or a combination of these. Ongoing conditions that have the potential to result in adverse consequences are Incidents.
Medical Treatment	Treatment by a registered medical practitioner.
Minor Damage	Damage assessed, reasonably estimated, or quoted at between \$50,000 - \$150,000 to a vessel or infrastructure, or both.
Near Miss	An unplanned Incident that occurred although not resulting in any injury or disease, had the potential to do so.
Notifiable Incident	The death, serious injury or illness of a person, dangerous incident, or marine Incident that is required to be reported to an Authority for example AMSA, SafeWork / WorkSafe, or EPA.
Property Damage	An Incident that has resulted in damage to company or third-party owned property or assets including vessels, infrastructure, vehicles, plant, and equipment.
Security Incident	An Incident involving threats to personal security, theft, or terrorism-related events, for example, break-in, theft of cash, or bomb threat.

Vehicle Damage	Damage sustained to a vehicle owned or operated by Transperth, including buses, coaches, tour vehicles, and powered mobile plant, as well as damage to vehicles on vessels and in carparks.
Vessel Incident	An Incident involving a vessel owned or operated by Transperth, for example, collision with a wharf, contact with another vessel, grounding, flooding, fire onboard, person overboard, loss of critical equipment, technical failures, securing lines Incidents, close quarter situations.
VTs	Vessel Traffic Services
WHS	Work Health Safety.
Worker	A person performing work or work-related activities that are under the control of the business. This includes workers from external providers, contractors, and volunteers.
Work Health and Safety Regulator	The State or Territory regulator who monitors and enforces compliance within work health and safety or occupational health and safety laws.

SECTION 3 - Servicing Requirements / Maintenance Procedures

Planned Maintenance

Our strategy is continually reassessed with the aim of improving efficiency and cost-effectiveness and then applying the most appropriate maintenance strategy to each asset, based on its criticality, age, and condition.

Transperth applies the following to key aspects of asset maintenance and management:

- Preventative Maintenance - decisions that impact on reliability and compliance.
- Predictive Maintenance - planned maintenance activities
- Proactive Maintenance - reporting and early intervention
- Corrective Maintenance - fault reporting and early intervention

The overall objective of maintenance is to make sure that assets continue to meet their service and performance requirements including safety, environmental and output parameters.

In the context of asset management, the maintenance strategy and plans for an asset or system need to be determined and documented in line with the asset management strategy and objectives and asset management planning activities. In broad terms, maintenance tasks can be divided into three groups:

1. Inspection, Testing and Monitoring - non-intrusive checks to confirm safety and integrity of assets and to provide information for defining maintenance and renewal needs. This may include the use of remote monitoring systems.
2. Preventative Maintenance - planned maintenance to prevent (reduce the risk of) faults, failures, or excessive deterioration. The criteria for initiating preventative maintenance may be time-based, condition based, or usage based but should always take account of risk.
3. Corrective Maintenance - activities performed to repair defects, damage, or a shortfall in performance/outside specified limits and where work is necessary to bring the asset up to standard and keep it operational.

The scope of maintenance management and the remit of those responsible for it are often broad and include legal and commercial accountability for:

- Meeting legislative, environmental or safety requirements and standards
- Ensuring asset inventories, configuration and interfaces are maintained.
- Managing the supply chain
- Ensuring the competence of resources

The following Maintenance Program is the minimum that is to be adopted for the life of the Contract to ensure the safety, structural integrity, weather proofing and operating characteristics of the vessels.

Daily Servicing & General Repairs

Charging, cleaning, safety and equipment checks, bilge pumping, electrical and lighting checks and minor mechanical and body repairs.

Lubricant Changes

Every 750 hours.

Periodical Maintenance (every 400 hours)

Change filters, inspect and lubricate steering gear, check alarms and gauges, inspect and oil Morse controls, drain water from tanks, clean engine room and bilges, inspect batteries, adjust belts and inspect hoses and fittings. Check valve timing, inspect all pumps, service and repair, restock all first aid boxes, inspect and repair leaks.

Maintenance Surveys

Each vessel is to be slipped and dry docked annually for a 4–5-week period. During this time all underwater repairs are undertaken. The hull is inspected and repaired as necessary and all external painting carried out. Survey of safety gears, jets and shafts are undertaken. All other Surveys are to be carried out by the due date as determined by the Department of Transport & Major Infrastructure.

Other Intermittent Maintenance

Cooling system flushed: every 6 months

Upholstery thorough clean: every 3 months

Carpets/ Floors thorough clean: Monthly

Energy storage system inspection: as required

Maintenance as Required

Painting, window repairs, rope splicing and replacement, seat and upholstery repairs, motor and shaft repairs.

Logbooks

Contractors operating the Transperth Ferry Service must keep a separate logbook for each vessel used in operation of the Service. The logbooks are to contain all information on all maintenance and breakdowns and be made available for inspection

Unplanned Maintenance

There will be instances where we need to respond to unplanned maintenance. Part of our approach is to ensure key members of our operational teams are integral to our communications.

Unscheduled maintenance of vessels, if of a minor nature, is addressed by the vessel-based master /engineers.

Unscheduled maintenance is prioritized and managed on a three-level priority basis. These priorities are:

- Priority 1 – Repairs must be rectified immediately to allow the vessel to continue.
- Priority 2 – Repairs to be undertaken the next time alongside, or overnight.
- Priority 3 – Repairs to be undertaken at the next planned maintenance availability.

The WA Fleet Maintenance Manager is responsible for reviewing priorities and allocating service or spares in a timely manner.

Fleet Availability and Reliability

Commuters and visitors are dependent on the Transperth Ferry as a critical piece of public transport infrastructure. The availability and reliability of the fleet is core to ensuring that disruptions are maintained at the lowest possible level.

Transperth's proactive approach to maintenance has delivered an extremely reliable service over the past 30 years at multiple contract sites around Australia, and more specifically with the Transperth river service, with minimal service disruptions caused by unplanned maintenance requirements. The facilitation of planned maintenance has been undertaken during off-peak periods, to ensure fleet availability to meet capacity demand.

The tables below describe the risks around fleet availability and our mitigation strategies to ensure we maintain reliability.

IN SERVICE MAINTENANCE AND REPAIRS		
Core Duties	Timing and dependencies	Risks, mitigations, and alternatives
Daily Inspections Machinery and systems servicing Fault identification	Pre-start	Identifying and prioritising faults and maintenance interventions

PLANNED MAINTENANCE OUTAGES		
Core Duties	Timing and dependencies	Risks, mitigations, and alternatives
Budget planning Project Management Securing goods and services Booking of maintenance facilities	Dates secured 24-36 months in advance. Customers advised of services	Vessels designed to be able to manage the service during low periods as a single vessel operation. Availability of either out of service or out of water berths is crucial to planning

BREAKDOWN		
Core Duties	Timing and dependencies	Risks, mitigations, and alternatives
Daily Inspections Machinery and system servicing Fault Identification Reporting Rectification	Pre-start During Service Shut down	Daily rounds being conducted and reported critical. Planned maintenance to develop with all identified faults. Supplier communication

Asset Information Systems

Our AIS support the asset management activities and decision-making processes in accordance with ISO 55001 and the HSEQ Management System. Transperth ferry operator uses MEX Maintenance Software, to further integrate all assets including land-based infrastructure.

MEX collects, stores, processes, and analyses the information needed to manage the assets over their Life Cycle. MEX includes:

- Assets register to detail all assets of interest.
- Work management systems to plan and record work activities related to an asset.
- Logistics systems to manage the storage, issue and use of services, materials, and spares.
- Possession management systems to plan access to assets for work activities.
- Decision support tools such as investment modelling systems for strategic planning activities
- Condition monitoring indicators of assets to help predict probable future failures.
- Access through mobile devices to allow crew to review and input.

Whilst MEX is primarily a tool for ongoing maintenance of our assets, it is also integral to the short, medium, and long-term planning for the management of the assets.

For example, the survey intervals for commercial vessels include several key aspects:

- Compliance including survey and safety.
- Repairs and maintenance relating to the asset's utilisation.
- Refurbishments and upgrades, particularly passenger service amenities

These aspects are also able to be actioned either whilst a vessel or terminal is in service or for planned out of service maintenance intervals. For a ferry, these out of service intervals include the vessel being taken out of the water which must be planned and budgeted well in advance.

Therefore, MEX plays a primary function of the day-to-day management of the ferries and infrastructure and is integral to the Asset Management Plans.

Appendix I Ferry Wake Shoreline Impact Assessment Report

Ferry Operations Development Application

METRONET on Swan Ferry Service Expansion

Public Transport Authority of Western Australia

SLR Project No.: 675.V25085.00EA1

21 August 2026



Swan River Ferry Expansion Project Perth to Applecross

Ferry Wake Shoreline Impact Assessment



Seashore Engineering

August 2026

Report SE185-01-R03-Rev0

For: Public Transport Authority



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Limitations of this Report

This report and the work undertaken for its preparation, is presented for the use of the client. The report may not contain sufficient or appropriate information to meet the purpose of other potential users. Seashore Engineering does not accept any responsibility for the use of the information in the report by other parties.

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1. Introduction

This document characterises potential for increased shoreline wave energy associated with the proposed Swan River Ferry Expansion Project, led by the Public Transport Authority (PTA). It subsequently outlines implications for shoreline erosion and management. This has involved modelling the increase in shoreline wave energy from new electric ferry vessels relative to estuary-wide wind waves. Evaluation considered:

- Investigation of wakes generated by the new electric ferry vessels operating between Applecross, Matilda Bay and Elizabeth Quay (INCAT 2025, AMC 2026).
- Estuary-wide wind wave modelling undertaken by Geophysical Fluid Dynamics, through collaboration with Seashore Engineering.

Areas with notable increases in shoreline wave energy have been assessed for existing shore condition, previous patterns of foreshore change and management approaches.

1.1. FERRY ROUTE AND SPEEDS

The proposed ferry route connects Applecross, Matilda Bay and Elizabeth Quay terminals, with ferries operating at 25 to 30-minute intervals (subject to speed exemptions) between 6:00 am and midnight each day. Three operating cases have been provided by PTA (Figure 1-1), which have been assessed for their potential to increase shoreline wave energy.

- **Case 1 – Gazetted Speeds:** Vessels adhere to the gazetted speed limits, operating at approximately 5 knots during terminal approach and departure, increasing to around 8 knots nearby, before accelerating to approximately 25 knots along sections of the route between Como and Pelican Point and near the Narrows. The round-trip time is estimated to be approximately 1 hour 15 minutes, including berthing time. The basis for gazetted speeds includes consideration of water craft activity, foreshore uses and relative areas of sensitivity (SRT 1995, ERM 2002).
- **Case 2, Case 3 and Case 2A – Speed Exemption Scenarios:** Alternative operating scenarios involving speed exemptions along parts of the route have been identified by PTA with the intent of reducing the round-trip travel time. These scenarios incorporate extended sections of 12-knot and 25-knot operation.

Other route considerations are discussed in Section 3.5, including potential variations in operating speeds and minor route refinements identified by PTA.

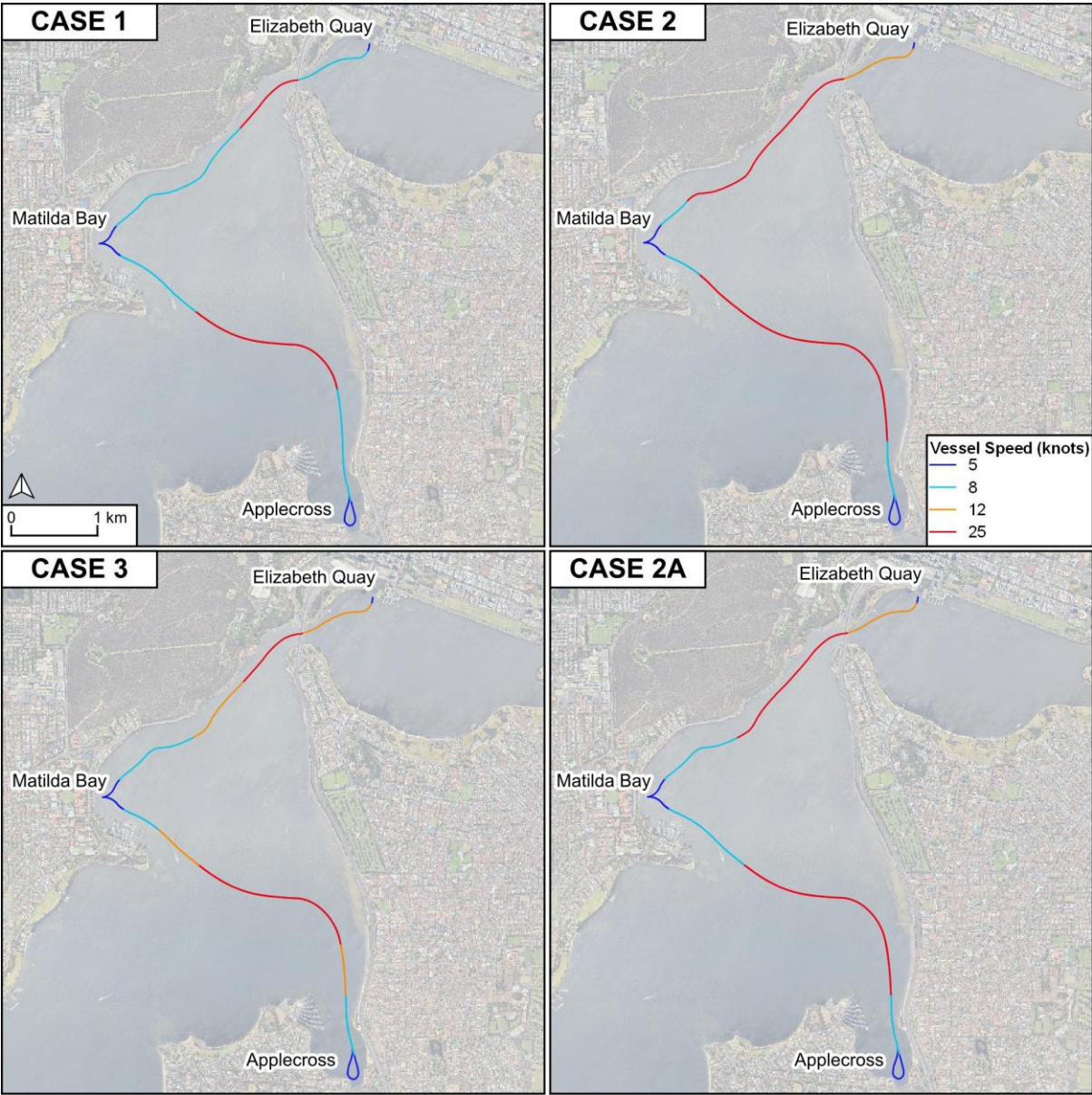


Figure 1-1: Proposed Ferry Route (varying speeds) and Terminal Sites



2. Shoreline Wave Assessment Approach

This section documents the approach used to characterise vessel wakes and wind waves along shorelines in the vicinity of the proposed ferry route, with the aim of identifying shoreline areas likely to experience the greatest wake influence.

Shoreline response is influenced by both the cumulative effect of repeated wave events driving sediment transport patterns and the largest individual wave events (Glamore 2008). These can be responsible for the greatest erosion and damage. This approach therefore includes:

- Calculation of cumulative average annual wind-wave energy over a typical year, based on the modelled wind-wave climate, compared to cumulative wake energy generated by all ferry passages¹. The proportional increase in annual wave energy at each shoreline location was calculated as the ratio of cumulative annual wake energy to cumulative annual wind-wave energy.
- Comparison of the peak modelled wave height ($H_{\max}$) likely to be experienced during a typical year, represented by modelled 1-year ARI wind-wave conditions, with the maximum wake generated by ferry passage.
- Comparison of wave energy associated with the modelled 1-year ARI wind-wave conditions and the maximum wake generated during ferry passage.

It is noted that individual vessel wakes are capable of greater landward excursion and runup than locally generated wind waves of similar amplitude because their longer wavelength (Erikson *et al.* 2003, Stul 2003). This can have greater relative influence on foreshore erosion, particularly (i) if wake runup reaches steeper parts of the profile, above the intertidal zone, or (ii) where wakes can arrive from angles that are otherwise sheltered from wind waves. However, erosive effect of wakes can be partly offset by more substantial energy loss in the shallow nearshore (Lim 2023) and the intermittent influence of vessel wakes, while wind waves are far more persistent, with many more waves than wakes.

2.1. WIND WAVES

This assessment uses wind-wave modelling for Swan and Canning River estuaries undertaken by Geophysical Fluid Dynamics, through collaboration with Seashore Engineering. Description of the modelling approach, including grid development and validation is in Appendix A.

The model was used to generate a set of wave conditions under a range of steady state wind forcing scenarios comprising 2.5 m/s wind speed increments (up to 30m/s) and 45° directional bins. This approach significantly reduces the duration of model simulations required (compared to a long-term hindcast) while enabling reconstruction of wave conditions at any shoreline location and for any period of observed wind conditions.

¹ Based on operating schedules of 30-minute intervals between 6:00 am and 12:00 midnight resulting in 33 return trips per day and 12,045 per year. This does not assess boat wakes from other watercraft.



Simulations were undertaken using a fixed ocean water level of MSL (0.0 m AHD), with output points located around the estuary margin at approximately 100 m intervals. Output points were selected in sufficient water depth (typ -1.0m AHD) such that normal water level fluctuations have a negligible influence on modelled wave conditions. Sensitivity testing using an elevated water level of +1.0 m AHD demonstrated only minor changes in wave conditions at these locations.

Wave conditions (H_s , T_p and direction) for each modelled wind speed and direction bin were subsequently interpolated to a finer set of scenarios comprising 0.5 m/s wind speed increments and 10° directional bins, giving a more refined representation of wave conditions at each output point. H_{max} has been derived using a factor of 1.6, based on an 'upper' range of observed H_{max}/H_s ratios from the longest available AWAC deployment within the Swan River at Como Foreshore (Appendix B).

Wind-wave conditions were subsequently derived based on:

- Annual wind frequency distributions for the interpolated wind speed and directional bins, based on observations at Melville Water (BOM AWS 9091), with observations from Swanbourne (BOM AWS 9215) substituted for wind directions between southwest and north-northeast (250°–360°). This substitution addresses overland sheltering of winds from these directions at the Melville Water station site, which results in lower recorded wind speeds than at more exposed locations (Seashore Engineering 2025).
- The directional extreme wind climate is defined in Appendix B, which was used to derive the modelled 1-year ARI significant wave height (H_s) and estimate the corresponding maximum wave height (H_{max}).

The energy per metre of wave crest associated with each wind bin was estimated using linear wave theory (e.g. USACE Coastal Engineering Manual, Part II, Chapter II-1), consistent with the approach adopted by AMC (2025).

$$E = \frac{\rho g^2 H^2 T^2}{16\pi}$$

where:

- E = wave energy per metre of wave crest (J/m)
- ρ = density of seawater (1024 kg/m³);
- g = gravitational acceleration (9.81 m/s²)
- H = significant wave height (m); and
- T = wave period (s).

2.2. FERRY WAKES

Wake generation depends mainly on water depth, vessel speed, and hull geometry, with wake energy dissipating as it moves away from the vessel's path (PIANC 2003).

Potential wake generation from the proposed 24 m catamaran passenger ferry has been evaluated by INCAT (2025) and AMC (2026). The approaches adopted in these studies differ, with variation in results likely reflecting differences in methodology and updates to vessel parameters. This assessment does not include a critical review of the respective approaches but uses both studies to estimate wake conditions at the shore. For context, AMC generally predicted lower wake heights than INCAT, with a maximum wake height of approximately 0.40 m at 60 m from the vessel route



occurring at a vessel speed of approximately 13 knots, compared with a maximum of 0.59 m predicted by INCAT at 16 knots.

AMC has generally been adopted as the basis for Wave A, B and C wake train characteristics (wave height, period and energy) during each vessel passage, 60 m from the vessel route, noting it represents the most recent assessment and incorporates updated vessel parameters. However, as AMC did not assess wake attenuation with increasing distance from the vessel route, decay relationships derived from the INCAT have been used to estimate wake conditions at shoreline locations offset from the ferry route ². Cumulative wake energy has been estimated considering a simplified representation of the wave trains, combining Wave A, B and C cases, with total energy estimated as:

$$E_{\text{Tot}} = E_A + 2.2 E_B + 2.2 E_C$$

This was estimated by assuming three waves of type B and C, with the 'additional' two being 80% amplitude of the largest wave in each part of the wake train.

INCAT assessed wake attenuation at transverse offset distances of 60 m, 120 m, 200 m, 300 m and 400 m from the vessel route. Consequently, curve fitting of INCAT results was undertaken to develop a continuous lookup matrix of wave height and energy as functions of vessel speed and transverse distance from the route, acknowledging increased uncertainty associated with extrapolation beyond the maximum assessed distance of 400m (Figure 2-1). The implications of this uncertainty are considered minimal, as the greatest shoreline wake impacts generally occur where the vessel route is relatively close to the shoreline.

Points were generated at 50 m intervals along the vessel route. From each point, rays were projected towards the shoreline at 85°, 90° and 95° to the vessel heading (i.e. transverse). This is a simplified representation, as wakes can approach the shoreline over a range of angles depending on the vessel path, speed and nearshore interactions (see Figure 2-2).

The distance along each ray, together with vessel speed, was used to determine wake conditions at the shoreline interception points from the lookup matrix. For each wind-wave model output point, the maximum Wave A, Wave B and Wave C conditions were determined by considering all intersection points for which that output point was the nearest.

² INCAT assessment did not provide results for Wave C. Unlike Waves A and B, Wave C wake exhibits a marked increase in wave height between 20 and 25 knots. In the absence of specific decay relationships for Wave C, the decay relationship for the <12 knot Wave B wake was adopted for the 25 knot Wave C wake, based on the similarity in wave heights.

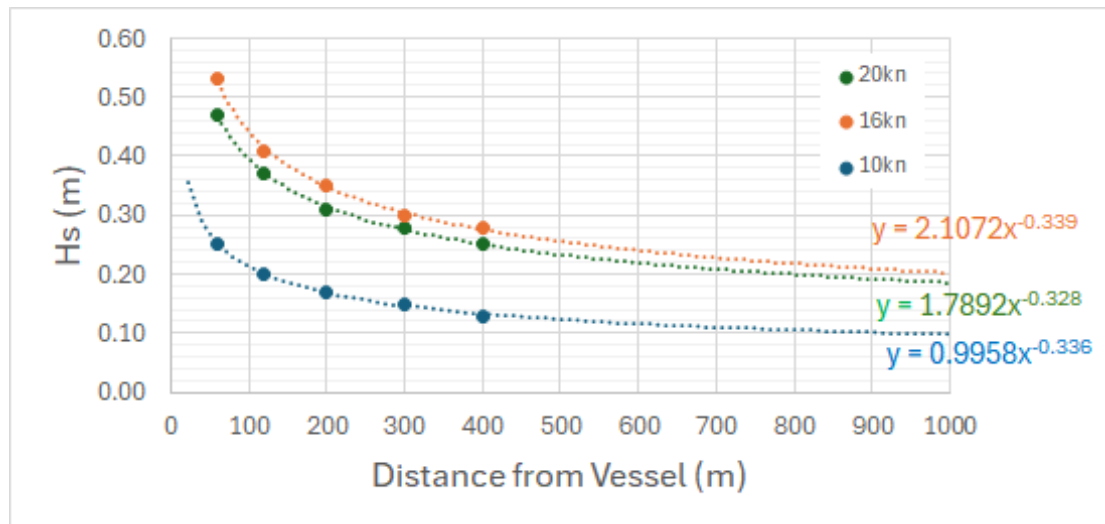


Figure 2-1: Curve Fitting of INCAT Wake Attenuation
Distances are Transverse from the Vessel Route

NUMECA

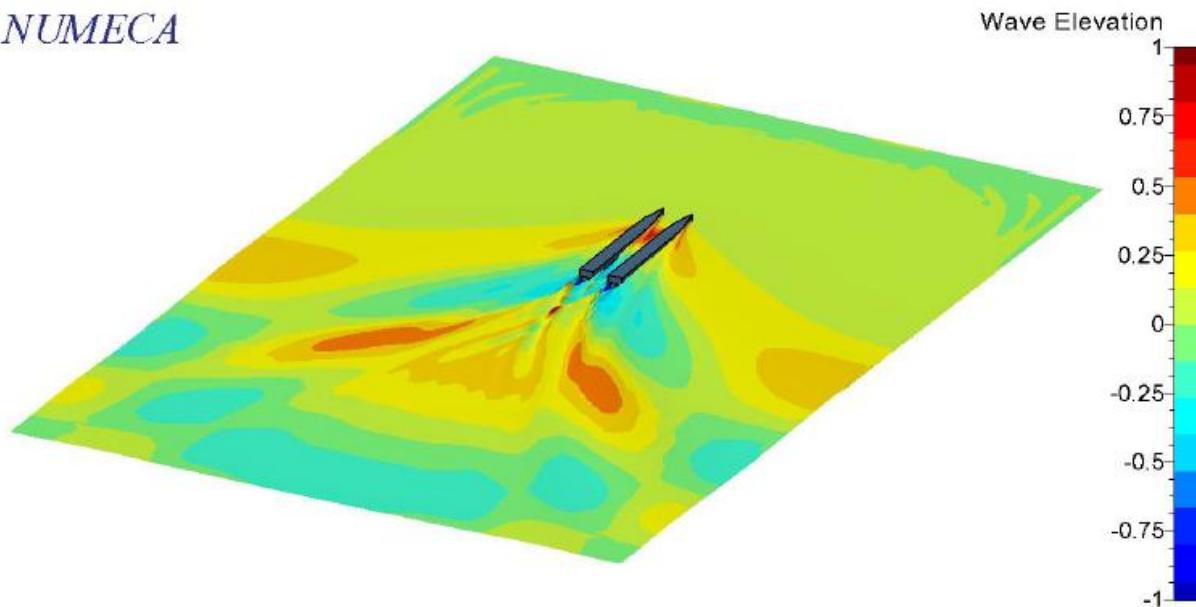


Figure 2-2: Modelled Wake Height from Vessel Moving at 16 knots (INCAT 2025)



2.3. KEY ASSUMPTIONS AND LIMITATIONS

Assessment has been based on wind-wave modelling, boat wake modelling, and assumed relationships between waves, wakes and foreshore impacts.

Assumptions and limitations associated with wind wave modelling (Section 2.1) include:

- Wind-wave modelling is dependent on the quality of wind inputs, along with assumptions and limitations inherent in numerical models.
- While measured wind data within the model domain has been used, spatial and temporal variations in wind speed and direction, including effects of topography, sheltering and funnelling across the estuary basins, may not be fully represented.
- Modelled wind waves in fetch limited environments tend to underrepresent wind-wave conditions during low wind events. Cumulative wind-wave energy may be under-estimated.

Assumptions and limitations associated with boat wake modelling (Section 2.2) include:

- Wake assessment has been determined based on vessels travelling with nominated speeds and routes. In reality, vessel speeds and position may vary slightly between individual journeys. For example, vessels operating within the nominal 25-knot speed zones will likely travel at lower speeds, including consideration for other vessels. This may affect wake generation, noting that 'Wake A' in the wake train has approximately 50% greater energy at 20 knots than at 25 knots, based on the AMC assessment. Similarly, slight variations from the route may alter propagation distance to the shore, locally increasing or decreasing shoreline wake.
- Wake assessment adopts assumptions inherent in the AMC and INCAT studies, which both considered wake generation for a representative water depth of 4.5 m and under steady-state vessel operating conditions. Consequently, the assessment does not consider variations in water depth along the route or changes to vessel speed. Where vessels accelerate or decelerate, wake conditions might be higher than simulated.
- Wake attenuation across shallow nearshore areas has not been considered. Lim (2023) demonstrated that boat wakes may undergo greater attenuation than wind waves when propagating across broad, shallow areas, indicating that shoreline wake conditions may be overestimated where similar features are present.
- Shoreline wake conditions have been estimated using the transverse offset distance to the vessel route. Consequently, differences may occur where a shoreline is influenced by wakes generated from a different location along the route than the nearest transverse point.
- Cumulative wake energy has been estimated using a simplified representation of the wake train, as limited information on complete wake train characteristics was available from the INCAT and AMC studies. *Alternate interpretations would allow -40% to +100% wake energy.*

Assumptions and limitations associated with shoreline impact assessment (Sections 3 & 4) include:

- Relative shoreline impact has been considered due to changing cumulative or maximum wave energy. This is a simplified description of change to foreshore processes, which can include seasonal dynamics, and influences of structures or riparian vegetation.
- Varied wake and wave impacts due to angle or vertical excursion haven't been represented.
- Geomorphic sensitivity or robustness has mainly been considered for areas where there is a relatively large increase to wave energy (Section 4).



3. Results

For most of the shore along the route, existing cumulative annual wind-wave energy and maximum wind-wave conditions substantially exceed the corresponding ferry wake conditions, indicating that relative influence of ferry operations is generally small, which is consistent with previous assessments on exposed parts of the estuary (Jorgensen 1980, Pattiaratchi & Hegge 1990). However, the potential for localised wake impacts increases under the higher-speed exemption scenarios (Cases 2, 3 and 2A).

3.1. CASE 1

Generally low wake energy associated for this case reflects extensive sections of the route where vessels operate at approximately 8 knots, for which wake energy is limited (Figure 3-1). This is particularly evident around Pelican Point and the entirety of Matilda Bay, where low vessel speeds result in proportional increases in cumulative wave energy of less than 3% and 1%, respectively.

Notable proportional increases in cumulative annual wave energy occur:

- Along foreshores **around the Narrows**, particularly on the western side, where close proximity to the route and 25-knot operating speed results in proportional increase to cumulative wave energy in the order of 5-15%.
- More substantial proportional increase occurs at the **artificial beach at Mill Point Reserve**, on the south side of Narrows Bridge, where cumulative wake energy exceeds cumulative wind-wave energy. This reflects close proximity of the vessel route during 25-knot operations, combined with a very sheltered wind-wave climate at this beach.
- Along both sides of the **approach to Applecross terminal**, where the shoreline is highly sheltered from prevailing winds and proportional increases in cumulative wave energy are in the order of 5-15%, despite low vessel operating speeds.
- Between **Heathcote and Applecross Jetty**, where wake exposure is associated with 25-knot operations approximately 1–2 km offshore, proportional increases to cumulative wave energy are generally 4–8%. In this case, the extended propagation distance and presence of shallow areas increases uncertainty in predicted wake conditions.

At almost all locations, maximum ferry wake conditions are lower than 1-year ARI wind-wave (H_{max}) conditions for both amplitude and maximum wave energy (Figure 3-2). The only exception is the artificial beach at Mill Point Reserve, where ferry wake energy is just above wind-wave energy (1,800-2,000 J/m compared with 1,500-1,800 J/m).

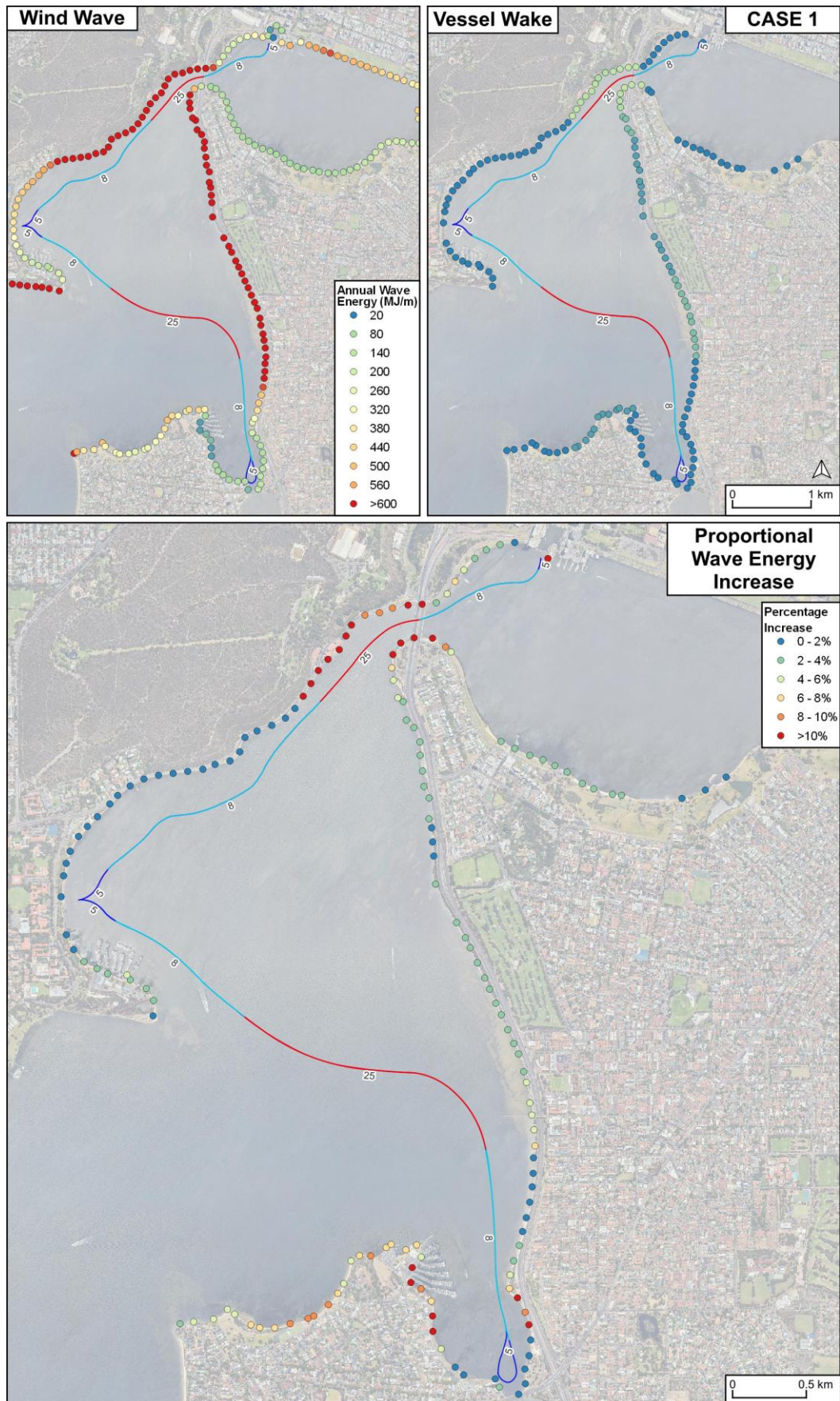


Figure 3-1: CASE 1 Cumulative Annual Wind-Wave Energy, Ferry Wake Energy and Associated Proportional Increase in Wave Energy

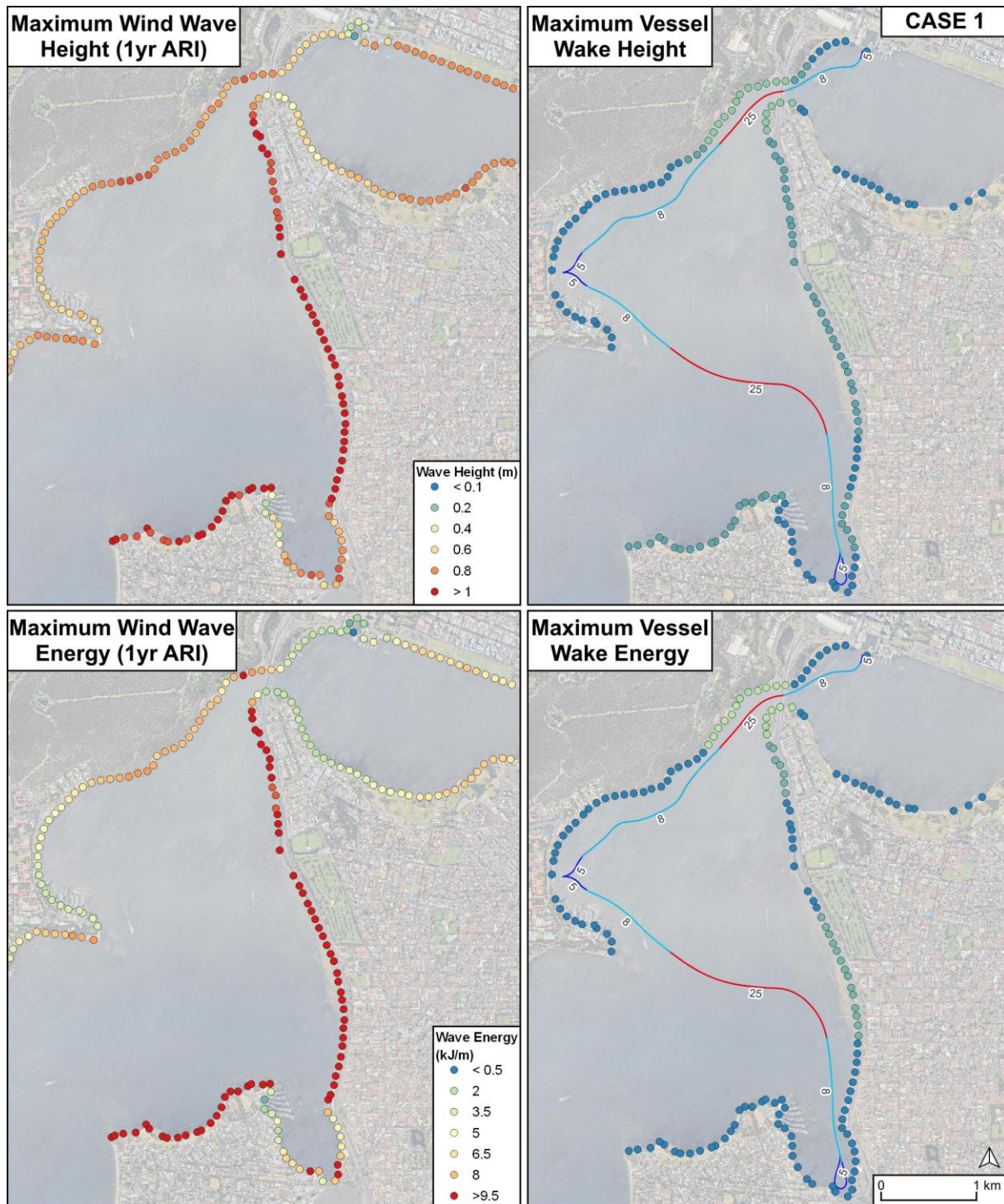


Figure 3-2: CASE 1 Comparison of 1-Year ARI Wind-Wave with Maximum Ferry Wake
(Top) Maximum Wave Amplitude
(Bottom) Maximum Wave Energy



3.2. CASE 2

The introduction of 12-knot operating speeds within Perth Water and an extension of 25-knot operating speeds along Mounts Bay Road, western Como foreshores and north of Pelican Point in Case 2 results in notable (proportional) increase to cumulative wave energy beyond those identified in Case 1 (Figure 3-3):

- **Within Perth Water** (east of the Narrows), increased operating speed from 8 to 12 knots substantially increases wake period (and energy), as the vessel operates near the critical speed. Wake energy becomes comparable to local wind-wave energy along much of Perth foreshore between Elizabeth Quay and the Narrows and South Perth foreshore. It is locally up to three times greater than wind-wave energy at Mill Point Reserve.
- **Along Mounts Bay Road**, between the Old Swan Brewery and Crawley Avenue, extension of the 25-knot operating zone increases wake exposure. This increases cumulative ferry wake energy from less than 1% (for Case 1) to approximately 5-10% of the cumulative wind-wave energy.
- **Along western Como foreshore**, between Saunders Street and Thelma Street, extension of the 25-knot operating zone increases wake exposure. Proportional increases in cumulative wave energy are approximately 20% at the southern end of this section, which is more sheltered from wind waves, reducing to around 8% towards the northern end.
- **For the north-facing foreshore of Pelican Point** where introduction of the 25-knot operating zone approximately 300 m from shore replaces the 8-knot speed adopted in Case 1. This increases cumulative ferry wake energy from less than 2% (for Case 1) to approximately 20 - 30% of the cumulative wind-wave energy.

It is noted that vessel acceleration and deceleration between 25 and 8 knots may locally enhance wake generation. These effects have not been explicitly represented and may lead to locally elevated wake conditions, particularly in areas north of Pelican Point and north of Matilda Bay.

The largest wave conditions remain associated with wind-wave forcing (Figure 3-4), with the 1-year ARI wind-wave $H_{\max}$ amplitude exceeding the maximum ferry wake amplitude at all foreshores. However, at two sheltered locations, maximum ferry wake energy exceeds the corresponding 1-year ARI wind-wave energy:

- **South Perth foreshore (east of the Narrows)**, where maximum ferry wake energy is approximately 1-2 times greater than the 1-year ARI maximum wind-wave energy, increasing to around 3-4 times at the artificial beach at Mill Point Reserve.
- **Perth foreshore (between Elizabeth Quay and the Narrows)**, where maximum ferry wake energy exceeds the corresponding 1-year ARI wind-wave energy by approximately 1.5-3 times.

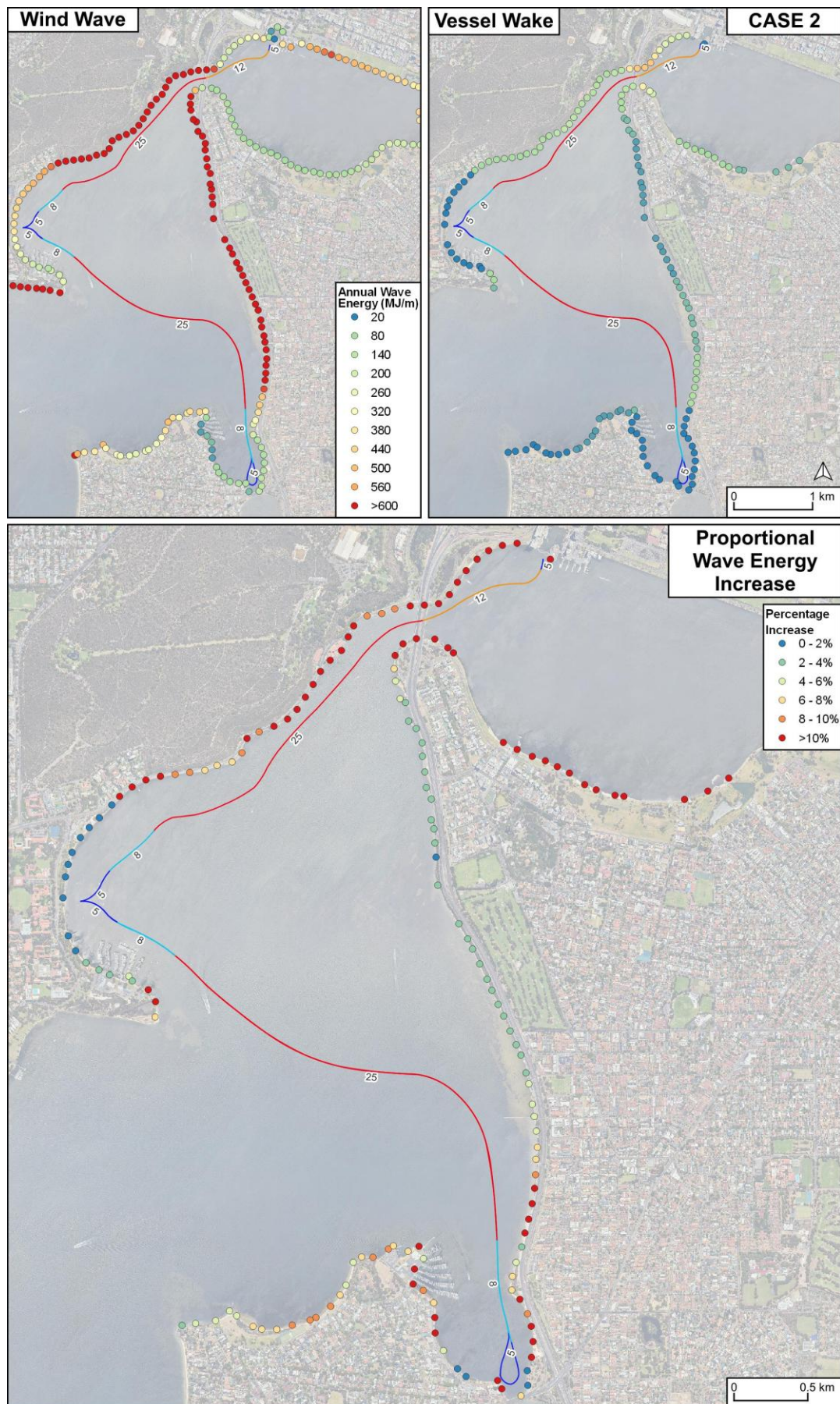


Figure 3-3: CASE 2 Cumulative Annual Wind-Wave Energy, Ferry Wake Energy & Associated Proportional Increase in Wave Energy

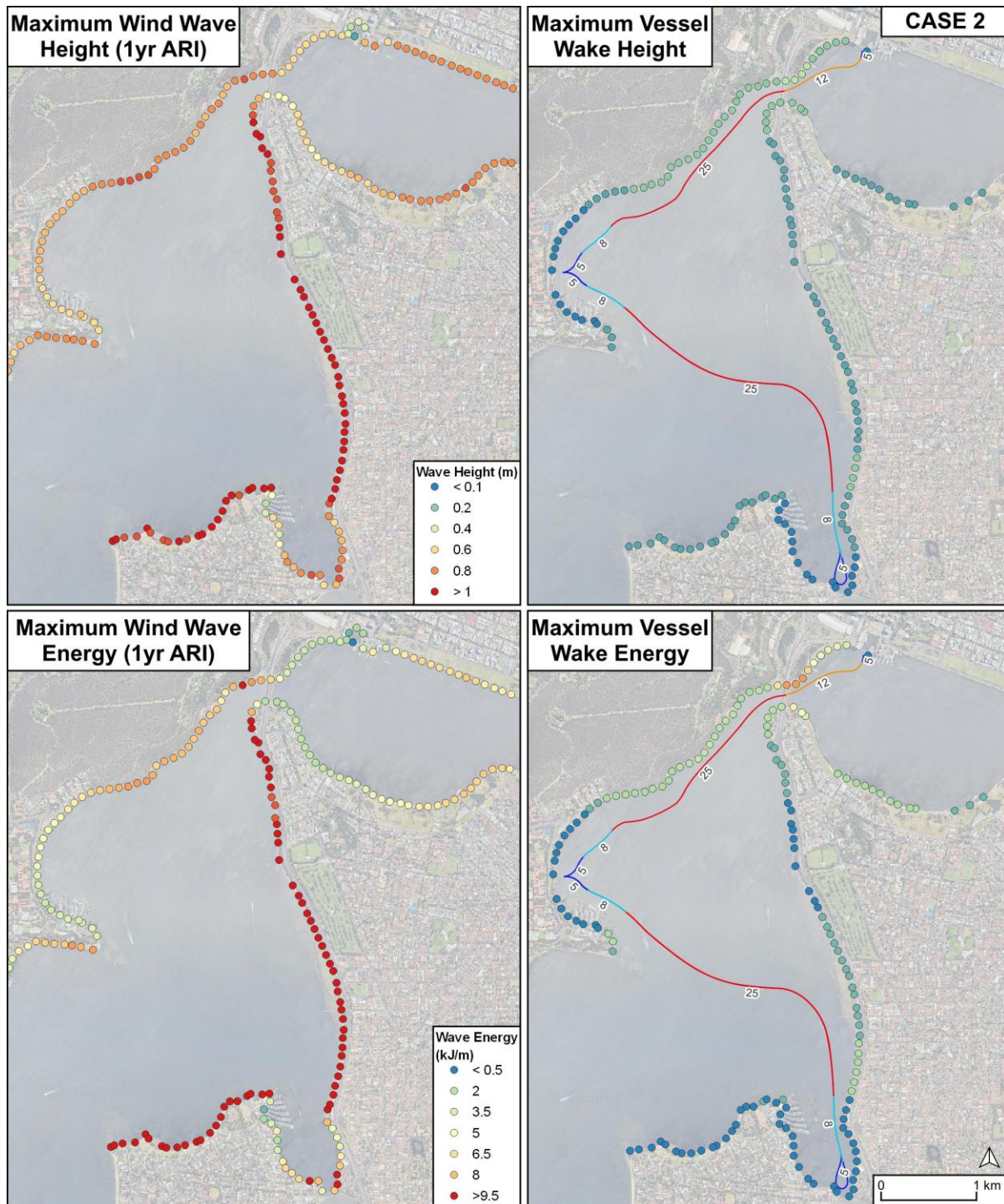


Figure 3-4: CASE 2 Comparison of 1-Year ARI Wind-Wave with Maximum Ferry Wake
(Top) Maximum Wave Amplitude
(Bottom) Maximum Wave Energy



3.3. CASE 2A

The 25-knot speed exemption along Mounts Bay Road and north of Pelican Point in Case 2 was identified to substantially increase proportional cumulative wave energy at northern Matilda Bay and Pelican Point. As a result, Case 2A was developed as a variation to Case 2, truncating the extent of the 25-knot exemption in these areas. This modification alleviates elevated wave energy at Pelican Point's foreshore and along approximately 500 m of foreshore along Mounts Bay Road, which includes a susceptible (unwalled) part of northern Matilda Bay.

The 12-knot operating speeds within Perth Water and extension of the 25-knot operating speeds at western Como foreshores remains unchanged from Case 2, consequently, proportional cumulative wave energy in these areas are identical to Case 2.

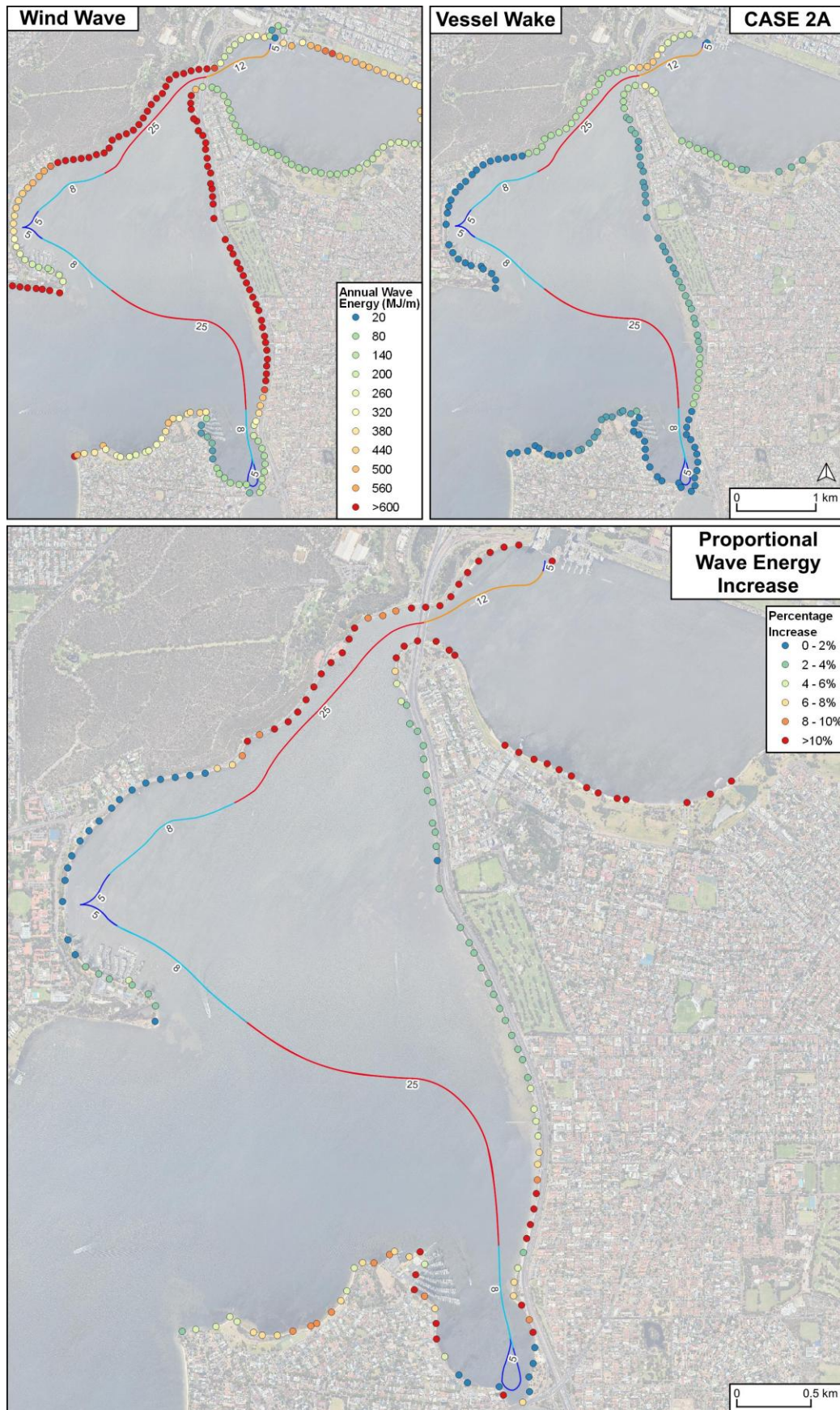


Figure 3-5: CASE 2A Cumulative Annual Wind-Wave Energy, Ferry Wake Energy & Associated Proportional Increase in Wave Energy

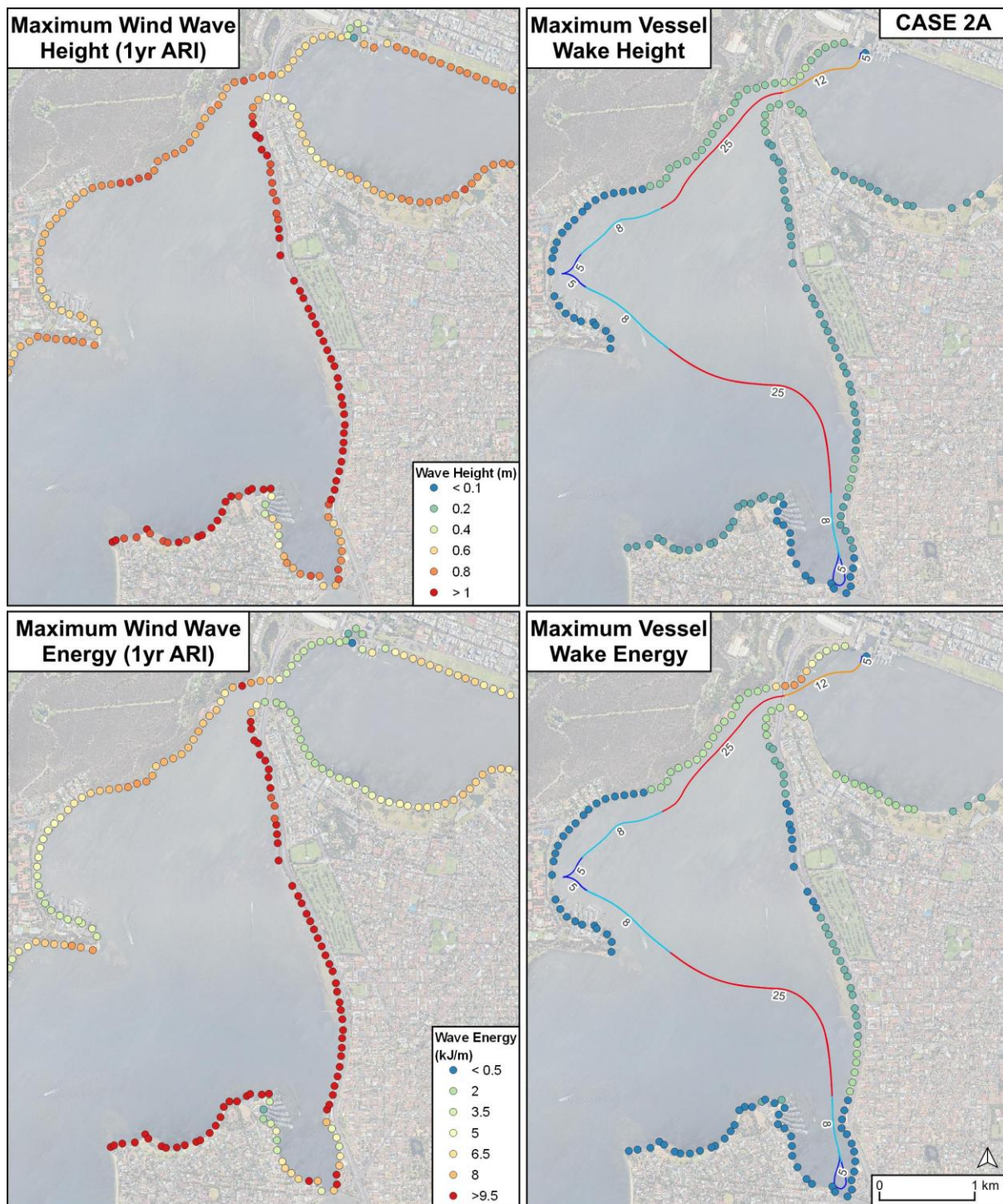


Figure 3-6: CASE 2A Comparison of 1-Year ARI Wind-Wave with Maximum Ferry Wake
(Top) Maximum Wave Amplitude
(Bottom) Maximum Wave Energy



3.4. CASE 3

The extended 12-knot speed exemptions within Perth Water, along Mounts Bay Road, north of Pelican Point and along the southern Como foreshore in Case 3 increase operation near the critical speed, generally producing the greatest shoreline wake conditions of the three scenarios (Figure 3-7). Notable increases in proportional cumulative wave energy, relative to Cases 1 and 2, occur:

- **Along Mounts Bay Road**, west of the Old Swan Brewery, where proportional increases in cumulative wave energy are in the order of 20-40%, approximately 2-3 times those predicted for the corresponding 25-knot operating zone in Case 2.
- **Along the western Como foreshore**, between Saunders Street and Thelma Street, where proportional increases to cumulative wave energy (wakes relative to wind waves) are approximately 50% at the southern end of this section, reducing to around 20% towards the northern end.
- **For the north-facing foreshore of Pelican Point**, where the 25-knot speed exemption in Case 2 is replaced with a 12-knot speed exemption. This adjustment further increases the cumulative ferry-wake contribution (relative to Case 2) to approximately 70–80% of the cumulative wind-wave energy.

Largest wave conditions remain associated with wind-wave forcing (Figure 3-8), with the 1-year ARI wind-wave amplitude $H_{\max}$ exceeding the maximum ferry wake amplitude at all foreshores.

However, maximum ferry-wake energy exceeds the corresponding 1-year ARI wind-wave energy at the same locations identified in Case 2. In addition, the wake energy in Case 3 along the north-facing Pelican Point foreshore results in wake energy levels that are approximately equivalent to the local wind-wave energy.

However, maximum ferry-wake energy exceeds the corresponding 1-year ARI wind-wave energy at the same locations identified in Case 2. In addition to these locations, maximum ferry-wake energy in Case 3 is approximately equivalent to the corresponding 1-year ARI wind-wave energy along the north-facing Pelican Point foreshore.

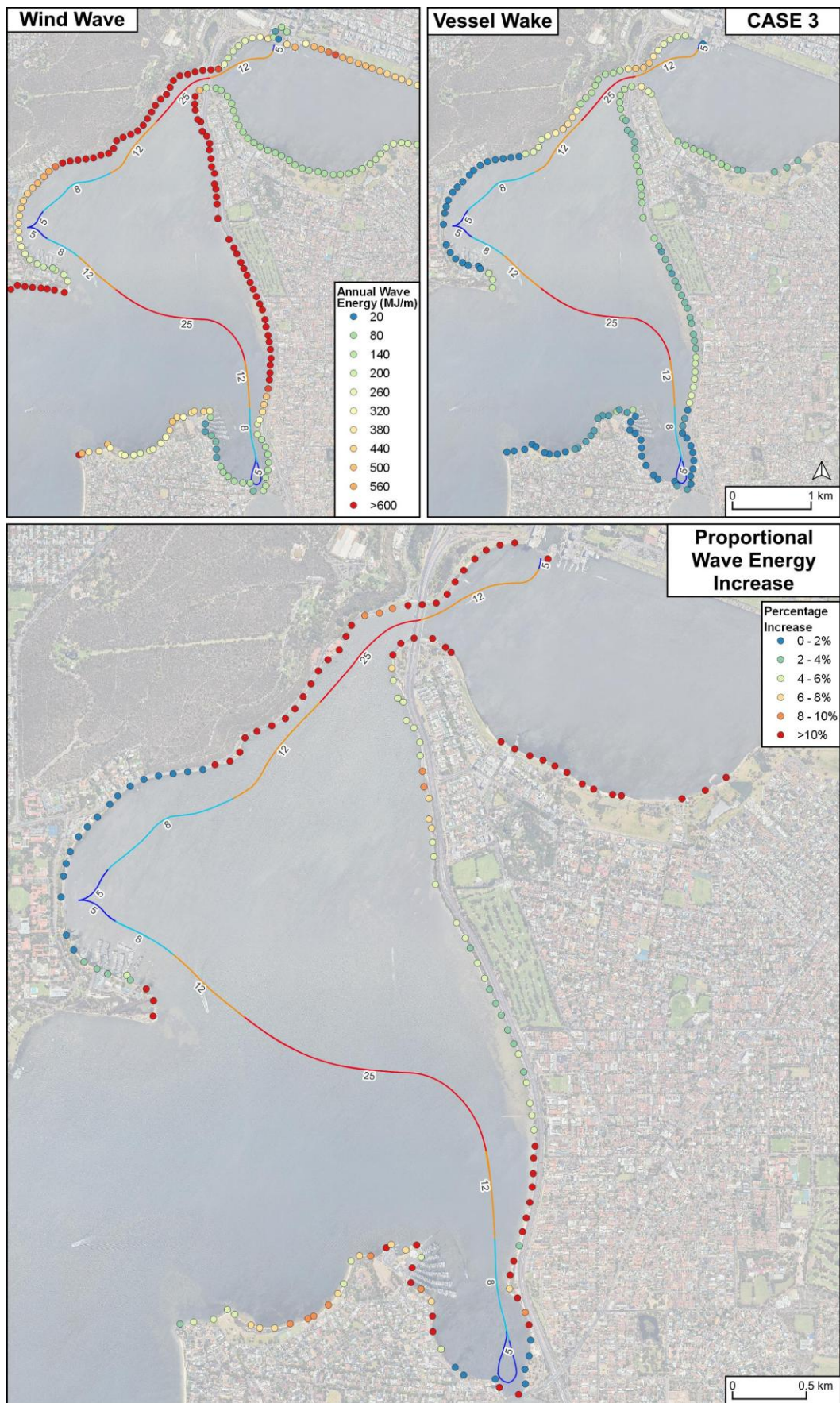


Figure 3-7: CASE 3 Cumulative Annual Wind-Wave Energy, Ferry Wake Energy & Associated Proportional Increase in Wave Energy

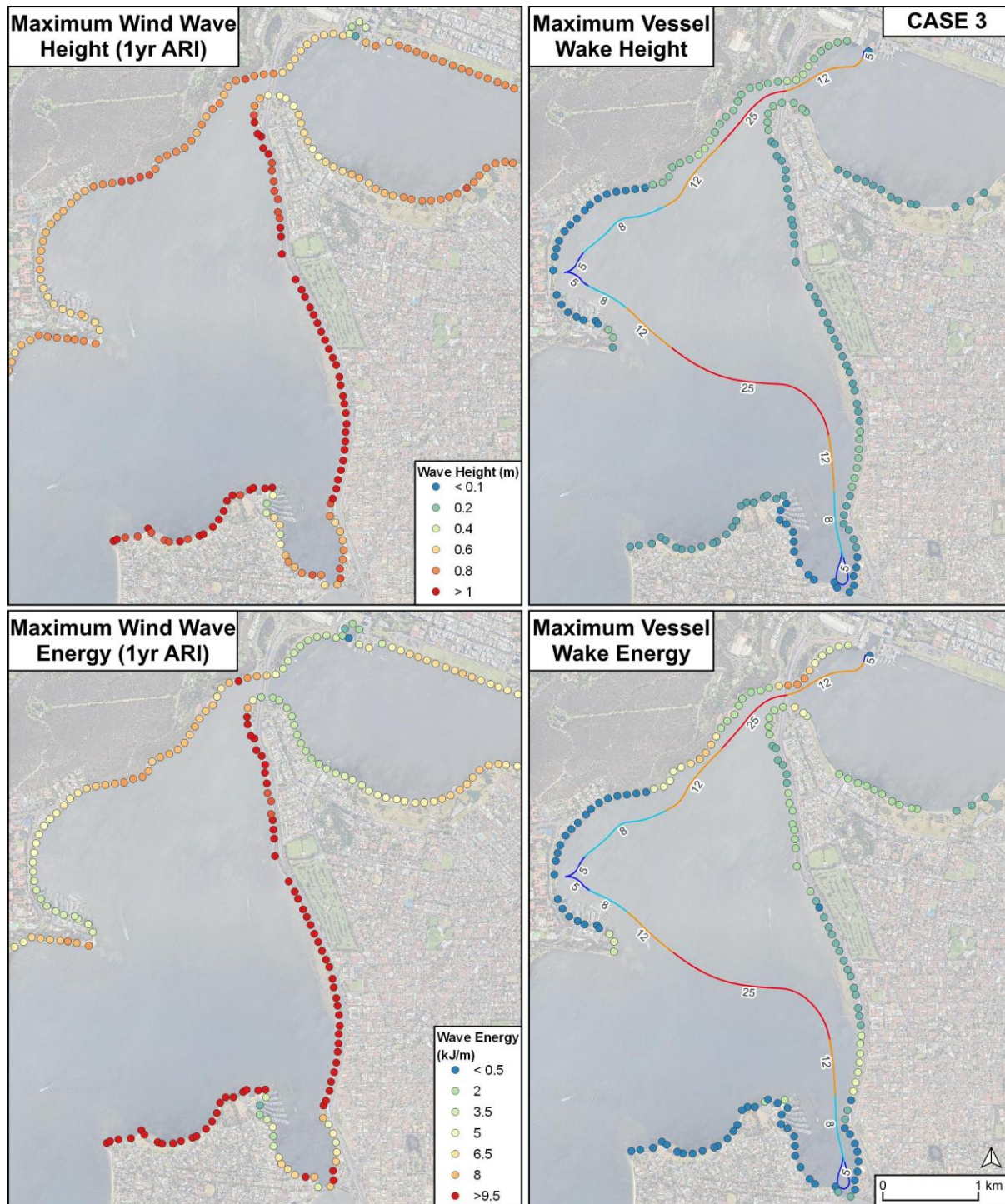


Figure 3-8: CASE 3 Comparison of 1-Year ARI Wind-Wave with Maximum Ferry Wake
 (Top) Maximum Wave Amplitude
 (Bottom) Maximum Wave Energy



3.5. OTHER CONSIDERATIONS

3.5.1. Alternative Routes

Potential route variations beyond Cases 1 to 3 were also considered qualitatively.

- A route tracking slightly further west during the 8-knot approach to Applecross Terminal before adopting a more southerly track across Melville Water towards Pelican Point at 25 knots. This option would result in only minor changes to wake impacts along the foreshores adjacent to the approach (i.e. south of the South of Perth Yacht Club), as vessels are operating at relatively low speeds and therefore generate limited wake energy. Marginally greater benefits would occur along Como foreshore (near Saunders Street) under the speed exemption scenarios (Section 4.4), where vessel operating speeds are higher.

3.5.2. Other Vessel Traffic

Assessment has focused on impacts associated with the proposed ferry operations and has not considered influence of other vessel traffic. It is noted that additional vessel traffic may represent an important component of the wave climate in constrained sections of the estuary, where vessels are required to navigate close to the shoreline, such as near the Narrows.

For context, previous measurements of wakes generated by Rottnest ferry vessel *Star Flyte Express* (draft 1.1 m) in the Swan Estuary by Curtin University (2010) showed a maximum wake height of 0.76 m, with a wave period of approximately 7 s, recorded 70 m from the vessel during transit at 12 knots. This exceeds the maximum wake heights predicted by both the AMC and INCAT studies.

DTMI has undertaken AWAC deployments of varying durations within the Swan River Estuary, including at locations in the vicinity of the route at Canning Bridge, the Como foreshore and Barrack Street. These datasets may provide useful information on existing wake conditions; however, it is understood that they have not been processed to identify individual vessel wakes.



4. Shorelines Potentially Sensitive to Ferry Wakes

Potential for ferry wakes to influence shoreline processes has been evaluated based on the magnitude of additional wake energy relative to the existing wave climate, together with existing shoreline condition and processes.

Figure 4-1 identifies shoreline sections where ferry operations result in notable increases in wake energy, which were reviewed for potential influence on shoreline dynamics. These locations are discussed in Sections 4.1 to 4.6, considering the history of shoreline modification, previous patterns of foreshore change, recent shoreline management approaches, and shoreline condition observed during July 2026 site inspections. Each section includes a summary table presenting the calculated cumulative annual wave energy, the maximum single-wave energy and significant wave height (H_s), derived from the mapping presented in Section 3.

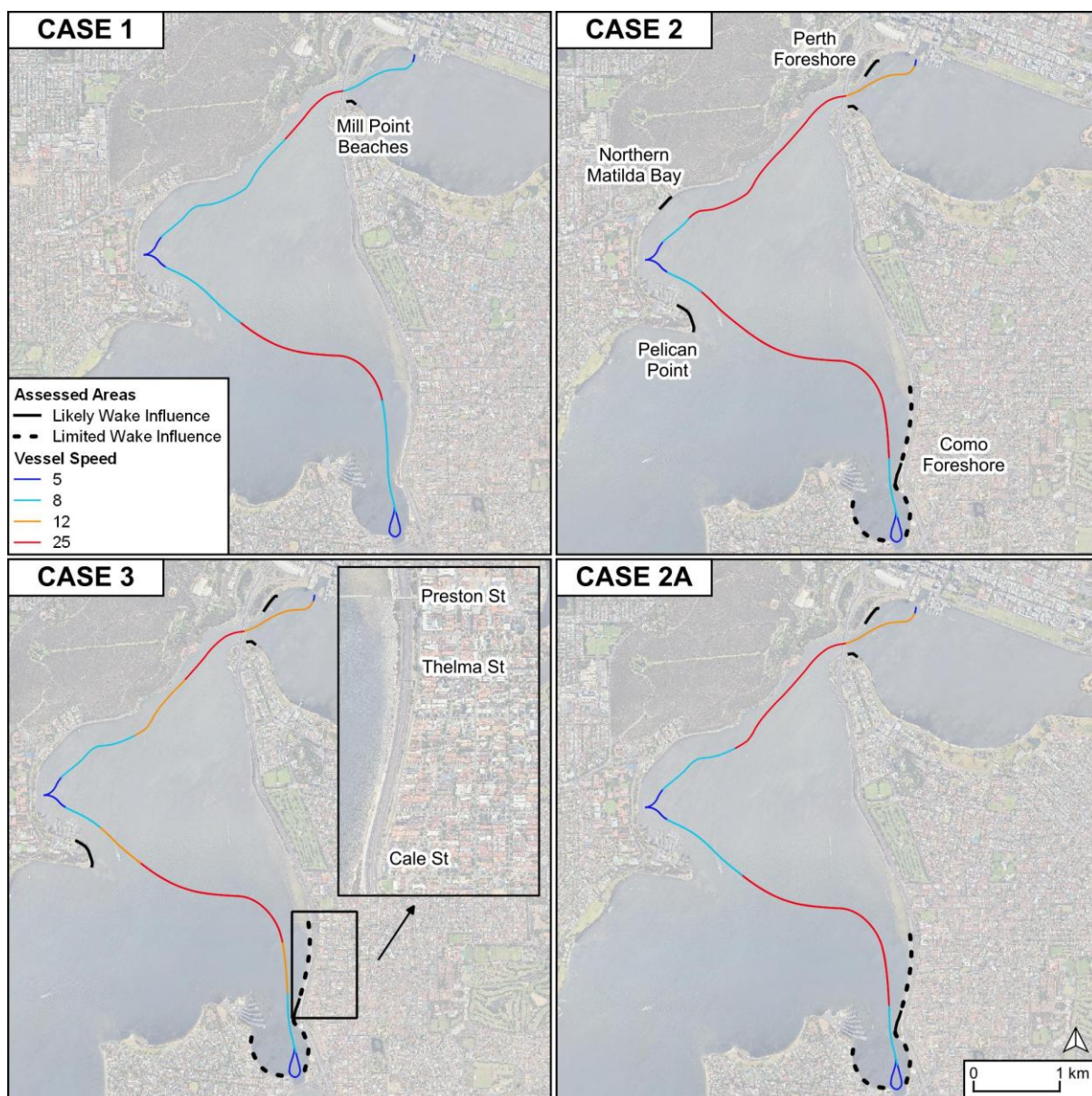


Figure 4-1: Locations of Shoreline Areas Identified for Potential Wake Impacts



The remaining shoreline sections were screened from further assessment because the predicted increase in ferry wake energy under all cases is unlikely to materially influence shoreline processes or performance of existing shoreline protection structures. These include:

- More exposed foreshores between Como western foreshore and the Narrows, and between Heathcote and Applecross Jetty, where maximum ferry wake energy and wave height remain substantially lower than the corresponding 1-year ARI wind-wave conditions. Subsequently, wind-wave forcing is expected to remain the dominant driver of sediment transport and shoreline erosion.
- Shorelines protected by walling and revetments around the Narrows (excluding Mill Point Reserve), along Mounts Bay Road, and along South Perth foreshore. Most of these structures are identified in DBCA Foreshore Condition Database as being in reasonable condition, with additional ferry wake energy small relative to existing wave loading acting on these structures.
- Matilda Bay, where increases in wake energy remain limited due to low ferry operating speeds (5–8 knots).

4.1. PERTH FORESHORE

The wider foreshore between the Narrows and Elizabeth Quay is situated on land reclaimed during the late 1950s as part of the Narrows Bridge and Kwinana Freeway construction (refer Appendix E.1). Since reclamation, the shoreline has demonstrated an overall tendency for net sediment loss, with much of the foreshore now stabilised by rock revetments and vertical walling.

This assessment focuses on approximately 200 m of beach along Birdiya Drive. This section extends from a headland (to the north) to the vertical retaining wall with gabion scour protection extending south from the Narrows. This shoreline was modified in 2017 to comprise:

- Approximately 100 m of renourished sandy beach between two limestone headlands, bounded landward by a limestone crest wall (Figure 4-2).
- Approximately 100 m of renourished sandy beach with a vegetated upper bank. There is low vegetation to the north, transitioning southwards to a treed section fronted by rock toe protection (Figure 4-3).



Figure 4-2: Southern Segment – Beach with Headland Controls



Figure 4-3: Northern Segment – Vegetation and Rock Toe Protection

Since 2017, this area has demonstrated a tendency for net sediment loss from the shoreline together with pronounced beach rotation. This has resulted in narrowing of the northern end of the beach, with the shoreline locally encroaching onto the limestone wall and exposing sections of the wall footing. Erosion at the southern end of the beach has been less pronounced, consistent with net southward sediment transport under prevailing easterly wave conditions and potentially including local sheltering effects from "The Raft Perth", located approximately 40 m from shore.

Under Cases 2, 3 and 2A vessel wakes are predicted to become a major component of the wave climate acting on this foreshore (Table 4-1), with their relative influence expected to be greatest during winter, when south-easterly wind-wave conditions occur less frequently and water levels are generally higher. As the ferry track is not parallel to the shore, waves generated during transits towards Elizabeth Quay would approach the shoreline at a greater angle, likely introducing an additional northward longshore transport component. This may partially offset the existing tendency for southward sediment transport and beach rotation.

Table 4-1: Summary of Wake and Wind-Wave Conditions – Elizabeth Quay to Narrows³

Bold red text highlights where wakes are greater than wind waves.

Scenario	Operating Condition	Annual Wave Energy (MJ/m)	Max. Single Wave Energy (kJ/m)	Max. Single Wave Hs (m)
Wind wave	12.5m/s ESE 1yr ARI wind	190 - 300	2.4 – 3.2	<0.65
Wake – Case 1	Vessel 8 kn	6.5 - 15	0.05 - 0.14	<0.12
Wake – Case 2	Vessel 12 kn	190 - 450	3.5 - 8.5	<0.34
Wake – Case 3	Vessel 12 kn	190 - 450	3.5 - 8.5	<0.34
Wake – Case 2A	Vessel 12 kn	190 - 450	3.5 - 8.5	<0.34

³ Annual wave energy represents the cumulative wave energy acting on the shoreline over a typical year. Maximum single-wave energy and H_s represent the largest individual wave within the wake train or, for wind waves, the corresponding 1-year ARI wind from the critical direction.

4.1. MILL POINT RESERVE ARTIFICIAL BEACH

The foreshore encompassing Mill Point Reserve was modified during construction of the Narrows Bridge and Kwinana Freeway in the late 1950s, with much of the adjacent shoreline subsequently stabilised by walling (refer Appendix E.2). Following reclamation, sediments progressively redistributed along the walled foreshore and accumulated beneath and immediately east of the Narrows, where the shoreline is highly sheltered from wind-wave action. Historical aerial imagery indicates this depositional feature initially formed mainly beneath the Narrows Bridge before gradually migrating approximately 120 m eastwards over time, while remaining mobile.

In 2016, the shoreline was reconfigured into two beach compartments by construction of three limestone headlands (Figure 4-4). The typical orientation of each beach compartment reflects the wave climate under combined influence of wind waves and existing vessel wakes, with:

- the western beach aligned almost exclusively towards wave energy from the northwest.
- the eastern beach aligned more variably, but mainly towards wave energy from the east.

The greater variability of the eastern beach is due to its exposure to seasonal changes in easterly wind-wave conditions. Consequently, the eastern beach exhibits a more easterly shoreline alignment from late summer through early winter, transitioning to a more northerly alignment from around September to January as easterly wind forcing declines.

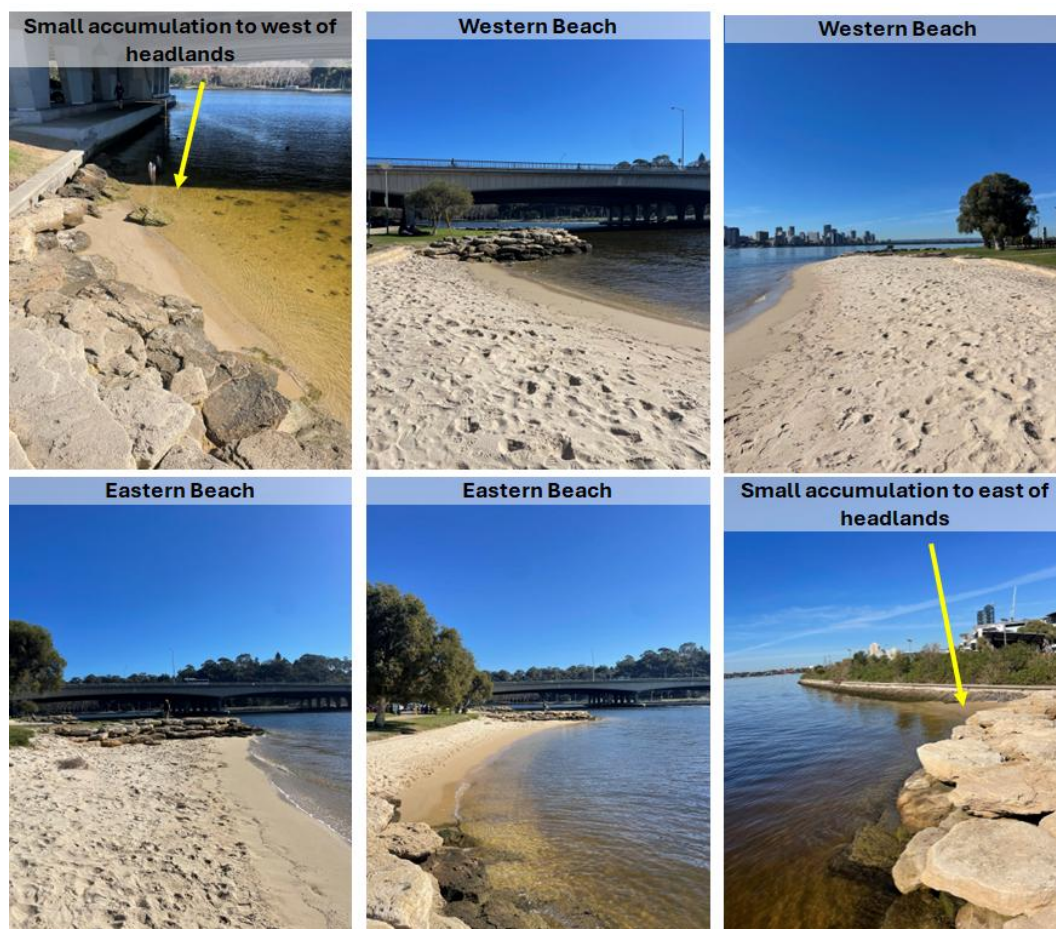


Figure 4-4: Mill Point Reserve – Artificial Beach with Headland Controls



Presence of only small sand accumulations immediately 'outside' the eastern and western headlands suggest the headlands are largely effective in retaining sediment within the two beach compartments (i.e. limited bypassing). However, intermittent sediment exchange between the two beach compartments appear to occur, as the beach toe on either side can extend beyond the central headland under certain conditions.

Although the headlands appear to effectively limit alongshore sediment transfer, an apparent reduction in beach volume since construction suggests some net offshore sediment loss has occurred. This is likely to be facilitated by the relatively deep beach toe (approximately –3 m AHD) and the proximity of the beach compartments to higher flows through the constriction provided by the adjacent Narrows Bridge.

Under all four cases, vessel wakes would form a major component of the wave climate acting on this beach, particularly under Cases 2, 3 and 2A where vessels operate near the critical speed for wake generation (Table 4-2). This reflects both the magnitude of the vessel wakes and the beaches' relatively sheltered setting.

Table 4-2: Summary of Wake and Wind-Wave Conditions – Mill Point Reserve

Bold red text highlights where wakes are greater than wind waves.

Scenario	Operating Condition	Annual Wave Energy (MJ/m)	Single Wave Energy (kJ/m)	Single Wave Hs (m)
Wind wave	12m/s E 1yr ARI	75 - 103	1.7 – 2.3	<0.59
Wake – Case 1	Vessel 8 kn	6 - 120	0.06 – 1.8	<0.26
Wake – Case 2	Vessel 12 kn	180 - 343	3.4 – 5.9	<0.29
Wake – Case 3	Vessel 12 kn	180 - 343	3.4 – 5.9	<0.29
Wake – Case 2A	Vessel 12 kn	180 - 343	3.4 – 5.9	<0.29

4.2. NORTHERN MATILDA BAY

The northern end of Matilda Bay has experienced ongoing erosion following removal of Crawley Baths between 1953 and 1965, which released sediment previously retained on the south side of the baths (refer Appendix E.3; Seashore Engineering 2025). As erosion progressively threatened the narrow foreshore buffer adjacent to Mounts Bay Road, walling and revetements were extended to the south, with southernmost ~80m revetment section completed in the mid-2000s. These structures are identified in DBCA Foreshore Condition Database as being in reasonable condition.

The area immediately south of this walling has experienced increasing erosion pressure due to the transfer of erosion, resulting in localised flanking erosion. This occurs within the broader context of an ongoing tendency for erosion along the foreshore between this location and UWA Boat Club since around 2003 (Seashore Engineering 2025).

Site inspection undertaken in July 2026 identified approximately 50m section of foreshore which exhibits significant erosion scarping (Figure 4-5), with only a narrow buffer remaining to the shared path along Mounts Bay Road. Exposure of reticulation associated with previous revegetation works indicates recent erosion has occurred.

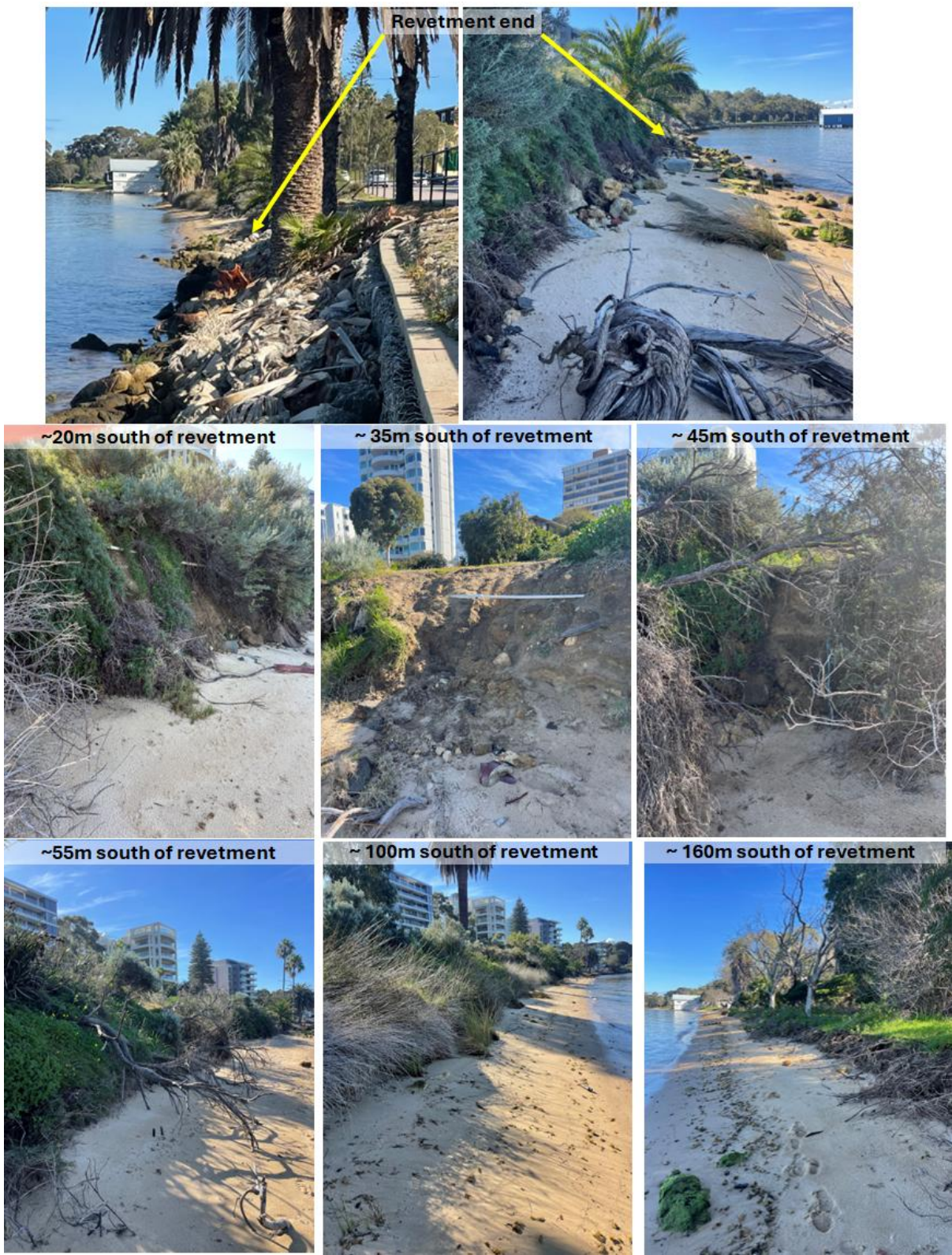


Figure 4-5: Northern Matilda Bay – North of Crawley Avenue



While wind waves are expected to remain the dominant driver of coastal processes, Case 2 results in approximately 11% increase in cumulative annual wave energy over the 50 m scarp section (Table 4-3)⁴, with the potential to marginally increase erosion. This corresponds to the section where ferries operate at 25 knots approximately 330 m offshore, with the proportional increase diminishing southwards as vessel speeds transition to 8 knots. Most of the additional wake energy affecting this section is likely to approach from the northeast, as wakes propagate forward from their point of generation and the 25-knot operating zone extends to the north. This may contribute to southward sediment transport, potentially enhancing existing flanking erosion.

Table 4-3: Summary of Wake and Wind-Wave Conditions – Northern Matilda Bay

Scenario	Operating Condition	Annual Wave Energy (MJ/m)	Single Wave Energy (kJ/m)	Single Wave Hs (m)
Wind wave	13.5m/s SSE 1yr ARI	470 -575	5.2 – 6.9	< 0.8
Wake – Case 1	Vessel 8 kn	5.3 – 5.4	0.05	<0.08
Wake – Case 2	Vessel 25 kn	5.4 – 62	0.05 – 0.96	< 0.19
Wake – Case 3	Vessel 8 kn	5.3 – 5.4	0.05	<0.08
Wake – Case 2A	Vessel 8 kn	5.3 – 5.4	0.05	<0.08

4.3. NORTH SIDE OF PELICAN POINT

The southern end of Matilda Bay and Pelican Point foreshores have been substantially modified from their original form through construction of Royal Perth Yacht Club, together with major reclamation and dredging works undertaken between 1936 and 1938 around Pelican Point to reclaim former swamp areas and create a more regular shoreline configuration. The Pelican Point section of the foreshore now forms part of the Class A Pelican Point Nature Reserve.

Historical aerial imagery since 1953 indicates that Pelican Point shoreline has been highly dynamic (refer Appendix E.4), with sediment supply and transport patterns strongly influenced by these modifications. Evolution of the area is described in detail by Seashore Engineering (2026) and includes development of a sand spit after 1953, through sediment supply from the south, which progressively enclosed a lagoon. Continued sediment supply subsequently widened the beaches and the barrier along the northern side of the point. Since around 1995, sediment supply from the south has reduced, resulting in:

- Erosion and breaching of the northern barrier, with sediments subsequently redistributed to the southern side of the point.
- Erosion within beach segments fronting Pelican Point Sea Scout Group.

A relatively narrow barrier was observed during the July 2026 site inspection, with a small channel providing tidal exchange between the lagoon and the river (Figure 4-6). The barrier appears to have begun migrating landwards into the lagoon through overwash processes. Within Pelican Point Sea Scout Group area, erosion has formed scarps up to 0.5 m high, with a low limestone wall locally undermined. Recent management has included brushwalling and revegetation (Figure 4-7).

⁴ At this location, the magnitude and extent of this increase would depend on the location of speed transitions and wake generation during acceleration and deceleration, which are not explicitly represented in the modelling.



Figure 4-6: Lagoon Barrier at the North-Facing Foreshore of Pelican Point



Figure 4-7: Erosion at the Pelican Point Sea Scout Group

While Cases 1 and 2A are expected to have only a minor influence due to the existing 8-knot operating speeds, Cases 2 and 3 result in a notable increase in both cumulative annual and maximum single-event wake energy, with potential to influence local sediment dynamics (Table 4-4). Specifically, during acceleration to 12 or 25 knots while travelling towards Applecross, wakes are expected to approach the shoreline at a relatively oblique angle, likely reinforcing the existing southward sediment transport around Pelican Point.

Table 4-4: Summary of Wake and Wind-Wave Conditions – North side of Pelican Point

Scenario	Operating Condition	Annual Wave Energy (MJ/m)	Single Wave Energy (kJ/m)	Single Wave Hs (m)
Wind wave	14.5m/s N 1yr ARI	200 - 243	3.3 – 3.6	< 0.7
Wake – Case 1	Vessel 8 kn	4.6 – 5.6	0.04 – 0.05	< 0.08
Wake – Case 2	Vessel 25 kn	54 – 65	0.82 - 1	< 0.20
Wake – Case 3	Vessel 12 kn	145 - 176	2.7 – 3.2	< 0.22
Wake – Case 2A	Vessel 8 kn	4.6 – 5.6	0.04 – 0.05	< 0.08



4.4. WESTERN COMO FORESHORE

The broader western Como foreshore was substantially modified through reclamation associated with construction of Kwinana Freeway around 1960 (refer Appendix E.5). Since reclamation, the foreshore has undergone sustained erosion, characterised by progressive beach narrowing, depletion of nearshore sediments and shoreline realignment (Seashore Engineering 2026).

This erosion has resulted in progressive installation of shoreline protection along much of the foreshore adjacent to the ferry route to preserve the remaining foreshore and protect the shared path in front of Kwinana Freeway.

Due to the length of this foreshore and variability in wave forcing and vessel wake exposure, it has been divided into sections, with an overall wake energy summary provided for the entire foreshore (Table 4-5).

Table 4-5: Summary of Wake and Wind-Wave Conditions – Como Foreshore

Scenario	Operating Condition	Annual Wave Energy (MJ/m)	Single Wave Energy (kJ/m)	Single Wave Hs (m)
Wind wave	17 m/s WNW 1yr ARI	235 - 1163	12 – 22	< 1.3
Wake – Case 1	Vessel 8 kn	5.6 – 59	0.05 – 0.9	< 0.11
Wake – Case 2	Vessel 25 kn	9 - 88	0.08 – 1.4	< 0.23
Wake – Case 3	Vessel 12 kn	9 - 238	0.08 – 4.4	< 0.25
Wake – Case 2A	Vessel 25 kn	9 - 88	0.08 – 1.4	< 0.23

4.4.1. Preston Street to Thelma Street

A degraded section of limestone walling provides shoreline protection along this section of foreshore, but it is prone to overtopping during westerly wind events and elevated water levels. Although this area will experience a minor increase in vessel wake energy, wind waves will remain the dominant loading condition governing stability and performance of the walling.



Figure 4-8: Preston Street to Thelma Street – Damaged Limestone Walling



4.4.2. Thelma Street to north of Cale Street

In 2024, approximately 650 m of rock revetment was installed in front of the existing ageing limestone walling, extending from north of Cale Street to Kwinana Freeway overpass near Thelma Street. As a result, this section of foreshore is now resistant to the predicted increase in vessel wake energy.



Figure 4-9: Thelma Street to north of Cale Street – Rock Revetment and Headland

4.4.3. Cale Street to Scout Hall

Immediately south of the 2024 revetment, a tendency for southward sediment redistribution has caused progressive erosion along the north side of the sediment lobe fronting Olives Reserve, with corresponding accumulation to the south, adjacent to the Scout Hall. This pattern reflects net southward sediment transport under the wind wave climate, developed by extended fetches across Melville Water and sheltering from Point Heathcote. As the beach along the reclaimed Kwinana Freeway foreshore has progressively eroded from north to south from the 1990s, management has involved ongoing extension of protection southward, including:

- Extension of limestone walling in late 1990s.
- Construction of a 30 m rock headland at the limestone wall termination in 2011.
- A further 20 m southward extension of the rock revetment from the headland in 2020.

As the erosion has continued to migrate southwards, a 20 m section immediately south of the 2020 revetment extension has become increasingly scarped, with loss of trees and exposure of tree roots. A sand nourishment trial undertaken by the City of South Perth in 2024 to slow this erosion appears to have been eroded relatively rapidly following placement.



Figure 4-10: Erosion Scarps and Tree Loss and Undermining Near Cale Street

While the influence of ferry wake on this erosion pattern is likely to be modest under Case 1, the influence is expected to increase under Cases 2 and 3. In these cases, most wake energy is expected to approach from the northwest, as the 12-knot and 25-knot operating zones extend north of this location and wakes propagate forward from their point of generation. This may reinforce the prevailing southward sediment transport, marginally enhancing the ongoing erosion.

4.5. APPROACH TO APPLECROSS TERMINAL

Como western foreshore south from the Scout Hall and east of the ferry route (Section 4.4.3), is protected by limestone walling identified as being in reasonable condition in DBCA Foreshore Condition Database. However, localised flanking erosion between a section of limestone wall and the adjacent revetment opposite Casey Street was observed during the July 2026 site inspection (Figure 4-11).



Figure 4-11: Como Western Foreshore – South of the Scout Hall



The Applecross foreshore west of the ferry route, extending north towards the South of Perth Yacht Club, comprises small pocket beaches separated by vegetated sections, drainage outlets and localised revetments (Figure 4-12). Setback distances to the adjacent shared path are variable, with sections where the available buffer is limited generally exhibiting gradual erosion.



Figure 4-12: Applecross Foreshore – South of South Perth Yacht Club

These areas will experience only a small increase in vessel wake energy under all assessment cases, as ferry operating speeds are generally limited to 5–8 knots. Although the proportional increase in cumulative wave energy exceeds 10% adjacent to the 8-knot operating zone, this reflects the relatively low existing wind-wave energy rather than a large increase in absolute wake energy. Consequently, the predicted increase in wake energy is not expected to significantly enhance observed erosion.

Table 4-6: Summary of Wake and Wind-Wave Conditions – Approach to Applecross Terminal

Scenario	Operating Condition	Annual Wave Energy (MJ/m)	Single Wave Energy (kJ/m)	Single Wave Hs (m)
Wind wave	14.5 – 17 m/s NWN 1yr ARI	33 - 194	2 – 9.6	<0.9
Wake – Case 1	5-8 kn	0.56 – 13.6	0.005 -0.13	<0.12
Wake – Case 2	5-8 kn	0.56 – 13.6	0.005 – 0.17	<0.12
Wake – Case 3	5-8 kn	0.56 – 13.6	0.005 – 0.13	<0.12
Wake – Case 2A	5-8 kn	0.56 – 13.6	0.005 – 0.17	<0.12



5. Management Considerations

The preceding assessment identified shoreline sections where proposed operating scenarios may have implications for future shoreline management. In most cases, predicted wake influence is expected to exacerbate existing shoreline processes and management considerations rather than introduce new management issues. These management considerations are summarised in Table 5-1

Table 5-1: Shoreline Management Considerations for the Proposed Ferry Operating Scenarios

Location	Management Considerations from wake influence	Applicable Case
Perth Foreshore (Birdiya Drive)	- Potential for enhanced offshore sediment transfer, increasing future beach renourishment requirements and the potential for further undermining of the limestone crest wall footing adjacent to the northern headland. - Should the southern section of the beach narrow, there may be greater reliance on the rock toe protection to protect the foreshore vegetation, with an increased potential for movement of smaller limestone spalls under vessel wake loading.	2, 3 & 2A
Mill Point Reserve Artificial Beach	- Potential for increased offshore sediment transfer, reducing the available beach width for recreation and potentially increasing future beach renourishment requirements. - Potential for enhanced shoreline rotation towards the northwest, with greater sediment redistribution to the eastern beach. - Potential for a marginal increase in sediment transfer across the easternmost headland, resulting in gradual net sediment loss. - For Case 1, consider reducing the 25-knot operating limit slightly further west (e.g. more than 100 m west of the Narrows Bridge) to substantially reduce wake impacts on this shoreline.	1, 2, 3 & 2A
Northern Matilda Bay	- Significant existing scarping, with ongoing erosion trend and limited setback to the shared path and road across a 50 m section mean this foreshore already warrants management. The relatively minor increase in wave energy under Case 2 should be considered as part of any future management. - Consider truncating the 25-knot operating zone slightly further north to locally reduce wake energy over the 50 m scarped section.	2
North-facing Pelican Point	Given Pelican Point forms part of the Class A Pelican Point Nature Reserve, the potential influence of Case 2 and 3 on sediment dynamics and the associated environmental values of the reserve and Sea Scout foreshore should be further investigated before implementation.	2 & 3
Como Cale Street to Scout Hall	- Ongoing southward migration of erosion means this foreshore already warrants management. The potential increase in wake energy under Cases 2 and 3, and its potential to locally exacerbate this issue should be considered as part of any future management. - Consider truncating the 12-knot and 25-knot operating zones slightly further north so that the additional wake energy is largely confined to the revetment-protected foreshore.	2, 3 & 2A



6. Conclusions and Considerations

Introduction of the ferry service will cause boat wakes which are additional to existing wind wave conditions within the Swan River estuary. However, wind waves are likely to remain the dominant driver of foreshore dynamics and continue to provide critical design parameters for shoreline protection structures adjacent to the proposed ferry route within Swan River estuary.

Boat wake generation for three alternative ferry routes (varying speeds) has been simulated, with the additional boat wake energy compared against wind waves:

- Case 1 typically adds limited (<5%) wake energy to the existing wind wave energy and is expected to have only minor shoreline influence. The greatest simulated energy increase (5-15%) was identified at the artificial beach at Mill Point Reserve.
- Cases 2, 3 and 2A which consider extensions of the 12-knot and 25-knot operating zones, introduce substantially greater wake energy, particularly along the Como foreshore (near Cale Street), northern Matilda Bay (north of Crawley Avenue) and north-facing Pelican Point. Additionally, areas of moderate wake energy, which coincide with low wind wave conditions, were identified along Perth foreshore (from the Narrows to Elizabeth Quay) and along the foreshores north of Canning Bridge.

Evaluation of locations experiencing proportionally high increases to wave energy indicated these sections are generally already affected by erosion and presently requiring management, rather than locations where ferry wakes introduce new erosion mechanisms or shoreline management issues.

Targeted refinements to the proposed operating zones, including local truncation of selected 12-knot and 25-knot speed exemptions, could reduce wake influence at Mill Point Reserve, northern Matilda Bay, Pelican Point and the Como foreshore (near Cale Street).

Simulation of boat wakes involves use of modelling systems and assumptions, which introduce a level of uncertainty when inferring likely shoreline impacts. Should the proposed operating scenarios be implemented, ongoing monitoring of the identified shoreline sections, and a program for measurement of boat wakes is recommended to confirm shoreline response and inform management.



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Appendix A Wind Wave Modelling Approach

The modelling was undertaken using SCHISM (Semi-implicit Cross-scale Hydroscience Integrated System Model), an open-source numerical modelling platform configured to simulate wind-wave processes within the Swan and Canning River estuaries.

APPENDIX A.1 MODEL GRID

A high-resolution unstructured numerical grid was developed with spatial resolution down to 10 metres (and finer in key areas), enabling detailed representation of the Swan-Canning Estuarine System's bathymetry and topography.

The model grid was developed using the best and most recent survey information available for the Swan-Canning Estuarine System. Areas along the ferry route utilised 2010 multibeam and 2012 single-beam surveys undertaken by DTMI, which together provide the most recent estuary-wide bathymetric coverage.

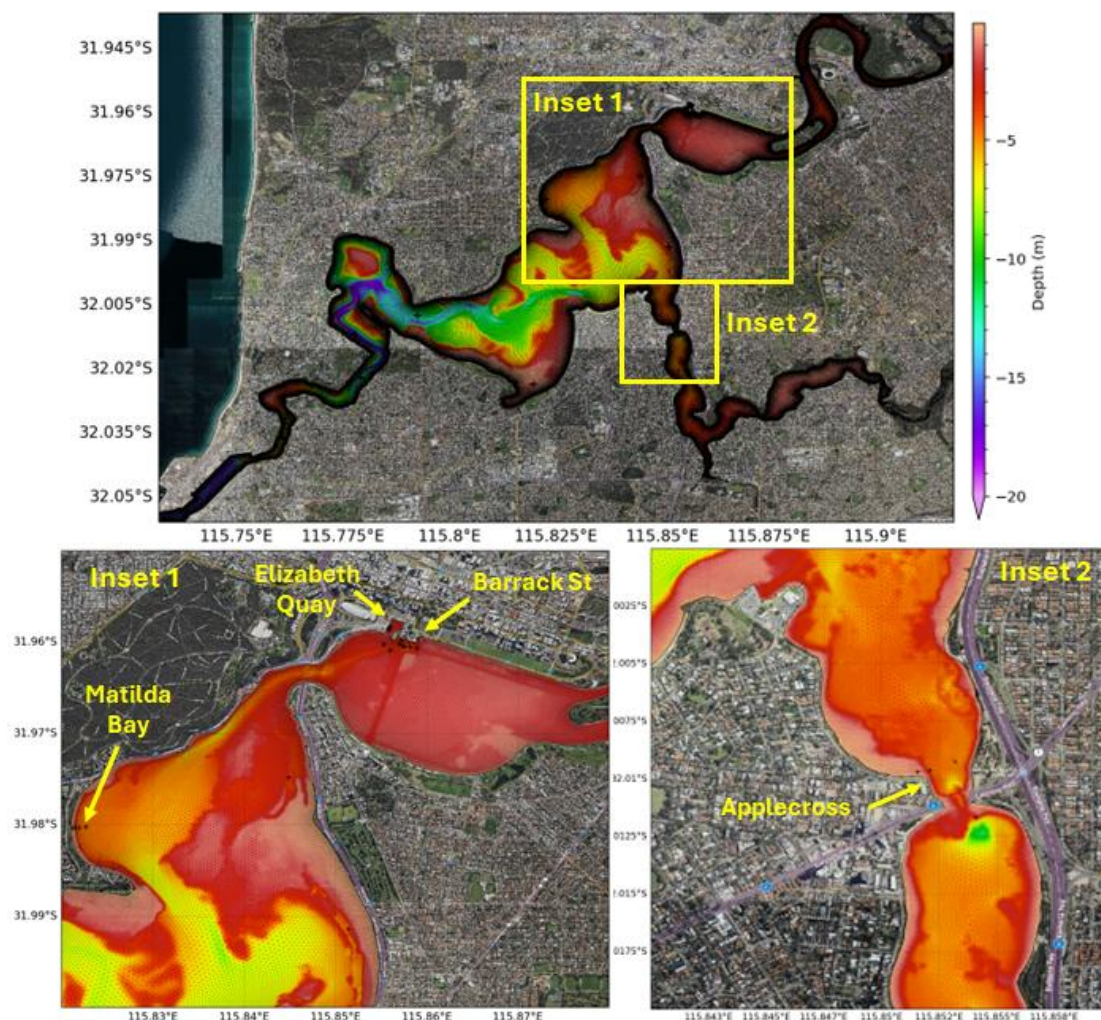


Figure A-1: Model Grid



APPENDIX A.2 MODEL VALIDATION

This section documents model validation through comparison with waves measured at AWACs within the Swan River, with a focus on energetic conditions. AWAC data availability allowed for model validation immediately adjacent to Applecross and Barrack Street terminal sites, and along the Como foreshore.

Overall, wave modelling is considered to provide a reasonable representation of wave conditions.

Validation Periods: Three validation periods were selected to capture multiple high wind-wave events recorded during the AWAC observational periods (V03–V05). These periods were limited to a maximum of two months to balance modelling effort with the declining benefit of extending validation across longer periods, particularly during times without significant forcing.

Table A-1: Summary of Validation Periods and Inputs

Scenario	Start Date	End Date	No. Days	Purpose
V03	8/08/2019	8/10/2019	62	Wave/current validation to Canning Bridge North AWAC
V04	1/07/2018	31/08/2018	62	Wave validation to Como AWAC
V05	15/09/2017	31/10/2017	47	Wave/current validation to Barrack St AWAC

Modelling Inputs: Inputs to the validation modelling comprised:

- **Uniform wind forcing** across model domain was derived from observations at the Melville Water AWS, with observations from Swanbourne AWS substituted when wind directions were between southwest and north-northeast (250°–360°). The substitution was adopted because winds from these directions at Melville Water are subject to overland sheltering by the western margin of the estuary, resulting in lower recorded wind speeds than more exposed sites.
- **Ocean water levels** based on measurements at Hillarys Boat Harbour tide gauge, preferred over Fremantle Port or Boat Harbour records due to the smoother signal it provides. Water levels were applied as a boundary condition at the ocean



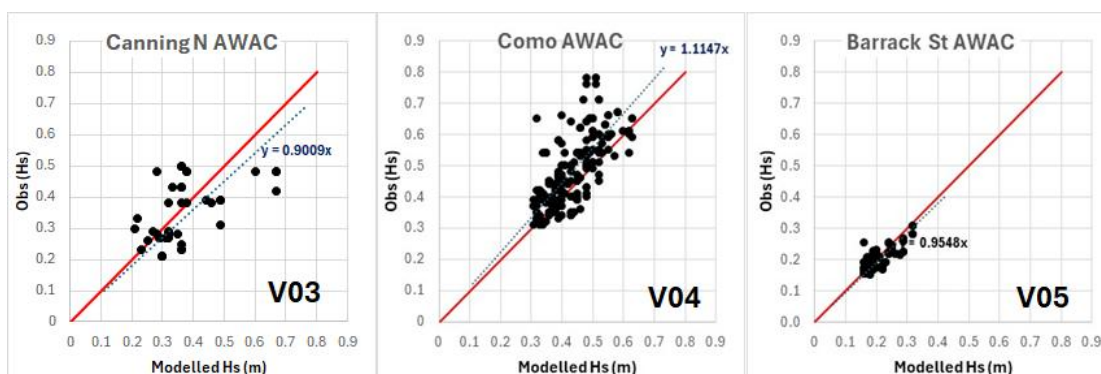
Wave Validation Results: Overall, the model provides a solid representation of elevated wave conditions at the three AWAC sites. It is acknowledged that discrepancies are evident during individual events, reflecting that the strong dependence of locally generated wind waves on wind speed and direction within fetch-limited environments. It is noted that accurate representation of wind during individual events is less critical, as extreme and ambient conditions are derived from an extrapolation of all observed or plausible winds.

The model performance is demonstrated through peak-to-peak cross-plots of modelled and observed significant wave height, H_s (Figure A-2), as well as comparison plots of H_s against T_p (Figure A-3), and peak wave direction (Figure A-4).

Linear fit slopes between 0.9 and 1.1 for the peak H_s plots indicate good agreement, with scatter expected due to the reliance of the model on accurate wind representation across the available fetch during each event. In particular:

- There is greater scatter at the Canning North site, which can be attributed to the relatively narrow extended fetch to the north and the possible sheltering effects of South of Perth Yacht Club jetties. In this setting, differences between wind conditions represented in the model inputs and real wind fields can influence the height and timing of peaks.
- At the Como site, a series of events with observed wave heights in the order of 0.8 m were underrepresented by the model. This discrepancy may be attributed to funnelling of west-south-westerly winds along the alignment of the Melville Water basin, which could generate higher wind speeds through the centre of the estuary than represented by the uniform modelled winds.

Time series plots show modelled and observed H_s for the full validation periods and for selected events at each site (Figure A-5 to Figure A-7). Small waves (<0.1 m) are not captured by the model, and while these waves appear in the observed records, they are near the lower limit of AWAC detection capability, with wave direction under these conditions particularly unreliable. Additionally, at Canning Bridge North, modest wind waves generated by southerly winds are represented in the model but were not observed. This discrepancy is attributed to sheltering effects of Canning Bridge, which are not included in the model.



Observed peaks were matched to modelled peaks within a three-hour window

Figure A-2: Comparison of Peak Observed and Modelled Wave Heights During Validation Runs

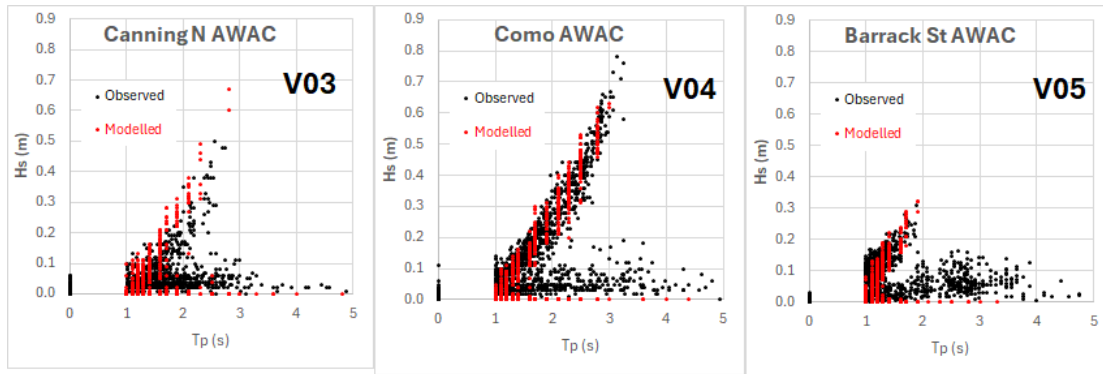
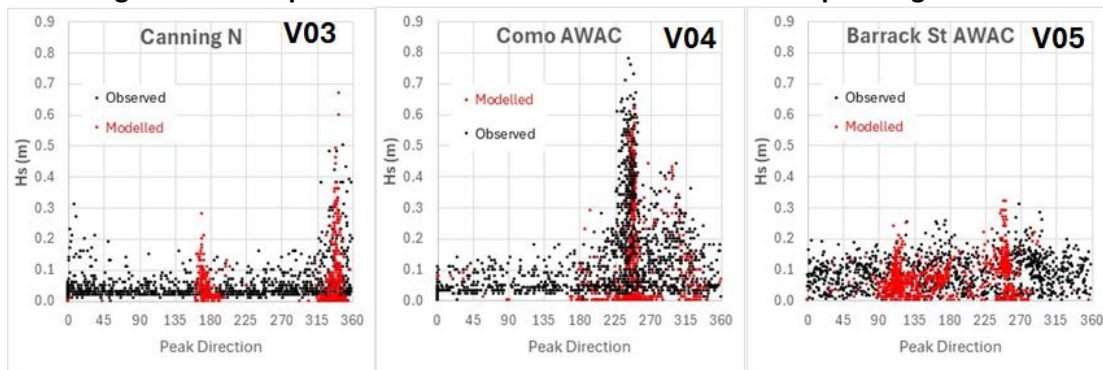


Figure A-3: Comparison of Observed and Modelled H_s and T_p During Validation Runs



Modest southerly waves at Canning N were simulated by the model but were not evident in the observations, likely due to sheltering effects from the Canning Bridge, which is not represented in the model. Similar local sheltering effects may also occur in the vicinity of other bridges (e.g. the Narrows).

Figure A-4: Comparison of Observed and Modelled H_s and Peak Direction During Validation Runs

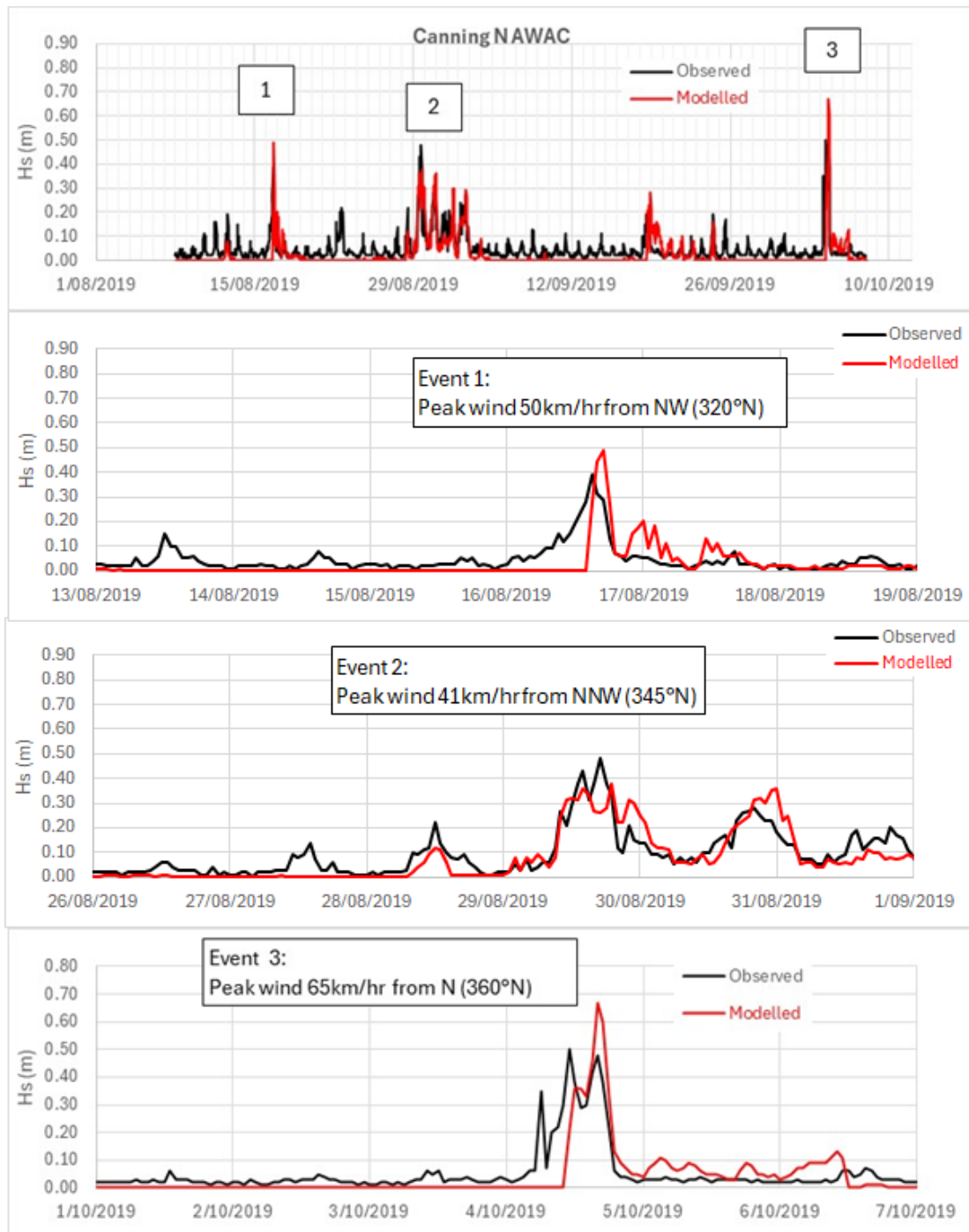


Figure A-5: Timeseries of observed and modelled Hs at Canning North AWAC (V3)

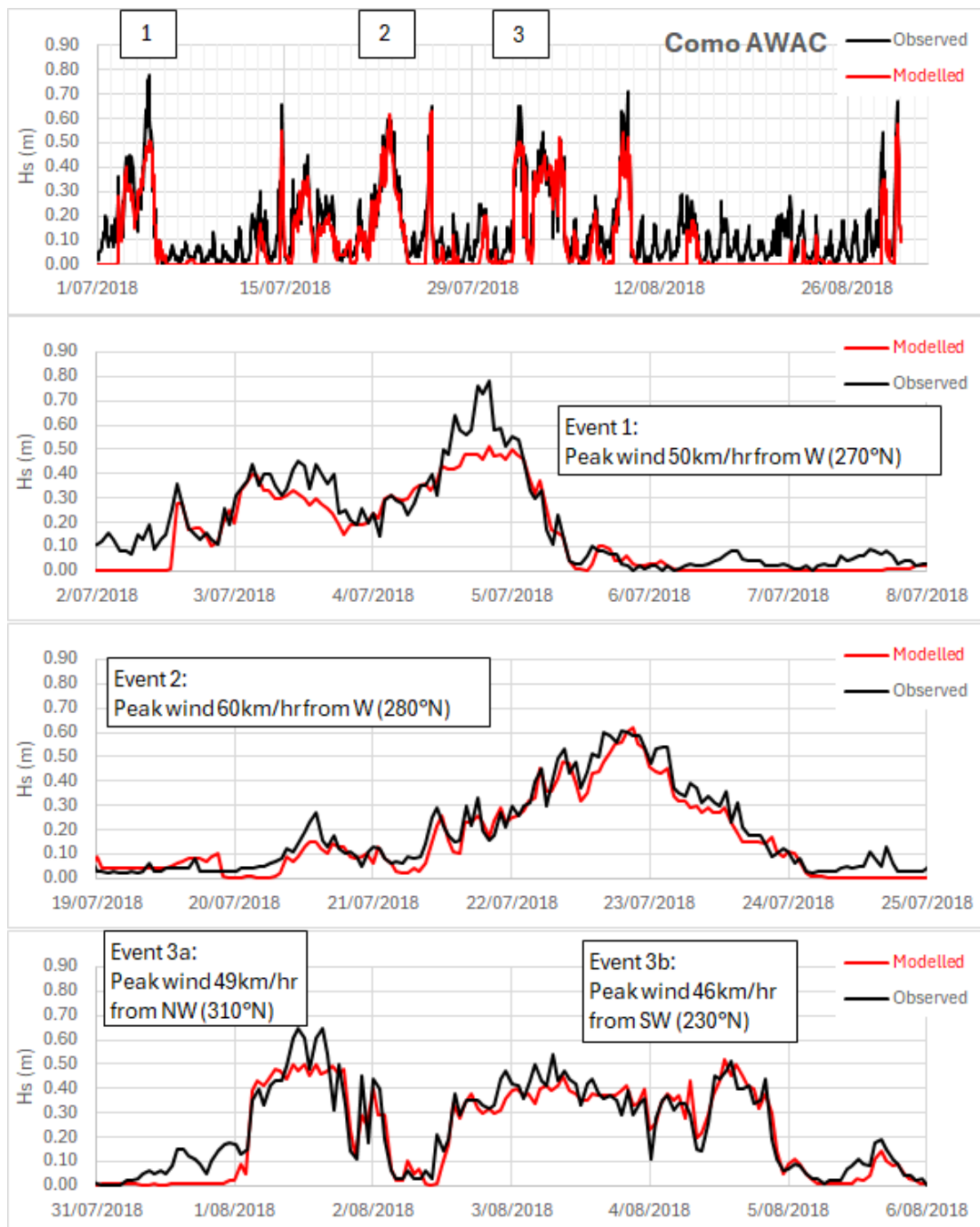


Figure A-6: Timeseries of observed and modelled Hs at Como AWAC (V4)

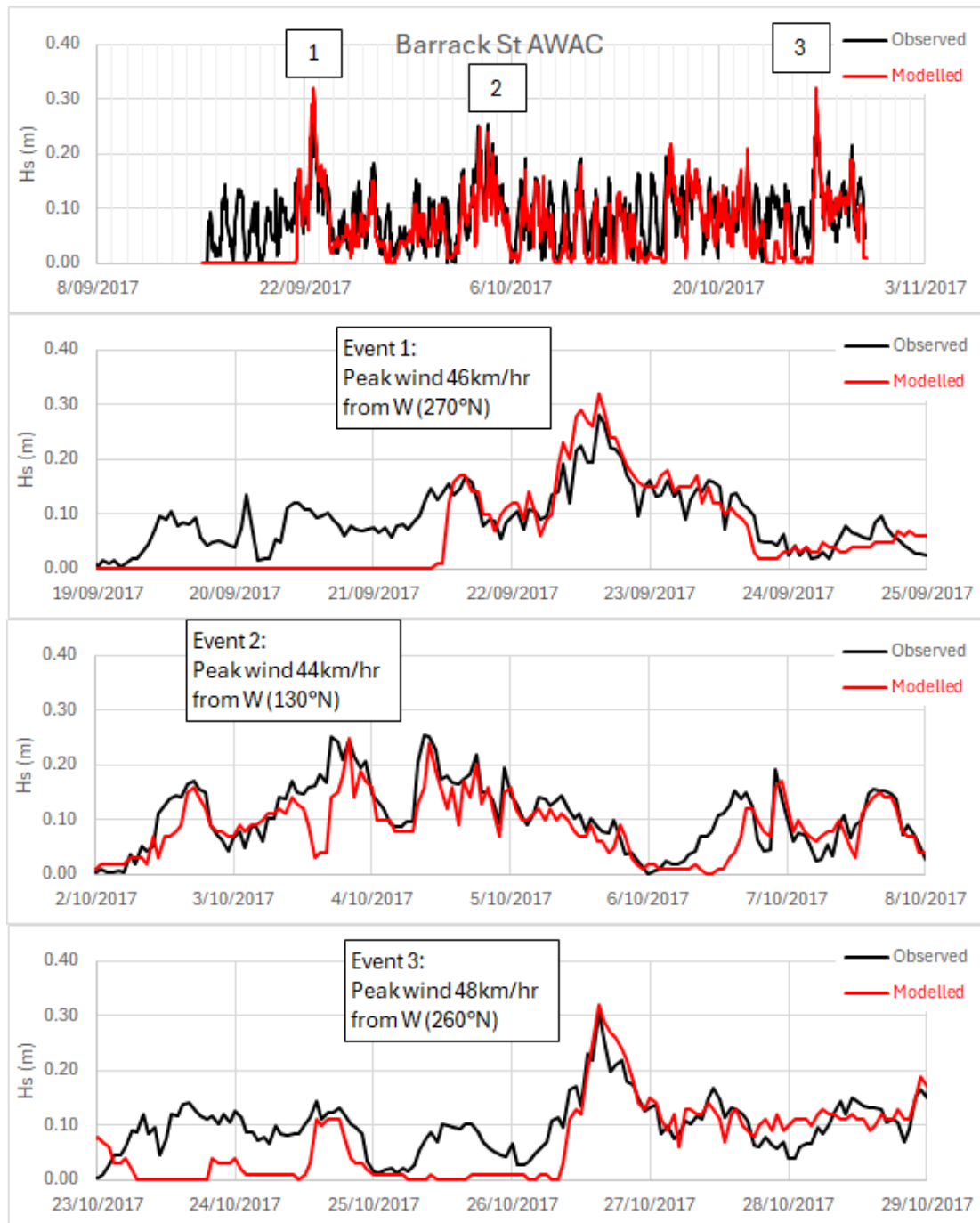


Figure A-7: Timeseries of observed and modelled Hs at Barrack St AWAC (V5)



Maximum wave heights and directions during each validation run illustrate the spatially varying wave patterns across the model domain (Figure A-8).

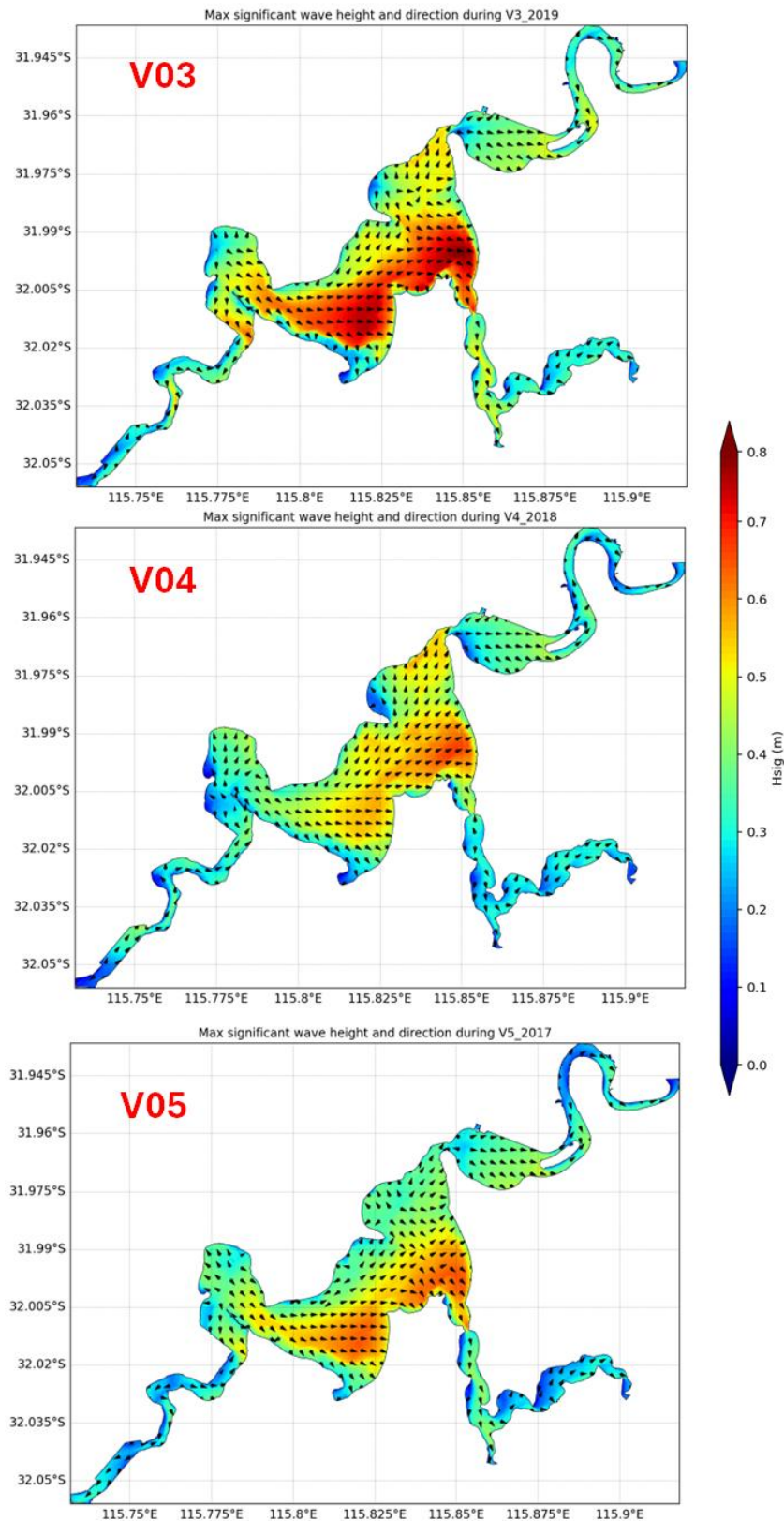
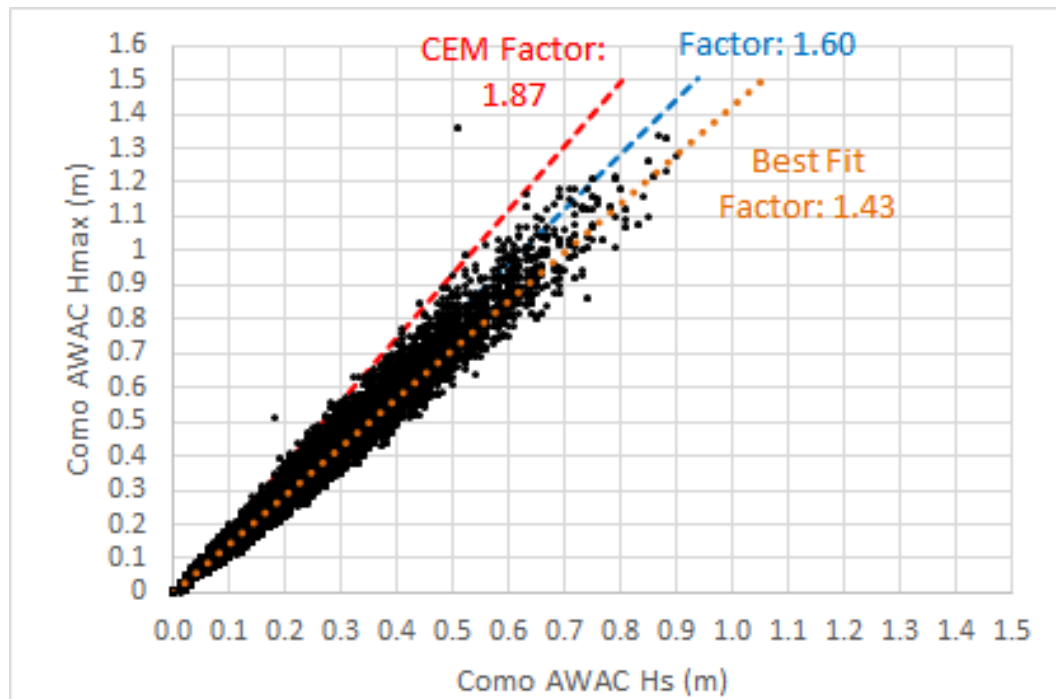


Figure A-8: Maximum Hs and corresponding directions during the three validation periods



Appendix B Observed Hmax/Hs Observations from Como AWAC



Note: Factor of 1.87 specified in the *Coastal Engineering Manual* (USACE 2006) is generally conservative for fetch-limited settings.

Appendix C Directional Extreme Non-Cyclonic Winds

A recommended design wind climate for non-cyclonic wind-wave generation in the lower estuary has been previously derived in Seashore Engineering (2025) using Melville Water for winds from NNE to SW (clockwise) and Swanbourne for winds from SW to NNE (Figure A-28).

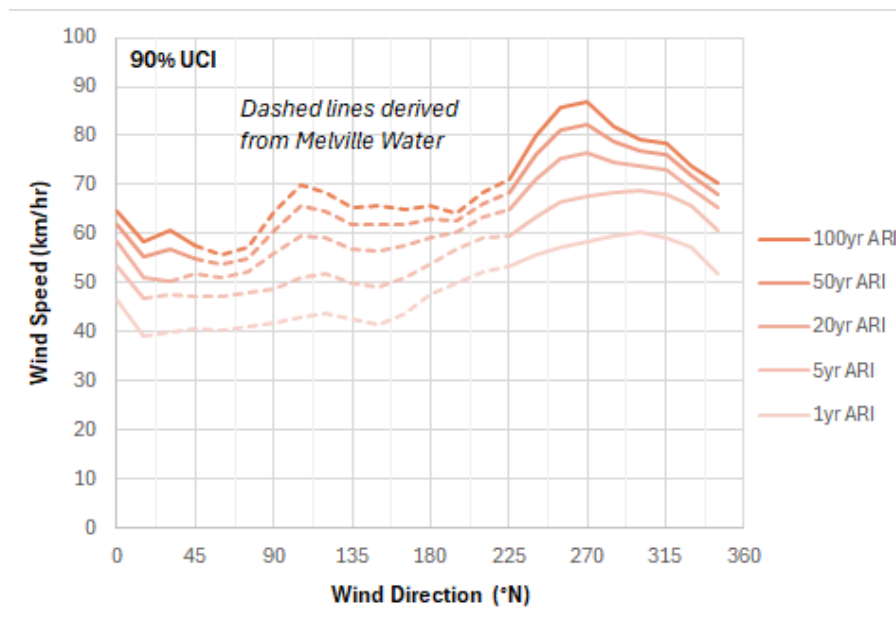
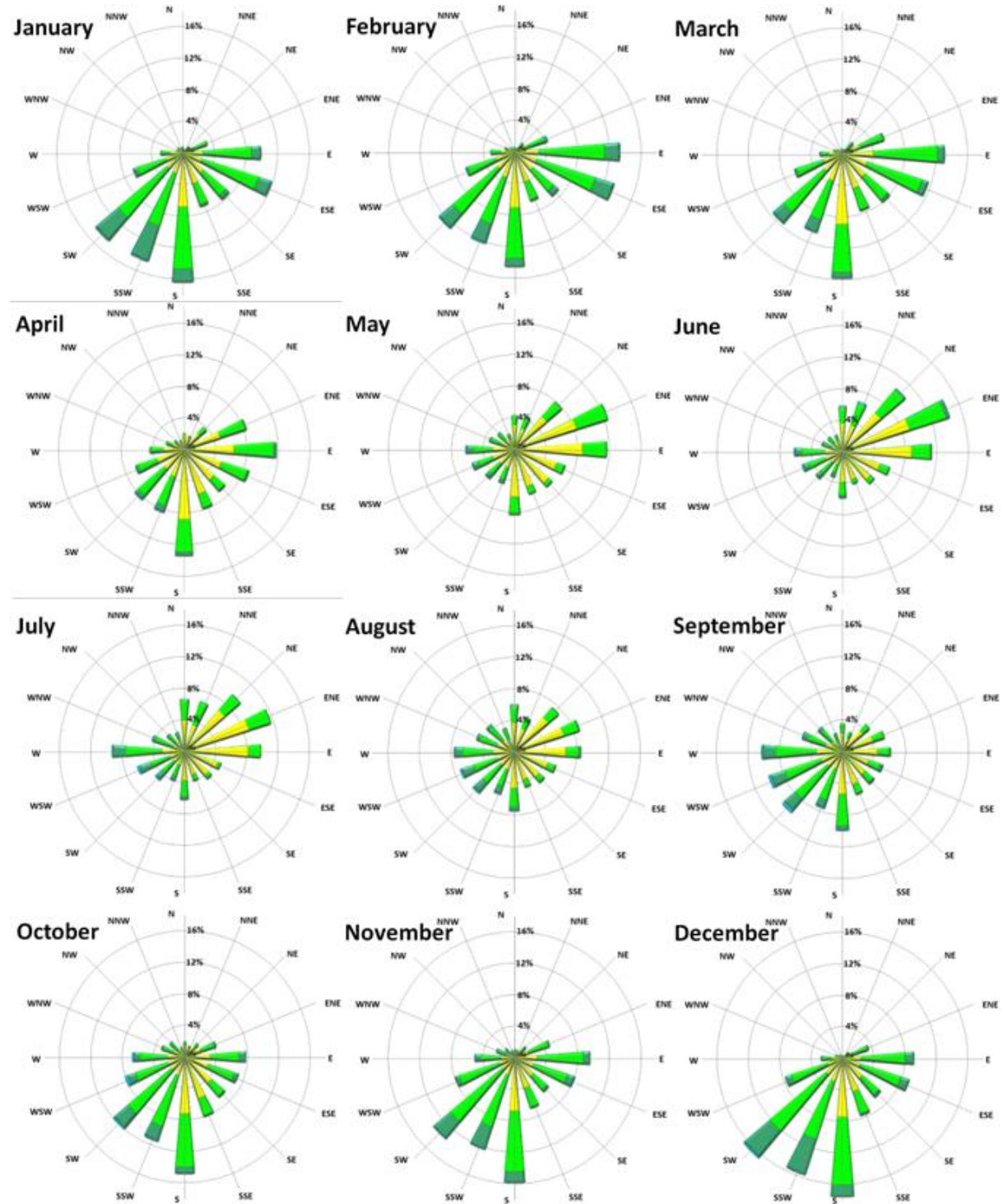


Figure A-9: Recommended Design Directional Wind Speeds for Non-Cyclonic Conditions

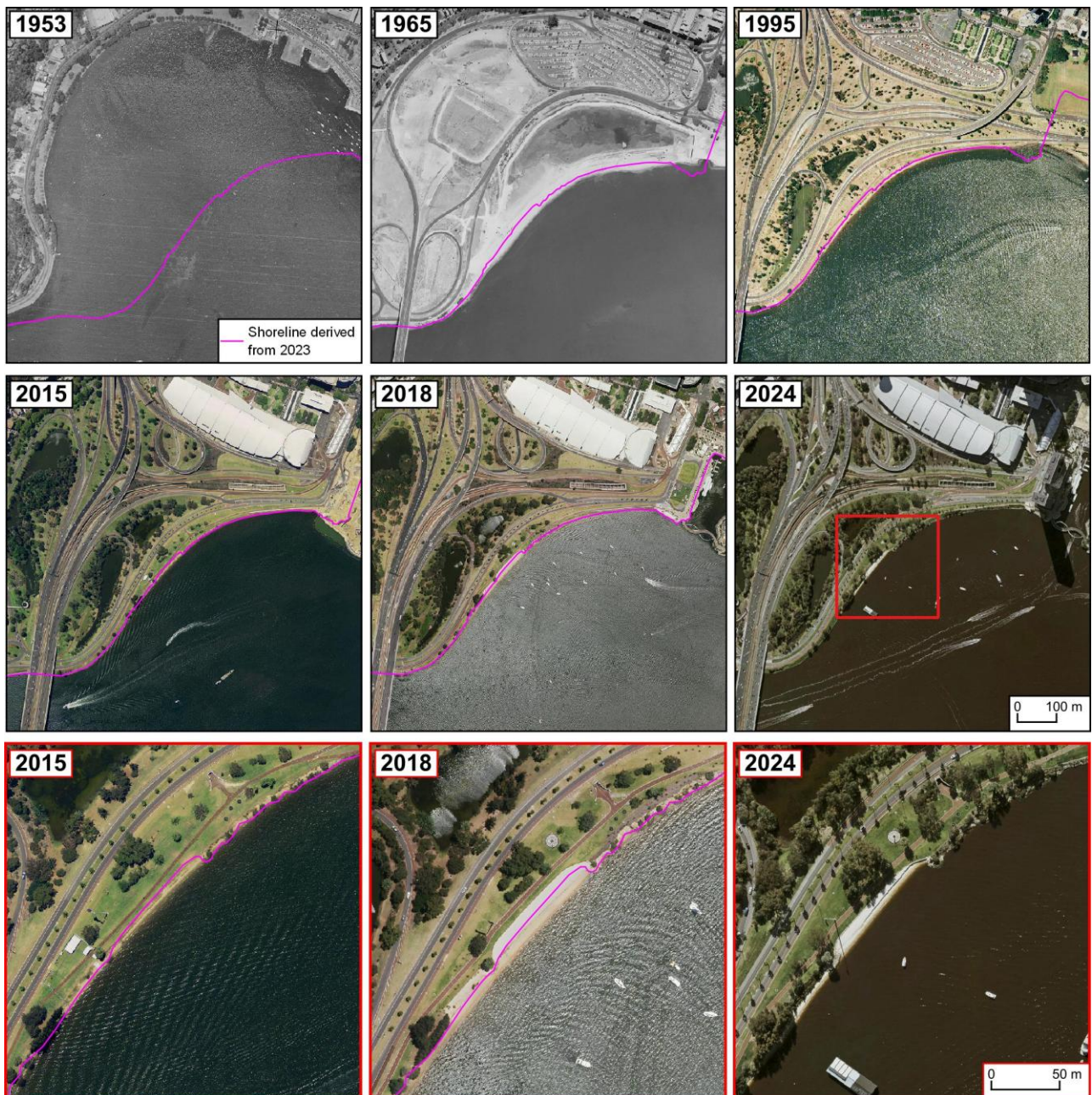


Appendix D Monthly Wind Roses – BoM Melville Water Station



Appendix E Historic Aerial Imagery

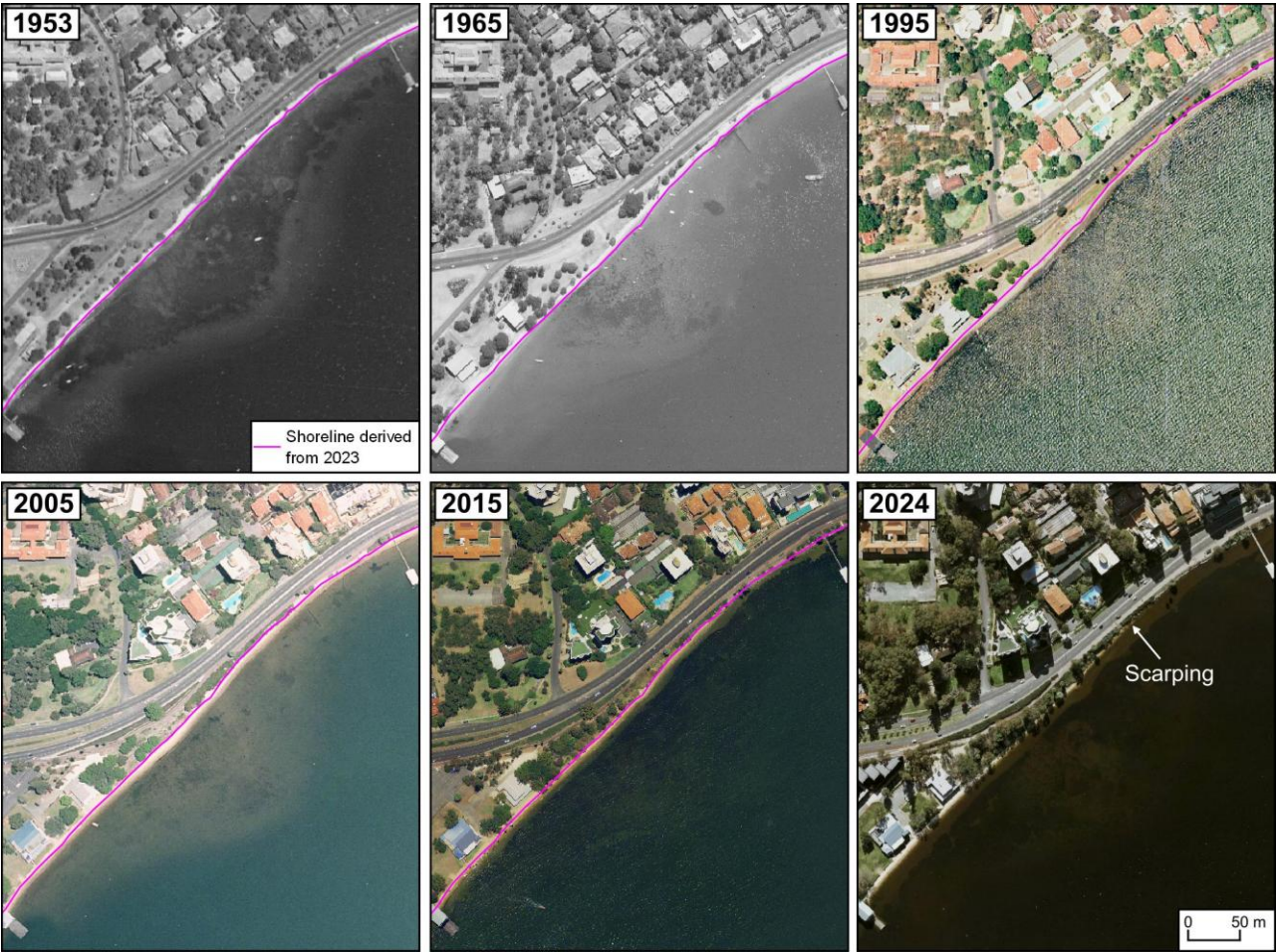
APPENDIX E.1 PERTH FORESHORE



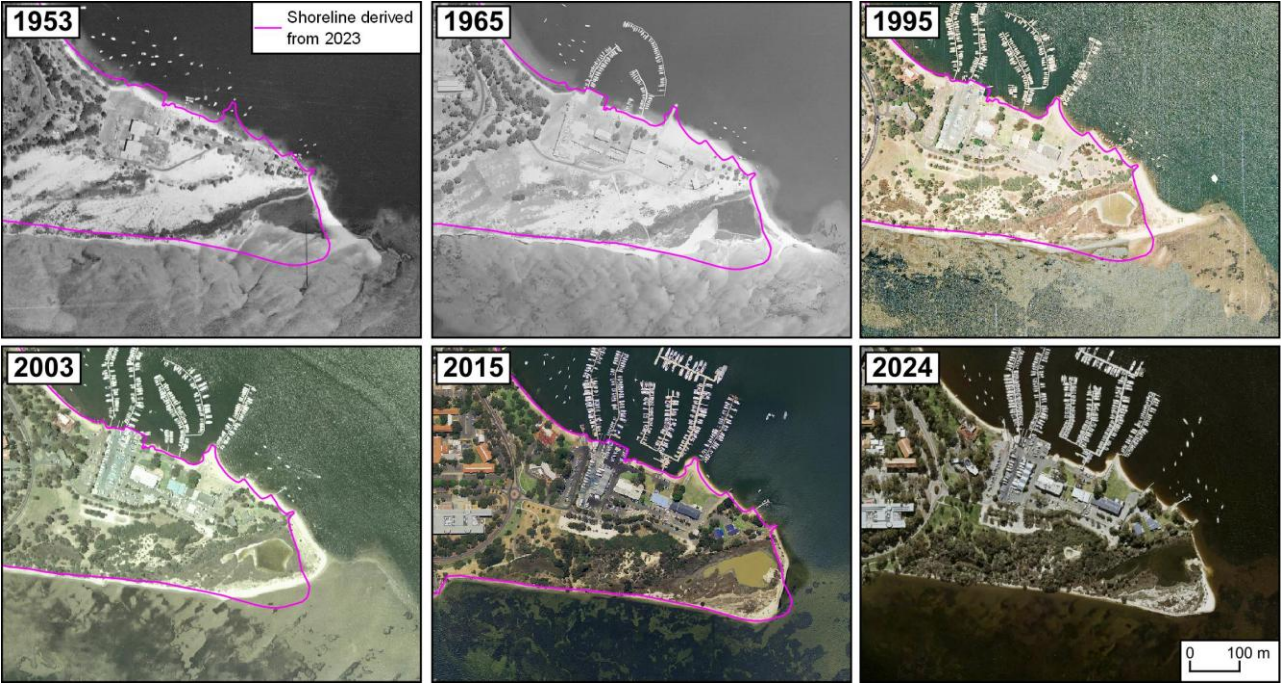
APPENDIX E.2 MILL POINT RESERVE



APPENDIX E.3 NORTHERN MATILDA BAY



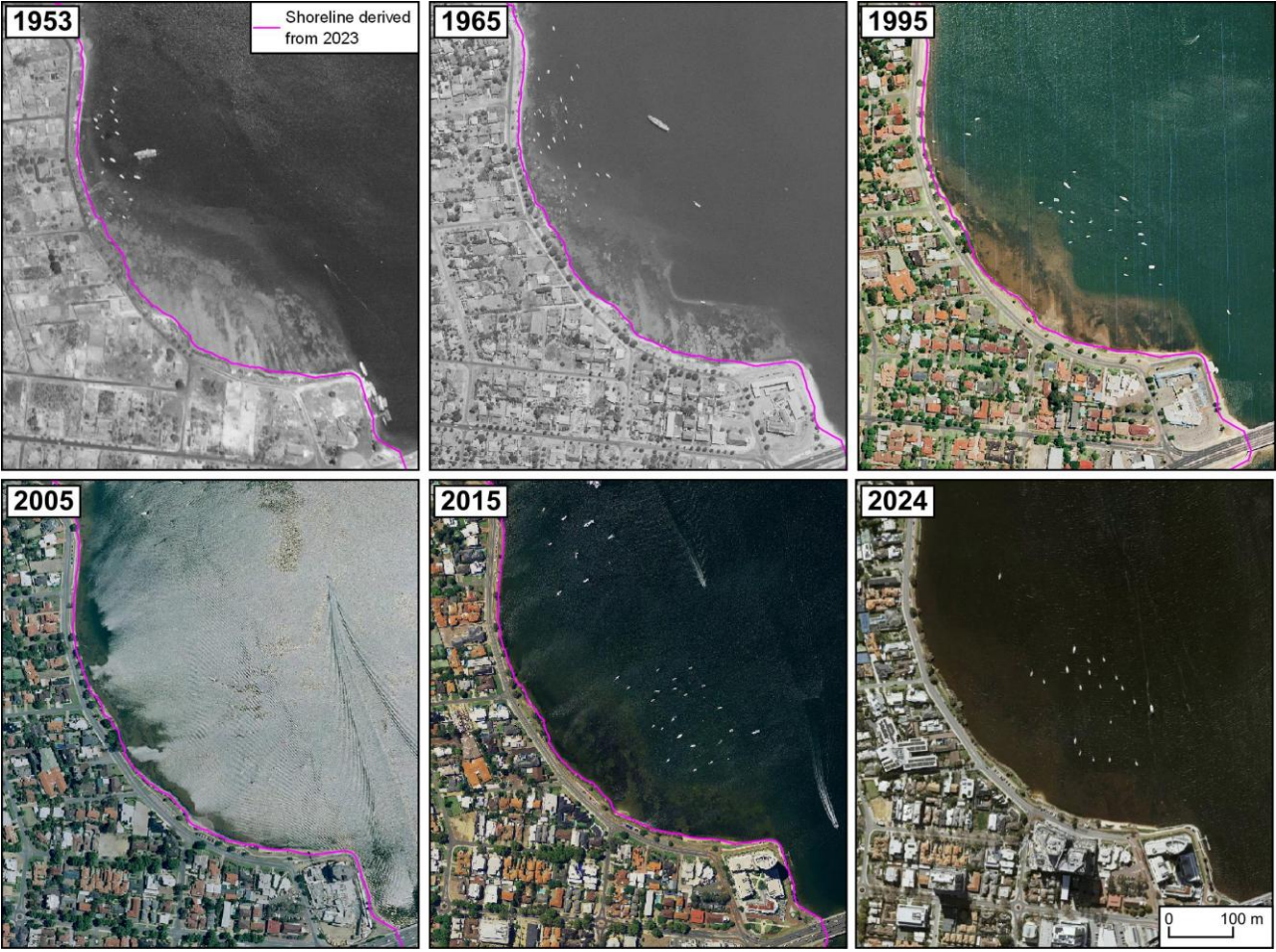
APPENDIX E.4 PELICAN POINT



APPENDIX E.5 SOUTH COMO FORESHORE



APPENDIX E.6 APPROACH TO APPLECROSS TERMINAL



Appendix J Operational Noise Assessment

Ferry Operations Development Application

METRONET on Swan Ferry Service Expansion

Public Transport Authority of Western Australia

SLR Project No.: 675.V25085.00EA1

21 August 2026



Metronet on Swan Ferry Service Expansion

Operational Noise Assessment

Public Transport Authority

Public Transport Centre
Perth WA 6000

Prepared by:

SLR Consulting Australia Pty Ltd

SLR Report 675.V11323.11411

31 July 2026

Revision: 1

Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
1	31 July 2026	Louisa Cheung	Luke Zoontjens	Luke Zoontjens
0	16 July 2026	Louisa Cheung	Luke Zoontjens	Luke Zoontjens

Basis of Report

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Public Transport Authority (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid. SLR may have used artificial intelligence (AI) in the preparation of this document. Should SLR use AI, any information and analysis resulting therefrom will be reviewed for accuracy.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.



Executive Summary

The Public Transport Authority (PTA) is proposing to expand the ferry service for the Swan River area, as part of the State Government's METRONET on Swan Ferry Service Expansion (MOSFSE). The MOSFSE includes the procurement of five (5) new electric ferries which will be operated by Transperth on the expanded route between terminals at Matilda Bay, Applecross and Elizabeth Quay, with overnight berthing occurring at the Barrack Square Jetties and the Matilda Bay terminal.

This document presents assessments of the potential noise and vibration impacts from operation of the project on nearby terrestrial and marine environments.

Marine

Aquatic sensitive receptors of concern include marine mammals, particularly Swan River Dolphins (i.e. Indo-Pacific bottlenose dolphins), fish species and human divers/swimmers. Noise impact criteria in terms of physiological and behavioural impacts for these sensitive receptors have been established via a review of the literature.

Detailed modelling has been undertaken for noise emissions from ferry operations. To inform environmental management measures, various zones of impact have been estimated, based on comparisons between predicted noise levels and impact assessment criteria.

Terrestrial

Airborne noise and ground vibration effects from operation of the project have been addressed.

During operations, ferries on the river is not predicted to generate significant levels of airborne noise emission that could reasonably impact surrounding terrestrial areas. The only significant source of noise assessable under state noise regulations in a charging infrastructure located at Matilda Bay. This has already been assessed in SLR's previous report (dated 25 July 2025, SLR's reference: 675.11323.11380-R01_SwanRiverFerry-NoiseAssessment_Rev1_20250725) and is not relevant to the current proposal for on-water ferry operations.



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1.0 Introduction

1.1 Project background

The Public Transport Authority (PTA) is proposing a ferry service expansion for the Swan River area as part of the State Government's METRONET on Swan Ferry Service Expansion (MOSFSE). The MOSFSE includes the procurement of five (5) new electric ferries which will be operated by Transperth on the expanded route between terminals at Matilda Bay, Applecross and Elizabeth Quay, with overnight berthing occurring at the Barrack Square Jetties and the Matilda Bay terminal.

For the operational phase, SLR Consulting Australia Pty Ltd (SLR) was engaged to:

- Undertake aquatic noise modelling and impact assessment on marine fauna species and human divers/swimmers.
- Predict and assess airborne noise.
- Review ground vibration risks.

to support a development application for this project.

This report has been prepared to accompany a planning submission under Part 5 of the Swan and Canning Rivers Management Act 2006, and specifically addresses the potential operational noise emissions associated with the proposed development once constructed and in use.

Development application for three(3) new ferry terminals at Matilda Bay, Applecross and Elizabeth Quay have recently been approved by the Western Australian Planning Commission (WAPC) and Development WA. As such, this assessment does not address any works or land-side operations and is for the river ferry operations only.

2.0 Underwater noise assessments

2.1 Background

2.1.1 Introduction to Underwater Noise Concepts

Sound is a form of energy made by vibrations. When an object vibrates, it causes the fluid particles around it to move. These particles collide with nearby particles, and this continues until they run out of energy.

In underwater acoustics, the word sound is used to describe all the pressure waves that are generated in an underwater medium. Sound waves propagate as alternate phases of compression and rarefaction.

There are two types of sound waves considered here: transverse and longitudinal. Sound typically propagates from a source as a longitudinal wave, where particle vibrations occur parallel to the direction of wave travel. In contrast, transverse waves involve particle motion that is perpendicular to the direction of wave propagation. While longitudinal waves are the primary mode for sound in fluids such as air and water, transverse waves can occur in solids, such as through the seabed or structural materials. Wavelength is the spatial distance between two successive peaks in a propagation wave; sound frequency is the number of waves passing through a fixed point per second.

Sound levels are typically reported in units of decibels (dB). The decibel is defined as a ratio of measured acoustic intensity and a reference intensity level and is expressed in a



logarithmic scale. However, the sound is often measured as pressure rather than directly as intensity.

The sound pressure level (SPL) indicates the amplitude level of sound at a specific location in space and is a scalar quantity. The level is dependent on the location and distance the sound is observed relative to a sound source. Sound pressure is measured in Pascals but can be computed in decibels. A standard reference pressure is used to compare sound levels given in decibels to one another. In underwater acoustics, the traditional standard reference pressure is 1 micro-Pascal (μPa), leading to the use of the unit dB re 1 μPa , which represents a decibel referenced to a pressure of 1 μPa .

Measurement type refers to how the pressure was measured:

- Peak SPL (Pk SPL) measurements simply measure the signal's maximum amplitude without considering time.
- Root-mean-square SPL (RMS SPL) measures are essentially an average intensity over a given amount of time.
- Sound exposure level (SEL) is a measurement type that is applied to impulsive signals such as piling or seismic pulses to determine their effect on marine fauna. It is the integration of sound energy produced from a source, normalized to the level necessary to produce that amount of energy in a single second. These values are reported with units of dB re 1 $\mu\text{Pa}^2\cdot\text{s}$ and can represent the energy accumulated over a given time period (i.e., 24 hours).

Spectral analyses display of the frequency content of a sound signal. It shows how sound level varies with frequency. Spectra are typically presented in third-octave bands (1/3-octave), which measure the sound level in frequency bands that widen exponentially with increasing frequency and are evenly spaced on a logarithmic frequency axis. In underwater acoustics, this is used to approximate the bandwidths of the marine mammals' fish' and turtles' auditory systems.

2.1.2 Major aquatic noise generating activities and sensitive receptors

Major activities in regard to aquatic noise emissions during operation are ferry movements associated with the new proposed routes.

The sensitive aquatic receptors that are potentially to be adversely affected by noise emissions from the construction and operation activities include marine mammals particularly Swan River Dolphins (i.e. Indo-Pacific Bottlenose Dolphins), fish species and human divers/swimmers.

2.1.3 General aquatic ambient noise

Ambient underwater noise forms the background sound environment that marine animals experience. The level and frequency content of this background noise influences how easily animals can detect and interpret important sounds such as communication calls, prey movements and navigation cues (Richardson et al, 1995). It is comprised of a variety of sounds of different origin at different frequency ranges, having both temporal and spatial variations. It primarily consists of noise from natural physical events, noise produced by marine biological species and anthropogenic noise. These sources are detailed as follows:

- Natural events: the major natural physical events contributing to aquatic ambient noise include, but are not limited to, wave/turbulence interactions, wind, precipitation (rain and hail), breaking waves and seismic events (e.g., earthquakes/tremors):
 - The interactions between waves/turbulence can cause very low frequency noise in the infrasonic range (below 20 Hz). Seismic events such as



- earthquakes/tremors and underwater volcanos also generate noise predominantly at low frequencies from a few Hz to a few hundred Hz.
- Wind and breaking waves, as the prevailing noise sources in much of the world's oceans, generate noise across a very wide frequency range, typically dominating the ambient environment from 100 Hz to 20 kHz in the absence of biological noise sources. The wind-dependent noise spectral levels also strongly depend on sea states which are essentially correlated with wind force.
 - Precipitation, particularly heavy rainfall, can produce much higher noise levels over a wider frequency range of approximately 500 Hz to 20 kHz.
 - Bioacoustic production: some marine animals produce various sounds (e.g., whistles, clicks) for different purposes (e.g., communication, navigation or detection):
 - Marine mammals. Baleen whales (e.g., great whales like humpback whales) regularly produce intense low-frequency sound (whale songs) that can be detected at long range in the open water. Odontocete whales, including dolphins, can produce rapid burst of high-frequency clicks (up to 150 kHz) that are primarily for echolocation purposes.
 - Fish. Some fish species produce sounds individually, and some species also make noise in choruses. Typically, fish chorusing sounds depend on species, time of day and time of season.
 - Invertebrates. Snapping shrimps are important contributors among marine biological species to the aquatic ambient noise environment, particularly in shallow coastal waters. The noise from snapping shrimps is extremely broadband in nature, covering a frequency range from below 100 Hz to above 100 kHz. Snapping shrimp noise can interfere with other measurement and recording exercises, for example it can adversely affect sonar performance.
 - Anthropogenic sources: anthropogenic noise primarily consists of noise from shipping or ferrying activities, offshore seismic explorations, marine industrial developments and operations, as well as equipment such as sonar and echo sounders:
 - Shipping traffic from various sizes of ships is the prevailing man-made noise source around nearshore port areas. Shipping noise is typically due to cavitation from propellers and thrusters, with energy predominantly below 1 kHz.
 - Pile driving and offshore seismic exploration generate repetitive pulse signals with intense energy at relatively low frequencies (hundreds of Hz) that can potentially cause physical injuries to marine species close to the noise source. The full frequency range for these impulsive signals could be up to 10k Hz.
 - Dredging activities and other marine industry operations are additional man-made sources, generating broadband noise over relatively long durations.

Figure 1 provides an overview of the indicative noise spectral levels produced by various natural and anthropogenic sources, relative to typical background or ambient noise levels in the ocean. Human contributions to ambient noise are often significant at low frequencies, between about 20 Hz and 500 Hz, with ambient noise in this frequency range being predominantly from distant shipping (Hildebrand, 2009).

In areas located away from anthropogenic sources, background noise at higher frequencies tends to be dominated by natural physical or bioacoustics sources such as rainfall, surface waves and spray, as well as fish choruses and snapping shrimp for coastal waters.



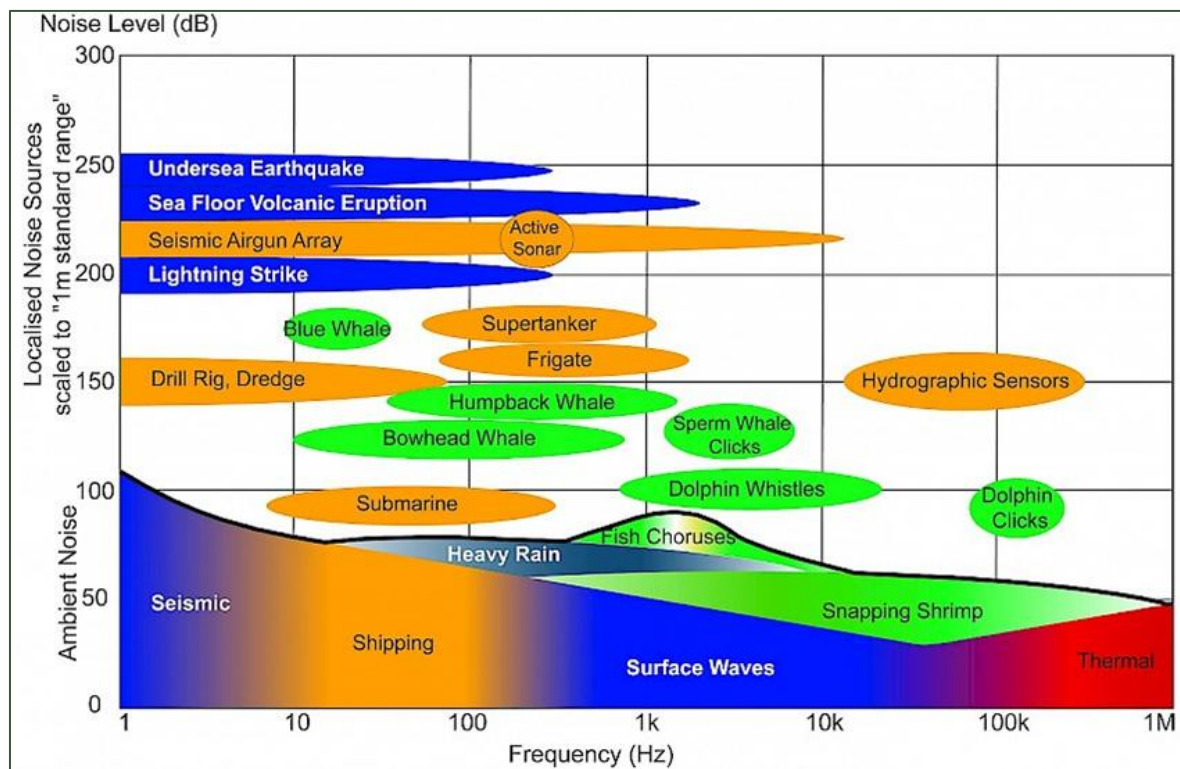


Figure 1 Levels and frequencies of anthropogenic and naturally occurring sound sources in the marine environment (from <https://www.ospar.org/work-areas/eiha/noise>). Natural physical noise sources represented in blue; marine fauna noise sources in green; human noise sources in orange

A summary of the spectra of various ambient noise sources based on a review study undertaken by Wenz (1962) is shown in **Figure 2**. It should be noted that although the spectral curves in the figure are based on average levels from reviewed references primarily for the North Atlantic Ocean region, they are regarded as representative in general for respective ocean ambient noise spectral components.



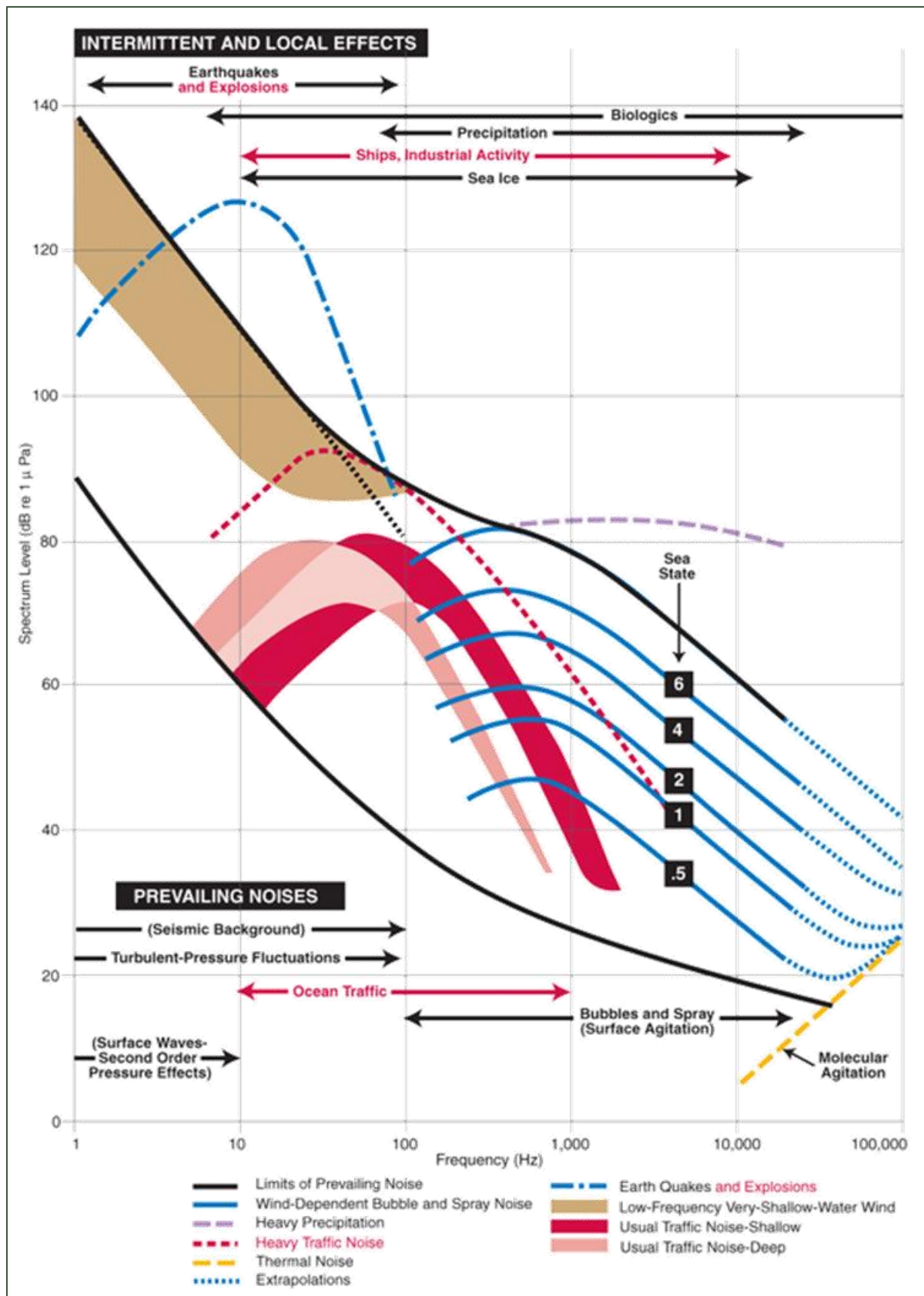


Figure 2 Wenz curves: spectra and frequency distribution of ocean ambient noise spectra (Miksis-Olds et al., 2013, reproduction from Wenz (1962))



Studies in Australian waters have shown that there are some significant differences in the ambient noise compared to the colder Northern Hemisphere waters where most existing measurements have been recorded. **Figure 3** summarises the main components of sea ambient noise for the Australian waters, where the differences from Wenz's ambient noise spectra are due to the different environment of tropical waters, particularly in respect to noise from marine animals. Wind-generated noise and the traffic noise due to ship movements are generally consistent in level range between the two studies (Wenz, 1962 and Cato, 1997).

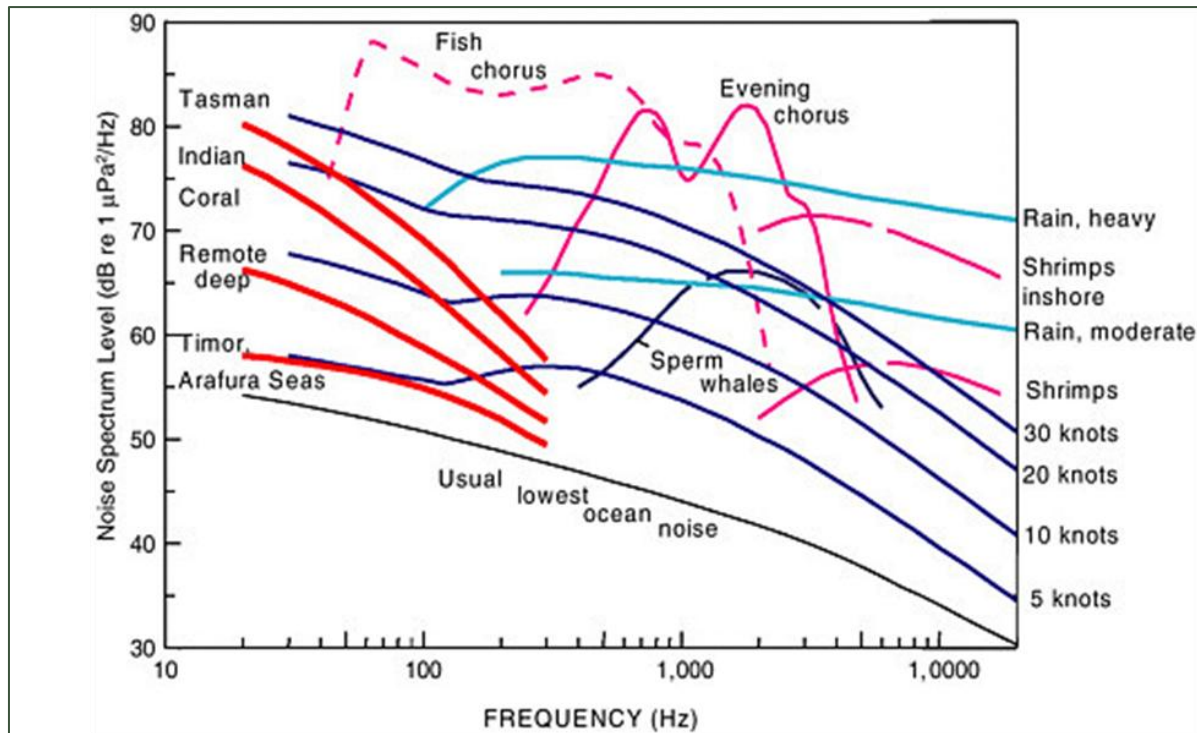


Figure 3 Summary of Aquatic Ambient Noise Spectra for the Australian Region (from Cato (1997))

2.1.4 Aquatic soundscape studies in project area

The aquatic noise environment for the middle reaches of the Swan River estuary has been well investigated based on the long-term noise monitoring studies at Narrows Bridge (Marley et al, 2016).

Soundscape analyses for the middle reach of the Swan River estuarine was undertaken based on underwater noise monitoring data over a six-week period (27th November to 4th January 2014) (Marley et al, 2016). The noise monitoring logger was deployed near the Narrows Bridge and adjacent to the ferry channels as shown in **Figure 4**.

The study found that the soundscape at the monitoring site comprised of natural events (waves, precipitation), anthropogenic noise (bridge traffic, machinery) and biological sources (fish, snapping shrimps and dolphins), and was strongly influenced by vessel traffic at relatively low frequency range (below 200 Hz) and particularly snapping shrimp clicks at very wide high frequency range (above 1 kHz). **Figure 5** presents an example spectrogram of the monitoring noise recording over a week period.

The noise level variation over the entire 6-week monitoring period, as shown in **Figure 6**, indicates that the overall noise levels are quite consistent over time at around 120 dB re



1uPa RMS. This is due to the dominant and consistent noise contributions from snapping shrimp clicks.



Figure 4 Long-term noise monitoring logger location near the Narrows Bridge

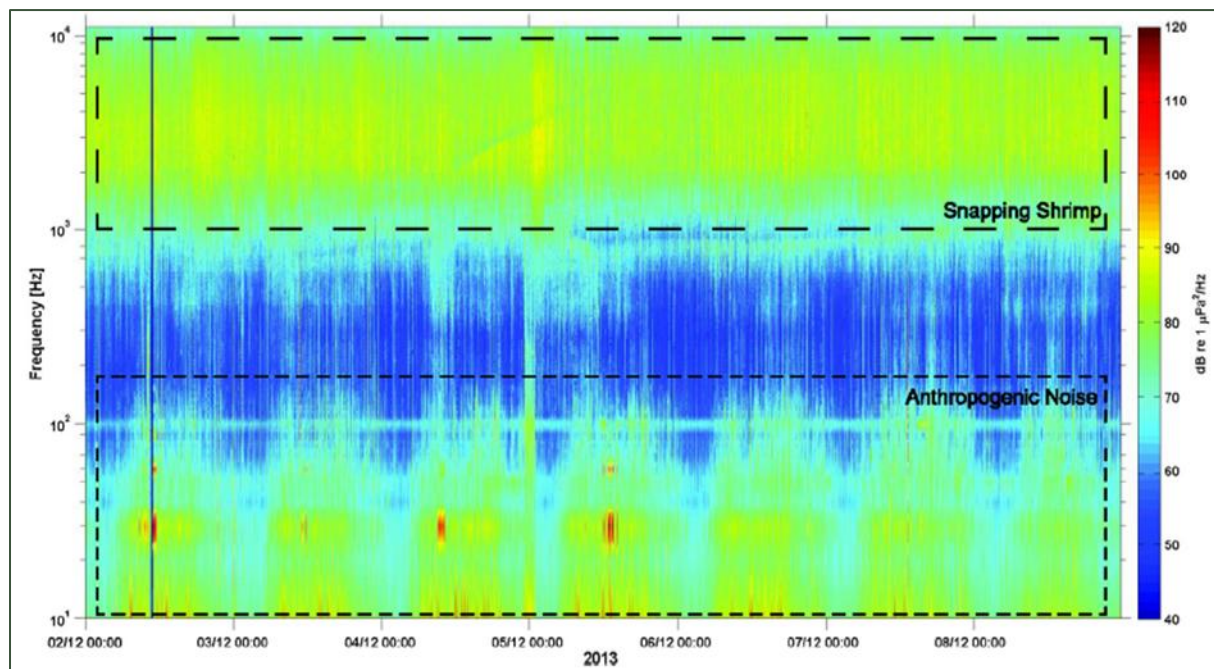


Figure 5 Spectrogram of underwater noise recorded over a week in December 2013, showing prominent anthropogenic noise sources at low frequency range, as well as snapping shrimps over higher frequency range



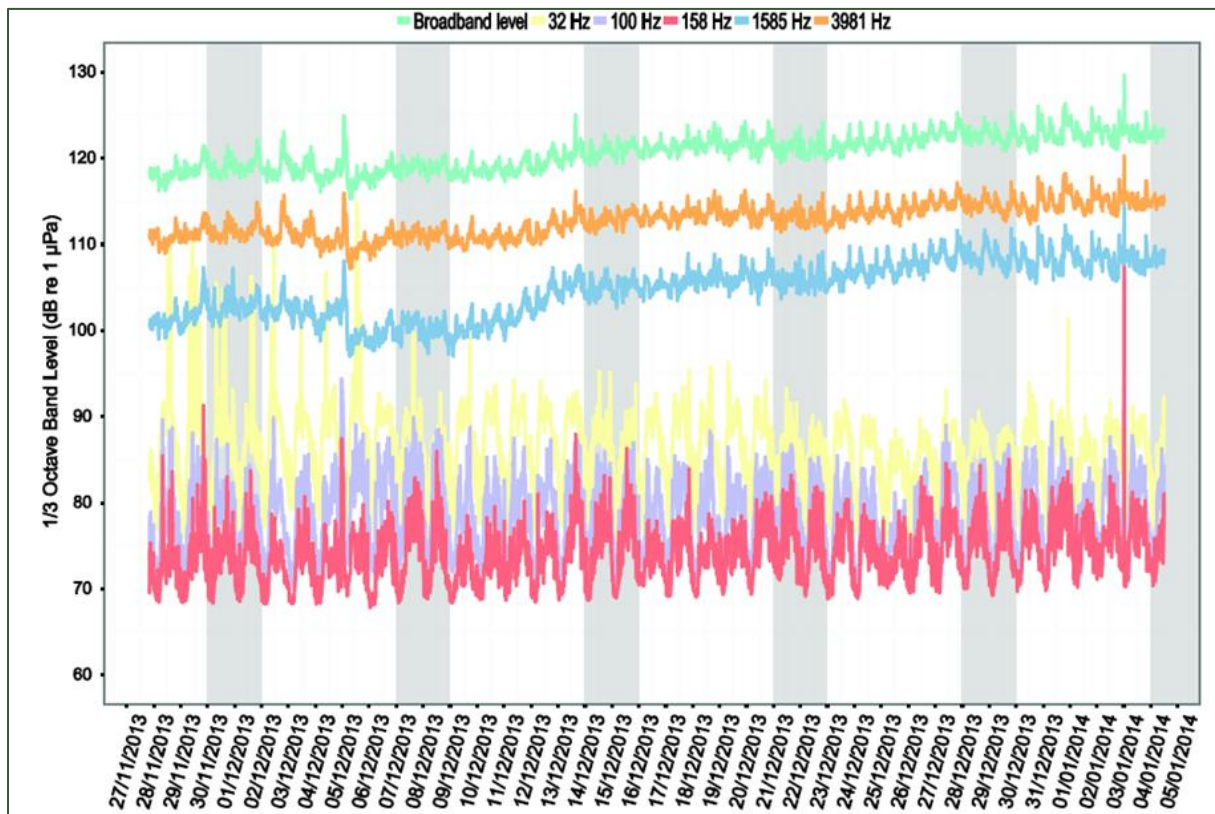


Figure 6 Recorded noise level variation in broadband (9 Hz to 9 kHz) and selected 1/3 octave band across the six-week monitoring period at Narrows Bridge

2.2 Aquatic noise impact assessment criteria

2.2.1 Impact of aquatic noise on marine fauna species

Underwater sound transmits effectively within the water column and is an important sensory modality for many marine organisms. A variety of marine fauna species, including marine mammals, fish species and invertebrates, have special mechanisms both for emitting and detecting underwater sound (Richardson et al, 1995; Popper et al, 2001 and 2003).

Marine mammals, including cetaceans and pinnipeds, use underwater sound in communication, orientation, predator avoidance and foraging (Tyack, 1998; Tyack et al, 2000; Janik, 2005). Many marine fish species produce sounds for communication (Fay and Popper, 1999; Popper et al, 2003 and 2004; Ladich et al, 2004 and 2006(a)&(b)), and potentially they also use acoustic environment for orientation (Montgomery et al, 2006). Some invertebrates such as decapod crustaceans are reported to be sensitive to low frequency underwater sound (Popper et al, 2001).

The impact of underwater noise depends on the type and level of noise produced, how sound travels through the environment, and how sensitive different marine species are to that noise. These factors also influence how far from the source any effects may occur.

The potential impacts of noise on marine fauna species include audibility, detection and masking of communication and other biological important sounds, behavioural responses and physiological impacts which generally include discomfort, hearing loss, physical injury and mortality (Richardson et al, 1995; Hasting and Popper, 2005).

The theoretical zones of noise influence based on the severity of noise impact is illustrated in **Figure 7** below.



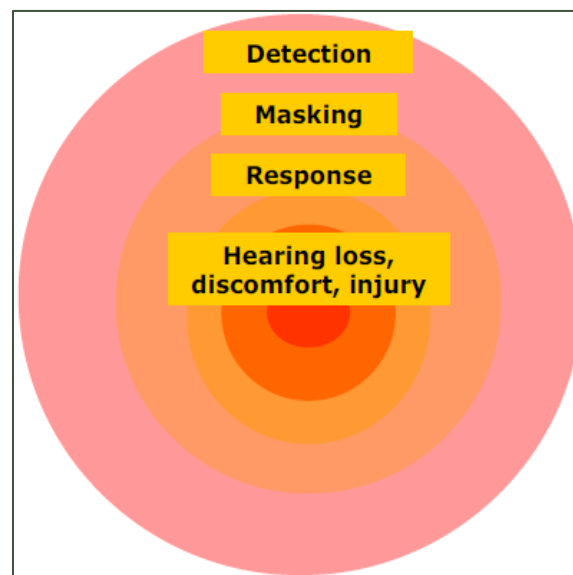


Figure 7 Theoretical zones of noise influence (Richardson et al. 1995)

2.2.1.1 Audibility/detection

A sound is considered audible when it can be heard above the surrounding background noise. Different species hear better at some frequencies than others, meaning their ability to detect a sound depends on both its loudness and frequency. The frequency dependant hearing sensitivity is expressed in the form of a hearing curve (i.e. audiogram). In general, marine mammals and fish species usually have U-shaped audiograms, meaning that within their respective hearing ranges, they are more sensitive to the sound energy component in the mid frequency range, and less sensitive to the energy components in the lower and upper frequency ranges (Whitlow et al, 2008; Southall et al, 2007; Popper et al, 2014).

For fish species, their sound detection is based on the response of the auditory portion of their ears (i.e. the otolithic organs) to particle motion of the surrounding fluid (Popper et al, 2014). Some fish species have the ability to detect sound pressure via gas-filled structures near the ear and/or extensions of the swim bladder that functionally affect the ear, in addition to purely the fluid particle motion, which as a result increase hearing sensitivity and broaden the hearing bandwidth (Popper et al, 2014).

2.2.1.2 Masking

Masking occurs when background noise makes it more difficult for an animal to hear important sounds, such as communication calls, navigation signals or prey movements. The likelihood of masking depends on both the noise source and existing background noise levels. The zone of masking is defined by the range at which sound levels from the noise source are received above threshold within the 'critical band'¹ centred on the signal (Richardson et al. 1995; NRC 2003), and therefore strongly dependent on background noise environment.

The potential for masking can be reduced due to an animal's frequency and temporal discrimination ability, directional hearing, co-modulation masking release (if noise is amplitude modulated over a number of frequency bands) and multiple looks (if the noise has

¹ In biological hearing systems, noise is integrated over several frequency filters, called the critical bands.



gaps or the signal is repetitive), as well as anti-masking strategies (increasing call level, shifting frequency, repetition, etc.) (Erbe, 2008).

2.2.1.3 Behavioural responses

Behavioural responses to noise include changes in vocalisation, resting, diving and breathing patterns, changes in mother-infant relationships, and avoidance of the noise sources. For behavioural responses to occur, a sound would mostly have to be significantly above ambient levels and the animal's audiogram.

Behavioural responses vary between species and individuals. Reactions can range from minor changes in behaviour through to avoidance of an area, depending on factors such as the type of sound, its level, and the animal's activity at the time of exposure. Therefore, the extent of behavioural disturbance for any given signal can vary both within a population as well as within the same individual. Behavioural reactions can vary significantly, ranging from very subtle changes in behaviour to strong avoidance reactions (Richardson et al, 1995).

2.2.1.4 Physiological impacts / hearing loss and physical injury

Physiological effects of underwater noise are primarily associated with the auditory system which is likely to be most sensitive to noise. The exposure of the auditory system to a high level of noise for a specific duration can cause a reduction in the animal's hearing sensitivity, or an increase in hearing threshold. If the noise exposure is below some critical sound energy level, the hearing loss is generally only temporary, and this effect is called temporary hearing threshold shift (TTS). If the noise exposure exceeds the critical sound energy level, the hearing loss can be permanent, and this effect is called permanent hearing threshold shift (PTS).

In a broader sense, physiological impacts also include non-auditory physiological effects. Other physiological systems of marine animals potentially affected by noise include the vestibular system, reproductive system, nervous system, liver or organs with high levels of dissolved gas concentrations and gas filled spaces. Noise at high levels may cause concussive effects, physical damage to tissues and organs, cavitation or result in rapid formation of bubbles in venous system due to massive oscillations of pressure.

From an adverse impact assessment perspective, among the potential noise impacts above, physiological impacts are deemed as the primary adverse impact, and behavioural responses as the secondary adverse impact. The following sub-sections outline the corresponding impact assessment criteria for marine mammals and fish and sea turtle species, as well as human divers and swimmers, based on a review of relevant guidelines and/or literature published.

2.2.2 Marine mammals

There have been extensive scientific studies and research efforts to develop quantitative links between marine noise and impacts on marine mammal species. For example, Southall et al (2007 & 2019) have proposed noise exposure criteria associated with various sound types, including impulsive² and non-impulsive³ noise for certain marine mammal species (i.e.

² Impulsive noise is typically very short (with seconds) and intermittent with rapid time and decay back to ambient levels. E.g. noise from pile driving, seismic airguns and seabed survey sonar signals.

³ Non-impulsive or continuous noise refers to a noise event with pressure level remains above ambient levels during an extended period of time (minutes to hours), but varies in intensity with time. E.g. noise from marine vessels.



cetaceans and sirenians and carnivores), based on review of expanding literature on marine mammal hearing and on physiological and behavioural responses to anthropogenic sounds.

The following subsections provide the recommended frequency-weighting functions for use in assessing the effects of relatively intense sounds on hearing, as well as the noise exposure levels above which adverse effects on various groups of marine mammals, and they are derived based on all available relevant data and published literature.

In this study, the Swan-Canning River system is home to a small resident community of Indo-Pacific bottlenose dolphins (*Tursiops aduncus*), plus juveniles and calves (Chabanne et al., 2012; SRT, 2015). The spatial and temporal patterns of dolphins' occurrence within the river has shown that animals are distributed heterogeneously, with the Matilda Bay area being identified as a sighting 'hotspot' used for foraging and Perth Waters being the transiting area between the middle and upper reaches of the Swan River (Moiler, 2008; Marley et al, 2017). Further details on bottlenose dolphin hearing sensitivity are provided in the following subsections.

2.2.2.1 Marine mammal auditory weighting functions

Marine animals do not hear equally well at all frequencies within their functional hearing range. Based on the hearing range and sensitivities, Southall et al (2019) have categorised marine mammal species (i.e. cetaceans and pinnipeds) into six underwater hearing groups: low-frequency (LF), high-frequency (HF), very high-frequency (VHF) cetaceans, Sirenians (SI), Phocid carnivores in water (PCW) and Other marine carnivores in water (OCW). For each specific marine mammal species, *Marine Mammal Noise Exposure Criteria: Updated Scientific Recommendations for Residual Hearing Effects* (Southall et al, 2019) provides their corresponding hearing groups. A summary of these appendices is presented as **Appendix B** in this report.

The potential noise effects on animals depend on how well the animals can hear the noise. Different marine mammal species are more sensitive to some frequencies than others. Auditory weighting functions account for these differences and allow modelled noise levels to be assessed in a way that better reflects how animals actually hear sound (Southall et al, 2007 & 2019).

When developing scientific recommendations in marine mammal noise exposure criteria, Southall et al (2019) adopt the auditory weighting functions as expressed in the equation below, which are based on the quantitative method by Finneran (2015 & 2016) and are consistent with the U.S. National Oceanic and Atmospheric Administration (NOAA) technical guidance (NMFS, 2016 & 2018).

$$W(f) = C + 10 \log_{10} \left\{ \frac{(f/f_1)^{2a}}{[1 + (f/f_1)^2]^a [1 + (f/f_2)^2]^b} \right\}$$

Where:

- ***W(f)*** is the weighting function amplitude (in dB) at frequency *f* (in kHz).
- ***f*₁** represents LF transition value (in kHz), i.e., the lower frequency at which the function amplitude begins to change from the flat, central portion of the curve.
- ***f*₂** represents HF transition value (in kHz), i.e., the upper frequency at which the function amplitude begins to change from the flat, central portion of the curve.
- ***a*** represents the LF exponent value (dimensionless) which defines the rate of decline of the weighting function amplitude at low frequencies. The change in weighting function amplitude with frequency at low frequencies (the LF slope) is 20*a* dB/decade.



- ***b*** represents the HF exponent value (dimensionless) which defines the rate of decline of weighting function amplitude at high frequencies, becoming linear with the logarithm of frequency. The change in weighting function amplitude with frequency at high frequencies (the HF slope) is $-20b$ dB/decade.
- ***C*** is the constant that defines the vertical position of the curve. It is defined so that the maximum amplitude of the weighting function equals 0 dB (with all other values being negative).

An updated Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 3.0) (NMFS 2024) updated the auditory weighting parameters for LF, HF, VHF, PCW and OCW hearing groups.

Table 1 lists the updated auditory weighting parameters for the six hearing groups with corresponding auditory weighting functions for all hearing groups presented in **Figure 8**.

Table 1 Parameters for the auditory weighting functions

Marine mammal hearing group	<i>a</i>	<i>b</i>	<i>f</i> ₁ (Hz)	<i>f</i> ₂ (Hz)	<i>C</i> (dB)
Low-frequency cetaceans (LF)	0.99	5	168	26600	0.12
High-frequency cetaceans (HF)	1.55	5	1730	129000	0.32
Very high-frequency cetaceans (VHF)	2.23	5	5930	186000	0.91
Sirenians (SI)	1.8	2	4,300	25,000	2.62
Phocid carnivores in water (PCW)	1.63	5	810	68300	0.75
Other marine carnivores in water (OCW)	1.58	5	2530	43800	1.37

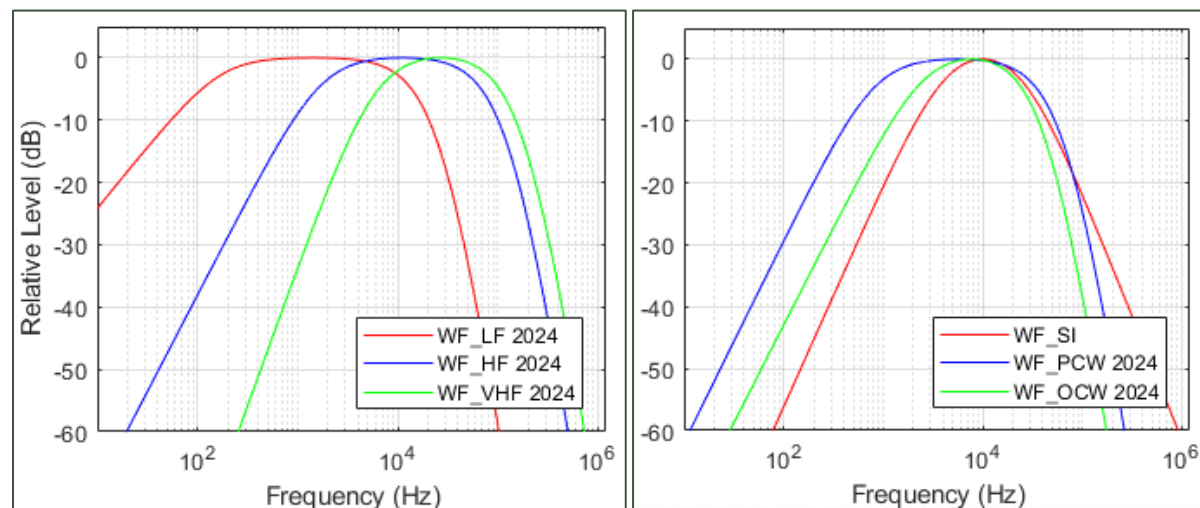


Figure 8 Auditory weighting functions - LF, HF, VHF, SI, PCW and OCW

The auditory weighting functions are applied to weighted sound exposure levels (SEL_w) to calculate the cumulative exposure levels.

2.2.2.2 Hearing thresholds

The auditory sensitivities of bottlenose dolphins are greatest at very high frequencies (15 – 130 kHz), where the hearing threshold is in the range 40 – 80 dB, as demonstrated in **Figure 9** below. Hearing is progressively less sensitive as the frequency decreases, failing to approximately 130 dB for 100 Hz sounds (Johnson, 1967). In general, bottlenose



dolphins' hearing threshold curve is broadly in line with the auditory weighting function for High-frequency (HF) cetacean hearing group as shown in **Figure 8**.

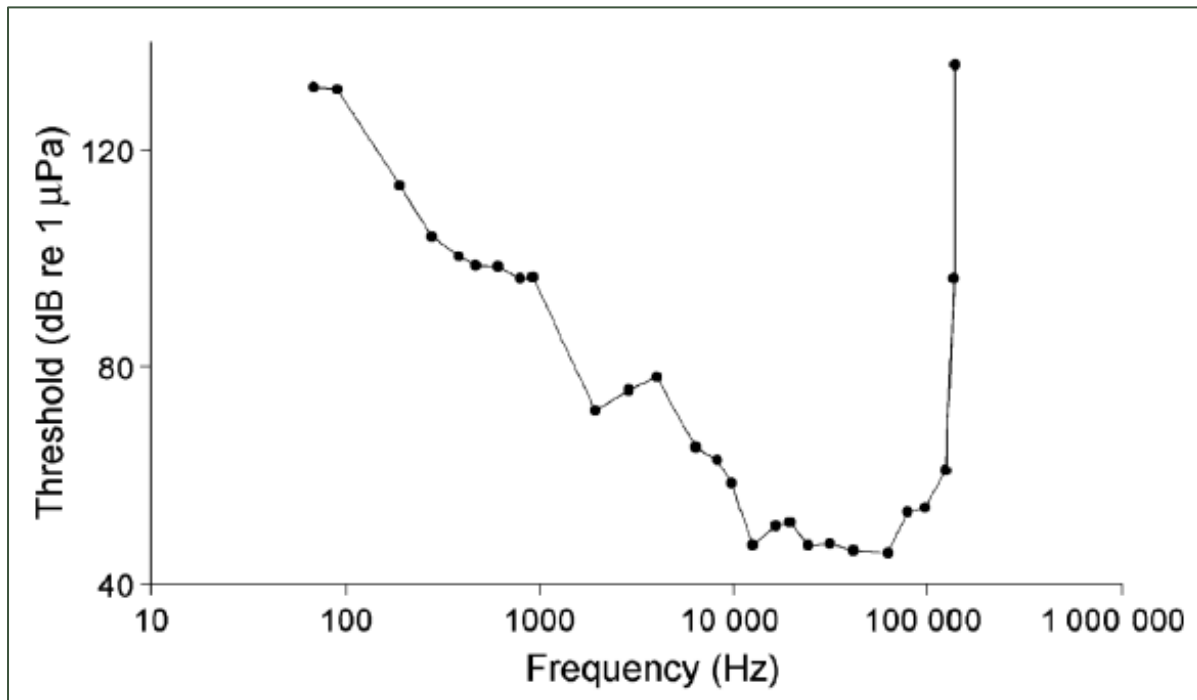


Figure 9 Hearing thresholds of a bottlenose dolphin (Johnson, 1967)

There has been limited research into detailed noise impact on Indo-Pacific bottlenose dolphin species (Southall et al, 2019). Their likely sensitivity to pile-driving and vessel traffic noise have been investigated previously (David, 2006; Marley et al, 2017), on the basis of potential noise effects on movements, behavior and vocalizations of the species, rather than more severe physiological effects. The assessment criteria for Indo-Pacific bottlenose dolphin species are based on those criteria for HF cetaceans.

Based on existing records and ecological knowledge of the Swan River estuary, this area is not known to support resident populations of low-frequency (LF) cetaceans, such as baleen whales, very high frequency (VHF) cetaceans (e.g., porpoises) or other cetacean species that fall outside the HF hearing group. However, to ensure a conservative and precautionary approach to underwater noise management, the modelled noise levels have been assessed against auditory thresholds for all hearing groups. This ensures that, should additional species be identified or recorded in the area in the future, the noise modelling remains valid and protective. It also enables management strategies to be adapted proactively to avoid potential impacts on a broader range of marine fauna.

2.2.2.3 Noise impact criteria for marine mammals

The newly updated scientific recommendations in marine mammal noise exposure criteria (Southall et al, 2019) propose PTS-onset and TTS-onset criteria for both impulsive noise and non-impulsive noise events.

The PTS-onset and TTS-onset criteria for non-impulsive noise are outlined in **Table 2**, which are based on cumulative SEL within a 24-hour period (SEL_{24hr}) only.



Table 2 PTS- and TTS-onset threshold levels for marine mammals exposed to non-impulsive noise

Marine mammal hearing group	PTS and TTS threshold levels – non-impulsive noise, cumulative exposure, SEL _{24hr} , dB re 1µPa ² ·S(weighted)	
	Injury (PTS) onset	TTS onset
Low frequency cetaceans (LF)	199	179
High frequency cetaceans (HF)	198	179 (Note ¹)
Very high-frequency cetaceans (VHF)	173	153
Sirenians (SI)	206	186
Phocid carnivores in water (PCW)	201	181
Other marine carnivores in water (OCW)	219	199

Note 1 Based on discussion with authorities which revealed preference to use the Underwater Piling and Dredging Noise Guidelines (Govt. South Australia, 2023) target for this specific group and effect.

For behavioural changes, the widely used assessment criterion for the onset of possible behavioural disruption in marine mammals is root-mean-square (RMS) SPL of 160 dB re 1µPa for impulsive noise and 120 dB re 1µPa or ambient level for non-impulsive noise (NMFS, 2013), as shown in **Table 3**.

Table 3 The behavioural disruption threshold level for marine mammals – impulsive and non-impulsive noise

Marine mammal hearing group	Behavioural disruption threshold levels, RMS SPL, dB re 1µPa	
	Impulsive noise	Non-impulsive noise
All hearing groups	160	120 (ambient level)

2.2.3 Fish and turtles

In general, limited scientific data are available regarding the effects of sound for fishes and turtles. As such, assessment procedures and subsequent regulatory and mitigation measures are often severely limited in their relevance and efficacy.

To improve consistency in the assessment of underwater noise impacts, the U.S. National Oceanic and Atmospheric Administration (NOAA) convened an international panel of experts to develop noise exposure criteria for fishes and sea turtles in 2004, primarily based on published scientific data in the peer-reviewed literature. The panel was organized as a Working Group (WG) under the ANSI-Accredited Standards Committee S3/SC 1, Animal Bioacoustics, which is sponsored by the Acoustical Society of America.

The outcomes of the WG are applicable sound exposure guidelines for fishes and sea turtles (Popper *et al.*, 2014), considering the diversity of fish and sea turtle species, the different ways they detect sound, as well as various sound sources and their acoustic characteristics.

While sea turtles are not commonly reported within the Swan River, the applied guideline may have been used in reference to other turtle species, such as freshwater turtles, or as a conservative measure in the absence of species-specific auditory data. The sound exposure criteria for sound sources of non-impulsive noise from ferrying and other sources are presented in **Table 4**.



Table 4 Noise exposure criteria for continuous sounds (ferrying) – fishes and sea turtles

Type of animal	Mortality and potential mortal injury	Impairment			Behaviour
		Recovery injury	TTS	Masking	
Fish: no swim bladder (particle motion detection)	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	150 dB (RMS SPL)
Fish: swim bladder is not involved in hearing (particle motion detection)	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	
Fish: swim bladder involved in hearing (primarily pressure detection)	(N) Low (I) Low (F) Low	170 dB (RMS SPL)	158 dB (RMS SPL)	(N) High (I) High (F) High	
Turtles	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	175 dB (RMS SPL)
Fish eggs and fish larvae	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) High (I) Moderate (F) High	(N) Moderate (I) Moderate (F) Low

Notes: RMS sound pressure levels (RMS SPL) are in terms of dB re 1 µPa. All criteria are presented as sound pressure even for fish without swim bladders. Relative risk (high, moderate, low) is given for animals at three distances from the source defined in relative terms as near (N), intermediate (I), and far (F).

Within the tables, where data exist that can be used to suggest provisional guidelines, received signal levels are reported in appropriate forms (e.g., peak SPL, SEL). Where insufficient data exist to make a recommendation for guidelines, a subjective approach is adopted in which the relative risk of an effect is placed in order of rank at three distances from the source – near (N), intermediate (I), and far (F) (top to bottom within each cell of the table, respectively). In general, “near” might be considered to be in the tens of meters from the source, “intermediate” in the hundreds of meters, and “far” in the thousands of meters. The relative risk of an effect is then rated as being “high,” “moderate,” and “low” with respect to source distance and animal type. The rating for effects in these tables is highly subjective and represents general consensus within the WG.

It should be noted that the period over which the cumulative sound exposure level (SEL_{cum}) is calculated must be carefully specified. For example, SEL_{cum} may be defined over a standard period (e.g., 12 hours of pile driving) or for the duration of an activity (e.g., the full period of construction), or over the total period that the animal will be exposed. Whether an animal would be exposed to a full period of sound activity will depend on its behaviour, as well as the source movements.

Currently, there is no direct evidence of mortality or potential mortal injury to fish from non-impulsive noise sources such as noise from DPS (Popper et al. 2014). However, continuous noise of any level that is detectable by fish can mask signal detection and impact their behaviour (Popper and Hawkins 2019). Increased noise levels may affect a wide range of behaviour patterns over the long term.

For example, anthropogenic sounds can interfere with foraging behaviour by masking the relevant sounds or resembling sounds that prey may generate. Similarly, fish might avoid



predators by listening to sounds that predators make deliberately or inadvertently (Popper and Hawkins 2019).

To determine the behaviour response (to single exposure) threshold for all fish species, except fish eggs and fish larvae, to impulsive and non-impulsive noise, NMFS uses the common SPL of 150 dB re 1 μ Pa (NMFS 2024b). The derivation and origin of the informal 150 dB threshold is not as well-defined as other thresholds. However, recent publications do not refute that behavioural disturbance can occur around this level (Hawkins et al. 2014).

Data on the behavioural reactions of sea turtles to sound sources is limited. Currently, there is not enough data to derive separate thresholds for different source types. However, behavioural disturbance from impulsive and non-impulsive noise generally occurs around 175 dB re 1 μ Pa SPL (Finneran et al. 2017; McCauley et al. 2000), which has also been adopted by NMFS (NMFS 2023a).

2.2.4 Human divers/swimmers

Human divers and swimmers were included as a conservative receptor group due to recreational use of the Swan River.

Hearing underwater differs from hearing in air as the acoustic properties of water and air are different. Human hearing underwater, with a 'wet' ear (i.e. where the external ear canal is filled with water, and water is in direct contact with the tympanic membrane), is less sensitive than it is in air, and so noise underwater is believed to produce less hearing damage than airborne noise.

The comparison between hearing threshold levels for humans in the air and underwater (Parvin, 1998) is illustrated in **Figure 10**.

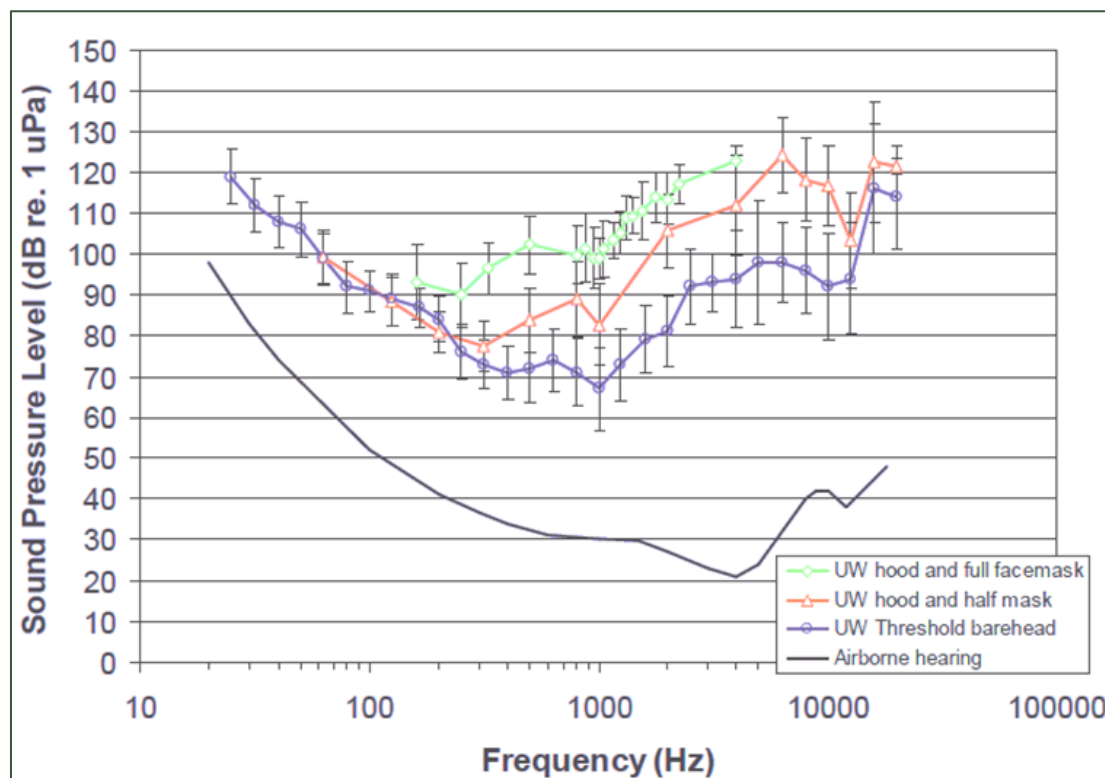


Figure 10 Hearing threshold levels for humans in the air and underwater (Parvin, 1998).



As can be seen in the figure, the hood and face mask for recreational divers further increase the hearing threshold levels. A number of studies on the human diver exposure to underwater sound has been carried out, and relevant safety thresholds for both military and commercial/recreational divers under various frequency range have been proposed (Ainslie, 2008; Pestorius et al, 2009).

For low frequency range, a study with the Low Frequency Active (LFA) sonar as the noise source (Pestorius et al, 2009) shows that underwater noise with dominant energy component within frequency range 100 – 500 Hz would not have an adverse effect on human divers at levels less than 145 dB re 1 μ Pa RMS over certain exposure settings (i.e. maximum continuous exposure of 100 seconds or with a maximum duty cycle of 20% and a maximum daily cumulative total of 3 hrs).

For relatively high frequency range, joint UK-US research published by Parvin et al (2002) reports that for sound in the frequency range 500-2500 Hz, advised threshold 'exposure level' for human divers of 155 dB re μ Pa RMS for use in environmental impact assessment.

As such, the threshold levels for human divers and swimmers under both frequency ranges are summarised in **Table 5**, with the lower level of 145 dB re μ Pa RMS SPL to be used for assessment purpose based on a conservative consideration.

Table 5 Threshold levels for human divers and swimmers (Pestorius et al, 2009; Parvin et al, 2002)

Frequency range	RMS SPL (dB re 1 μ Pa RMS)
100 – 500 Hz	145
500 – 2500 Hz	155

2.2.5 Zones of bioacoustics impact

The distances from the sound source within which various types of impacts on marine fauna can be expected ("zones of impact") are determined by modelling the transmission loss of sound in water (i.e., the decrease in noise levels when moving away from the noise source) and determining the distance at which predicted noise levels fall below the various threshold levels described in Section 4.1 to 4.4.

Zones of impact thus identify the horizontal distance from an area within which the project activities may have certain types of adverse impacts on certain marine fauna species.

In this report, zones of impact are defined as follows:

- Immediate impact from a single pulse – this is applicable if animals move out of or avoid entering the impact zone and are thus exposed at most for a short period.
- Cumulative impact from exposure over an entire event to impulsive noise – this would be applicable if an animal remains or moves with the noise source over an entire period and thus remains within the impact zone over an extended period of time. It is highly likely that animals will not remain in proximity of the noise source and that their exposure to sound levels above the various thresholds is much shorter. The distances identified for cumulative thresholds are thus very conservative (worst case) and very likely to overstate the extent of the typical impact area.

This information can be used to assess the risk (likelihood) of potential adverse noise impacts, by combining the acoustic zones of impact with ecological information such as habitat significance in the affected area.



2.3 Underwater noise modelling prediction methods

2.3.1 Ferry operation scenarios

The assessment of potential future ferry operations considers noise emissions from a 24-metre catamaran electric passenger ferry operating between Elizabeth Quay, Matilda Bay, and Applecross.

Two route options and three operating speed scenarios were assessed. **Figure 11** shows the two proposed routing. The three speed scenarios are as follows:

- Scenario 1: Gazetted speeds with existing open waters up to 25knots.
- Scenario 2: Extension of existing open speeds (red dashed line in **Figure 11**) up to 25 knots , and only 12 knots for Elizabeth Quay as per existing ferry exemption.
- Scenario 3: Speed exemption of 12knots in all areas marked as red dashed line in **Figure 11**.

As ferries are not expected to operate at 25 knots continuously across all sections of the route, the assessment has adopted a conservative worst-case approach based on the highest operating speeds considered.

In each scenario, the ferry frequency follows the proposed service timetable. The worst-case scenario assumes up to 30 return trips (a total of 60 single trips) per 24-hour period, operating from 6:00 am to 12:30 am.





Figure 11 Swan River Ferry Expansion Project overview – Site names and indicative ferry routes (Route 1 as dashed line and Route 2 as solid line)

2.3.2 Key noise sources

The ferries are the primary noise source during operation. Ferries are modelled along the routes shown in **Figure 11**.

Ferry noise levels were based on historical measurements on Elvy hybrid electric ferry in fully electric battery powered propulsion as well as in hybrid propulsion with the on-board diesel generator running (Andersson Carl et al. 2023). The one-third octave SEL source spectral levels (unweighted and M-weighted) for the ferry operation noise is presented in **Figure 12**.



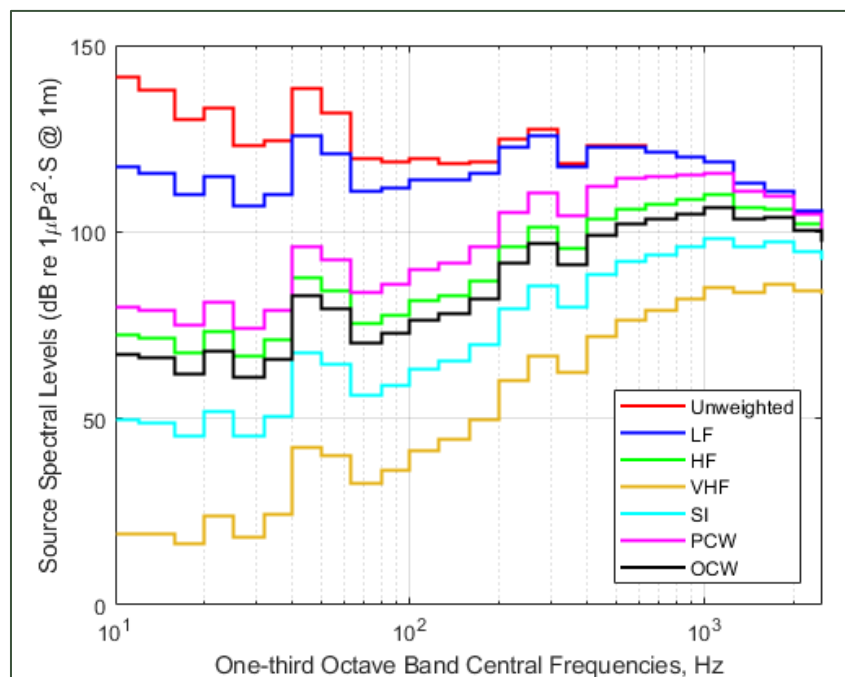


Figure 12 One-third octave SEL source spectral levels (unweighted and M-weighted) for the ferry operation noise (overall unweighted level of 145 dB re 1 $\mu\text{Pa}^2\cdot\text{S}$)

2.3.3 Modelling methodology

2.3.3.1 Long Range Modelling

Underwater noise modelling was used to estimate how sound levels reduce with distance from the ferry. This allows the likely sound levels experienced by marine fauna at different locations to be predicted. When the source level (SL) of the assessed noise-generating activity is known, the predicted transmission loss (TL) is then used to predict the received level (RL) at the receiver location as:

$$RL = SL - TL \quad (5.3.1)$$

The fluid parabolic equation (PE) modelling algorithm RAMGeo (Collins, 1993) is used to calculate the transmission loss between the source and the receiver. RAMGeo is an efficient and reliable PE algorithm for solving range-dependent acoustic problems with fluid seabed geoacoustic properties. The noise sources were assumed to be omnidirectional and modelled as point sources.

With the known noise source levels, either frequency weighted or unweighted, the received noise levels are calculated following the procedure outlined below.

- One-third octave source spectral levels are sourced via empirical reference data out of the historical measurements carried out on relevant noise sources in similar construction setting (as detailed in Section 5.2).
- Transmission loss is calculated using RAMGeo at one-third octave band central frequencies from 40 Hz to 8 kHz, based on appropriate source depths corresponding to relevant source scenarios. The acoustic energy of higher frequency range is significantly lower, and therefore is not included in the modelling calculation.
- Propagation paths for the TL calculation have a maximum range of up to 10.0 km and bearing angles with a 2-degree azimuth increment from 0 degrees to 358



degrees around the source locations. The bathymetry variation of the vertical plane along each modelling path is obtained via interpolation of the bathymetry dataset.

- The one-third octave source levels and transmission loss are combined to obtain the received levels as a function of range, depth and frequency.
- The overall received levels are calculated by summing all frequency band spectral levels.

2.3.3.2 Cumulative SEL Modelling

For cumulative SEL estimates, the following cumulative factor (CF) is applied:

$$CF = 10 \times \log_{10} (N \text{ (or } T)) \quad (5.3.2)$$

Where N is the number of ferrying trips during the assessed time period and T is the exposure duration for a continuous noise source.

For non-impulsive noise, it is assumed the root-mean-square sound pressure levels (RMS SPLs) are equivalent to be the sound exposure levels (SELs) of 1-second duration.

The weighted SEL modelling results for different marine mammal hearing groups are based on weighted SEL source level inputs which are derived by applying relevant auditory hearing functions as in Figure 8 of Section 4.2.1 to the unweighted SEL source levels.

Note that the range of frequencies modelled is limited to the third octaves with centre frequencies 10 Hz to 2.5 kHz for ships. These frequency ranges are considered appropriate for the source content (considerate of likely spectral weightings), given available source data and the purposes of this study.

2.3.3.3 SEL and RMS SPL

For this project, the SPLs were estimated using the following conservative conversion factors, derived from the historical measurements described in relevant literature and study report (Hastings and Popper, 2005; Parnum et al, 2015), to be applied to the modelled SELs at different distance ranges:

- 0 – 20 m: Conversion factor of 15 dB.
- 20 – 200 m: Conversion factors of 15 to 10 dB, following a logarithmic trend with distance.
- 200 – 500 m: Conversion factors of 10 to 5 dB, following a logarithmic trend with distance.
- 500 m and beyond: Conversion factor of 5 dB.

The SEL to RMS SPL conversion factors, as a function of horizontal distance from the source, are illustrated in **Figure 13**.



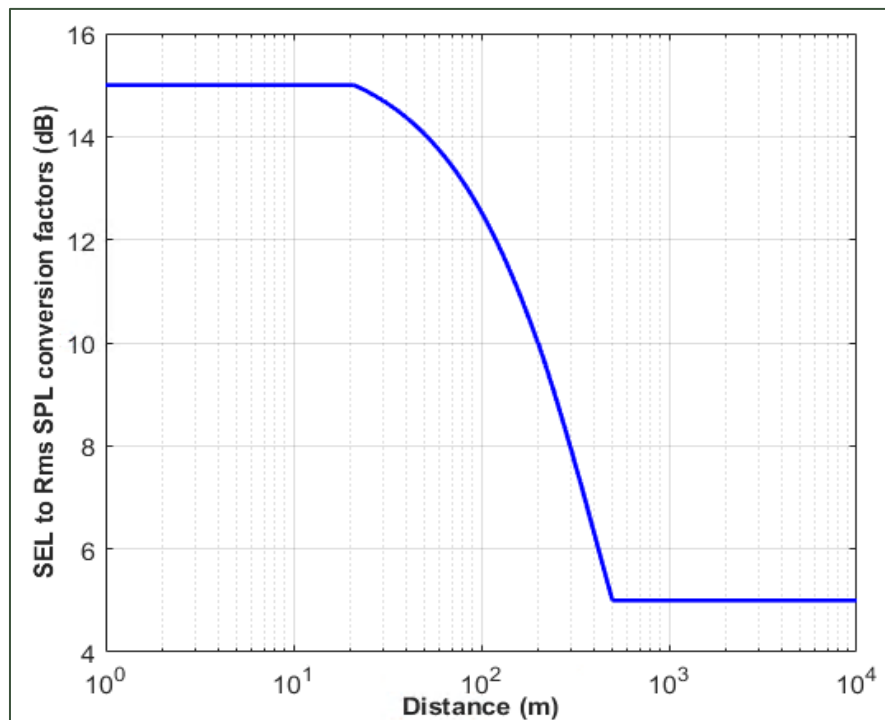


Figure 13 SEL to SPL conversion factor versus distance.

2.3.4 Input parameters

2.3.4.1 Bathymetry

The bathymetry data used for the sound propagation modelling were based on provided bathymetric/hydrographic point survey datasets held within the Western Australian Department of Transport (DoT) and WA898 Swan and Canning Rivers e7-45.

Available bathymetric survey data were combined to develop a representative model of river depths across the study area. Where local data gaps existed, depths were estimated using surrounding survey information and aerial imagery

Based on the Australian National Tide Tables (ANTT, 2021) and Admiralty Tide Tables Volume 4 (ATT, 2020), the Highest Astronomical Tide (HAT) for the project area is around 1.40m. As such, an adjustment of 1.40m is applied to the bathymetry dataset based on a conservative consideration.

The imagery of merged and reconstructed bathymetry dataset of Swan River is shown in **Figure 14**. From this figure it can be seen that the study area of interest involves relatively shallow water.



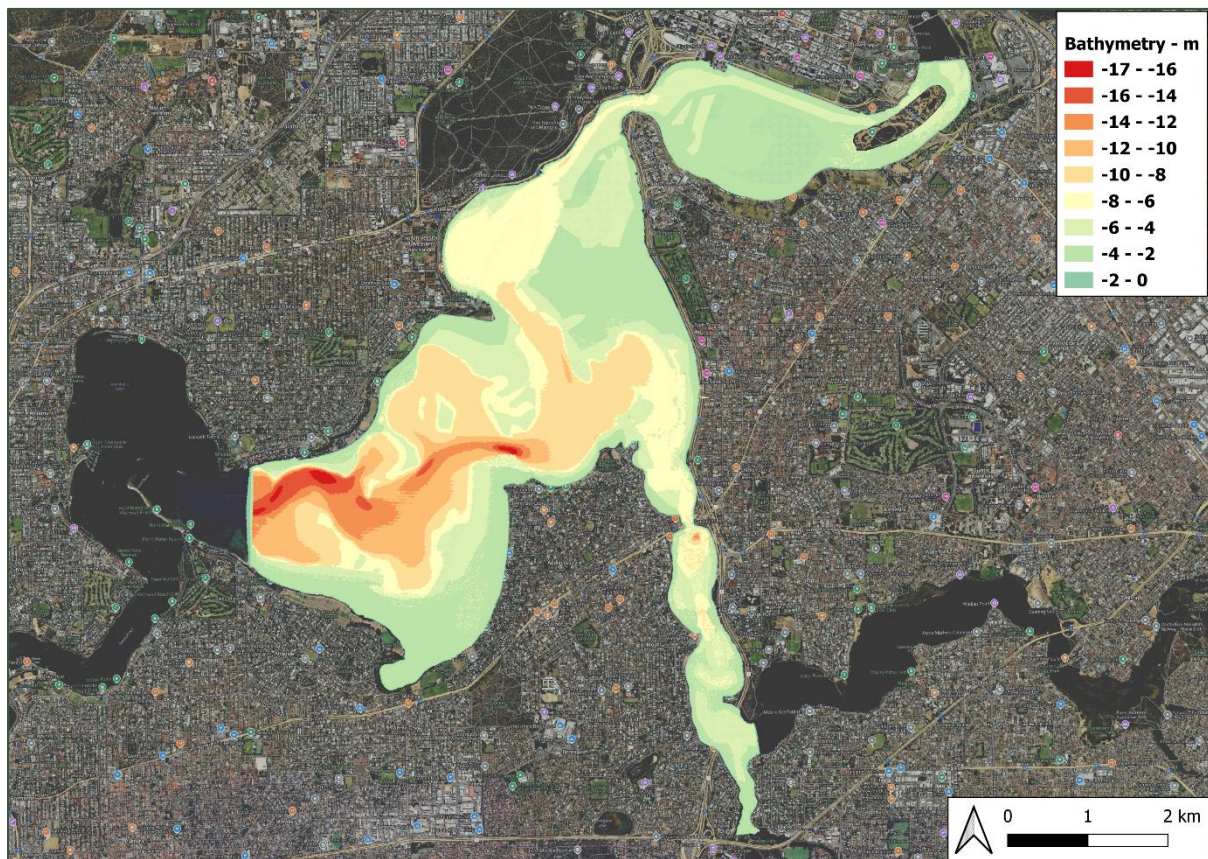


Figure 14 The imagery of merged and reconstructed bathymetry dataset around the project area.

2.3.4.2 Sound Speed Profiles

Sound travels through water at different speeds depending on temperature, salinity and depth. These factors influence how underwater sound propagates. Seasonal data from the Swan Canning Estuary (DWER, 2018) were used to develop representative sound speed profiles for the modelling assessment. The data report used was developed during the financial year 2017 – 2018 and presents data from June 2017 to May 2018 over background data generally from June 2012 to May 2017. Selected monthly data values are presented in **Figure 15** below.

Figure 16 presents the derived seasonal sound speed profiles within the Lower Swan Canning Estuary near the project area. The sound speed profiles were derived based on an empirical function of the three independent variables (temperature (T) in degrees centigrade, salinity (S) in parts per thousand, and depth (z) in meters) (Medwin et al, 1997). Seasonal averages of the monthly median values of the sampling data collected over the monitoring sites within the Lower Swan Canning Estuary were used to derive the sound speed profiles.

For Spring, Summer and Autumn seasons, the water column is relatively well mixed and sound speeds are relatively stable across the water depths. For Winter season, the surface water has low temperature and salinity compared with the bottom water, and the speed profile generally has relatively stronger upward refraction characteristics and is expected to be most favourable to propagation of sound from acoustic sources within the water column. As such, the winter season sound speed profile has been used for the sound propagation modelling in this study.



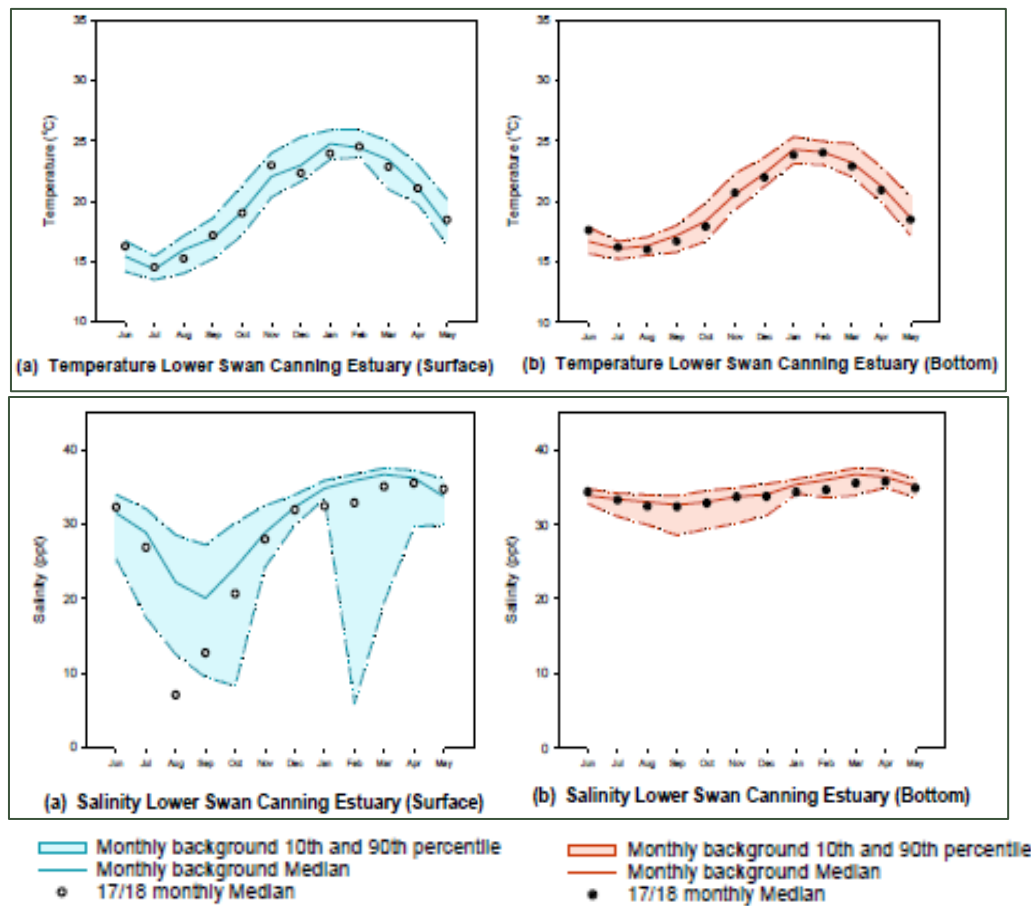


Figure 15 2017 – 2018 in situ temperature (°C) (top panels) and salinity (ppt) (bottom panels) in surface and bottom water, background (June 2012 – May 2017) sampling data, Swan Canning Estuary.

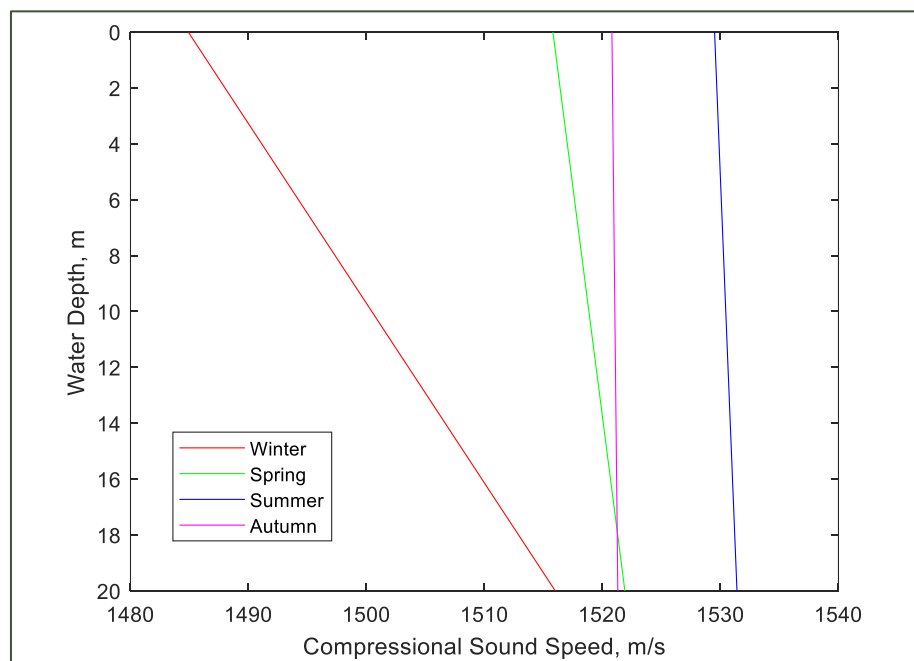


Figure 16 Sound speed profiles, Swan Canning Estuary for different southern atmosphere seasons



2.3.4.3 Seafloor geoacoustic model

The seafloor geoacoustic model for the modelling area is developed based on the sediment distribution assessment over the Swan River estuary (Quilty et al, 2006), as well as the regional geologic and geomorphic settings for the Perth region (McPerson et al, 2005; Davidson, 1995).

Sediment samples from 51 locations between the Narrows Bridge and Fremantle Harbour have been examined to assess the sediment distribution over the Swan River estuary (Quilty et al, 2006). The study revealed that the sediments over the estuary are dominantly clastic but include a significant biogenic content in certain areas. The distribution of the clastic component is controlled by water energy (and thus, secondarily, by depth). Fine-grained material (grey mud) is restricted to the basin and deeper, quieter channel setting. Sand is in the higher energy, shallow, floodplain and beach environments, including the estuary section between North Fremantle and Mosman Park.

A detailed review study on the geological settings and the geomorphic settings for the Perth region (Davidson, 1995) indicates that, along the coastal trip of the Perth region, the superficial formation is predominantly the Tamala Limestone as defined by Playford et al (1976). The Tamala Limestone contains various proportions of quartz sand, fine- to medium-grained shell fragments, and minor clayey lenses. Depending on the location, this formation has a maximum known thickness of 110 m in the Perth region. Its upper surface is exposed and leached to the extent that the upper part of the formation comprises unconsolidated limestone sand. This superficial formation is consistent with the site classification results based on the analysis of numerous geological borehole survey data within the central Perth region (Davidson, 1995).

Based on the above relevant studies on the top layer sediment distribution over the Swan River estuary, as well as the superficial geological formation over the Perth Basin, it is proposed that the seafloor geoacoustic model for the modelling area comprises of

- A 5.0-m sandy surface sediment layer.
- A 15-m slightly to semi-cemented sand/calcarenite layer.
- Followed by a semi-cemented sand/calcarenite half space as detailed in **Table 6**.

The geoacoustic properties for relevant sediments are as described in Hamilton (1980) and Jensen et al (2011).

Table 6 Geoacoustic parameters for the proposed seafloor model

Seafloor Materials	Thickness, m	Density ρ , (kg/m ³)	Compressional Wave		Shear Wave	
			Speed c_p , (m/s)	Attenuation α_p , (dB/ λ)	Speed c_s , (m/s)	Attenuation α_s , (dB/ λ)
Unconsolidated sandy layer	5.0	1,800	1,750	0.80	-	-
Slightly to semi-cemented sand/calcarenite layer	15	1,900	2,100	0.12	550	0.25
Semi-cemented sand/calcarenite half space	∞	2,200	2,600	0.20	1,200	0.40

It is noted that the modelling algorithm (i.e. RAMGeo) proposed for this modelling study, as detailed in **Section 2.3.2**, is based on a fluid geo-acoustic model (all layers are modelled as



fluid). Therefore, the geo-acoustic model inputs only consider the compressional wave parameters for the substrate layer materials as listed in **Table 6**, with shear wave parameter values set as zeros.

2.4 Uncertainty of prediction

All predictive models contain uncertainty. The expected level of system prediction uncertainty as estimated according to the ISO Guide to Measurement Uncertainty is outlined in **Table 7**.

Table 7 Estimated measurement uncertainty by system

Car park	System	U ₉₅ (Note 1)	Student's t-factor
Underwater noise SEL _{24hr} , SPL	RAMGeo	3.1 dB	2.00

Note 1 The U₉₅ is the expanded uncertainty of measurement for a 95% confidence interval. It represents the estimated range in which the true value lies for 95 out of 100 repeated events.

2.5 Underwater noise prediction results and discussion

2.5.1 Summary

The predicted ferrying noise levels were compared with relevant threshold criteria as listed in **Section 2.2** to determine distances at which the criteria are considered to be met. The model is based on measurement on similar electric ferry with overall unweighted SEL level of 145 dB re 1 µPa²·S or equivalent, proposed speed of 12-25 knots and up to 30 return trips daily.

Table 8 listed the max weighted and unweighed SEL modelled for each route and speed profile.

Table 8 Maximum cumulative exposure SEL_{24hr} modelled in different route

Marine mammal hearing group	PTS and TTS threshold levels – non-impulsive noise, cumulative exposure, SEL _{24hr} , dB re 1µPa ² ·S(weighted)		Maximum cumulative exposure SEL _{24hr} modelled	
	Injury (PTS) onset	TTS onset	Route 1	Route 2
Low frequency cetaceans (LF)	199	179	158	161
High frequency cetaceans (HF)	198	179 (Note 1)	141	141
Very high-frequency cetaceans (VHF)	173	153	117	117
Sirenians (SI)	206	186	130	130
Phocid carnivores in water (PCW)	201	181	148	148
Other marine carnivores in water (OCW)	219	199	138	138



Based on the modelling outcomes, and assuming direct acoustic line-of-sight propagation, the following conclusions are drawn:

- Operation of the proposed ferry service is not predicted to result in PTS or TTS threshold exceedances for marine mammals under the assessed 24-hour exposure scenario.
- The noise from ferry operations is considered to have very low physiological impacts (both mortality and recovery injury) on fish with swim bladder involved in hearing as the threshold levels are not reached.
- Potential behavioural disturbance from the non-impulsive noise emissions from ferry operations (pass by) is predicted to be within 10 m from the assessed ferry routes for marine mammals of all hearing groups, human divers and swimmers along Route 1 and most part of Route 2.

For fish and turtle, exceedance of injury thresholds was not predicted. However, lower-level behavioural responses cannot be entirely excluded and are expected to be localised and transient.

- Between 2.22km to 2.94km (as indicated in **Figure 17**) along the ferry Route 2 from Matilda Bay to Applecross, the water is shallow, with approximately 3m to 4m depth, such that there are increased reflections of noise from seabed and lateral spread of underwater noise to the surrounding. The predicted unweighted levels are up to the low frequency threshold levels for human divers and swimmers. Despite these propagation effects, frequency-specific levels remain below the applicable assessment criteria.
- While adverse underwater noise impacts are not anticipated, vessel strike remains a potential risk to dolphins, particularly within areas of concentrated use and during behaviours such as resting or social interaction. The quieter operation of electric vessels, while beneficial for reducing underwater noise pollution, may inadvertently increase collision risks by making vessels harder for dolphins to detect. As such, dolphin mitigation strategies should still be considered as the project progresses to minimise potential impacts.

The modelled noise contours of ferry cumulative unweighted noise are included in **Appendix C**. Modelled cumulative noise contours for Route 2 indicate levels exceeding 150 dB across portions of the study area. From the comparison of cumulative levels including and excluding the shallow water section mentioned above, it can be seen that over the 150dB noise are from the ferry travelling across this particular location. Additional contour plots excluding the shallow-water section are provided in **Appendix C** to illustrate the influence of local bathymetric conditions on modelled sound propagation.



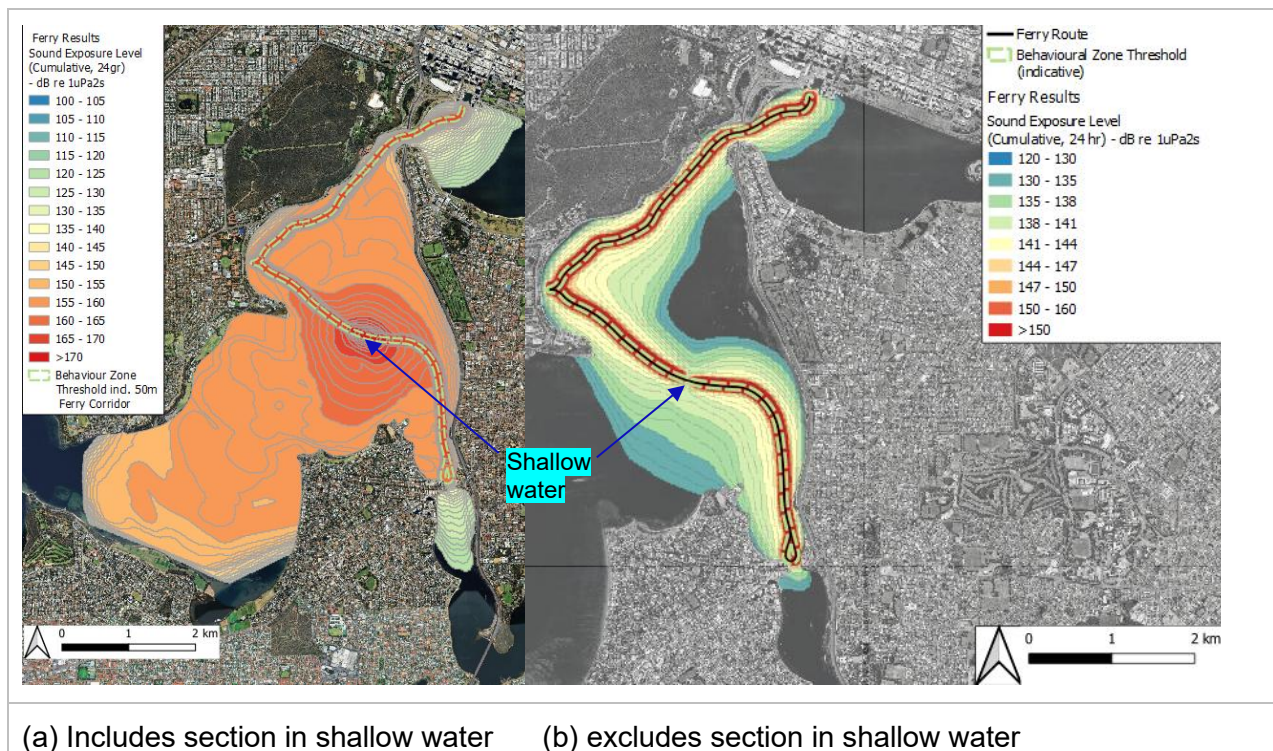


Figure 17 Comparison of Modelled noise contour plot for ferry Route 2

The following sub-sections further detail these zones of impact estimated for all generic marine mammals, fish and turtle species, and human divers and swimmers.

2.5.2 Ferry operation

Impact zones from the ferry operation are calculated and assessed regarding cumulative 24-hour continuous exposure for marine mammals.

The modelled results show that, with proposed ferry operational source level or equivalent, the threshold levels of PTS and TTS are not reached for marine mammals for Routes 1 and 2.

Modelled levels remain more than 20 dB below the relevant injury thresholds, representing a substantial margin of compliance along Route 1 and Route 2. If the ferry speed were reduced — for example, halved — while maintaining the same sound power level (which is considered unlikely), noise emissions would still not exceed the threshold levels.

Modelled ferrying results show that noise from ferry operations is considered to have very low physiological impacts (both mortality, recovery injury and TTS) on fish with swim bladder involved in hearing as the threshold levels are not reached along Route 1 and Route 2.

Table 9 presents zones of impact from ferry operation for behavioural disturbance for marine mammals and humans for each ferry pass-by. Potential behavioural disturbance from the non-impulsive noise emissions from ferry operations is predicted to be within 10 metres from the assessed ferry routes for marine mammals of all hearing groups, human divers and swimmers. For other groups, the threshold levels are not reached.



Table 9 Zones of immediate impact from non-impulsive noise for behavioural disturbance – marine mammals and human divers/swimmers

Receivers	Zones of impact – maximum horizontal distances with direct line of sight to source	
	Criteria - RMS SPL, dB re 1µPa	Maximum threshold distance, m
Marine mammals, behavioural distance – all hearing groups	120	<10
Human divers and swimmers	145	<10
Fish	150	-
Turtles	175	-

Note A dash indicates the threshold is not reached.

2.6 Aquatic Noise Management Plan

While underwater noise impacts are predicted to be low, operational environmental management should include vessel operator awareness measures regarding dolphin interactions, controls and monitoring of any future changes in ferry frequency or vessel characteristics that may alter underwater noise emissions.

3.0 Airborne noise assessment

The operation of the ferries on the river is not predicted to generate significant levels of airborne noise emission that could reasonably impact surrounding terrestrial areas. Noise from the propulsion system or the movement through the water of a vessel operating in water other than water on private premises are excluded under Regulation⁴ 3(1)(f).

4.0 Ground vibration assessment

Based on the studies presented in **Section 2.0**, operation of the ferries is not predicted to generate significant levels of ground vibration that could reasonably impact on the surrounding terrestrial areas.

5.0 Summary

The MOSFE includes the operation of five new electric ferries which will be operated by Transperth on the expanded route between terminals at Matilda Bay, Applecross and Elizabeth Quay, with overnight berthing occurring at the Barrack Street Jetties and the Matilda Bay terminal.

This document presents assessments of the potential noise and vibration impacts from operation of the project on nearby marine and terrestrial environments. The studies presented in this report demonstrate that the project as proposed can comply with state noise regulations.

⁴ Western Australia Environmental Protection (Noise) Regulations 1997



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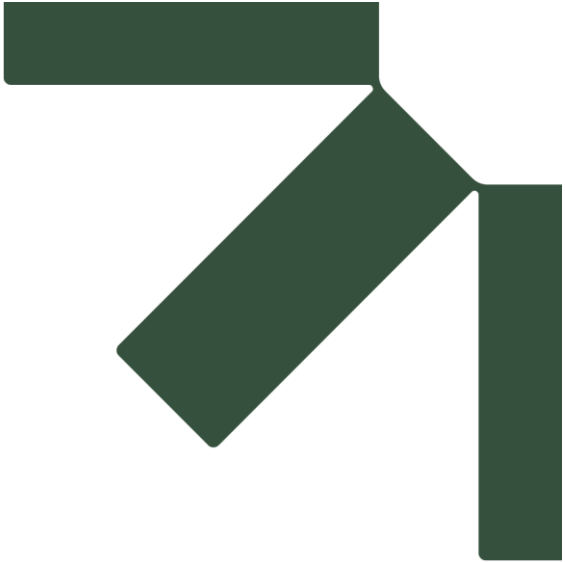
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Appendix A Acoustic Terminology

Metronet on Swan Ferry Service Expansion

Operational Noise Assessment

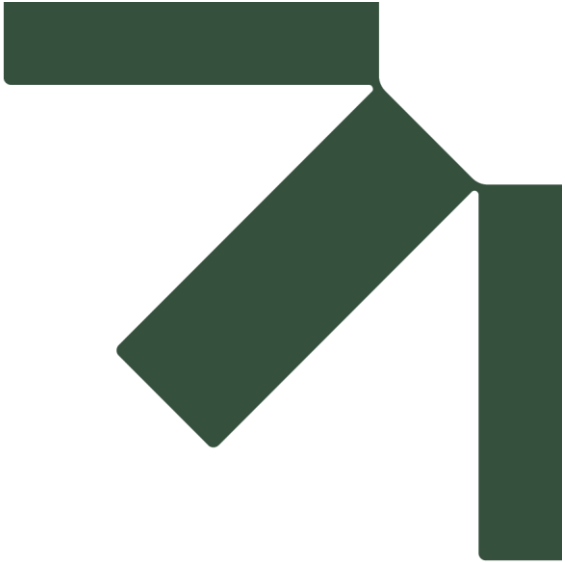
Public Transport Authority

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<i>Sound Pressure</i>	A deviation from the ambient hydrostatic pressure caused by a sound wave
<i>Sound Pressure Level (SPL)</i>	The logarithmic ratio of sound pressure to the reference pressure. The reference pressure underwater is $P_{\text{ref}} = 1 \mu\text{Pa}$
<i>Root-Mean-Square Sound Pressure Level (RMS SPL)</i>	The mean-square sound pressure is the average of the squared pressure over the pulse duration. The root-mean-square sound pressure level is the logarithmic ratio of the root of the mean-square pressure to the reference pressure. Pulse duration is taken as the duration between the 5% and the 95% points on the cumulative energy curve
<i>Peak Sound Pressure Level (Pk SPL)</i>	The peak sound pressure level is the logarithmic ratio of the peak pressure over the impulsive signal event to the reference pressure
<i>Peak-to-Peak Sound Pressure Level (Pk-Pk SPL)</i>	The peak-to-peak sound pressure level is the logarithmic ratio of the difference between the maximum and minimum pressure over the impulsive signal event to the reference pressure
<i>Sound Exposure Level (SEL)</i>	SEL is a measure of energy. Specifically, it is the dB level of the time integral of the squared instantaneous sound pressure normalised to a 1-s period
<i>Power Spectral Density (PSD)</i>	PSD describes how the power of a signal is distributed with frequency
<i>Source Level (SL)</i>	The acoustic source level is the level referenced to a distance of 1m from a point source
<i>1/3 Octave Band Levels</i>	The energy of a sound split into a series of adjacent frequency bands, each being 1/3 of an octave wide
<i>Sound Speed Profile</i>	A graph of the speed of sound in the water column as a function of depth





Appendix B Marine Mammal Hearing Group Classification

Metronet on Swan Ferry Service Expansion

Operational Noise Assessment

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The following table gives a summary of marine mammal hearing group classification.

Table B1 Summary of marine mammal classification

Classification	Common Name	Scientific Name
Low frequency cetaceans (extracted from Appendix 1 Southall <i>et al.</i> (2019))	Bowhead whale	<i>Balaena mysticetus</i>
	Southern right whale	<i>Eubalaena australis</i>
	North Atlantic right whale	<i>Eubalaena glacialis</i>
	North Pacific right whale	<i>Eubalaena japonica</i>
	Common minke whale	<i>Balaenoptera acutorostrata</i>
	Antarctic minke whale	<i>Balaenoptera bonaerensis</i>
	Sei whale	<i>Balaenoptera borealis</i>
	Bryde's whale	<i>Balaenoptera edeni</i>
	Omura's whale	<i>Balaenoptera omurai</i>
	Fin whale	<i>Balaenoptera physalus</i>
	Humpback whale	<i>Megaptera novaeangliae</i>
	Pygmy right whale	<i>Caperea marginate</i>
	Gray whale	<i>Eschrichtius robustus</i>
High frequency cetaceans (extracted from Appendix 2 Southall <i>et al.</i> (2019))	Sperm whale	<i>Physeter macrocephalus</i>
	Arnoux' beaked whale	<i>Berardius arnuxii</i>
	Baird's beaked whale	<i>Berardius bairdii</i>
	Northern bottlenose whale	<i>Hyperoodon ampullatus</i>
	Southern bottlenose whale	<i>Hyperoodon planifrons</i>
	Tropical bottlenose whale	<i>Indopacetus pacificus</i>
	Sowerby's beaked whale	<i>Mesoplodon bidens</i>
	Andrews' beaked whale	<i>Mesoplodon bowdoini</i>
	Hubb's beaked whale	<i>Mesoplodon carlbubbsi</i>
	Blainville's beaked whale	<i>Mesoplodon densirostris</i>
	Gervais' beaked whale	<i>Mesoplodon europaeus</i>
	Ginkgo-toothed beaked whale	<i>Mesoplodon ginkgodens</i>
	Gray's beaked whale	<i>Mesoplodon grayi</i>
	Hector's beaked whale	<i>Mesoplodon hectori</i>
	Deraniyagala's beaked whale	<i>Mesoplodon hotaula</i>
	Layard's beaked whale	<i>Mesoplodon layardii</i>
	True's beaked whale	<i>Mesoplodon mirus</i>
	Perrin's beaked whale	<i>Mesoplodon perrini</i>
	Pygmy beaked whale	<i>Mesoplodon peruvianus</i>
	Stejneger's beaked whale	<i>Mesoplodon stejnegeri</i>
	Spade-toothed whale	<i>Mesoplodon traversii</i>



Classification	Common Name	Scientific Name
	Tasman beaked whale	<i>Tasmacetus shepherdi</i>
	Cuvier's beaked whale	<i>Ziphius cavirostris</i>
	Killer whale	<i>Orcinus orca</i>
	Beluga	<i>Delphinapterus leucas</i>
	Narwhal	<i>Monodon monoceros</i>
	Short- and long-beaked common dolphins	<i>Delphinus delphis</i>
	Pygmy killer whale	<i>Feresa attenuata</i>
	Short-finned pilot whale	<i>Globicephala macrorhynchus</i>
	Long-finned pilot whale	<i>Globicephala melas</i>
	Risso's dolphin	<i>Grampus griseus</i>
	Fraser's dolphin	<i>Lagenodelphis hosei</i>
	Atlantic white-sided dolphin	<i>Lagenorhynchus acutus</i>
	White-beaked dolphin	<i>Lagenorhynchus albirostris</i>
	Pacific white-sided dolphin	<i>Lagenorhynchus obliquidens</i>
	Dusky dolphin	<i>Lagenorhynchus obscurus</i>
	Northern right whale dolphin	<i>Lissodelphis borealis</i>
	Southern right whale dolphin	<i>Lissodelphis peronii</i>
	Irrawaddy dolphin	<i>Orcaella brevirostris</i>
	Australian snubfin dolphin	<i>Orcaella heinsohni</i>
	Melon-headed whale	<i>Peponocephala electra</i>
	False killer whale	<i>Pseudorca crassidens</i>
	Indo-Pacific humpback dolphin	<i>Sousa chinensis</i>
	Indian Ocean humpback dolphin	<i>Sousa plumbea</i>
	Australian humpback dolphin	<i>Sousa sahalensis</i>
	Atlantic humpback dolphin	<i>Sousa teuszii</i>
	Tucuxi	<i>Sotalia fluviatilis</i>
	Guiana dolphin	<i>Sotalia guianensis</i>
	Pantropical spotted dolphin	<i>Stenella attenuata</i>
	Clymene dolphin	<i>Stenella clymene</i>
	Striped dolphin	<i>Stenella coeruleoalba</i>
	Atlantic spotted dolphin	<i>Stenella frontalis</i>
	Spinner dolphin	<i>Stenella longirostris</i>
	Rough-toothed dolphin	<i>Steno bredanensis</i>
	Indo-Pacific bottlenose dolphin	<i>Tursiops aduncus</i>
	Common bottlenose dolphin	<i>Tursiops truncatus</i>
	South Asian river dolphin	<i>Platanista gangetica</i>

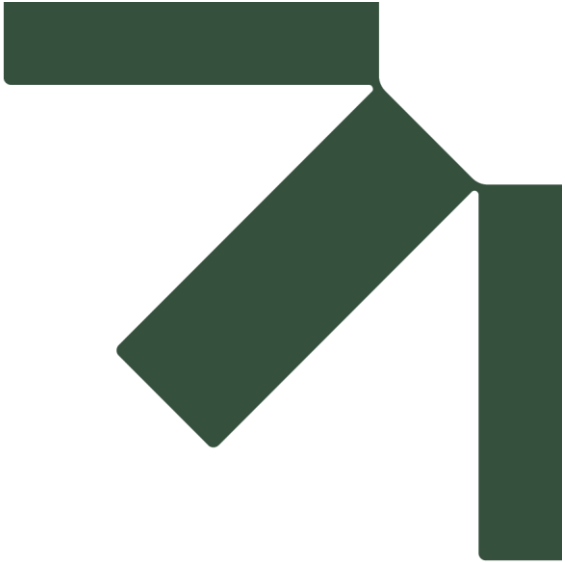


Classification	Common Name	Scientific Name
Very high frequency cetaceans (extracted from Appendix 3 Southall <i>et al.</i> (2019))	Peale's dolphin	<i>Lagenorhynchus australis</i>
	Hourglass dolphin	<i>Lagenorhynchus cruciger</i>
	Commerson's dolphin	<i>Cephalorhynchus commersonii</i>
	Chilean dolphin	<i>Cephalorhynchus eutropia</i>
	Heaviside's dolphin	<i>Cephalorhynchus heavisidii</i>
	Hector's dolphin	<i>Cephalorhynchus hectori</i>
	Narrow-ridged finless porpoise	<i>Neophocaena asiaeorientalis</i>
	Indo-Pacific finless porpoise	<i>Neophocaena phocaenoides</i>
	Spectacled porpoise	<i>Phocoena dioptrica</i>
	Harbor porpoise	<i>Phocoena phocoena</i>
	Vaquita	<i>Phocoena sinus</i>
	Burmeister's porpoise	<i>Phocoena spinipinnis</i>
	Dall's porpoise	<i>Phocoenoides dalli</i>
	Amazon river dolphin	<i>Inia geoffrensis</i>
	Yangtze river dolphin	<i>Lipotes vexillifer</i>
	Franciscana	<i>Pontoporia blainvillei</i>
	Pygmy sperm whale	<i>Kogia breviceps</i>
	Dwarf sperm whale	<i>Kogia sima</i>
Sirenians (extracted from Appendix 4 Southall <i>et al.</i> (2019))	Amazonian manatee	<i>Trichechus inunguis</i>
	West Indian manatee	<i>Trichechus manatus</i>
	West African manatee	<i>Trichechus senegalensis</i>
	Dugong	<i>Dugong dugon</i>
Phocid carnivores (extracted from Appendix 5 Southall <i>et al.</i> (2019))	Hooded seal	<i>Cystophora cristata</i>
	Bearded seal	<i>Erignathus barbatus</i>
	Gray seal	<i>Halichoerus grypus</i>
	Ribbon seal	<i>Histiophoca fasciata</i>
	Leopard seal	<i>Hydrurga leptonyx</i>
	Weddell seal	<i>Leptonychotes weddellii</i>
	Crabeater seal	<i>Lobodon carcinophaga</i>
	Northern elephant seal	<i>Mirounga angustirostris</i>
	Southern elephant seal	<i>Mirounga leonina</i>
	Mediterranean monk seal	<i>Monachus monachus</i>
	Hawaiian monk seal	<i>Neomonachus schauinslandi</i>
	Ross seal	<i>Ommatophoca rossii</i>
	Harp seal	<i>Pagophilus groenlandicus</i>
	Spotted seal	<i>Phoca largha</i>



Classification	Common Name	Scientific Name
	Harbor seal	<i>Phoca vitulina</i>
	Caspian seal	<i>Pusa caspica</i>
	Ringed seal	<i>Pusa hispida</i>
	Baikal seal	<i>Pusa sibirica</i>
Other marine carnivores (extracted from Appendix 6 Southall <i>et al.</i> (2019))	Walrus	<i>Odobenus rosmarus</i>
	South American fur seal	<i>Arctocephalus australis</i>
	New Zealand fur seal	<i>Arctocephalus forsteri</i>
	Galapagos fur seal	<i>Arctocephalus galapagoensis</i>
	Antarctic fur seal	<i>Arctocephalus gazella</i>
	Juan Fernandez fur seal	<i>Arctocephalus philippii</i>
	Cape fur seal	<i>Arctocephalus pusillus</i>
	Subantarctic fur seal	<i>Arctocephalus tropicalis</i>
	Northern fur seal	<i>Callorhinus ursinus</i>
	Steller sea lion	<i>Eumetopias jubatus</i>
	Australian sea lion	<i>Neophoca cinerea</i>
	South American sea lion	<i>Otaria byronia</i>
	Hooker's sea lion	<i>Phocarctos hookeri</i>
	California sea lion	<i>Zalophus californianus</i>
	Galapagos sea lion	<i>Zalophus wolfebaeki</i>
	Polar bear	<i>Ursus maritimus</i>
	Sea otter	<i>Enhydra lutris</i>
	Marine otter	<i>Lontra felina</i>





Appendix C Noise contour plots – Ferrying Noise

Metronet on Swan Ferry Service Expansion

Operational Noise Assessment

Public Transport Authority

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31 July 2026

Figure C 1 Distribution in predicted noise emission for ferry Route 1, unweighted SEL_{24hr} (contours range from 120dB to >165dB)

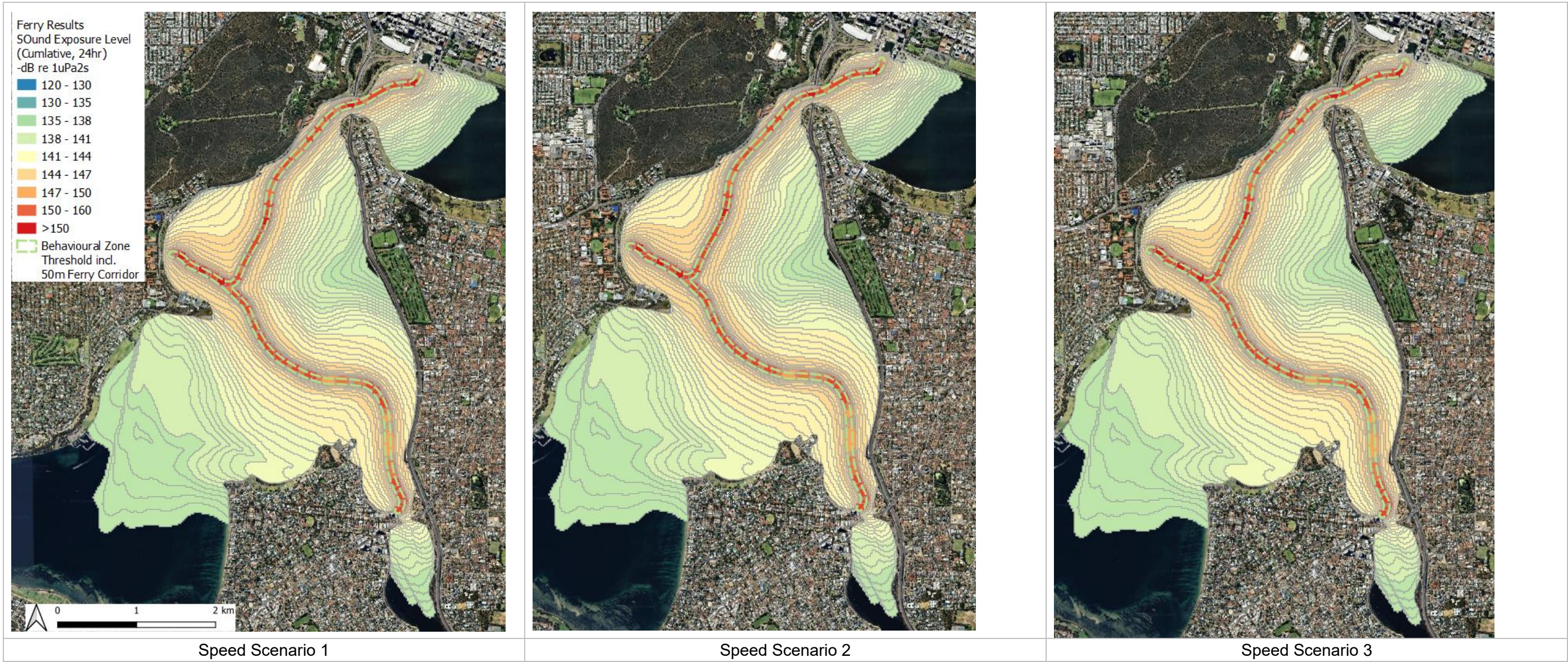


Figure C 2 Modelled noise contour plot for ferry Route 1 VHF (contours range from 100dB to 120dB)



Figure C 3 Modelled noise contour plot for ferry Route 1 HF (contours range from 120dB to 145dB)



Figure C 4 **Modelled noise contour plot for ferry Route 1 LF (contours range from 120dB to 160dB)**

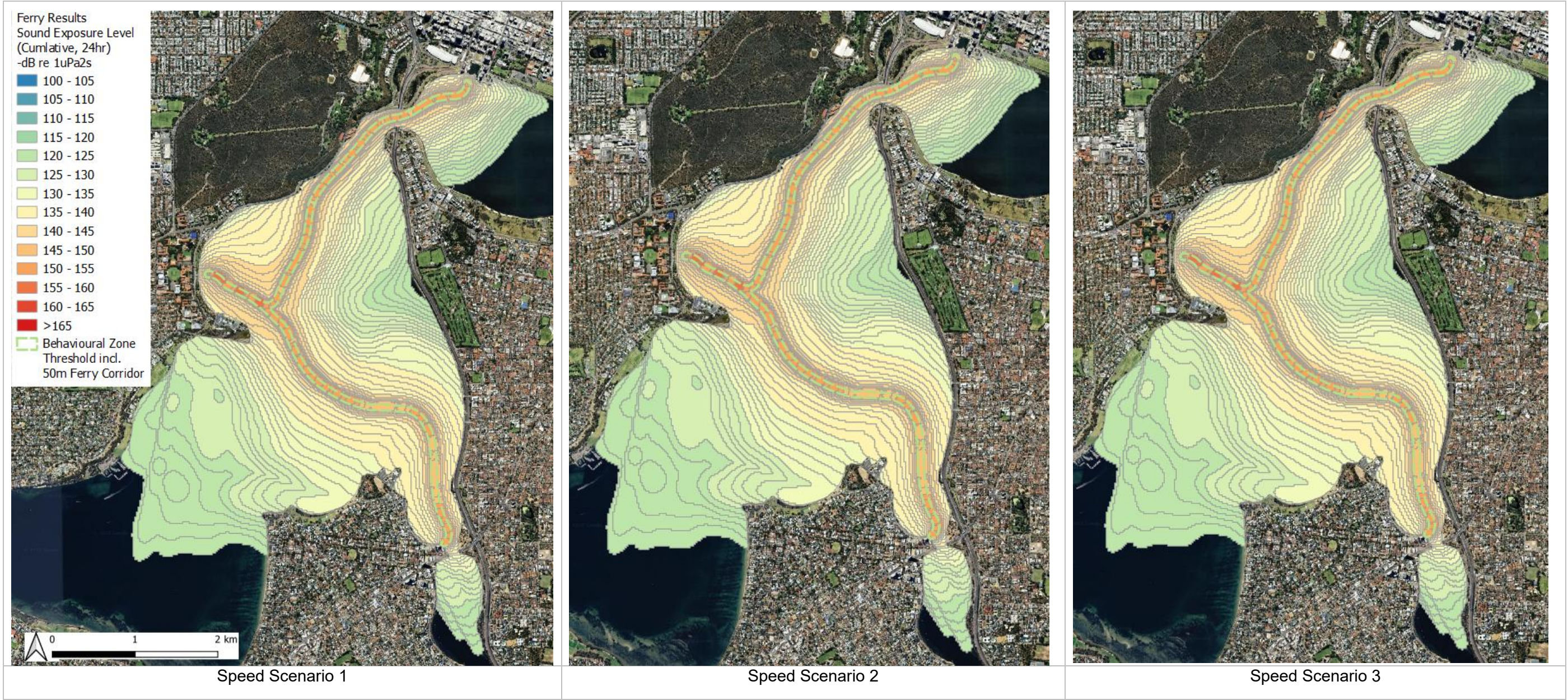


Figure C 5 Modelled noise contour plot for ferry Route 1 OCW (contours range from 120dB to 140dB)



Figure C 6 Modelled noise contour plot for ferry Route 1 PCW (contours range from 120dB to 150dB)



Figure C 7 Modelled noise contour plot for ferry Route 1 SI (contours range from 110dB to 130dB)

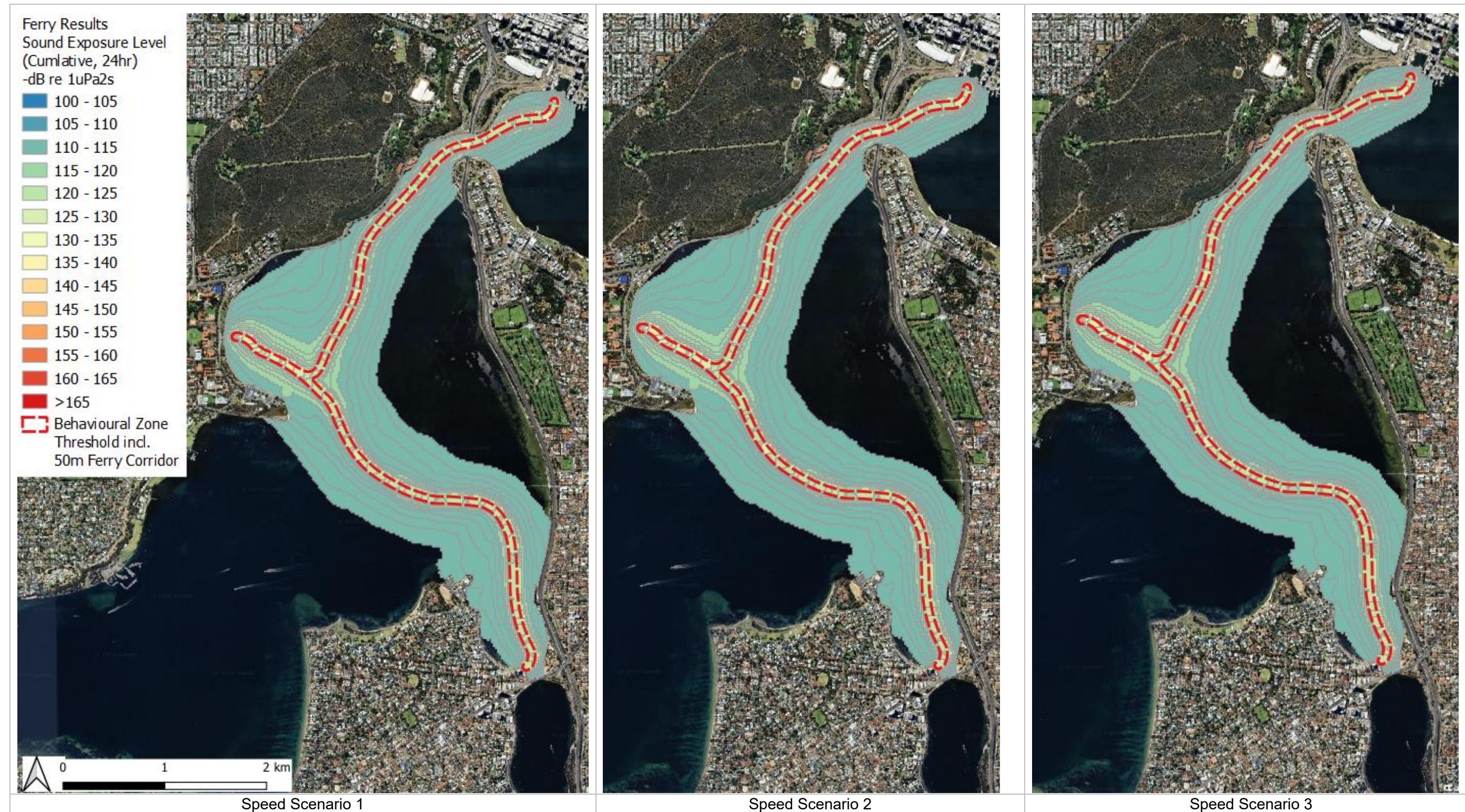


Figure C 8 Modelled noise contour plot for ferry Route 2 Unweighted (contours range from 120dB to >170dB)

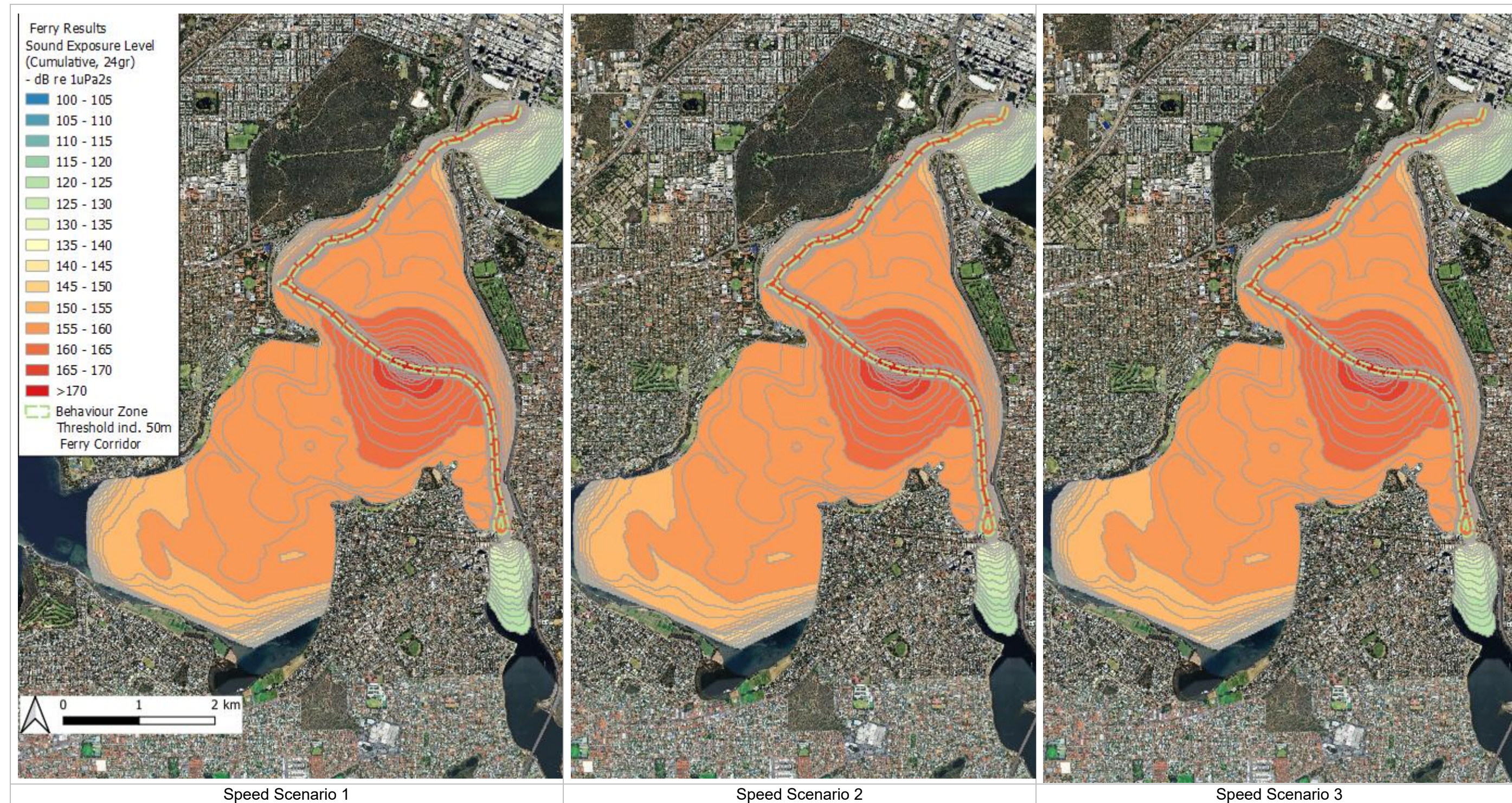


Figure C 9 Modelled noise contour plot for ferry Route 2 VHF (contours range from 100dB to 120dB)



Figure C 10 Modelled noise contour plot for ferry Route 2 HF (contours range from 120dB to 145dB)



Figure C 11 Modelled noise contour plot for ferry Route 2 LF (contours range from 120dB to 165dB)

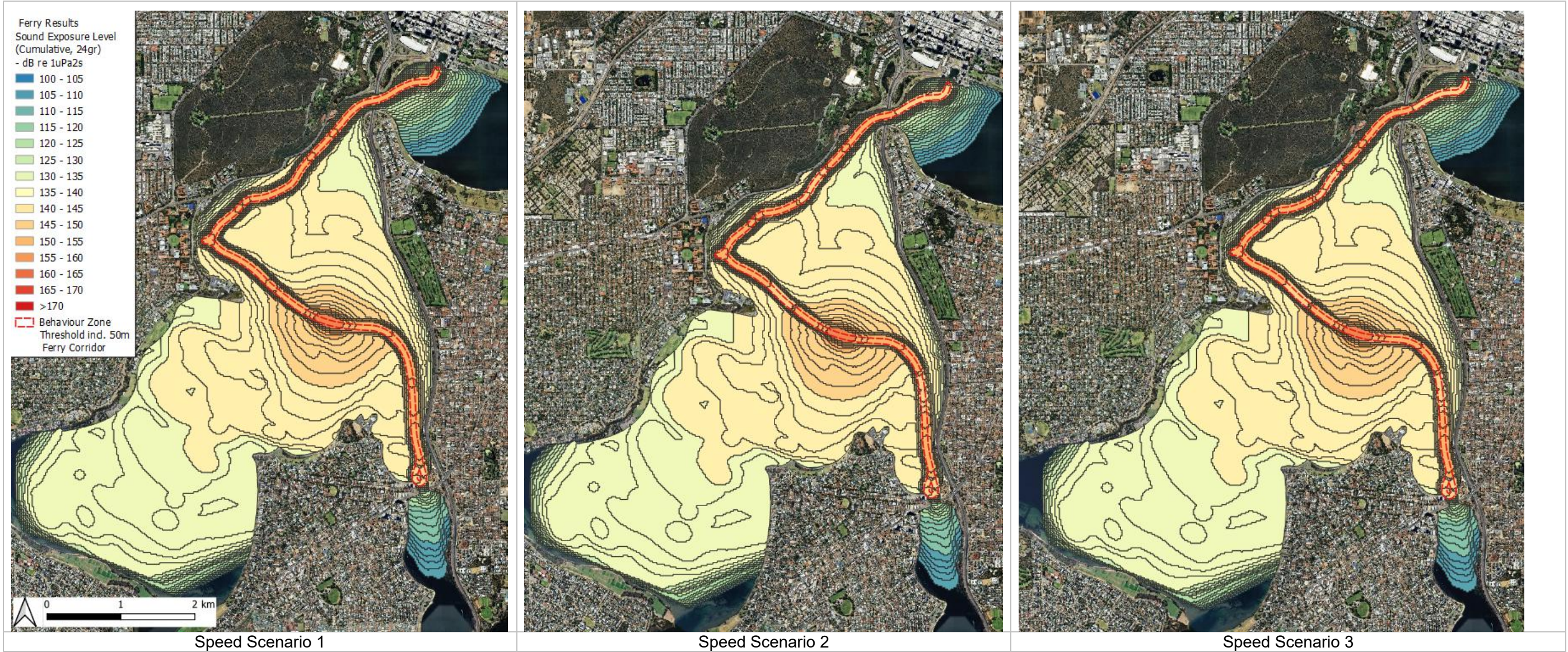


Figure C 12 Modelled noise contour plot for ferry Route 2 OCW (contours range from 110dB to 140dB)

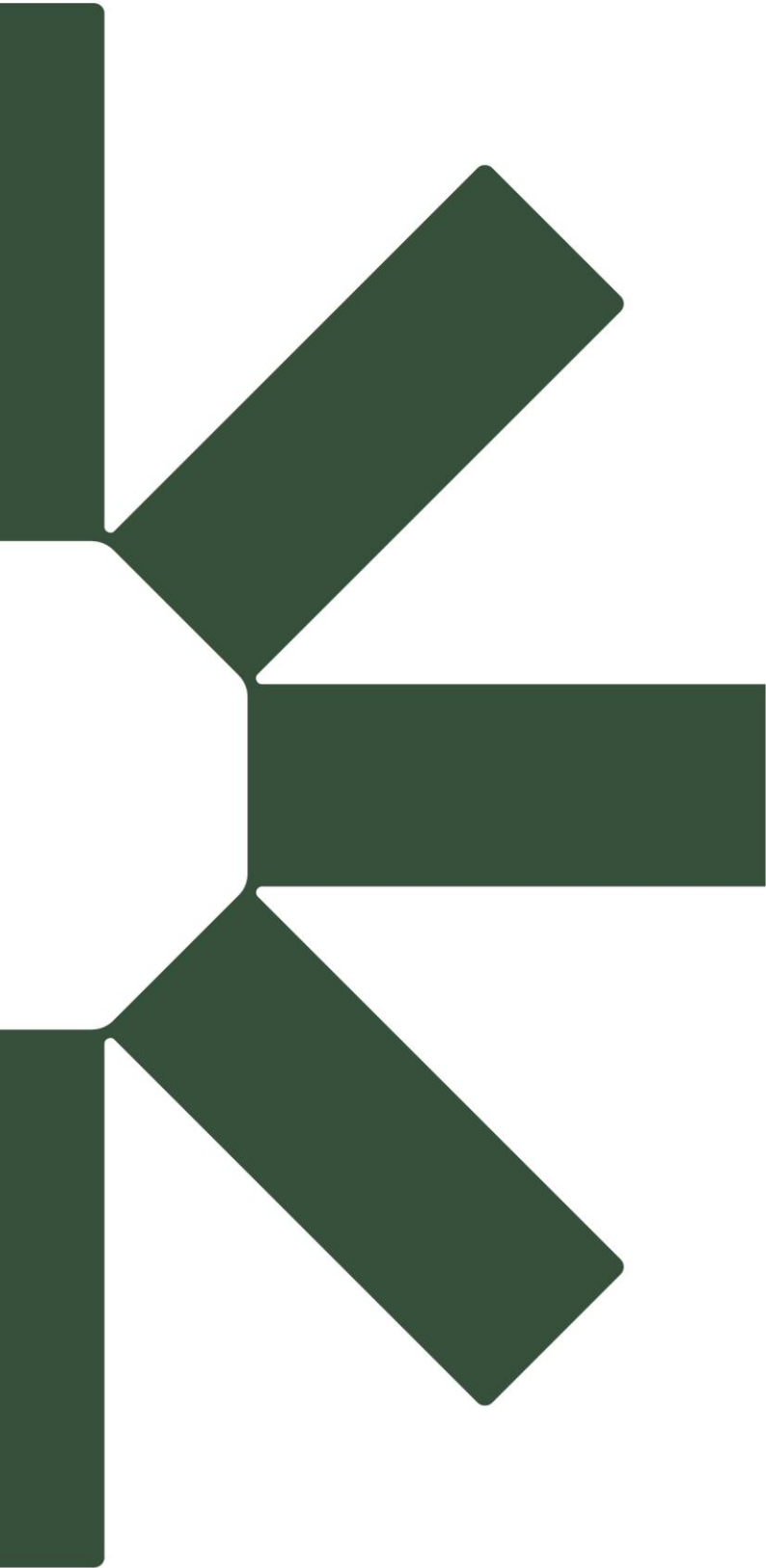


Figure C 13 Modelled noise contour plot for ferry Route 2 PCW (contours range from 120dB to 150dB)



Figure C 14 Modelled noise contour plot for ferry Route 2 SI (contours range from 110dB to 130dB)





Making Sustainability Happen

Appendix K Environmental Assessment Report

Ferry Operations Development Application

METRONET on Swan Ferry Service Expansion

Public Transport Authority of Western Australia

SLR Project No.: 675.V25085.00EA1

21 August 2026

Environmental Assessment Report

METRONET on Swan Ferry Operations

10-Aug-2026

Environmental Assessment Report

METRONET on Swan Ferry Operations

Client: Public Transport Authority

ABN: 61 850 109 576

Prepared by

AECOM Australia Pty Ltd

Whadjuk Noongar Country, Level 15, Alluvion Building, 58 Mounts Bay Road, Perth WA 6000, GPO Box B59, Perth WA 6849, Australia

T +61 1800 868 654 www.aecom.com

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Verifier/s Monica Goggin

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Executive Summary

The Public Transport Authority of Western Australia (PTA) (the Proponent) is expanding the existing Swan River ferry service which currently operates between Elizabeth Quay and South Perth, within the Swan Canning Estuary.

The METRONET on Swan Ferry Service Expansion: Perth to Applecross Project (the Project) is situated within in-river environments, with minimal terrestrial and landside works proposed in already developed areas and will feature new electric ferries.

Key components of the Project include the operation of five new electric ferry vessels between Elizabeth Quay, Matilda Bay and Applecross, along with constructing new ferry terminals located at Applecross and Matilda Bay, and upgrading the existing boarding facilities at Elizabeth Quay Terminal.

This Environmental Assessment Report (EAR) has been prepared to assess the environmental impacts of the operational aspects of the Project, being the movement of ferries. This report has been prepared to support the Part V Development Application under the SCR *Swan and Canning Rivers Management Act 2006* for the operational aspects of the Project for assessment by Swan River Trust.

The ferries will be electric catamarans with a maximum length of 24.95 m and will travel at a maximum speed of 8 knots (15 km/hr) as they approach terminals and otherwise travel at a variety of speeds depending upon conditions and location.

The operation of ferry services between Applecross, Matilda Bay and Elizabeth Quay Terminals may result in impacts to the environmental values that have been identified within this document. The ferries have been designed to minimise potential impacts to the Swan-Canning Estuary environment by:

- Operating electric vessels with zero fuel storage and emissions
- Using efficient hull design to minimise wave wake and wash, reducing the risk of erosion
- Reducing noise when compared to conventional diesel-powered vessels
- Utilising waterjet propulsion removing damage associated with propellers, including injury to marine fauna.

A summary of potential operational impacts is presented in Table ES-1. With appropriate management, these impacts are anticipated to be minor and not cause a significant impact to the environment of the Swan-Canning Estuary.

Table ES 1 Potential Operational Impacts

Factor	Potential Impacts	Anticipated Impact and Management
Foreshore erosion	• Potential erosion of beaches and embankments, including Pelican Point under speed exemption scenarios. • Reduction in ecological values and public amenities.	Impact is anticipated to be low due to minimisation of wave wake through control of operating speeds and hull design. This impact has been modelled for confirmation as part of a wake prediction assessment report, revised report provided by Seashore Engineering (2026). Speed exemption scenarios impacting Pelican Point are likely to require further modelling and monitoring and mitigation.

Factor	Potential Impacts	Anticipated Impact and Management
Water and sediment quality	- Direct impacts to water and sediment quality due to spills, leaks or debris / litter from the ferries - Increased turbidity due to mobilisation of sediment due to vessel interaction with riverbed (propulsion turbulence) - Indirect impacts to water quality due to existing poor quality sediments being disturbed and mixing with the water column. - Risk of battery and fire retardant chemicals entering the water column in the unlikely event of a battery fire.	Impact anticipated to be highly localised, managed through good housekeeping and maintaining low speeds in shallow water to minimise sediment disturbance. Baseline water and sediment quality sampling is currently being undertaken to understand existing conditions. Design of ferry and associated fire suppression system will minimize the risk of battery fire.
Benthic habitat	- Erosion (scour) of benthic habitat due to propulsion turbulence and wake wash - Mobilisation of sediments causing decreased light availability and smothering of BCH (seagrasses) - Mobilisation of sediment causing changes to water quality through elevated nutrient concentrations in the water column, leading to algal blooms, decreased light availability and smothering of BCH.	The Option 2 ferry route intersects a very small area of sparse to medium seagrass near the Kwinana Freeway and thus is more likely to impact seagrass. Within the limitations of available data, it cannot be stated with certainty that Option 1 route does not intersect any seagrass, however the route has been located as far as practicably possible in areas believe to be free from seagrass The ferries will maintain low speeds in shallow water to minimise sediment disturbance. Orientation of waterjet nozzle and use of stern deflectors as much as practicably possible to reduce scour in shallow environments. Crew awareness of Environmental concerns resulting from mobilisation of sediment will be included in an Operational Environmental Management Plan (OEMP) (draft attached).
Marine fauna	- Vessel strike of marine fauna - Erosion / scour causing physical removal of infauna and epifauna species (affecting food source of larger species) - Vessel noise creating behavioural response and impacting foraging / breeding (Indo-Pacific dolphins) and causing a response behaviour in other species - Fauna death due to entanglement in or ingestion of ferry waste (including passenger litter). - Artificial lighting impacting predator / prey relationship	Proposed ferry route avoids benthic habitat outside of immediate Terminal area. The ferries will maintain low speeds in shallow water to minimise benthic disturbance for infauna and epifauna. Ferry noise is not anticipated to cause impacts at distances greater than 10 m from the ferry. Ferry waste will be minimised through use of litter bins with lids, signage and regular emptying of bins. Limited light use (particularly blue / green) and use of shielding in accordance with navigation and safety requirements. With these measures, impacts are anticipated to be localised and low.

Factor	Potential Impacts	Anticipated Impact and Management
Conservation reserves	• Potential impact to water quality in the Swan Estuary Marine Park • Potential impacts to benthic habitat within the Swan Estuary Marine Park through erosion and loss of habitat. • Vessel strike of fauna. Potential impact to shorelines under certain speed exemption scenarios.	The ferry will not traverse Swan Estuary Marine Park and a minimum distance of 100 m from the Marine Park will be maintained. Under most scenarios ,potential impacts to the Marine Park will be indirect and are anticipated to be limited to very minor erosion and vessel strike of mobile fauna species outside the Marine Park itself. The impacts of future speed exemption scenarios will need to be evaluated on the Swan Estuary Marine Park and may require additional intervention.

1.0 Introduction

1.1 Project Overview

The Public Transport Authority of Western Australia (PTA) (the Proponent) is expanding the existing Swan River ferry service which currently operates between Elizabeth Quay and South Perth, within the Swan Canning Estuary.

The METRONET on Swan Ferry Service Expansion: Perth to Applecross Project (the Project) is situated within in-river environments, with minimal terrestrial and landside works proposed in already developed areas and will feature new electric ferries. The new electric ferries are considered a more sustainable option than the current diesel ferries that operate to South Perth.

Key components of the Project include the operation of five new electric ferry vessels between Elizabeth Quay, Matilda Bay and Applecross, along with constructing new ferry terminals located at Applecross and Matilda Bay, and upgrading the existing boarding facilities at Elizabeth Quay terminal. Ferries will operate between 6 am and 12:30 am, daily.

Subject to obtaining the necessary approvals, the proposed development of the Elizabeth Quay, Matilda Bay and Applecross terminals is scheduled for completion to enable commencement of the new ferry service by late 2027.

1.1.1 Legislative Framework

The proposed operation is subject to the Metropolitan Region Scheme (MRS) established under the *Planning and Development Act 2005*. The operations intersect with the Development Control Area (DCA) established under the *Swan and Canning Rivers Management Act 2006* (SCRM Act) and therefore require separate approvals under this legislation. Since 1 July 2015, the roles and functions of the Swan River Trust (SRT) have been merged with the Department of Biodiversity, Conservation and Attractions (DBCA) but the term SRT is used to refer to the approval body under the SCRM Act.

Developments within the DCA are referred to the SRT. Under Section 70 of the SCRM Act, the term 'development' includes 'any material change in the use of land or waters' and as such the operation of the ferry vessels is considered a 'development'.

Development approval has been sought via separate applications for construction of the proposed Elizabeth Quay, Matilda Bay and Applecross terminals.

A number of policies that guide the implementation of the relevant legislation (Section 2.0) have been considered in the development approach and the content of this report. The relevant policies are summarised below and relevant policy provisions have been addressed in Table 3.

1.2 Report Purpose

This Environmental Assessment Report (EAR) has been prepared to assess the environmental impacts of the operational aspects of the Project, being the movement of ferries along the routes shown on Figure 1. This report has been prepared to support the Part V Development Application under the SCRM Act for the operational aspects of the Project for assessment by SRT.

Part 5 of the SCRM Act applies to development proposed within a DCA, provided that no part of the development is located outside the DCA. The ferry operations occur entirely within the DCA (except where located at Elizabeth Quay which falls outside the DCA).

While development under the *Planning and Development Act 2005* is primarily a land-based concept focused on built form and land use, the SCRM Act adopts a broader approach, encompassing both land and waters and includes 'material changes' to the use of land and waters.

Regulation 4(h) of the *Swan and Canning Rivers Management Regulations 2007* modifies the definition of development by excluding certain acts and activities that do not involve the carrying out of physical works.

Given that one of the primary purposes of the SCRM Act is to protect and manage the rivers and associated land for ecological and community benefit, and the ferry operations involve a material change in the use of the Swan River, the ferry operations require assessment under Part 5 of the SCRM Act.

In assessing and determining an application under Part 5, decision-makers must have regard to:

- The objectives of the SCRM Act
- Key principles including sustainability (environmental, social and economic factors), the precautionary principle, intergenerational equity, biodiversity conservation, shared responsibility, best practice, and continuous improvement.

In response to these matters, this report provides an overview of relevant legislation and policies, the existing estuarine environment, potential impacts of the development on the environment, and proposed management of environmental impacts.

1.3 Description of Operations

The new ferry service is aimed at providing a regular and reliable cross-river public transport connection, between Elizabeth Quay, Matilda Bay and Applecross. At the time of writing, it is intended for ferries to operate to a 25 minute frequency (subject to speed exemptions), between 06:00 and 00:00 (mirroring current ferry timetables), commencing at the end of 2027.

Project timetables will be finalised upon confirmation of operational speeds, completion of sea trials, and finalisation of the charging strategy. Timetables may also be amended after a trial period based on demand.

Ferries will be of an electric catamaran type with a maximum length of 23.99 m (Table 2).

Ferries will travel at a maximum of 8 knots as they approach terminals and otherwise travel at a variety of speeds depending upon conditions and location. Ferry speeds are discussed further in 5.1.

Table 2 Ferry dimensions

Ferry dimension	Maximum value (m)
Overall length and waterline length	23.99
Beam (maximum width), excluding sponsons	7.2
Draft (depth below waterline)	1.0
Rated passenger capacity	100
Crew required	2

The operation of ferry services between Applecross, Matilda Bay and Elizabeth Quay may result in impacts to the environmental and social/heritage values that have been identified within this document.

The ferry has been designed to minimise potential impacts to the Swan-Canning Estuary environment by:

- Operating electric vessels with zero fuel storage and emissions
- Using efficient hull design to minimise wave wake and wash, reducing the risk of erosion
- Reducing noise when compared to conventional diesel-powered vessels
- Utilising waterjet propulsion removing damage associated with propellers, including injury to marine fauna.

Please note that while reference to Elizabeth Quay is made within this document for context, it is beyond the scope of this assessment as it lies outside the DCA.



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LEGEND

- Ferry Terminal
- Proposed Ferry Route
- Option 1
- Option 2

Site Location and Operational Route

PUBLIC TRANSPORT AUTHORITY

METRONET ON SWAN FERRY
OPERATIONS - ENVIRONMENTAL
ASSESSMENT REPORT

Figure
1

2.0 Relevant Legislation

2.1 Swan and Canning Rivers Management Act 2006

The SCRM Act applies for development within the DCA and requires SRT approval of the development prior to commencement. The SRT is responsible for assessment of development applications in the Swan Canning Development Control Area under section 72(1) of the SCRM Act.

The proposed development at Elizabeth Quay is subject to [the Central Perth Redevelopment Scheme](#) (2022) (CPRS) established under the *Metropolitan Redevelopment Authority Act 2011*. The application for development approval at this location will be determined by DevelopmentWA.

The proposed development at Matilda Bay and Applecross is subject to the Metropolitan Region Scheme (MRS) established under the *Planning and Development Act 2005*. These locations intersect with the Development Control Area (DCA) established under the *Swan and Canning Rivers Management Act 2006* (SCRM Act). Applications for development approval at these locations will be determined by the Western Australian Planning Commission (WAPC), on the advice of the Swan River Trust (SRT).

These applications were prepared separately for submission, with a Supporting Environmental Assessment Report included, covering environmental and legislative assessments.

2.2 Environmental Protection Act 1986

To obtain primary approvals and comply with the *Environmental Protection Act 1986* (EP Act), projects with potential significant environmental impacts are either referred under Part IV (Section 38) of the EP Act, or if the impacts are limited to native vegetation, dealt with via Part V (Division 2) of the Act.

2.2.1 Environmental Impact Assessment

The legal basis for Environmental Impact Assessment (EIA) in Western Australia is contained in Part IV of the EP Act. Guidance documentation for approvals and legislative requirements is provided by the Environmental Protection Authority (EPA) for many of the environmental requirements for this project. Each of these guidance documents is linked to the primary guidance document 'Statement of environmental principles, factors, objectives and aims of EIA' (EPA 2023).

The Project has been referred to the EPA under Section 38 (Part IV) of the EP Act and was determined not to require assessment.

2.2.2 Environmental Noise

The *Environmental Protection (Noise) Regulations 1997* operate as a prescribed standard under the EP Act and set limits on noise emissions. The Regulations address noise passing from one premises to another, including noise from public places and impacts to adjacent premises.

Environmental noise is discussed further in Section 5.4.

2.3 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places (among others), which are defined as 'Matters of National Environmental Significance' (MNES).

The EPBC Act protects listed MNES, and it is an offence to implement any action that would have a significant impact on any MNES. If an action is likely to have a significant impact upon a protected matter, then it must be referred to the Department of Climate Change, Energy, the Environment and Water (DCCEEW).

It is not expected that there will be significant impacts to any MNES during the operational phase of the Project. Referral under the EPBC Act is not anticipated.

2.4 Aboriginal Heritage Act 1972

The *Aboriginal Heritage Act 1972* (AH Act) protects all Aboriginal heritage sites in Western Australia. Consent is required from the Minister for Aboriginal Affairs for any activity that will negatively impact an Aboriginal heritage site.

There are different types of approval under the AH Act and the *Aboriginal Heritage Regulations 1974*. Approval may be required from either the Minister for Aboriginal Affairs or the Registrar of Aboriginal Sites for any activity which may harm an Aboriginal site. There are four types of authorisations:

- Section 18 consent – for more significant impacts and harm to Aboriginal sites
- Section 16 authorisation – for excavation purposes (generally related to research)
- Regulation 7 approval – to bring plant and equipment to an Aboriginal site
- Regulation 10 consent – for more minor activities and impacts.

Aboriginal heritage surveys and consultation with Traditional Owners is being undertaken, and appropriate authorisations will be obtained prior to any disturbance activities. Aboriginal heritage is discussed further in Section 4.12.

2.5 Conservation and Land Management Act 1984

The *Conservation and Land Management Act 1984* (CALM Act) provides a framework for the use, protection and management of certain public lands and waters, as well as the flora and fauna within them. The Act establishes several statutory bodies, including the Conservation Commission of Western Australia, the Marine Parks and Reserves Authority, and the Marine Parks and Reserves Scientific Advisory Committee, defining their roles and responsibilities.

The primary purposes of the CALM Act include:

- Conservation: Protecting and conserving the natural environment, including biodiversity, ecosystems, and cultural heritage.
- Sustainable Management: Ensuring the sustainable use of natural resources, such as forests and marine areas.
- Public Enjoyment and Education: Facilitating public access to natural areas for recreation and education while ensuring their protection.
- Research and Monitoring: Supporting scientific research and monitoring to inform conservation and management practices.

The Swan Estuary Marine Park includes portions of the Swan River near Matilda Bay. These areas are protected under the CALM Act (Figure 2). The proposed ferry routes do not intersect the Marine Park.

DBCA will be consulted regarding any necessary approvals that may be required under the CALM Act. CALM Act reserves affected by the Project are discussed in Section 4.5.

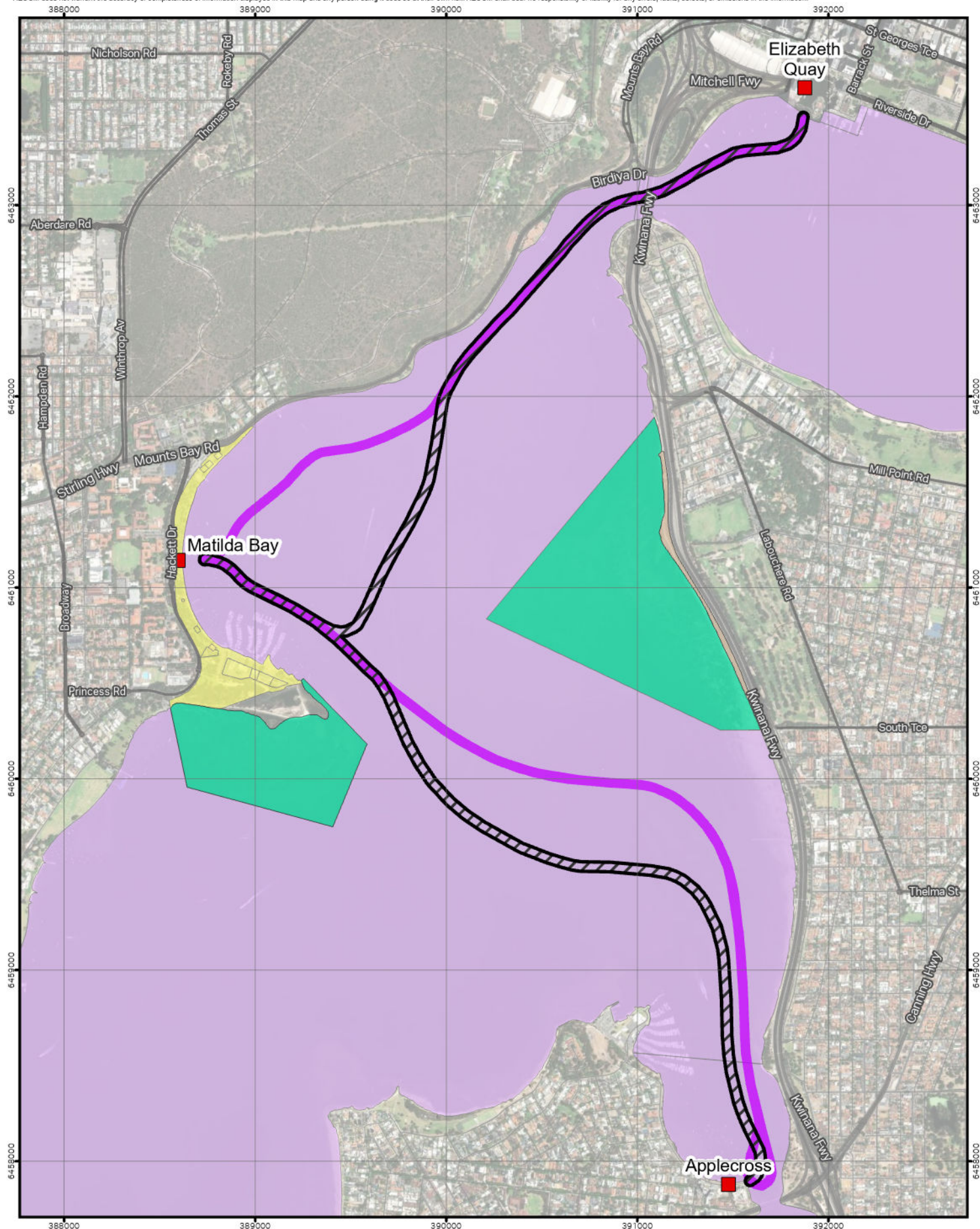
2.6 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BC Act) aims to protect biodiversity by providing for the listing of threatened species, Threatened Ecological Communities (TECs) and threatening processes. The Act regulates the taking and disturbance of fauna and flora and modification of TECs. It is not expected that there will be significant impact to any threatened species or TECs during the operational phase of the Project.

2.7 Rights in Water and Irrigation Act 1914

The *Rights in Water and Irrigation Act 1914* (RIWI Act) provides the framework for managing and allocating water resources in Western Australia, including surface water and groundwater.

The Project is not located within a Proclaimed Surface Water Area, and abstraction of surface water is not proposed, therefore a permit is not required under the RIWI Act. Although the Project lies within the Perth Proclaimed Groundwater Area, (DWER, 2022b), it is not expected that a groundwater licence will be required.



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Nature Reserve
Section 5(1)(g) Reserve
Marine Park
SCRM Act - River Reserve
Proposed Ferry Route
Option 1
Option 2
Ferry Terminal

Conservation Reserves

PUBLIC TRANSPORT AUTHORITY

**METRONET ON SWAN FERRY
OPERATIONS - ENVIRONMENTAL
ASSESSMENT REPORT**

Figure
2

3.0 Relevant Policy Provisions

A number of policies that guide the implementation of the relevant legislation (Section 2.0) have been considered in the development approach and the content of this report. The relevant policies and policy provisions are summarised below in Table 3.

3.1.1 State Planning Policies

State Planning Policies (SPPs) are the highest level of planning policy control in WA. They are prepared under Part 3 of the Planning and Development Act 2005 and provide guidance on land use planning and development across the state. Relevant SPPs that have been considered in this report include:

- State Planning Policy 2.0: Environment and Natural Resources Policy
- State Planning Policy 2.6: State Coastal Planning Policy
- State Planning Policy 2.9: Water
- State Planning Policy 2.10: Swan-Canning River System.

3.1.2 DBCA and SRT Corporate Policies

DBCA and SRT Corporate Policies are formal policy statements that define the agency's position on various operational and environmental matters, provide principles and rules to guide staff and stakeholders, and ensure consistency and accountability in the department's actions. Relevant policies that have been considered in this report include:

- DBCA and SRT Corporate Policy 42: Planning for Land Use, Development and Permitting Affecting the Swan Canning Development Control Area.

3.1.3 Pollution Response

In Western Australia, the uncontrolled release of pollutants or wastewater into the Swan River is governed by the SCRM Act and managed under the state's overarching River Protection Strategy, supported by EP Act Part V and the Contaminated Sites Act (2003).

SRT manages pollution response plans to intercept and remediate spills (such as fuel or oil) before they cause widespread environmental damage, requiring operators report to uncontrolled release, pollution, or an environmental threat in the Swan River immediately to the 24-hour reporting hotline 1300 784 782.

Table 3 Consideration of Relevant Policies

Relevant Policy	Policy Provision
WAPC Policies	
State Planning Policy 2.0: Environment and Natural Resources Policy	(5.1) General Measures Planning strategies, schemes and decision making should: (i) <i>Avoid development that may result in unacceptable environmental damage.</i> (ii) <i>Actively seek opportunities for improved environmental outcomes including support for development which provides for environmental restoration or enhancement.</i> (iv) <i>Protect significant natural, indigenous and cultural features, including sites and features significant as habitats and for their floral, cultural, built, archaeological, ethnographic, geological, geomorphological, visual or wilderness values.</i> (vii) <i>Take account of the potential for on-site and off-site impacts of land use on the environment, natural resources and natural systems.</i> (x) <i>Support conservation, protection and management of native remnant vegetation where possible, to enhance soil and land quality, water quality, biodiversity, fauna habitat, landscape, amenity values and ecosystem function.</i>
	(5.2) Water Resources Planning strategies, schemes and decision making should: (i) <i>Consider mechanisms to protect, manage, conserve and enhance:</i> (a) <i>wetlands of importance, Ramsar wetlands and wetlands identified in any relevant Environmental Protection Policy;</i> (b) <i>waterways;</i> (c) <i>estuaries;</i> (d) <i>marine environments;</i> (iv) <i>Ensure the provision of adequate setbacks between development and the foreshores of wetlands, waterways, estuaries and the coast, in order to maintain or improve the ecological and physical function of water bodies. Such setbacks will aim to maintain the natural drainage function, protect wildlife habitats and landscape values, lessen erosion of banks and verges, and facilitate filtration of sediment and waste associated with surface run-off from adjacent land uses, which may include retention or replacement of riparian vegetation.</i>
	(5.5) Biodiversity Planning strategies, schemes and decision-making should: (i) Consider mechanisms to protect areas of high biodiversity and/or conservation value, including: a. <i>land vested in the Conservation Commission as national park, nature reserve, conservation park or other reserve, and land acquired and managed by the Department of Conservation and Land Management (CALM) pending formal reservation;</i> b. <i>land and waters vested in the Marine Parks and Reserves Authority as marine park, marine nature reserve or marine management area, and areas identified in the Report of the Marine Parks and Reserves Selection Working Group;</i>
State Planning Policy 2.10: Swan-Canning River System	(7.2.1) The dynamic nature of the river, including its waters, floodplain, sustaining vegetation and habitats, should be taken into account when planning land use and development so as to ensure the long-term health and value of the river.
	(7.2.4) Fringing vegetation serves an important biological function and adds value to the river ecosystem. There is a general presumption against the clearing of native and other vegetation within the river area unless otherwise determined by a precinct plan or if there is a demonstrated problem such as weed invasion.
	(7.2.5) The protection and re-establishment of fringing riparian vegetation should be promoted as a means of stabilising riverbanks, providing wildlife habitat, intercepting nutrients, providing shade and improving river water quality.
	(7.2.6) The protection and re-establishment of wetlands, tributaries and bushland associated with the river should be promoted.
	(7.3.1) The natural and cultural heritage values of the river should be protected and enhanced.
	(7.3.2) Consideration of Aboriginal and European based cultural and natural heritage values should be taken into account when planning and determining proposals within the river area.

Relevant Policy	Policy Provision
State Planning Policy 2.6: State Coastal Planning Policy	(5.10) Coastal strategies and management plans: (i) Ensure that a rezoning, structure planning, subdivision or development – whichever arises first and is appropriate in scale, a coastal planning strategy or coastal foreshore management plan is prepared and implemented, by the local government and/or proponent, for the coastal foreshore reserve and any abutting freehold land with conservation values of the subject land. (ii) Any structure plan, zoning, subdivision, strata subdivision or development proposal for public purposes, residential, industrial, commercial, tourist, special rural and similar uses on the coast is only approved based on or in conjunction with a current detailed coastal planning strategy or foreshore management plan (whichever is appropriate for the stage and scale of development). (iii) Ensure that the coastal planning strategy or foreshore management plan is developed in consultation with the broad community and relevant public authorities, and achieve the approval of the local land manager and the WAPC if appropriate.
State Planning Policy 2.9: Water	(6.1) Planning and development maintains or enhances water quality and hydrological regimes to protect public health and support healthy ecosystems through the: (i) protection of sensitive water resources and other important environments; (ii) protection of existing vegetation and/or restoration of cleared or degraded vegetation, preferably with endemic species; (7.2) Proposals should, in accordance with the Guidelines: (i) minimise export of nutrient and all other contaminants, including sediment, entering water resources; (7.7) Specific area measures: Swan Canning River system (a) maintain and enhance the ecological and hydrological functions of the river system, and demonstrate detrimental impacts have been prevented (b) demonstrate a benefit to the community and a functional need to be located within the river and/or foreshore reserves, where the proposal is located on public land (c) maintain and enhance public access to and along the rivers and its foreshores, including through the establishment of foreshore reserves (d) consider the importance of the river as a strategic water transport network for commercial and recreational use (e) maintain and enhance the natural landscape character and sense of place of the river system.
DBCA and SRT Policies	
DBCA Corporate Policy 42: Planning for Land Use, Development and Permitting Affecting the Swan Canning Development Control Area	(5.1) Provide support, advice and decisions which protect and enhance the Swan Canning River system's ecological health. This includes maintaining tributary and stream habitats and their natural drainage functions, reducing nutrient enriched and polluted water inputs from adjacent land uses, minimising erosion of stream banks and protecting wetland ecosystems and associated wildlife habitats.
	(5.2) Prioritise the protection of threatened flora and fauna and threatened ecological communities.
	(5.4) Maintain a presumption against proposals which may, either directly or indirectly, unacceptably degrade shallow river flats, foreshore vegetation, fringing wetlands, saltmarshes or tributaries associated with the Swan Canning river system.
	(5.6) Where a proposal has the potential to contribute long term impacts on the Swan Canning river system, consider the need for a proponent to prepare and implement, as a condition of approval, an Environmental Management System to minimise any potential ongoing environmental impacts of development and use
	(5.7) Have due regard for the provisions of relevant international and national agreements, State environment and planning legislation, policy, plans and strategies when assessing proposals affecting the ecological health of the Swan Canning river system.

4.0 Existing Environment

4.1 Location

The Project is located within the Swan-Canning Estuary and adjacent foreshore, situated within the Swan coastal plain region of Western Australia. The Swan-Canning Estuary is approximately 50 km long and covers an area of approximately 55 km². It is a microtidal system supplied with freshwater from the Swan and Canning rivers, while marine water is supplied from a narrow entrance channel at Fremantle that opens into two basins (Melville Water and Perth Water). During summer months, a salt wedge extends upstream 29 km from Melville Water into the Swan River and 13 km into the Canning River. Although the majority of the estuary is shallow (less than 4 m in depth), it reaches a maximum depth of approximately 20 m in the entrance channel (Valesini, et al., 2014).

4.2 Climate

The climate in the South-West region of Western Australia is temperate - Mediterranean with mild wet winters and hot dry summers. The south-west is influenced by winter frontal systems, troughs and cut-off lows associated with westerly winds resulting in high winter rainfall and low summer rainfall (DWER, 2024). Precipitation occurs predominantly during the winter months, with the possibility of some summer storms, with ~80% of rainfall occurring between June and September (Hodgkin, E P; Hesp, P, 1998; Hallett, et al., 2017). Average temperatures in Perth range from 17.7°C to 31°C in summer and 8.4°C to 19.1°C in winter (BOM, 2026).

4.3 Geology and Soils

Gozzard (1986a) (1986b) describes the sediments of the Swan River under the ferry route as well sorted, pale coloured quartz sand with shell debris in the shallower areas and dark grey and black silt with a high organic content in deeper parts. The dark grey and black silt has a hydrogen sulfide smell and may be associated with anoxic conditions (Gozzard, 1986a).

4.3.1 Contaminated Land

There are no known contaminated sites along the shoreline in the vicinity of the ferry operations within . Contamination testing results for sediments are discussed in Section 4.4. Section 4.7 discusses water quality.

4.4 Sediments

Sediment properties are important for ferry operations where riverbed sediments may come into contact with propulsion turbulence and water intake beneath the vessel. Propulsion turbulence / wash can resuspend sediments, particularly the finer clay and silt sized material, increasing turbidity. If these sediments contain elevated levels of contaminants, under the right conditions, these contaminants may then dissolve into the water column, liberating them from the sediment. Resuspended materials can also be deposited elsewhere by the action of tides and currents, as well as via underwater intake and pump unit, and high velocity jet stream.

The chemically active fraction of sediment is typically cited as the organic component and the finest size fractions i.e., <63 µm (silt / clay). These finer fractions act as a sink for many persistent compounds including metals, hydrocarbons and chlorinated compounds. Contaminants in the water column are more bioavailable than those attached to sediments. To assess the risk of contaminants in sediments becoming bioavailable tests are undertaken to measure contaminant concentrations in:

- The sediments
- Sediment elutriate, which involves a process to simulate contaminant release through mixing sediment and local (river) water and agitated (shaken) to mimic the process by which potential contaminants may be released.

Previous surveys

Nice (2009) conducted a study on 20 sites throughout the Swan-Canning Estuary to assess surficial sediments for metals, organochlorine (OC) pesticides and polycyclic aromatic hydrocarbons (PAHs).

Overall, contaminants from all three groups were recorded in the sediments across the 20 sites. Of these 20 sites, one site (Melville Waters – Site 14), is nearest to Matilda Bay and Applecross Terminals. No contaminants were found to exceed the Interim Sediment Quality Guideline Values, and silts and clays (2-63 µm size class) constituted on average 52% of the sediment composition.

The most recent baseline surveys to characterise general chemical concentrations and particle size trends for sediments in the Swan-Canning Estuary were conducted by Novak & Hoeksema (2022), building upon previous surveys. This 2022 survey sampled for additional analytes including polychlorinated biphenyls (PCBs) and glyphosate due to their persistence in the environment. Five contaminants exceeded the revised Sediment Quality Guidelines, 2013 (SQGV) which were zinc, copper and lead metals, the organochlorine pesticide DDE and PCBs. The report noted that concentrations of contaminants remained highest in the Middle Swan Estuary, with little change in the contamination concentration in this region between the two studies (Novak & Hoeksema, 2022). At the Melville Waters site (no. 14), no contaminants were found to exceed the SQGVs, and silt constituted nearly half of the sediment particle size analysis. However, these sediments are highly mobile and could potentially create hotspots within the river system.

Project sediment and elutriate sampling

Marine sediment sampling was conducted for the Project by BMT in April 2025 (2025a) at Applecross and Matilda Bay terminal sites (Appendix A). Samples were collected using a Van Veen grab, which collected sediments at six sampling locations from surface to approximately 0.2 m depth.

Analyte concentrations were compared against the relevant guideline values to determine the potential environmental risks:

- Sediment results were compared to the Sediment Quality Guideline Trigger Values (SQGTVs) set by the Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council (ARMCANZ) of Australia and New Zealand (ANZG, 2018).
- Elutriate results were compared to ANZG Default Guideline Values (DGVs) for species protection levels from the ANZG DGVs. (ANZG, 2018). Marine guideline values were applied across all sites, as they are located downstream of the halocline and are consistently exposed to brackish or saline salinities above 2 parts per 1000 (ppt) (ANZG, 2018). No guidelines exist for total nutrients in sediments; as a precaution, elutriate nutrient testing was undertaken. Results were compared against the ANZECC & ARMCANZ (2000) DGVs for physical-chemical stressors in slightly disturbed estuarine ecosystems of south-west Australia.
- For metals, DGVs based on 95% species protection level (used for slightly to moderately disturbed ecosystems) were applied. For bioaccumulating toxicants, elutriate testing was conducted and compared against interim marine guideline values for 99% species protection, appropriate for high conservation value systems (ANZG, 2018).
- For Per- and Polyfluoroalkyl Substances (PFAS), assessment followed the Per- and Polyfluoroalkyl Substances National Environmental Management Plan (PFAS NEMP) guidelines (HEPA, 2025).
- For hydrophobic organic contaminants such as petroleum hydrocarbons, DGVs were normalised to 1.0% total organic carbon following the approach adopted by ANZG (2018).
- Acid Sulphate Soils parameters were used as an indicator for the presence of Monosulfidic Black Oozes (MBOs). MBOs are naturally occurring anoxic materials which are harmless unless they come in contact with oxygen, in which case they become acid forming. For Acid Sulphate Soils (ASS), reduced inorganic sulphur content (Chromium reducible sulfur) was assessed against texture-based Action Criteria for Acid Sulphate Soils (DER, 2015). Where thresholds were exceeded, total net acidity was calculated using acid-base accounting. Further details on these calculations are provided in the BMT sediment report (BMT, 2025a), which estimates actual and potential acidity of sediment samples.

The sediments sampled were typically low in contaminants, except for nutrients. The elevated nutrients are consistent with the long history of fertiliser from horticulture and domestic uses entering the Swan-Canning Estuary. To summarise the results:

- Exceedances of ANZG DGVs, but not ANGV GV-high, in metals were detected at one Matilda Bay sampling site (MB5); namely copper, lead, mercury, nickel and zinc (ANZG, 2018). The bioavailability of these metals were analysed via dilute acid extraction. Exceedances of the ANZG

DGV but not the ANZG GV-High, of bioavailable lead and zinc were detected (BMT, 2025a). This site also corresponded with highest distribution of the finer fractions of sediment (total silt / clay > 80%), (BMT, 2025a).

- No metal exceedances were detected at Applecross sites, however one exceedance of elutriate cobalt, of the ANZG DGV for 99% species protection, was detected at Applecross (AP1) with a concentration of 3.8 µg/L (BMT, 2025a).
- Exceedances of ANZG DGVs in elutriate nutrient concentrations were detected at all sites (ANZG, 2018).
- Concentrations of hydrocarbons and organotin antifoulants in sediments did not exceed the relevant guidelines (ANZG, 2018), with many analytes undetected (i.e., below the laboratory limit of reporting) across sites.
- No antifoulants, polychlorinated biphenyls or organochlorine pesticides were detected at any site.
- No asbestos was detected at any site.
- PFAS (total) were detected in sediments at all sites, with the highest concentration (0.005 µg/kg) recorded from Matilda Bay (MB6) (BMT, 2025a).
- Elutriate PFOS concentrations exceeded the PFAS NEMP Guideline (HEPA 2025) in all sediment samples from the Landing Sites, with concentrations ranging 0.0089–0.044 µg/L, based on the *Interim Marine Water 99% species protection for bioaccumulating toxicants* – high conservation value systems guideline as noted in HEPA, 2025. There were no exceedances of the equivalent PFOA guidelines.
- Several sites indicated potential ASS, however acid-based accounting suggested the neutralising capacity of the sediments and surrounding water was sufficient to neutralise actual ASS. However, several sites exceeded multiple MBO criteria, suggesting MBOs are present (BMT, 2025a).

A copy of the water quality report can be found in **Appendix B**.

4.5 Conservation Reserves

4.5.1 Swan-Canning River Reserve

The Project's operational route intersects the Swan-Canning River system which is identified as a DBCA legislated reserve (R 48325) for the purpose of Landscape Protection protected under the SCRM Act (Figure 2).

4.5.2 Matilda Bay Foreshore

The Matilda Bay terminal is located within the Matilda Bay Reserve (R 17375), listed as an 'A Class' reserve for the purpose of recreation and vested with the Conservation and Parks Commission (Figure 2). Ferry operations will avoid this reserve.

The Matilda Bay Management Plan (1992 – 2002) is still in effect and guides the objectives of the reserve and management by DBCA. The management plan lists a number of management objectives for the reserve including:

- Recreation – provide the public with recreational opportunities and facilities that are consistent with management objectives and conflict between users.
- Conservation – Protect and conserve the Reserve's physical, cultural and scenic resources.
- Information, Interpretation and Education – promote an understanding of the Reserve's history and natural environment and awareness and appreciation of its values.
- Research and Monitoring – promote and undertake studies on the Reserve's social values and natural processes, and monitor the impacts of visitor use and management.

The project is considered consistent with the stated purpose of the reserve.

4.5.3 Swan Estuary Marine Park

The Swan Estuary Marine Park is a shallow water A Class Marine Park that encompasses three biologically important areas within the Swan Canning estuary near the Project, which are Alfred Cove, Pelican Point (Figure 2) and Milyu (DCLM, 1999). These locations are considered biologically important areas (BIA) because they have a diverse ecosystem, are culturally significant and provide recreational opportunities. These sites hold significant cultural, mythological, and historical significance for the Whadjuk people and provide recreational opportunities, including swimming, fishing and boating. Restrictions are in place for recreational activities to ensure protection of the environment.

The Project's three terminal locations are zoned for general use under the Swan Estuary Marine Park and Adjacent Nature Reserves Management Plan (DCLM, 1999). Pelican Point lies near to the Matilda Bay terminal site. The two potential operational routes of the Project does not intersect the Swan Estuary Marine Park, but pass within 0.2 km of Pelican Point Marine Park (Option 1) and 0.4 km of Milyu Marine Park zone (Option 2) (Figure 2).

4.6 Wetlands and Water

4.6.1 Wetlands

The Geomorphic Wetlands of the Swan Coastal Plain mapping (DBCA-019) identifies the Swan River Estuary as a Conservation Category Wetland (CCW) (UFI 13316) (Figure 3), listed as a basin landform and Estuary waterbody. CCWs are those that support a high level of attributes and functions.

The Swan-Canning River system is also listed in the Directory of Important Wetlands in Australia (Site WA091) (DBCA-045) (Landgate, 2025) (Figure 3) which is a large database that encompasses a number of important elements and aims to identify important wetlands across Australia to provide a substantial knowledge base on what defines wetlands and their variety and dependence on them of many flora and fauna species.

4.6.2 Groundwater

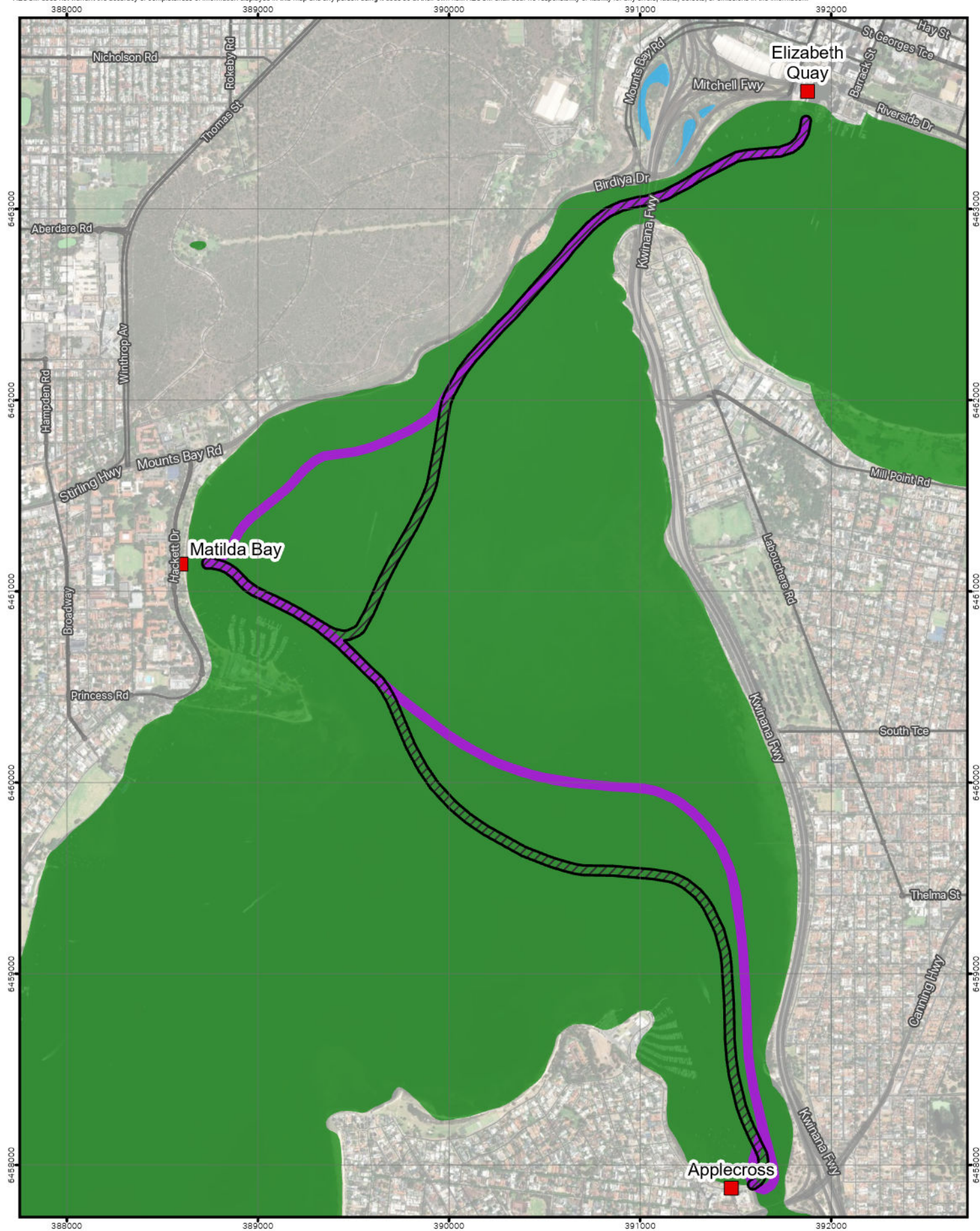
Review of the Perth Groundwater Map indicates that groundwater is present at depths of less than 5 metres below ground level in both project areas (DWER, 2022a). Additionally, the project areas lie within the Perth Groundwater Proclamation Area (DWER, 2022b).

No Public Drinking Water Source Areas (PDWSA) are present.

4.6.3 Surface Water Flows

A review of the freshwater catchment inputs into the Swan-Canning Estuary for the period 2013-2016 showed that the Swan River received significantly more freshwater inflow than the Canning River, contributing approximately 84% of the total flow. The highest monthly discharge during this period occurred in September 2013, reaching 111 gigalitres (GL), although the timing of peak flows varied annually depending on storm events. Freshwater inflows were consistently low (<5 GL per month) between November and April each year, highlighting the low rainfall during the summer.

Historical catchment flow data indicates that South-west Western Australia, including the Swan-Canning catchment, has experienced a drying trend, marked by reductions in overall rainfall, particularly during winter, and an increase in storm intensity. Concurrently, ambient temperatures and evaporation rates have risen. These climatic changes have led to a decline in average annual runoff since the 1970s, with rainfall and catchment flows decreasing by approximately 20% over this period (DWER, 2024) (DPIRD, 2023).



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LEGEND

Geomorphic Wetlands, Swan Coastal Plain (DBCA-019)

- Conservation
- Multiple Use
- Resource Enhancement

Proposed Ferry Route

- Option 1
- Option 2
- Ferry Terminal

Geomorphic Wetlands

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Figure
3

4.7 Water Quality

Historical research undertaken by the Swan River Trust has recorded temperature ranges from approximately 13°C to 16°C in winter and 23°C to 26°C in summer (Swan River Trust, 2000). Similarly, the snapshot of water temperatures recorded by GHD in September 2025, in a limited number of locations, ranged from 16.5°C to 21°C (GHD, 2025).

Nutrient inputs into the system are typically sourced from catchment flows, stormwater drainage outfalls and marine tidal exchange, with stormwater contributing a larger proportion of nutrient during the summer months (Twomey & John, 2001).

More recently, water quality sampling surveys of the Project areas commenced in April 2025 and will be undertaken monthly until September 2026. These surveys will assist in determining baseline data for comparison monitoring during and post development. Sampling was taken at all three Terminal locations and at Barrack Street Jetty, Victoria Park (Ellam Street), Narrows Bridge and Heathcote. Water quality samples were collected from 0.5 m below surface and 0.5 m above the riverbed (two samples per location) to investigate the full water column (GHD, 2025). The results presented here represent the findings for the period April to September 2025.

Field and analytical data were tabulated and presented with the adopted assessment criteria for the Project sourced from the following guidelines:

- Australian and New Zealand Environment and Conservation Council (ANZECC) & Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality [ANZG], amended 2018.
- HEPA (2025) PFAS National Environmental Management Plan Version 3.0 [PFAS NEMP], Heads of EPA Australia and New Zealand 2025.

The adopted assessment criteria currently utilised for the Project are ANZG (2018) 95% Loss of Species Protection for freshwater (FW) and marine water (MW) and 99% PFAS NEMP (2025).

The sampling results indicate that while most parameters remained within adopted assessment criteria, several nutrients and metals showed elevated concentrations during specific periods, largely associated with catchment runoff in the wetter months. Results of this survey included:

- Nutrients including ammonia, oxidised nitrogen (NO_x), total nitrogen and total phosphorus regularly exceeded guidelines and showed a significant increase in response to an August rainfall event.
- Consistent exceedances for copper and zinc, where high levels of dissolved (and consequently more bioavailable) forms (Geophysics, 2025) of these metals were encountered
- Sporadic exceedances for mercury, nickel and cadmium
- Exceedances for Perfluorooctane sulfonic acid (PFOS, part of the PFAS suite) in all samples
- Exceedances of guidelines for hydrocarbons, organometals, chlorophyll, pesticides, herbicides and fungicides were not recorded (GHD, 2025).

These exceedances of metals and nutrients are typical of waterbodies that receive urban runoff.

The results from discreet water quality samples provide a snapshot in time. These results aid in identifying potential contaminants of concern, and may be used to support further testing, particularly in localised waters in the vicinity of the landing terminals. Water quality will be monitored for up to 12 months during initial ferry operations. Parameters to be measured will be based on current and historical data.

4.8 Bathymetry

During October to November 2024 a series of geophysical surveys were completed by Surrich Hydrographics (Surrich) to provide information on the riverbed bathymetry and features. Data was collected using Sub bottom profilers (SBP - pinger and boomer), side scan sonar (SSS) and multibeam echo sounders (MBES) from five areas (Raffles [Area 1], Canning bridge [Area 2], Matilda Bay [two locations, Area 3 and 3B], Ellam Street [Area 5] and proposed dredge area running adjacent to the Perth foreshore [Riverside Drive – Area 6]) (Geophysics, Surrich Hydrographics and Marine, 2025).

Water depths in the vicinity of the proposed ferry transit routes vary, ranging from approximately 2.15 m to 7.85 m Chart Datum (CD, approximately Lowest Astronomical Tide [LAT]), (INCAT, 2026). The depths at the terminals in which the ferries will berth while passengers embark / disembark are approximately 4 m CD at Matilda Bay and approximately -3 m CD at Applecross estimated from Swan and Canning Rivers nautical charts (WA 898).

In January to February 2025, a second alternative area at Matilda Bay (Area 3B) was surveyed. Regularly spaced grid lines were not possible in this location due to the number of moorings and vessels preventing safe navigation of the survey vessel. Adequate coverage was achieved via numerous ad-hoc lines through the moorings (Geophysics, Surrich Hydrographics and Marine, 2025).

A series of hydrographic charts and riverbed feature maps (mosaics) were produced with MBES data around the shoreline / shallows collected up to the 1.5 m (AHD) contour, and higher in places depending on the tide and shoreline profile. Noisy data (due to shallow depth) was cleaned for the final dataset.

Over 96 km of SSS, 86.8 km of processed magnetic data, 108.1 km of SBP pinger data, and 38.7 km of SBP boomer data (excluding area five dredge channel) was processed and utilised in the project.

The Surrich report suggested that only a single seabed type classed as 'Alluvial Sediment' was identified within a boundary defined by the combined MBES and SSS datasets. Alluvial sediment is assumed silty sand to clay (Surrich, 2025).

Several 'seabed' feature types were described from the six areas including debris, raised feature (which can be natural or manmade), boulders and scour (Table 4, Appendix C).

Table 4 Seabed Feature Classes and Count

Class	Type	Simplified Description	Count
Boat Ramp	Point	Concrete boat ramp.	2
Boulder	Point	Isolated boulder on riverbed.	55
Debris	Point	Debris object. Man made debris object.	166
Debris Fender Tyre	Point	Car or truck tyres are commonly installed on work vessels as fenders. They may be torn off during operations.	37
Dredging	Line	Previous dredge area boundary.	1
Mound	Area	Raised feature. They may be natural or man-made.	2
Navigation Mark	Point	Fixed or floating navigation marks.	18
Reflector X	Point	Feature identified in the SBP pinger data. Interpreted as a potential fluid or gas discharge. A "Reflector X" feature is digitised where it is observed influencing the riverbed in the SBP section. Deeper occurrences are not digitised as features.	30
Scour	Line Area	Scours are depression in the seabed. They may be natural or manmade.	289
Vessel Mooring	Point	Object associated with operational vessel mooring.	57
Wharf or Jetty Pile	Point	May be an existing pile or a historical pile no longer in use.	50
Wreck	Point	Wreck on riverbed.	1

Source: (Geophysics, Surrich Hydrographics and Marine, 2025)

The data provides a snapshot of the present level of environmental degradation due to vessel operations in shallow waters prior to potential PTA construction activities (digitised scours through MBES/SSS imagery). Sources of scours were identified as:

- Anchoring systems for moorings and floating navigation marks
- Vessel interaction with riverbed in shallow water
- Drag marks (i.e., anchor being dragged along riverbed).

Surrich (2025) noted that scouring by vessels interacting with the seabed was common along the existing navigation channel adjacent to Riverside Drive in Perth. Surrich reported that no scour appeared evident at each end of the mapped channel, where water depths increased i.e., below 1.9 m LWMF (lowest water mark Fremantle) / >-2.7 m AHD. While the observation was directed at a suggested minimum dredge depth, the information is useful in providing depths at which vessel interaction with the riverbed is evident. The stir up of sediments from turbulence occurs naturally (due to strong currents, irregular depths) but can also be a function of vessels travelling at high speed in shallow areas (subject to size and speed). It is also assumed that the scour observed during this survey is related to propeller driven vessels as opposed to waterjets.

The data collected from Area 3B in Matilda Bay, also highlighted environmental degradation from depressions (scour), believed to be associated with the presence of vessel moorings (Geophysics, Surrich Hydrographics and Marine, 2025). Surrich (2025) reported that 5 m to 15 m diameter scour ranging from 0.3 m to 1.2 m in depth were observed.

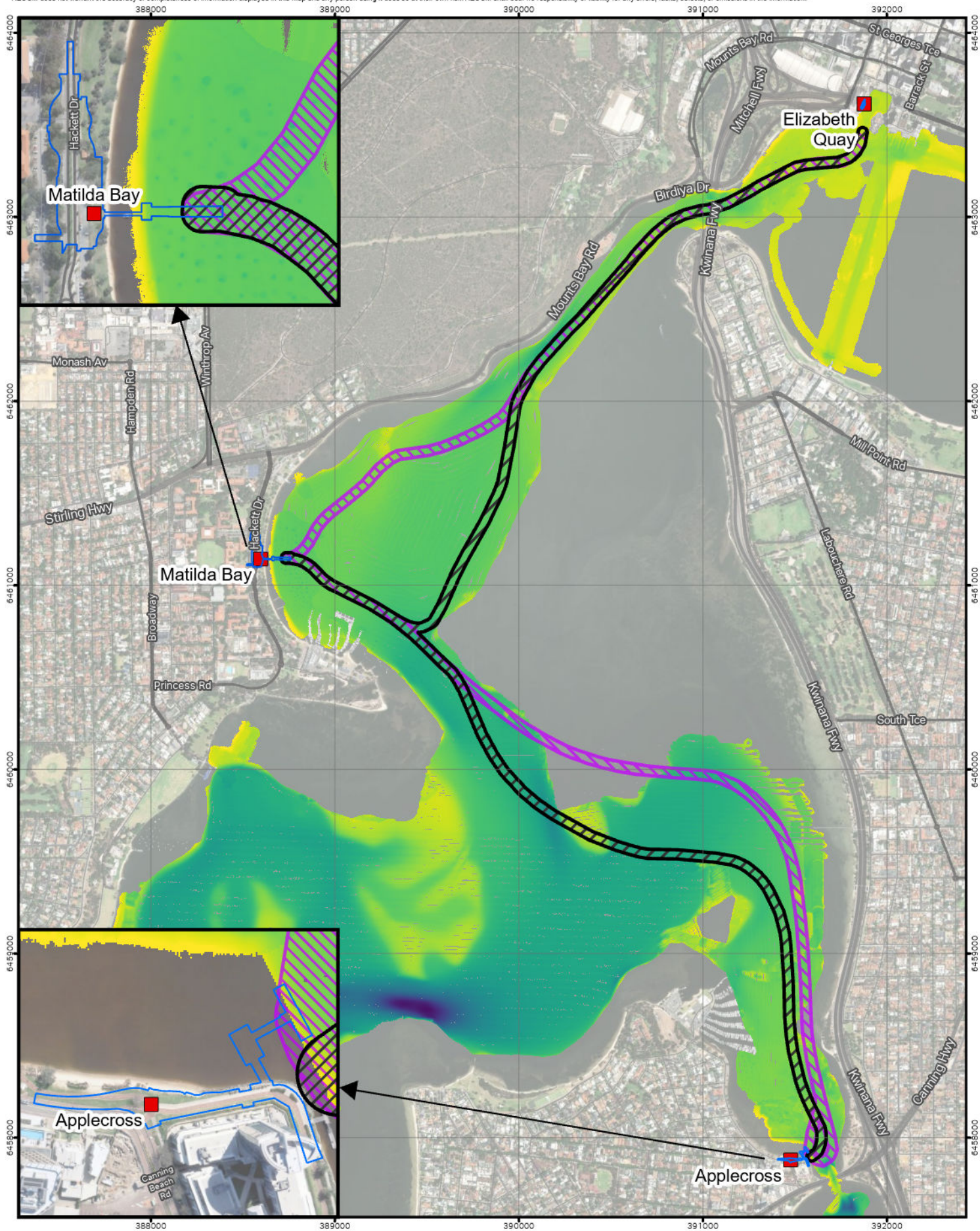
4.9 Benthic Habitat

Seagrasses are an important component of the Swan-Canning Estuary as they are a primary producer, food source and habitat for fauna, act as a nutrient and carbon sink and are a sediment oxygenator and stabiliser (DoW, 2014). The marine influence determines the types of seagrasses present in an estuary (Hodgkin & Brearley, 2005). Paddleweed (*Halophila ovalis*) is the most dominant seagrass species in the Swan-Canning Estuary. Three other species also inhabit the estuary including, *Halophila decipiens*, *Ruppia megacarpa* and *Zostera muelleri*. An ephemeral seagrass *H. ovalis*, has been estimated to cover around 20% to 25% of the total area of the Swan-Canning Estuary (Kilminster & Forbes, 2014), growing the quickest in the warmer seasons of summer and autumn, with a seasonal reduction in canopy cover during the winter months due to the onset of freshwater flows, leading to decreases in salinity and light penetration (DoW, 2010). The ability to photosynthesis during winter is critical to maintaining plant energy reserves and supporting subsequent growth and recovery. Along with seagrass, the Swan-Canning Estuary also supports ecosystems such as rocky reef, oyster beds, algal mats, and large extents of sand (Kilminster & Forbes, 2014).

The Swan-Canning Estuary hosts a diverse array of macroalgae, with 35 species identified in previous studies (DoW, 2010). The majority of these species are found in the lower reaches of the estuary, near the mouth at Fremantle. In the upper areas of the estuary, macroalgae is primarily found in the shallow waters, likely due to water clarity. Red algae are the most common algae found in the estuary, with *Gracilaria comosa*, being the most common species. Similar to seagrass, macroalgal abundance is lowest during the winter months (DoW, 2010).

Currently, seagrass health in the Swan-Canning Estuary is managed under the River Protection Strategy for Derbal Yirragan Djarlgarro (DPaW, 2015), which is a requirement of the *Swan and Canning Rivers Management Act 2006*. Annual surveys are conducted at monitoring locations in the Swan-Canning Basin area, located near the Swan Estuary Marine Park zones by DBCA to infer annual changes in abundance and distribution of seagrass and macroalgal species.

These sites also include locations near the Swan Estuary Marine Park zones of Pelican Point and Milyu. Historically, seagrass meadows within the estuary covered 598 ha in 1982, an increase from 568 ha in 1976. However, in 2011, the Department of Water reported the area had declined to 403 ha within the estuary (Kilminster & Forbes, 2014). Seagrass is considered to be native vegetation as defined in the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*. The last broadscale mapping of seagrass in the Swan-Canning Estuary was undertaken in 2011 (DoW, 2014).



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Scale bar: 0, 200, 400, 600 metres

LEGEND

- Option 1
- Option 2
- Ferry Terminal
- Indicative Development Footprint

Depth (m AHD)

-0.313
-4.359

Bathymetry

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Figure
4

Mapping of benthic communities and habitat (BCH) around the proposed jetties was conducted by BMT (2025b) between 10-12 March 2025, targeting a total area of 4.94 ha around the Project's terminal locations at Elizabeth Quay, Applecross and Matilda Bay (Figure 6¹). Results showed that bare sand was the dominant BCH category across the survey area, especially further offshore in Matilda Bay and Applecross (and entirely at Elizabeth Quay). Seagrass density and distribution map of the Swan Canning Estuary, produced by DCBA (2025), is presented in Figure 6, which shows the extent of sand in the vicinity of Elizabeth Quay and the patches of moderate to dense seagrass and macroalgae associated with the shallow areas of Matilda Bay and Applecross, respectively (Figure 5)

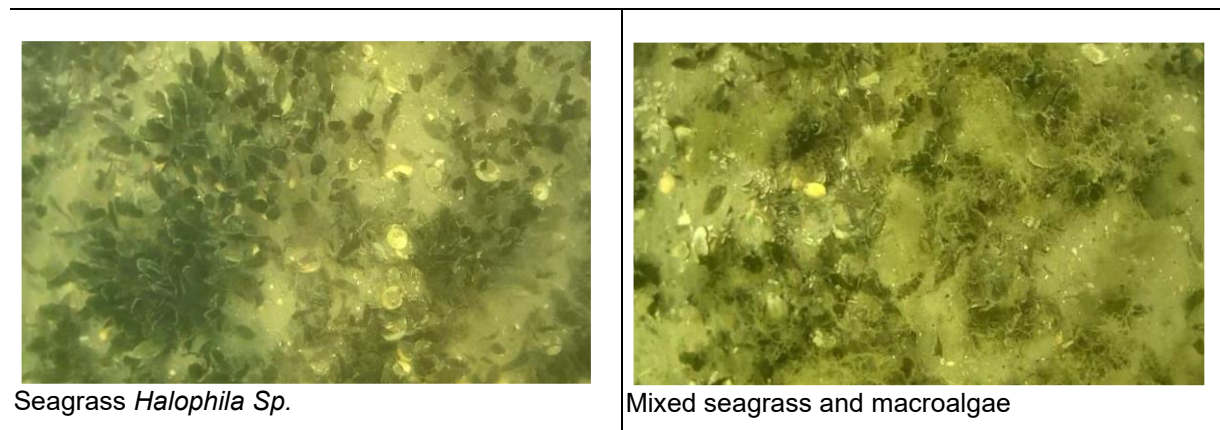


Figure 5 Example of major and minor habitat classes (BMT, 2025b)

4.10 Shoreline and Foreshore

The Project is located within the Swan-Canning Estuary and adjacent foreshore. The type of shoreline currently surrounding the ferry route is important as it affects the potential for shoreline erosion to occur.

The Elizabeth Quay terminal site, for context, is within a constructed quay that has no natural shoreline or foreshore, and instead has hard edge constructed elements interfacing with the water's edge. There are some planted natives in areas of landscaping. Constructed hard edges also occur along Mounts Bay Road and much of Kwinana Freeway (Figure 7). The exception to this is approximately 200 m of beach along Birdiya Drive, which was modified in 2017 with sand renourishment (artificially filled) due to an overall tendency for net sediment loss since land reclamation during the late 1950s (Seashore Engineering, 2026).

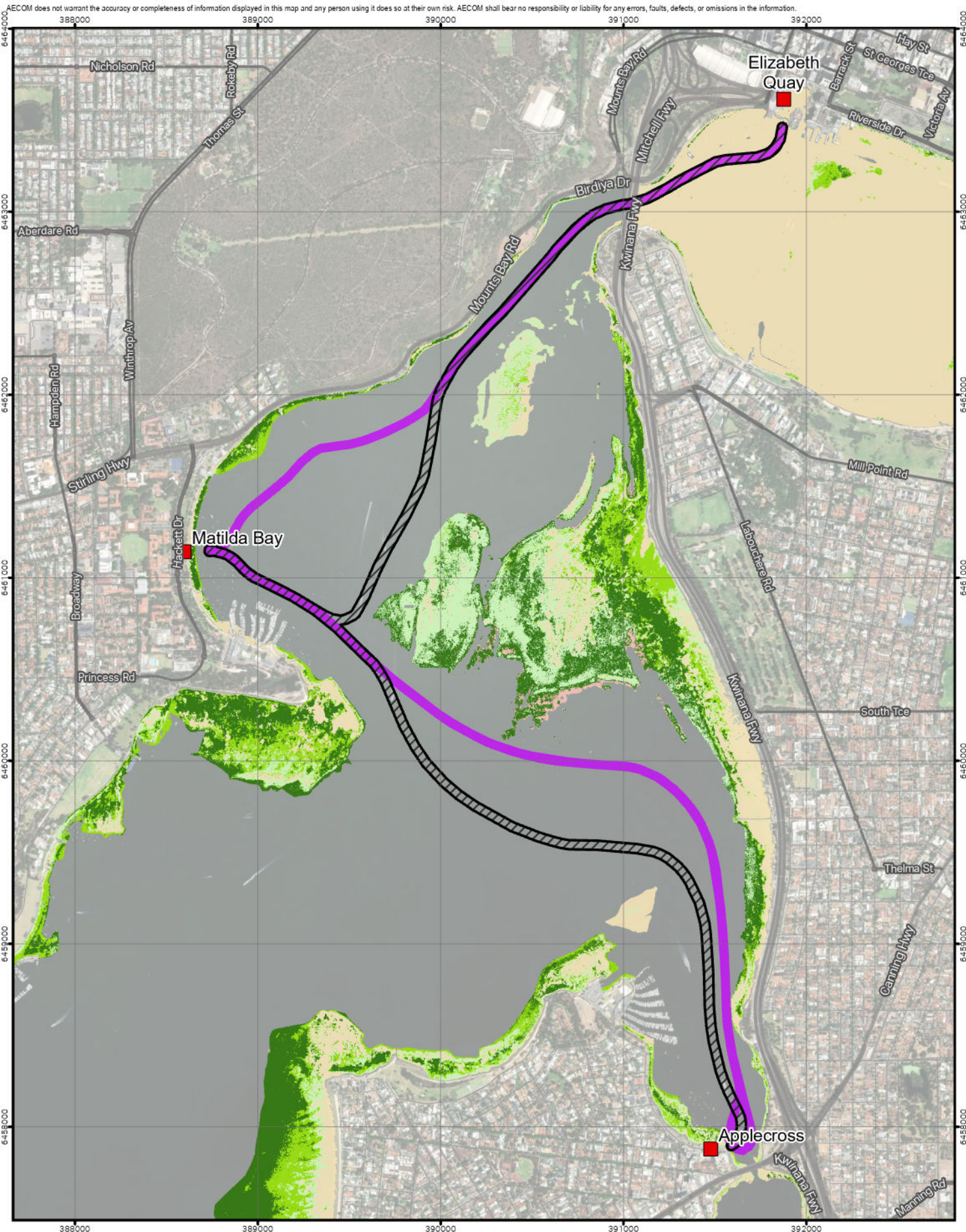
The foreshore areas at Matilda Bay and Applecross are well established recreational spaces for residents, visitors and tourists and contain riparian vegetation identified as wetland / shorebank vegetation in a site assessment undertaken by GHD (2025), and described as:

Estuarine vegetation communities with varying levels of reeds and Melaleuca species, and introduced River Oak (Casuarina cunninghamiana), as well as small sections of Sea Rush (Juncus kraussii). Includes some native and exotic emergent aquatic plants.

These areas are supported by public infrastructures such as parking, pathways, viewing points, picnic facilities and toilets, with landscaped lawns encouraging use of these areas. Nearby restaurants and cafes also take advantage of the natural viewsheds. These areas are exposed to disturbances in the form of noise, lighting and infrastructure such as jetties and seawalls.

The broader Matilda Bay foreshore has undergone historic reclamation, with fill used to raise bank levels. Since the earliest available imagery from 1953, the broader foreshore has undergone progressive erosion, estimated at approximately 5–10 m across much of the bay. This erosion has impacted amenity and use of foreshore sections due to exposure of building rubble used as fill, formation of steep banks and scarps, and encroachment into mature trees. In response, limestone block walling has been installed along parts of the bay. The foreshore environment is also located within the Matilda Bay Reserve (R 17375) with associated management guidelines as discussed in Section 4.5.

¹ Source: Department of Biodiversity, Conservation and Attractions, Swan-Canning seagrass density and distribution, 2025
Revision 1 – 10-Aug-2026
Prepared for – Public Transport Authority – ABN: 61 850 109 576



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DATA SOURCES: Best Available Data. Based on information provided by and with the permission of the Western Australian Government Information Authority (2020).
Service Layer Credits: Topographic & LIDAR (2018) Small scale: DEP (2021) CHIRAS, Minor Roads, Main Roads, Precincts & Highways, WIS, State & Regional, Transport Infrastructure (Source: Esri, various, Esri, Imagery, and the GIS user community)

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LEGEND

- Seagrass Dense
- Seagrass Medium
- Seagrass Sparse
- Sand
- Unclassified area

Proposed Ferry Route

- Option 1
- Option 2
- Ferry Terminal

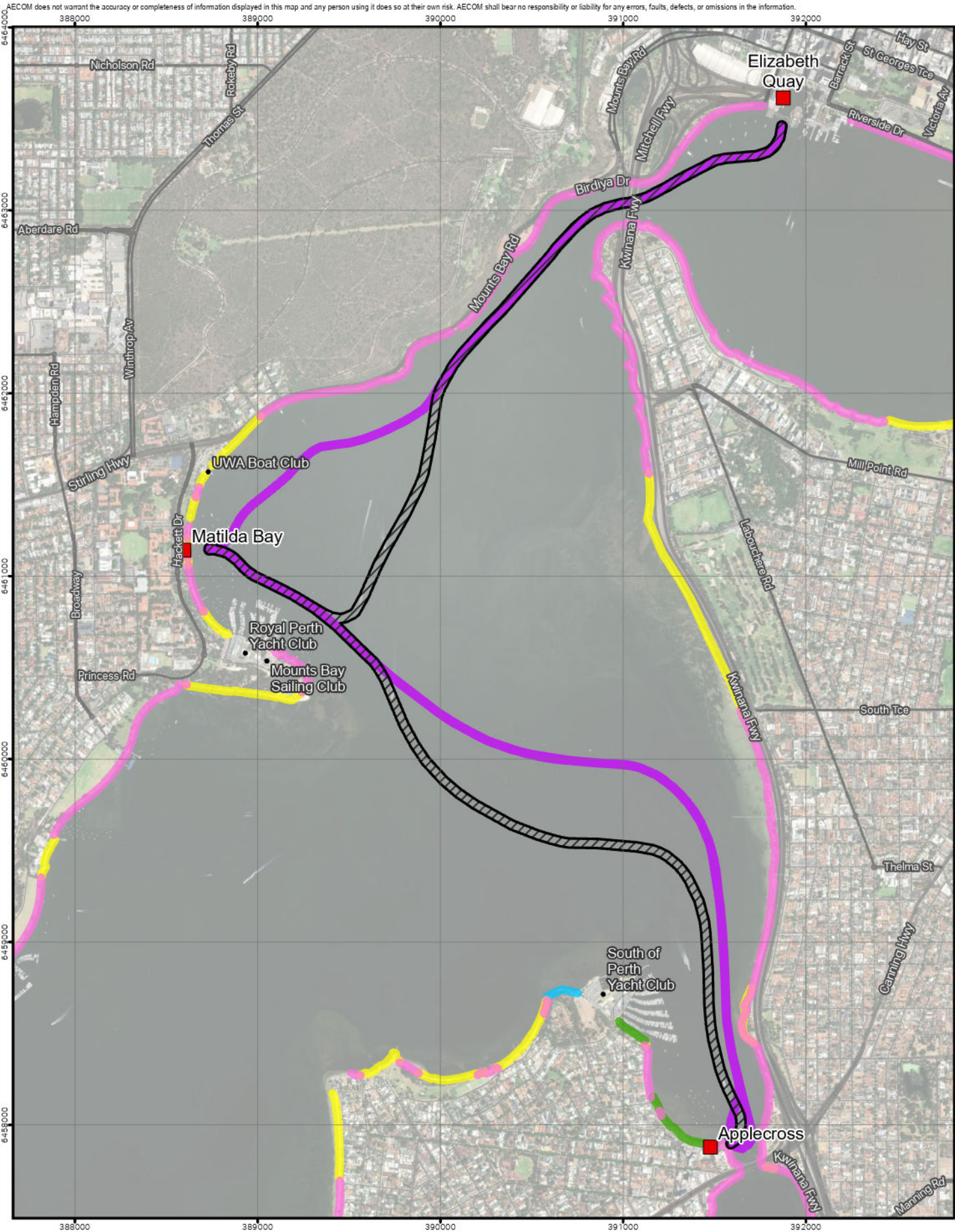
Benthic Habitats and Seagrass Mapping

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Figure
6

A4 size



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LEGEND

Built Foreshore

Rocky Shore

Sedimentary - Beach and Embankment

Vegetated - Sedges

Proposed Ferry Route

Option 1

Option 2

Ferry Terminal

Foreshore Types

PUBLIC TRANSPORT AUTHORITY

METRONET ON SWAN FERRY OPERATIONS - ENVIRONMENTAL ASSESSMENT REPORT

Figure

7

A4 size

The broader foreshore (Matilda Bay) adjacent to the site has experienced a net loss of sediment since reclamation of the foreshore to the west in the late 1950s, with a revetment constructed around 2003 to protect the shared path (adjacent to Mounts Bay Road) from ongoing erosion. Erosion stress has subsequently propagated westward, with retreat now encroaching on the path (Seashore, 2025).

Impact and management details are outlined in Section 5.0, which will be reviewed following sea trials and improved erosion / wake modelling.

4.11 Fauna

4.11.1 Fauna Habitats

4.11.1.1 Terrestrial Habitat

A terrestrial biological survey, including a desktop assessment and basic reconnaissance fauna survey, was conducted for an area encompassing all three terminal site locations on 7 March 2025 and 27 March 2025 by GHD (2025). A benthic habitat survey was conducted separately (Figure 6).

Within the Applecross site, five broad fauna habitats were identified, including Riparian, River and Shoreline, Native and exotic plantings and Parkland with planted trees, Cleared and Open water (GHD, 2025).

The Matilda Bay site had a total of five fauna habitats, including Shoreline or Riparian and River, Scattered trees, Parkland over revegetation and re-planted vegetation, Cleared areas, and Open water (GHD, 2025).

Two broad fauna habitats were recorded within the Elizabeth Quay site, including Native and exotic mixed plantings and Cleared areas (GHD, 2025).

No impacts are expected to terrestrial fauna or habitats from operations.

4.11.1.2 Marine Habitat

The Project's operational route is situated within the Swan-Canning Estuary, an open water habitat, characterised as a microtidal estuary location subject to seasonal increases in catchment flows. The area is home to a variety of species, many of which are of social, cultural, conservation, recreational and commercial importance. The marine environment in the area provides foraging and refuge for a range of endemic fish and crustacea species, particularly where seagrass is present. The majority of the selected route has been located in areas without seagrass (Figure 6).

Previous studies of benthic habitat composition by DBCA and estuary condition by Department of Water (Department of Water, 2014), highlight that the marine reserve areas are likely to be the most sensitive receptors that maintain ecosystem function in the river, due to their persistent populations of seagrass and use by waterbirds and juvenile fishes. Scientific literature of the use of habitat within the Swan-Canning Estuary conducted by Murdoch University also highlights that the Swan-Canning Estuary is a dynamic system that is prone to substantial changes in species richness and diversity naturally.

While the operational route and Project terminal locations at Matilda Bay and Applecross are not considered to be part of nearby Biologically Important Areas (BIAs) (refer to Section 4.3) under State legislation; they are known to provide brief foraging and refuge habitats for a range of endemic fish and crustacea. The region is also utilised by marine mammal species such as Indo-Pacific bottlenose dolphins, who are known to periodically hunt in the area.

Due to the existing high levels of recreational activities, dense infrastructure, elevated noise and artificial lighting, there is a reduced likelihood of the development area supporting permanent or breeding populations or serving as significant foraging areas.

4.11.2 Conservation Significant Fauna Species

A desktop assessment using the Protected Matters Search Tool (PMST) interactive map was conducted, with a 10 km buffer zone applied to capture significant areas and species that may be impacted by the Project's operation.

The PMST search identified seventeen (17) threatened species, including two species of sharks, four species of turtles and eleven species of birds. Additionally, the PMST identified twenty-two (22) migratory species of which three species were sharks and nineteen species were migratory birds.

The five shark species identified in the PMST were:

- Freshwater Sawfish (*Pristis pristis*), listed as Vulnerable and Migratory under the EPBC Act
- Scalloped Hammerhead (*Sphyrna lewini*), listed as Conservation Dependent under the EPBC Act
- Giant Manta Ray (*Mobula birostris*), listed as Migratory under the EPBC Act
- Reef Manta Ray (*Mobula alfredi*), listed as Migratory under the EPBC Act
- Porbeagle (*Lamna nasus*), listed as Migratory under the EPBC Act.

The four species of turtles identified in the PMST are:

- Green Turtle (*Chelonia mydas*), listed as Vulnerable, Migratory and Marine under the EPBC Act;
- Flatback Turtle (*Natator depressus*), listed as Vulnerable, Migratory and Marine under the EPBC Act
- Loggerhead Turtle (*Caretta caretta*), listed as Endangered, Migratory and Marine under the EPBC Act
- Leatherback Turtle, (*Dermochelys coriacea*), listed as Endangered, Migratory and Marine under the EPBC Act.

The threatened sharks and turtles are not expected to be present within the operational route due to a lack of suitable habitat for these species.

4.11.3 Waterbirds

Migratory shore birds may pass through the operational route temporarily while travelling to more suitable habitat. The Swan-Canning Estuary is not expected to support permanent or continuous breeding populations of migratory birds, or significant foraging areas, due to frequent recreational activities, dense infrastructure and existing noise and artificial light. However, seagrass beds, particularly the Swan Estuary Marine Park, may offer occasional foraging locations for migratory birds.

4.11.4 Marine Fauna

Many animals are only found in particular parts of the estuary due to the salinity gradient that exists between the upper reaches of the estuary to the river mouth (ocean).

In consideration of the above, the marine species specifically considered in this report include:

- Indo-Pacific bottlenose dolphins:

The Swan Canning Estuary is home to a resident pod of Indo-Pacific bottlenose dolphins (*Tursiops aduncus*), which utilise the estuary for foraging and breeding (Holyoake & et al., 2011). Indo-Pacific bottlenose dolphins are protected under the EPBC Act and the BC Act; the EPA provides specific guidance through its Marine Fauna Environmental Factor Guidance, which outlines best practices for managing potential impacts from vessel movements and jetty construction activities on marine fauna (EPA, 2016b). Monitoring for Indo-Pacific bottlenose dolphins in the Swan Canning Riverpark (Salgado Kent & Chabanne, 2021) indicated relatively high numbers of dolphin sightings, although sightings from scientific vessels were in deeper water set back from the shoreline.

- Estuarine cobbler:

The Estuarine cobbler (*Cnidogobius macrocephalus*), endemic to Australia, also inhabits the Swan-Canning Estuary. Commercial fishing of this species began in the 1940s and is restricted to estuaries in the South West. It is now managed under The South Coast Estuarine Managed Fishery (SCEF). Historically, the Estuarine Cobbler population in the Swan-Canning River dropped to significantly low levels, leading to a fishing ban in catching cobbler in the Swan-Canning estuary 2007. This species is known to utilise the BIA sites in the Swan Estuary Marine Park and is under continued fishery management (DoF, 2012).

- Bull sharks (*Carcharhinus leucas*) are also known to be present within the Swan Canning Estuary throughout the year (DPIRD, 2026). Based on recent tagging programs undertaken by the Department of Primary Industries and Regional Development (DPIRD) it is likely that female bull sharks give birth in the Swan Canning Estuary (presence of juvenile bull sharks) (DPIRD, 2026).
- While considered of least concern in Australia under the IUCN Red List, they are listed as vulnerable globally as assessed by the IUCN Red List (Global Assessment). In 2023, the species was listed on Appendix II of the Convention of International Trade in Endangered Species of Wild Flora and Fauna (CITES).
- Other fish and marine species – consideration of various potential impacts to fish and other marine fauna is presented in 5.3.2.

4.12 Aboriginal Heritage

The Project is located entirely within Whadjuk Country, one of six defined regions in Noongar Country. Whadjuk spans approximately 5,580 km², covering metropolitan Perth from Two Rocks in the north to Jervoise Bay in the south, extending west to Rottnest Island and east to the Darling Scarp. Two major waterways – Derbal Yerrigan (Swan River) and Dyarlgarro Beeliar (Canning River) – are central to this region.

The Whadjuk Aboriginal Corporation (WAC) manages the Whadjuk Indigenous Land Use Agreement (ILUA) on behalf of the Whadjuk community. The ILUA provides for the Noongar Standard Heritage Agreement (NSHA), which the PTA is a signatory with the South West Aboriginal Land and Sea Council (SWALSC).

One Aboriginal Cultural Heritage (ACH) registered site intersects with the Project, identified as the Swan River (ID 3536), registered as a Mythological site (Figure 8).

Two Aboriginal Ethnographic and Archaeological Surveys were undertaken to support two separate applications for Regulation 7 and Regulation 10 of the *Aboriginal Heritage Regulations 1974* to undertake sediment sampling and geotechnical testing activities only. These surveys included the involvement and participation of two representative groups, from Whadjuk and the Swan River Noongar Community. The applications supported the proposed sampling and have been approved.

In addition, an Aboriginal Ethnographic and Archaeological Survey was undertaken by AHA Logic (2025) to support the Project. This survey included consultation with representatives from the Whadjuk and Noongar families.

AHA Logic (AHA, 2025a) highlighted that the Swan River has been subject to extensive use, infrastructure development, land reclamation and regular dredging for over a century. While these activities have not diminished the Aboriginal heritage values, spiritual associations, or cultural significance of the Swan River (ID 3536), they have likely compromised the ability of riverbed sediments, particularly those located away from the shoreline, to preserve intact archaeological material.

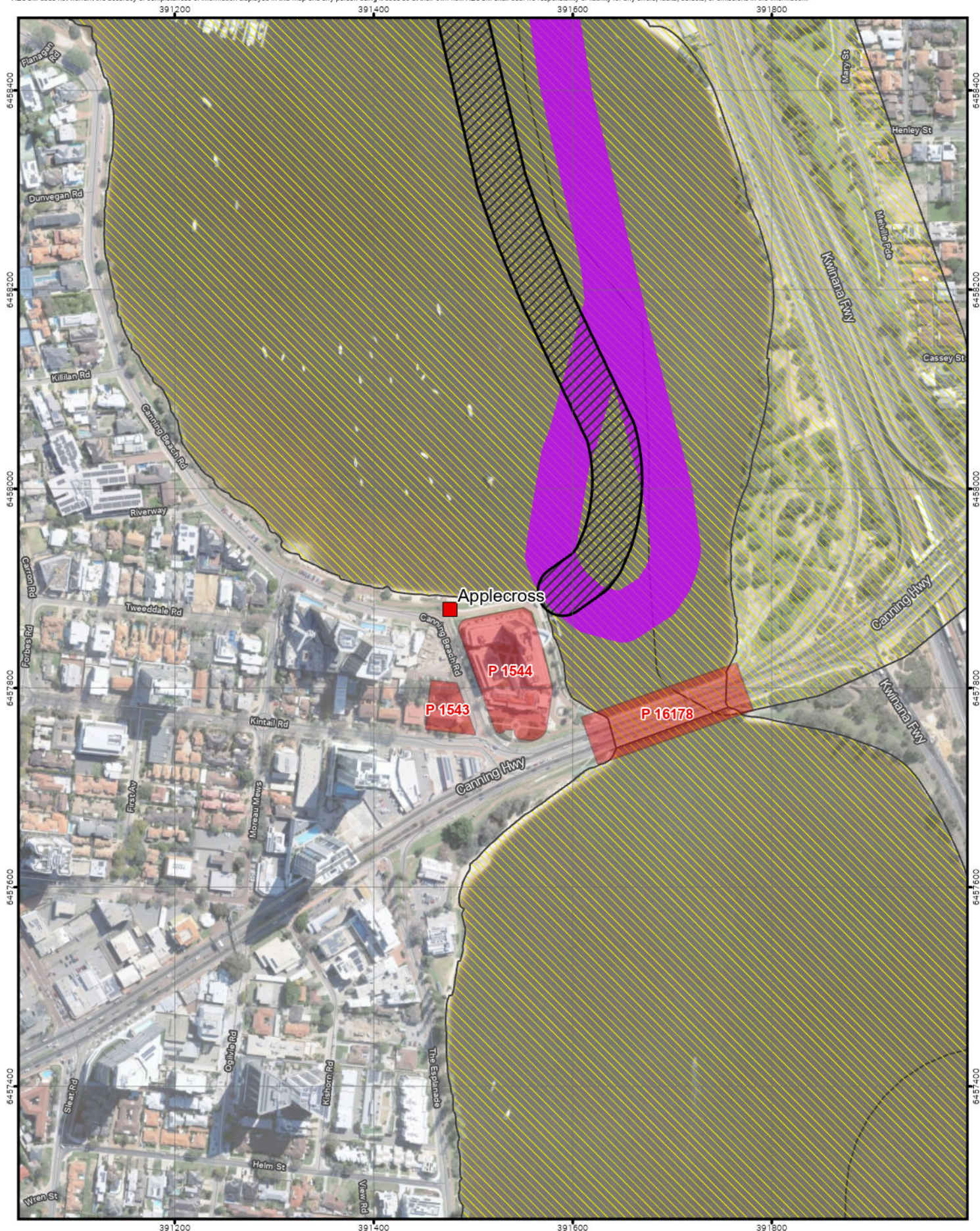
On the basis of this history of disturbance, the archaeological potential of the Project area is assessed as very low. Whadjuk and Noongar representatives agreed that monitoring of any ground-disturbing activity within the boundaries of Aboriginal site ID 3536 would be an appropriate measure to ensure that any cultural or archaeological material, if present, is identified and protected.

Ongoing consultation will continue prior to development and operation of the Project. This process will inform the necessary approvals under the Aboriginal Heritage Act and guide the management of potential impacts to ACH. The PTA received Section 18 consent pursuant to the *Aboriginal Heritage Act 1972* in March 2026. The consent requires that works are undertaken in accordance with the *METRONET on Swan Ferry Service Expansion: Perth to Applecross Cultural Heritage Management Plan* (PTA 2025) which outlines measures for survey and protection of Aboriginal Cultural Heritage.

4.13 Historic Heritage

The State Heritage Register (inherit database) and the City of Perth Municipal Inventory did not identify any State-registered sites of heritage significance within the Project's operational route. The Raffles Hotel (Site ID: 1544) is adjacent to the Applecross terminal, and is classified as a registered heritage site under the *Heritage Act 2018* (Figure 8).

Mounts Bay Road Foreshore (Place No. 27029) and an associated Archaeological site (Place No. 9209) within the Matilda Bay terminal site are on the assessment program for consideration by the Heritage Council of Western Australia but are not located adjacent to the operational route.



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LEGEND

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- Heritage Council WA - State Register (DPLH-006): Individual Place
- Proposed Ferry Route
- Option 1
- Option 2
- Ferry Terminal

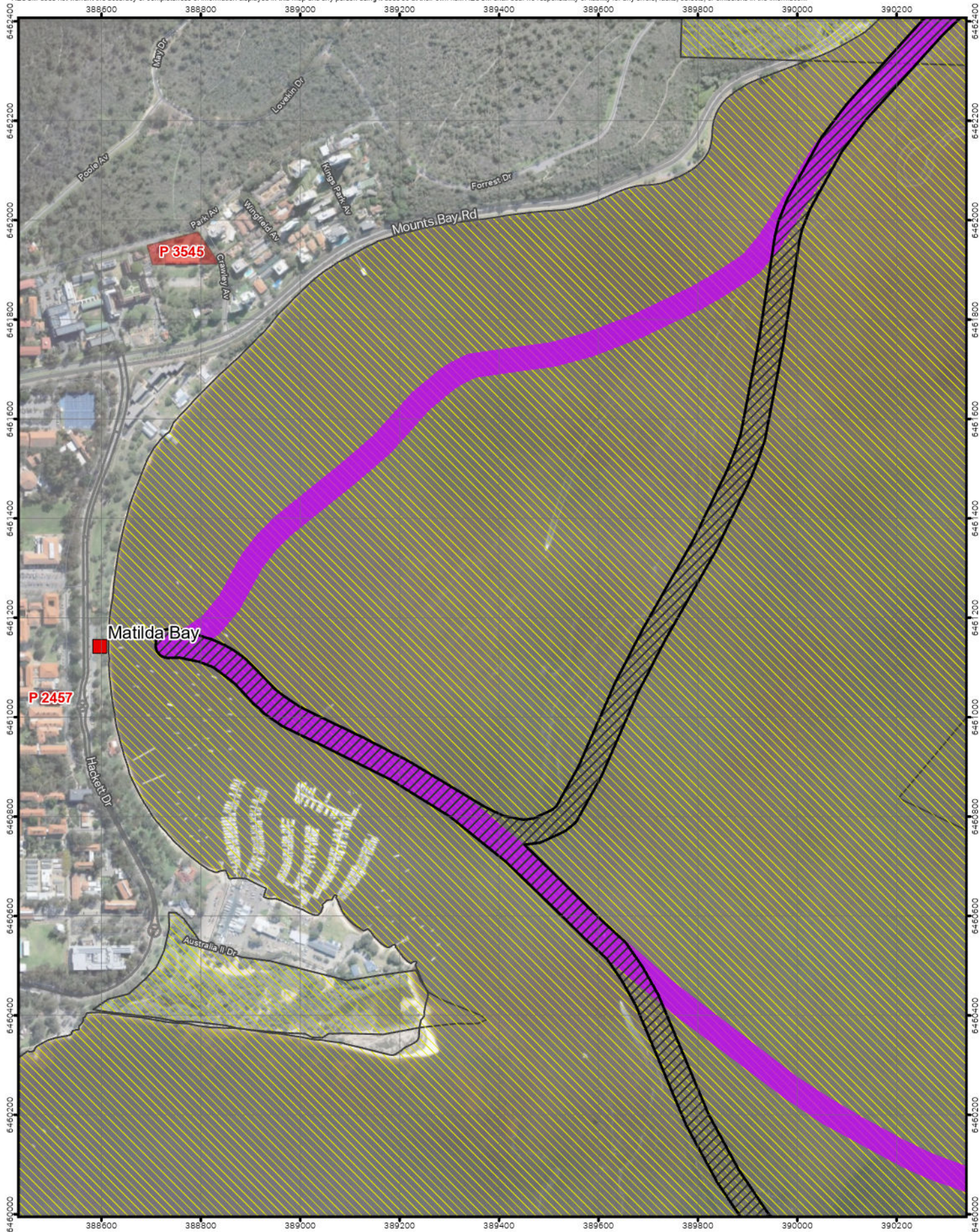


Aboriginal and Historic Cultural Heritage Applecross Site

PUBLIC TRANSPORT AUTHORITY

**METRONET ON SWAN FERRY SERVICE
EXPANSION: PERTH TO APPLECROSS**

Figure
8a



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LEGEND

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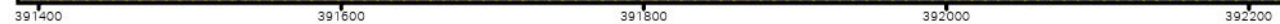


**Aboriginal and Historic Cultural Heritage
Matilda Bay Site**

PUBLIC TRANSPORT AUTHORITY

**METRONET ON SWAN FERRY SERVICE
EXPANSION: PERTH TO APPLECROSS**

Figure
8b



5.0 Operational Impacts and Management

Potential operational impacts to environmental values are discussed in the sections below, with further detail and proposed management responses outlined in Table 11. Alignment with relevant DBCA and WAPC policies and provisions for development within and adjacent to the Swan Canning River DCA is presented in Table 12.

Table 5 Potential Operational Impacts

Factor	Potential Impacts	Section where this is addressed
Foreshore erosion	- Potential erosion of beaches and embankments - Reduction in ecological values and public amenities.	Section 5.1
Water and sediment quality	- Direct impacts to water and sediment quality due to spills, leaks or debris / litter from the ferries - Increased turbidity due to mobilisation of sediment due to vessel interaction with riverbed (propulsion turbulence) - Indirect impacts to water quality due to existing poor quality sediments being disturbed and mixing with the water column.	Section 5.2
Benthic habitat	- Erosion (scour) of benthic habitat due to propulsion turbulence and wake wash - Mobilisation of sediments causing decreased light availability and smothering of BCH (seagrasses) - Mobilisation of sediment causing changes to water quality through elevated nutrient concentrations in the water column, leading to algal blooms, decreased light availability and smothering of BCH.	Section 5.3
Marine fauna	- Vessel strike of marine fauna - Vessel noise disturbing marine fauna and causing loss of amenity - Erosion / scour causing physical removal of infauna and epifauna species (affecting food source of larger species) - Vessel noise creating behavioural response and impacting foraging / breeding (Indo-Pacific dolphins) and causing a response behaviour in other species - Fauna death due to entanglement in or ingestion of ferry waste (including passenger litter). - Artificial lighting	Section 5.4

Factor	Potential Impacts	Section where this is addressed
Conservation reserves	• Potential impact to water quality in the Swan Estuary Marine Park • Potential impacts to benthic habitat within the Swan Estuary Marine Park through erosion and loss of habitat. • Vessel strike of fauna.	Section 5.5
Acoustic Noise	• Vessel operating noise permeating underwater • Vessel and foreshore infrastructure operating noise	Preliminary assessment by Seashore Engineering (2026) indicated that effects were not likely to cause significant impact to noise scape in water and minor, localised impacts at charge stations, therefore further assessment is not required.

5.1 Coastal and Foreshore Erosion

5.1.1 Potential impacts

Potential erosion impacts have been considered using distance from operating ferries to foreshore areas, coastal processes and more aptly, wave and wake considerations. Three proposed operating cases were assessed for their potential to increase shoreline wave energy by Seashore Engineering (2026).

- Case 1 – Gazetted Speeds: Vessels adhere to the gazetted speed limits, operating at approximately 5 knots during terminal approach and departure, increasing to around 8 knots nearby, before accelerating to approximately 25 knots along sections of the route between Como and Pelican Point and near the Narrows. The round-trip time is estimated to be approximately 1 hour 26 minutes, including berthing time. The basis for gazetted speeds includes consideration of water craft activity, foreshore uses and relative areas of sensitivity (SRT 1995, ERM 2002).
- Case 2, 2a and Case 3² – Speed Exemption Scenarios: Alternative operating scenarios involving speed exemptions along parts of the route have been identified by PTA with the intent of reducing the round-trip travel time. These scenarios incorporate extended sections of 12- knot and 25-knot operation.

The operational ferry route indicates that, aside from terminal approach areas, the closest proximity to the shoreline is likely to occur along the Como foreshore (Cale Street) and between Matilda Bay and Elizabeth Quay, particularly as vessels transit beneath the Narrows Bridge. In this section (Narrows Bridge), both sides of the foreshore have been reinforced with hard-edged retaining walls and rock groynes, which are not expected to be adversely affected by residual wake generated by ferry operations (Figure 7). The broader western Como foreshore has undergone sustained erosion since reclamation associated with the construction of Kwinana Freeway, around 1960 (Seashore Engineering, 2026). Shoreline protection has been installed for much of the foreshore adjacent to the ferry route, however along the north side of the sediment lobe fronting Olives Reserve, southward sediment redistribution has caused progressive erosion. The influence of ferry wake during operations on this erosion pattern is expected to increase under Cases 2, 2a and 3 with increased wake energy (Seashore Engineering, 2026). Erosion impacts to the foreshore at Applecross are considered extremely unlikely during operation.

Boat wake modelling is based on vessels travelling at nominated speeds. The reality however is that vessel speed varies during their operations due to external factors, such as weather conditions or passing vessels. The result is that wake generation may be affected (Seashore Engineering, 2026). Limitations in the Seashore Engineering (2026) report note that 'Wake A' in the wake train has approximately 50% greater energy at 20 knots than at 25 knots, according to a study undertaken by the Australian Maritime College in 2026 as part of this project.

A coastal processes impact assessment was conducted for the Matilda Bay and Applecross terminal sites. The coastal processes assessment aimed to determine the impact of vessel movements, including wave wake and scour, in the context of current and future coastal processes (Seashore Engineering, 2026). The assessment included review of existing information and historic shoreline modification, evaluation of historical shoreline and bed behaviour, an overview of key metocean processes (including winds, waves, water levels, and currents), and identification of primary drivers and controls of foreshore change.

Waves were assessed for both ambient and man-made occurrence, to determine the energy source and potential to cause erosion on coastal or foreshore environments. Wave energy in the Swan River is the sum of the natural energy from waves plus the wake from passing boats, including ferries, leisure boats and jet skis. The generation of wake is a function of water depth, vessel speed and hull geometry and the wake energy as it moves away from the vessels path (Seashore Engineering, 2026). Boat wakes tend to exert greater erosive power because they are typically steeper than wind generated waves (Seashore Engineering, 2026). However, wind waves occur continuously in high numbers, while wakes are generated as short sets during vessel passage (Seashore Engineering, 2026).

² Case 2 and 2a have various extensions of 25-knot speed exemptions into Matilda Bay.

Wave and wake considerations are the most relevant to erosion impacts on coastal and foreshore areas during operation of the ferries and as such are the focus of Sections 5.1.1.1 – 5.1.2.

5.1.1.1 Impacts around terminals

Boat wake energy is a function of the speed of the boat, water depth and vessel design. The ferries will berth along the proposed floating pontoons located at Applecross in water depths greater than 2 mCD and in water depths approximately 4 m CD at Matilda Bay. Due to the Department of Transport speed restrictions in shallow water areas of 8 knots (14.8 km/h), vessels will not be operating at these higher speeds in the shallow water areas in vicinity of terminals. The ferry route is expected to transit between terminals in water depths ranging up to approximately 8 m CD, operating at various speeds, from 8 to 12 knots up to 20 knots, and potentially 25 knots, depending upon approved speed exemptions. Water depths will have a significant influence on wave wake, with the most significant effects occurring in the shallowest water, when the ferries will be at their slowest speeds.

Results from the coastal processes impact assessment (Seashore Engineering, 2026) showed that around the Terminals:

- Wind waves at the Applecross and Matilda Bay Terminal sites typically reach shorelines over 1,000 times per hour (over 24,000 waves per day) while ferry vessels are expected to contribute two waves per passing, or less than 300 waves per day.
- Key existing active coastal processes include wind generated wave energy and the wave energy attributed to expected increases in rising sea levels and increased erosion.
- The high silt and clay content of the riverbeds at Applecross and Matilda Bay makes them susceptible to scour and deepening beneath the berth pocket and the resuspension of sediments. The extent of sediment resuspension depends upon the water depth and vessel thruster (jet stream dissipation) energy. At Matilda Bay, the shallowest depth is approximately 3.8 m CD (approximately 4.5 m depth, depending on tidal conditions). At this depth the dispersion of vessel thruster energy may be supported, limiting the extent of riverbed disturbance. Furthermore, the particle size distribution analysis undertaken by BMT in 2025 suggests that the dominant particle size in sediments at each of the terminal sites are reportedly sand (fine to medium sands).
- At Applecross, the terminal is located against the terrace margin and there may be localised slumping into the channel.
- Ferry wake energy may add to total wave energy at both Matilda Bay and Applecross sites. While there is a moderate likelihood of vessel scour within the berth pockets, including resuspension of sediments, the consequence is considered low and readily mitigated through operational procedures (reduced speed in these areas).
- Wake energy generated by vessel transit, at gazetted speeds, may contribute to overall wave energy however its influence, to overall sediment movements and wave energy reaching the shoreline, is anticipated to be minimal or less when compared to existing active coastal processes, including current vessel activity from large leisure boats on the Swan River.
- Overall, ferry operations at Applecross and Matilda Bay are expected to have relatively minor impacts on coastal processes, based on interaction with existing morphology, foreshore and bed dynamics, and active sediment transport pathways. Key factors contributing to this outcome include:
 - The shore-based elements (i.e. jetty abutments) being positioned landward of the existing shoreline at Matilda Bay and within an existing revetment footprint at Applecross, limiting potential interruption of sediment transport.
 - Adherence to the Swan-Canning Estuary speed limits, with maximum speeds of 8 knots as vessels approach the terminals, will ensure boat wakes generate waves smaller than the ambient wind wave climate, with impacts at Applecross primarily confined to the already walled foreshore areas.
 - Care when accelerating or decelerating on approach to / departing terminals, as this might increase wake (Seashore Engineering, 2026).

- The location of the proposed terminal at Matilda Bay is along a gentle sloping section for the foreshore without trees, reducing the potential for scarp development caused by erosion (Seashore Engineering, 2025).

5.1.1.2 Open water impacts

Wave Wake Analysis was also undertaken to determine the impacts of boat wake on shorelines and surrounding environments (INCAT, 2025). Results from this study determined that at a vessel speed of 5 to 10 knots and at 20 knots, wake wash generated is less than the wind wave height produced for 20 knot winds. This comparison is consistent for distances of 60 m at an operating speed of 8 knots and 90 m at an operating speed of 20 knots or more. The study considered water depth and results indicated that in shallow waters, operating speeds of 12 to 16 knots within 60 m or less of other vessels and vulnerable infrastructure, increased wave wash (Gourlay, 2025).

A review of the INCAT report by Perth Hydro (2025), reported that the use of open-water methods during the INCAT report to determine wind wave height, would have overestimated the wind wave heights. Using a fetch of 7 km, while possible is likely unrealistic given that the river is constricted on both sides and passes over a shallow sand bar (Perth Hydro, 2025). The report also suggested that, based on historical reports, the wakes produced by regular boat traffic, tend to be similar height to extreme wind waves, but with much longer wave period, giving them a much higher energy per wave (Perth Hydro, 2025). In 2010 CMST reported that large recreational vessels tend to produce higher-energy wakes than the existing commercial ferries at Quarry Point and Chidley Point.

Additionally, review of the DBCA foreshore data (Figure 7) highlights that the highest susceptibility to wave wake impacts is associated with modified shorelines such as walls. Given the engineered nature of these areas and the mitigation measures in place, wake wash is not anticipated to result in significant shoreline disturbance and impacts will be minimal, limited to existing shoreline environments.

5.1.2 Options analysis

Introduction of the ferry service will cause boat wakes which are additional to existing wind wave conditions within the Swan River estuary. However, wind waves are likely to remain the dominant driver of foreshore dynamics and continue to provide critical design parameters for shoreline protection structures adjacent to the proposed ferry route within Swan River estuary.

Seashore Engineering (2026), characterised the potential for increased shoreline wave energy generated by the new electric ferries operating at a variety of speeds while in transit between terminals. (Seashore Engineering, 2026).

Comparison of boat wake generation for three alternative ferry routes (varying speeds), with the additional boat wake energy compared against wind waves showed:

- Case 1 (gazetted speeds). Cumulative annual wind-wave energy and maximum wind-wave conditions substantially exceed the corresponding ferry wake conditions, for most of the shore along the route (Seashore Engineering, 2026). The greatest simulated proportional increases in cumulative annual wave energy (5-15%) was identified along the foreshores around the Narrows, reflecting the close proximity of the vessel route during 25 knot operations, and along both sides of the approach to Applecross terminal, despite low vessel operating speeds, as a consequence of being highly sheltered from prevailing winds. Only at the artificial beach at Mill Point Reserve was ferry wake energy found just above wind-wave energy (1800-2000 J/m compared with 1500-1800 J/m) (Seashore Engineering, 2026)
- Cases 2, 2a and 3, consider speed exemption scenarios, with extensions of the 12-knot and 25-knot operating zones, introduce notable (proportional) greater cumulative wake energy:
 - Case 2 extends the 25-knot operating zone along Mounts Bay Road, western Como foreshore and north of Pelican Point. Wake energy becomes comparable to local wind-wave energy along sections of the Perth and South Perth foreshores and is locally up to three times greater than wind-wave energy at Mill Point Reserve. Along Mounts Bay Road, wake energy increases to approximately 5-10% of cumulative wind-wave energy, while along western Como foreshore proportional increases are approximately 20% at the southern end. At the north-facing foreshore of Pelican Point, introduction of the 25-knot operating zone increases cumulative ferry wake energy to approximately 20-30% of cumulative wind-wave energy. However, wind waves remain the dominant driver of shoreline processes.

- Case 2a, particularly along the Como foreshore (between Saunders Street and Thelma Street) and within Perth Waters, where maximum ferry wake energy is approximately 1-2 times greater than the 1-year ARI maximum wind-wave energy, increasing to around 3-4 times at the artificial beach at Mill Point Reserve. A reduction to the extent of the 25 knot speed exemption in this scenario, however alleviates elevated wave energy for approximately 500 m of foreshore along Mounts Bay Road, which includes a susceptible (unwalled) part of northern Matilda Bay. Regarding the proportional increase in wave energy at Pelican Point, which remains relatively low, PTA will undertake further modelling to support a speed exemption application.
- Case 3, generally produced the greatest shoreline wake conditions with notable increases in proportional cumulative wave energy (relative to Cases 1 and 2) along Mounts Bay Road (west of the Old Swan Brewery), where proportional increases in cumulative wave energy are in the order of 20-40%; along the western Como foreshore (between Saunders Street and Thelma Street) where proportional increases to cumulative wave energy (wakes relative to wind waves) are approximately 50% at the southern end of this section, reducing to around 20% towards the northern end; and the north facing foreshore of Pelican Point where increasing the operating speed from 8 knots to 12 knots approximately 300 m from shore increased cumulative ferry wake energy to approximately 70-80% of the cumulative wind-wave energy (Seashore Engineering, 2026).

The largest wave conditions remain associated with wind-wave forcing (with the 1-year ARI wind-wave H_{max} amplitude) exceeding the maximum ferry wake amplitude at almost all foreshores (Seashore Engineering, 2026), for all three scenarios, with the exception of two sheltered locations. Maximum ferry wake energy was predicted to exceed the 1-year ARI maximum wind-wave energy, along South Perth foreshore (east of the Narrows), particularly at the artificial beach at Mill Point Reserve (see above) and Perth foreshore (between Elizabeth Quay and the Narrows) by approximately 1-2 times, 3-4 times and 1.5-3 times, respectively. During scenario 3, the north facing foreshore of Pelican Point predicted that wake and wind-wave energy are approximately equal (Seashore Engineering, 2026).

Additionally, areas of moderate wake energy, which coincide with low wind wave conditions, were identified along Perth foreshore (from the Narrows to Elizabeth Quay) and along the foreshores north of Canning Bridge.

Evaluation of locations experiencing proportionally high increases to wave energy indicated that these sections are generally already affected by erosion and presently requiring management, rather than locations where ferry wakes introduce new erosion mechanisms or shoreline management issues.

Pelican Point has also been identified as potentially sensitive to increased wake exposure under Cases 2 and 3. The revised wake assessment indicates that extension of the Case 2 25-knot speed exemption north of Pelican Point may increase cumulative ferry wake energy to approximately 20-30% of local wind-wave energy, while Case 3 may increase cumulative wake energy to approximately 70-80% of cumulative wind-wave energy. Given the environmental values associated with the Pelican Point Nature Reserve, implementation of any speed exemption would require further consideration of potential localised shoreline and habitat effects.

Shorelines will be monitored during initial ferry operations to measure if any notable increases in shoreline erosion, attributable to ferry operations, are found. The results of this monitoring may require further assessment of the current management conditions for suitability under the new impact regime.

5.1.3 Management measures

Management measures to control erosion impacts associated with the Project's ferry operations are outlined below in Table 6 with a summary presented in Table 11. Further detail and alignment with the relevant DBCA and WAPC policies and guidance for development within and adjacent to the Swan Canning River DCA is presented in Table 12.

Table 6 Management control actions for erosion and foreshore

Design or management measure	Description
Management Plans	An operational environmental management plan (OEMP) will be finalised prior to operations and include measures to be employed by the vessel crew (Master) aimed at reducing potential foreshore erosion resulting from sudden changes in speed (accelerating / decelerating). Refer to Section 0 for further information.
Vessel design and speed restrictions	Sudden changes in vessel speed will be avoided as far as reasonably practicable, to help reduce shoreline erosion. A smooth transition between fast operational speeds and slower operational speeds (and vice versa) has been communicated to vessel crew as part of the draft OEMP. Speed restrictions as per current navigational conditions imposed by Department of Transport (8 knots) in shallow water will minimise wake and wash and reduce mobilisation of sediments into the water column. Transit speeds up to 25 knots are proposed along the route where it can be shown to have minimal impact. Ferry design (Catamaran) allows for an efficient hull design and expected smaller wake. The waterjet system enables vessels to turn within a smaller area compared to conventional vessels (small turning circle) reducing the footprint of potential scour / sediment resuspension. The use of stern deflectors can be used to disseminate velocity while berthing in shallow waters thus allowing for good steering control while operating at a slow speed. This will assist to dissipate the high velocity stream associated with waterjet propulsion.

5.2 Water and Sediment Quality

5.2.1 Potential impacts

The Project may impact water and sediment quality through:

- Direct impacts to water and sediment quality due to spills, leaks or litter from the ferries
- Direct impacts to water and sediment quality due to fire water runoff
- Contamination from anti-fouling agent at the vessel / water interface
- Thermal stress due to the release of heated water
- Indirect impacts to water quality due to existing poor-quality sediments being disturbed and mixing with the water column, increasing turbidity and contaminant concentrations in the water column.

5.2.1.1 Spills, leaks and litter

Contamination may occur due to the uncontrolled spills and leaks associated with the general vessel operations. Traditional, diesel (or marine gas oil) fuelled engines also use a range of lubricants and hydraulic fuels (hydrocarbons) to maintain engine efficiency and maintenance. The use of battery powered ferries eliminates the primary risk of fuel oil contamination, which may occur due to hull breaches, poorly maintained / corroded fuel lines and also regularly during refuelling.

The Project's operational phase presents potential environmental risks associated with the vessels cooling and anticorrosion system, handling and management of waste and hazardous materials. Potential sources of spills, leaks and litter include:

- Improper litter handling by passengers (i.e. litter allowed to go overboard)
- Improper storage and handling of rubbish and sillage
- Leakage of sillage and other chemicals stored on board
- Ferry maintenance, including anti-corrosion chemicals and cooling water.

Litter

Litter from ferries includes passenger litter and materials that may fall overboard during regular maintenance such as sweeping the decks. The amount of litter will be reduced by providing litter receptacles, appropriate signage and ensuring that procedures for cleaning and maintenance are followed. The volume of litter is anticipated to be small prior to the implementation of additional mitigation measures.

Sullage

The ferries will have two toilets and capacity to store approximately 800 L of sullage (wastewater), which will be effectively emptied and maintained as part of the vessels' general maintenance in accordance with the OMP. Sullage will be discharged into the Water Corporation sewer system at Barrack Street. The risk of spills and leakage sullage is considered low.

The volumes of litter, sullage and maintenance chemicals involved in ferry operations will be low and the potential will be limited through:

- Adequate vessel planned maintenance system
- Use of non-biocide antifoulant
- Provision of adequate litter bins, designed to be vermin and wind resistant
- Minimum daily emptying and disposal of sullage and waste from waste receptacles
- Minimising the use of cleaning and maintenance chemicals and use of small containers to limit the volume of chemicals being bought on board
- Avoiding chemical storage aboard where practicable. Where stored this should be in a locked suitably secure cabinet
- Maintaining a spill kit onboard.

Coolant

It is expected that lubrication and the requirement for other chemicals to maintain the electric motor will be minimal and primarily comprising of a cooling system using a seawater loop to a heat exchanger, with a closed loop ethylene glycol (glycol) system. Glycol is an agent commonly used to prevent corrosion / scale buildup and to transfer heat (i.e., a coolant). Ethylene glycol exposure in high concentrations can result in death of animals, birds or fish and death or low growth rate in plants (DCCCEW, 2026). Acute toxicity values (LC(50)³s and EC(50)⁴s) were generally greater than 10,000 mg/L for fish and aquatic invertebrates (Staples CA, 2001).

However, with regular maintenance it is highly unlikely that a glycol spill will occur, particularly as this will be located within a closed loop system. Impurities and antifoulant chemicals may be discharged with the heated water during operations but these chemicals and volumes are unlikely to be environmentally significant under normal operating conditions.

5.2.2 Cooling Water and Thermal Stress

Increases in water temperature may influence pH, dissolved oxygen, salinity and the leaching (mobility) of metals, which may result in localised contamination particularly in the shallow waters around terminal facilities area affected, will be influenced by currents, season (increased rain fall) and water depth. This impact is relevant to two aspects of the vessel functional operation, first the discharge of seawater loop to a heat exchanger water, and second, heat exchange from friction caused within the jet propulsion unit into the wash. Current propulsion system proposed is the LTX36 jet stream unit, made by HamiltonJet.

Environmental effects of heated water discharged from the closed-loop coolant system will likely be limited, having minimal impact beyond those already seen in current vessel motors already in use in the Swan River.

³ Lethal concentration for 50% of a population

⁴ Effective concentration at which 50% of the maximum effect is observed

In terms of the friction heat exchanged into the wash from the propulsion units, current design is not mature enough to provide exact figures yet. However, estimates of the potential impact, based on the current vessel design may result in the following outcome.

If we assume the current design specifications provided by the vessel designer, then each propulsion unit comprises a compressor system expelling water with a thermal differential of ~10 – 12 °C. Estimated thrust will producing flows of ~16.3 m/s at maximum thrust, displacing 0.811 m³ of water per second.

When using a water depth of ~4m minimum for draft as the vertical component to the thermal sink and 2m of estimated beam per power unit (including wake), then the dilution rate of the thermal discharge could be:

$$0.811 / (2.0 \times 16.3 \times 4.0) = \sim 0.6 \text{ }^{\circ}\text{C increase in water temperature.}$$

For reference, Indicator species such as prawns and shrimp exhibit increased mortality rates when exposed to rapid changes in temperature exceeding 4 °C per hour from ambient (Crisp, J. A., et al., 2018) (Crisp, 2017). In addition, individual species exhibit thermal tolerances to water temperatures within natural thresholds. For example, indicator species such as *Penaeid sp.* larvae increase mortality at varying rates above ~29.4 °C and below ~15 °C, depending on local environmental adaptive ranges (AKTAŞ, 2012) (Jackson, 2003) (Ponce-Palafox, 1997).

Cooling rates of the minimum thrust under Newton's law of cooling for water would likely produce receiving water temperatures similar to ambient within a few minutes. Therefore, it is unlikely that the heat exchange into the heat sink from operations poses a substantial environmental risk, though temporary minor changes in thermal load may be observed around each berth.

5.2.2.1 Fire water runoff

Although highly unlikely, fire risks exist which may lead to the uncontrolled release of toxicants into the receiving environment. Peer-review literature on the subject of lithium-ion fires and their constituent runoff from water-based firefighting/suppression methods indicates that a range of battery chemicals could be present, including Formaldehyde, PAHs, Borate (B₄O₇), Al, B, Co, Cu, Pb, Li, Mn, Ni, Zn, chlorate (HClO₃), FI, Phosphorous (including phosphates) and Nitrogen species. In addition, there may be gases that may be present as gas-in-water, such as CO, HF, HCN, Br, Acetaldehyde, NO, SO₂ (Jalali, 2025) (Bordes, A., et al, 2024) (Ubaldi, S., et al., 2024) (Meraner, 2026). These chemicals may present acute or chronic toxicity risks to aquatic life.

In particular, a study by Jalali (2025) on the Air emissions and firewater runoff contamination from lithium-ion battery fires in rubbish trucks showed that Li-ion battery combustion releases a complex mixture of toxic gases and chemical byproducts, with multiple toxicants exceeding the ANZECC/ARMCANZ (now ANZG) freshwater ecosystem protection guidelines.

Toxicant profiles will vary according to fire suppression methods (including the use of additives) and situational factors (e.g., volumes of toxicants present, location of fire, timing of suppression) and as such, environmental impacts may not be quantifiable prior to an event occurring. Current fire suppression systems designed for this ferry include:

- Normal suite of portable extinguishers for this type of vessel, typically Dry Chemical and CO₂ portable extinguishers
- Fixed fire suppression, in combination with a sprinkler deluge system for the battery compartment.

The fire suppression system (FirePro) is designed to interrupt the chemical reaction of combustion, effectively suppressing a fire. FirePro aerosol generators use FPC (FirePro Compound) an aerosol forming solid compound. On activation the compound is transformed into a rapidly expanding, highly efficient fire extinguishing aerosol, based on Potassium salts. The residue of particulate matter after discharge is approximately 30 to 35% of the aerosol weight of the generator used. It is slightly alkaline with a pH of ~8. The residue is noted as non-toxic and non-corrosive (consisting of inorganic potassium salts) with no discernible effects on water bodies (ecosystems and potable drinking water), (Echo Marine Group, 20260701, PTA communications). The dust is hygroscopic, attracts and holds moisture from the air. The particulate dust should be cleaned up as soon as possible.

The sprinkler deluge system is designed to control / mitigate a fire within the batteries themselves. Typically, deluge systems spray a lot of water. A bilge or dewatering pump is used at the same time to

pump the water out to avoid flooding the void. In this particular case, it is currently being discussed with Class about the best approach, as it may be better to flood the void and submerge the batteries completely, without the need to pump water out. Due to the safety risk of destabilising the vessel (resulting in capsizing) the ability to install a closed system may be limited. While the best approach to contain a battery fire is still under review, the discharge of deluge water is not expected.

The ferry will be designed to minimize the risk of fires and staff will be trained in the management of battery fires. If an event does occur however, it will require thorough investigation of the environmental effects in consultation with the relevant regulatory authorities.

5.2.2.2 Sediment mobilisation

The Project's operational ferry movements may result in scour of sediments and increased turbidity, along with the mobilisation of potential contaminants associated with disturbed sediments.

Mobilisation of sediments may increase turbidity in the water column where fine sediments are disturbed. This is more likely to occur in the vicinity of the terminals where the ferries will be manoeuvring in more shallow waters. Fine material takes longer to settle and can be carried by water movement to sensitive areas. This is of particular concern where sensitive receptors may be present due to smothering over time and reduced light. The possible release of potential contaminants into the water column due to the disturbance of sediment is a complex process, influenced by many factors including pH, oxygen concentrations and salinity. The most recent sediment quality report, completed by BMT in 2025 suggests that disturbed sediments at Elizabeth Quay and Matilda Bay may result in the release of bioavailable lead and zinc. Furthermore, all of the sites sampled by BMT had elevated levels of nutrients, which may decrease water quality through the release of nutrients resulting in eutrophication (nutrient enrichment).

The dominant particle size in sediments at each of the landing / terminal sites are reportedly sand (fine to medium sands). One sample location at each of the three terminal sites was dominated by fine particles. With the exception of the site at Elizabeth Quay, both samples were located in deeper water, where finer sediment may be expected.

For the majority of operations (transit between terminals) the depth of water will be greater than 5 m (between 5 m to 9 m), making sediment disturbance during transit operations unlikely. Similarly, AECOM understand that the Matilda Bay terminal facility will be located in water depths greater than 4 m (Trinacria Consulting, 2025), which is unlikely to be disturbed by turbulence caused by the ferry waterjet.

The shallow water location of the Applecross floating pontoon (approximately -2.3 m AHD depth) and is likely to be prone to scour and sediment disturbance. Surrich (2024) noted that scour was not evident in water depths greater than -2.7 m AHD and attributed this degradation to fast moving leisure craft in shallow water. The speed of approach in shallow waters will be limited, furthermore the design of the waterjet nozzle will enable the jet stream to be directed more horizontally than downward, thereby limited the potential to stir up sediments in shallow waters.

As such, it is not expected that scour or the resuspension of sediment will occur during transit between terminals due to the water depth. The use of waterjet engines enables reactive steering at slow speeds, which should reduce the amount of wash produced when maneuvering the ferry(s) alongside at the terminals, which represent the areas most sensitive to scour and the resuspension of sediment (and displacement of benthic organisms).

The projects operation phase presents possible environmental degradation through the resuspension of sediments and the mobility of associated potential contaminants. This potential will be limited by:

- Operating in areas dominated by coarser sediment (sand) which is expected to settle more quickly if disturbed
- Operating at speeds below 8 knots in shallow and sensitive waters
- Orientation of waterjet nozzle away from riverbed while in vicinity of terminals and as far as practicably possible during transit
- Use of stern deflectors to dissipate stream flow in the vicinity of terminals to reduce potential for scour and turbulence.

5.2.3 Management measures

A summary of management measures to control the Project's potential impact on water quality is outlined in Table 7. Further detail and alignment with the relevant DBCA and WAPC policies and guidance for development within and adjacent to the Swan Canning River DCA is presented in Table 12.

Table 7 Management control actions for water quality

Design or management measure	Description
Water sampling surveys	Water quality sampling surveys of the Project areas commenced in April 2025 and will be undertaken monthly until September 2026. These surveys will assist in determining baseline data for comparison monitoring during initial ferry operations and have been used to inform operational management controls included in the draft OEMP. Water quality monitoring will be undertaken for up to 12 months following initial ferry operations in the vicinity of terminals. It is envisaged that monitoring will include in-situ turbidity loggers (pH, dissolved oxygen, salinity and temperature), supported with intermittent discreet water quality samples, as necessary.
Fire management	Ferry designed to minimise the risk of battery fire and effective fire suppression system. Crew will be trained in fire safety with regular drills as part of organisations Safety Management System. Vessels planned maintenance system will be implemented.
OEMP	A Project draft OEMP has been developed and include controls relating to management of water quality, including: • Ferry route, times and speeds to minimise sediment mobilisation / scour • Water quality monitoring around terminals for up to 12 months following initial ferry operations • Suitably qualified and experienced marine crew, regular training and route specific requirements (consideration to speed variations) • Fire risk procedures, particularly at charging points and shortly after charging • Vessel maintenance plan to include regular inspection of antifoulant silicone coating, as applicable • Pollution controls (spill kits, regular ferry inspections and maintenance and reporting procedures) • Integrated waste management procedures • Wastewater and litter management and servicing requirements. • Storage and handling of any hazardous materials in accordance with the Proponents internal control processes: - AS 1940:2004 The storage and handling of flammable and combustible liquids, - AS/NZS 4452:1997 Storage and handling of toxic substances, and - AS/NZS 3833:2007 Storage and handling of mixed classes of dangerous goods. The project will follow the International Convention for the Prevention of Pollution from Ships (MARPOL) management planning and requirements of the Australian Maritime Safety Authority (AMSA). Report uncontrolled releases immediately as per Section 3.1.3.

The draft OEMP will be developed further to include an integrated waste management approach to control environmental impacts associated with waste. This will comprise the following control measures:

- Waste receptacles designed to be vermin and wind resistant, preventing further distribution.
- Daily inspection of ferries and collection of errant waste.
- Daily emptying and disposal of waste from waste receptacles, transport and disposal of waste in accordance with AS standards and to an authorised facility.
- Recycling (three bin system) waste disposal opportunities and passenger signage at selected sites.
- Selection and use of cleaning chemicals that minimise waste and using small, reusable containers to avoid larger spills.
- Waste to be managed in accordance with contractual requirements, and in accordance with the waste control hierarchy (avoid, reuse, recycle or recover, treat, dispose) and attempts made to actively minimise waste.
- Waste is to be removed by a licensed waste service provider and taken to a waste facility for recovery or disposal.
- While transporting waste, the vehicle load is to be covered to prevent spillage and loss of waste.

The draft OEMP also includes the following controls for the storage and handling of hazardous materials:

- The storage of hazardous materials is prohibited from occurring on terminals and ferries, as far as practicably possible.
- The handling of hazardous substances shall be limited to a reasonable quantity required for cleaning or maintenance purposes.
- All materials will be managed in accordance with the Proponents internal control processes:
 - AS 1940:2004 The storage and handling of flammable and combustible liquids
 - AS/NZS 4452:1997 Storage and handling of toxic substances
 - AS/NZS 3833:2007 Storage and handling of mixed classes of dangerous goods.

Further detail on waste and hazardous material management is presented in Table 11, with controls aligned with DBCA and WAPC policies for development within the Swan Canning River DCA outlined in Table 12.

5.3 Benthic Habitat

5.3.1 Potential impacts

Terminal areas are located in close proximity to seagrass beds (Figure 6), which are an important habitat in the Swan Canning Estuary. The transit route is in deeper water and does not intersect with mapped BCH. Whilst there will be no direct disturbance, ferry operations may result in indirect impacts to seagrass beds and other BCH from reduced light availability and smothering due to increased turbidity resulting from the resuspension of sediment attributable to turbulence caused by ferries manoeuvring in shallow waters at terminals. The Option 2 ferry route intersects a very small area of sparse to medium seagrass near the Kwinana Freeway and thus is more likely to impact seagrass (Figure 6). It is possible that the Option 1 route also intersects areas of seagrass, however it is not possible, within the limitations of the available data, to confirm this with any certainty.

At Matilda Bay, benthic habitat beyond the intertidal zone was dominated by bare sand interspersed with patches of moderate to dense seagrass, running parallel to the bank and which extends approximately 20 to 40 m from the shore. Analysis of video imagery, classified seagrass assemblage as comprising mixed species of *Halophila decipiens* and *H. ovalis* (BMT, 2025). However, due to the morphological similarities between these species, and the absence of previous records of *H. decipiens* within the Swan Canning Estuary, its presence should be regarded as low confidence. Areas further from the shore, bare sand was the dominant BCH category (Figure 6).

BCH within the Applecross survey area was partitioned into three main categories:

- Predominantly bare sand habitat with isolated patches of mixed seagrass and macroalgae in the nearshore
- Connected patches of predominantly moderate to dense seagrass (*Halophila* spp.) in the transition zone
- Predominantly bare sand was observed further from the shore with the presence of filter feeders.

In the context of the broader environment within the Swan Canning Estuary, the Project's transit route is not expected to intercept with sensitive receptors. The shallow areas associated with the terminals represent a small segment of potential sites for the seasonal establishment of seagrass. Coupled with the proposed mitigation noted in Section 5.1.3, ferry operations are not anticipated to have a significant direct impact on BCH or an indirect impact due to smothering or reduced light availability through increased turbidity.

It should also be noted that though the marine reserve also constitutes the area of highest ecological protection in the local area, it is unlikely to be impacted by operational activities.

5.3.2 Management measures

A summary of management measures to control the Project's potential impact on benthic habitat is outlined in Table 11, with a summary presented in Table 8. Further detail and alignment with the relevant DBCA and WAPC policies and guidance for development within and adjacent to the Swan Canning River DCA is presented in Table 12.

Table 8 Management control actions for benthic habitat

Design or management measure	Description
BCH mapping	The operational ferry route has been designed in consideration with the mapping of BCH values to minimise impacts on habitats suitable for ephemeral seagrass establishment. This has reduced disturbance to BCH.
Vessel design and speed restrictions	Speed restrictions in shallow and sensitive areas, as per current navigational conditions imposed by Department of Transport (8 knots in shallow waters) will minimise erosion due to wake wash and will reduce resuspension of sediment. Ferry design (catamaran) is based on an efficient hull design and expected smaller wake reducing riverbank erosion. The waterjet system enables controlled maneuverability (steering) at slow speeds, enabling ferries to operate within a smaller footprint, while the direction of the jet nozzle enables the velocity stream to be directed away from the riverbed. Coupled with the use of stern reflectors to dissipate the velocity of the stream are designed to minimise interaction with the riverbed.
Location	The use of existing modified and/or constructed shoreline environments has been prioritised to reduce impact to environmental values.
Management Plans	The draft OEMP will be finalised prior to operations for approval by DBCA, with management measures including: • Pollution controls (spill kits, regular ferry inspections, planned maintenance system and reporting procedures) • Integrated waste management system • Wastewater and litter management and servicing requirements. • Storage of hazardous materials in accordance with COSHH (control of substances hazardous to health) / MSDS (material safety data sheet). • Report uncontrolled releases immediately as per Section 3.1.3.

5.4 Marine Fauna

5.4.1 Potential impacts

5.4.1.1 Operational noise

The propagation of underwater noise is extremely complex and is influenced by a variety of factors, including water depth, temperature, salinity, sediment type and sea/riverbed bathymetry. The extent to which it affects aquatic fauna is reflected in the means by which animals 'hear' underwater. The sounds generated by vessels are predominately low frequency (below 1 kHz) from onboard machinery, hydrodynamic flow around the hull, and from propeller cavitation (Popper et al., 2014). Individual vessels produce unique acoustic signatures, which may change with vessel speed, size, load, condition, age, engine type and activities that may be taking place on the vessel (Hildebrand, 2009).

Research on noise impacts on Indo-Pacific bottlenose dolphins is limited, but studies suggest they may be sensitive to vessel noise (SLR, 2026).

Scientific data on the effects of sound on fishes and turtles is somewhat limited, making regulatory and mitigation measures often less effective. To address this, the National Oceanic and Atmospheric Administration (NOAA) convened an expert panel in 2004 to establish sound exposure guidelines based on peer-reviewed research, resulting in criteria that account for species diversity and sound detection methods (Popper, et al., 2014). Although sea turtles are rarely found in the Swan River, these guidelines may be conservatively applied to other turtle species, such as freshwater turtles, in the absence of species-specific auditory data (SLR, 2026).

There is currently no direct evidence that non-impulsive noise (prolonged steady sound), such as from shipping, causes mortality in fish, but it can interfere with their behaviour by masking important sounds, including those related to foraging and predator avoidance (SLR, 2026). The U.S. National Marine Fisheries Service (NMFS) uses a general behavioural disturbance threshold of 150 dB re 1 μ Pa for fish, though its origin is less defined than other thresholds (NMFS, 2024). For sea turtles, behavioural disturbance is generally observed around 175 dB re 1 μ Pa, though data is limited and thresholds are not species-specific (NMFS, 2024).

To understand the Project's potential operational impacts to marine fauna associated with increased noise emissions, an Aquatic Noise Assessment (SLR, 2026) was completed, with an aquatic noise model developed to determine potential impacts on selected marine fauna from the proposed ferry operations. To provide an estimated sound exposure level (SEL – one-third octave source⁵), in lieu of undertaking in-situ noise modelling from the ferry, historical measurements on Elvy hybrid electric ferry in fully electric battery powered propulsion, as well as with an on-board diesel generator running (SLR, 2026).

The SLR (2026) model included the worst-case credible scenarios outlined in Table 9.

Table 9 Modelled worst-case scenarios of underwater noise

Scenario	Source Level
Ferry operation between Elizabeth Quay and Matilda Bay (return trip)	Overall unweighted 145 dB re 1 μ Pa ² .s
Ferry operation between Matilda Bay and Applecross (return trip)	
Ferry operation between Elizabeth Quay and Applecross without stopping (return trip)	
Ferry operation from Elizabeth Quay to Matilda Bay, and then to Applecross (return trip)	

⁵ One-third Octave refers to a frequency band that is one-third the width of an octave band used in acoustics for detailed frequency analysis

For each operating scenario, SLR predicted that the 24 m catamaran passenger ferry travels at a speed of 20 knots (approximately 10 m/s), following the current Transperth Ferry Service timetable. The worst-case scenario assumes up to 67 return trips (a total of 134 single trips) per 24-hour period, operating between 6:00 am to 12:30 am.

Potential impacts on marine fauna were assessed against the following criteria:

- **Audibility and detection:** Marine fauna detect sound based on frequency-dependent hearing sensitivity, with most having U-shaped audiograms, making them particularly sensitive to mid-range frequencies. Fish detect sound primarily through particle motion and, in some species, also through sound pressure via specialized anatomical structures (e.g., invertebrates)
- **Masking:** Masking occurs when anthropogenic noise interferes with the ability of marine fauna to detect biologically significant sounds. However, many species can mitigate these effects through auditory adaptations and behavioural strategies.
- **Behavioural responses:** Exposure to noise can trigger a range of behavioural changes in marine animals, from subtle shifts to strong avoidance, depending on the sound's characteristics and the individual traits of the affected species.
- **Physiological effects, hearing loss and physical injury:** High levels of noise exposure may result in temporary or permanent hearing loss and other physiological damage, including development abnormalities in invertebrate larvae. Among these, auditory impacts are considered the most severe, followed by behavioural disturbances.

Results of the noise survey were characterised into four levels:

- **Temporary hearing Threshold Shift (TTS)** – The distance boundary from the source noise that causes temporary hearing loss to fauna.
- **Permanent hearing Threshold Shift (PTS)** – The distance boundary from the source noise that causes permanent hearing loss to fauna.
- **Recovery from injury** – minimum distance boundary from which injury occurs to animals above hearing loss that is potentially recoverable to fauna.
- **Mortality and potentially mortal injury** – minimum distance boundary from which mortality can or will occur to fauna.

The impact zones from the ferry operation were modelled and assessed based on cumulative continuous noise exposure over a 24-hour period based on the schedule above for marine mammals and other fauna.

The predicted noise levels from ferry operations, based on the modelled results showed that the threshold levels of PTS and TTS are not reached for marine mammals. It also reported that a substantial margin of more than 20 dB exists between the assessed levels and the relevant threshold. Even under a hypothetical scenario where ferry speed is halved while maintaining the same sound power level (considered unlikely), noise emissions would still remain below threshold levels.

Potential behavioural responses / disturbance for marine mammals of all hearing groups (human divers and swimmers), is predicted to be within 10 metres from the assessed ferry routes. For other groups (i.e., fish and turtles) the threshold levels (that would imply a behavioural response) are not reached. "Between 2.94km to 2.22km along the ferry Route 2 from Matilda Bay to Applecross, the water is shallow, with approximately 3m to 4m depth, such that there are increased reflections of noise from seabed and lateral spread of underwater noise to the surrounding. The predicted unweighted levels are up to the low frequency threshold levels for human divers and swimmers. Despite these propagation effects, frequency-specific levels remain below the applicable assessment criteria" (SLR, 2026).

Modelled results also show that ferry noise poses very low physiological risks to fish species with swim bladder involved in hearing. Thresholds for mortality, recovery injury and TTS are not reached.

Potential behavioural disturbance from the non-impulsive noise emissions from ferry operations is predicted to be within 10 m of the ferry routes for marine mammals across all hearing groups, as well as for human divers and swimmers. For fish and turtles, behavioural thresholds are not exceeded (SLR, 2026), indicating that noise is unlikely to impact marine fauna unless these come within 10 m of the ferry, giving a wide berth for ferry avoidance.

Vessel strike

The Project's operational phase also presents the potential risk of harm or fatality to marine fauna from a direct strike with ferries. The reaction of marine fauna to the approach of a vessel varies between species. Some species remain motionless when in the vicinity of a ship, while others are known to be curious and often approach ships that have stopped or are slow moving (Richardson, et al., 1995).

Baseline mortality rates for dolphins in the Perth region remain poorly understood. However, available data suggest that most recorded dolphin deaths in the Swan River are not linked to human activities such as vessel strikes. A study by Chabanne et al. (2012) which analysed sighting data of Indo-Pacific bottlenose dolphins in the Swan-Canning Estuary between June 2011 and July 2012, documented 109 sightings. The study also reviewed mortality events over the preceding decade and found that the majority of deaths were attributed to bacterial or viral infections, rather than anthropogenic causes.

Anthropogenic factors are considered biologically significant when they affect key demographic parameters such as birth and death rates to the extent that population viability is threatened. However, this definition does not encompass non-lethal injuries (Chabanne, et al., 2012). In complex estuarine environments like the Swan-Canning Estuary, multiple stressors interact, making it difficult to isolate indirect causes of mortality. Environmental changes and food availability, when combined with human-related pressures, can increase susceptibility to infectious diseases due to physiological stress and injury (Van Bresse, et al., 2009). Injuries from collisions between vessels and cetaceans, for example, are not always fatal, individuals may sustain debilitating injuries, including those from propellers such as loss of fins or flukes and severe lacerations to the body (Department of the Environment and Energy, 2017) or blunt force trauma from vessel hull. Consequently, it may be impossible to determine whether vessel strikes have indirectly contributed to deaths. Therefore, management strategies must consider the overall risk of vessel strikes, not just direct fatalities.

While there is no universal solution to mitigating vessel strikes involving cetaceans, the International Maritime Organization (IMO), with support from Australia, developed a guidance document in 2008 to address this issue. This guidance has informed national policies, including the *Australian National Guidelines for Whale and Dolphin Watching* (DCCEEW, 2017), which incorporate principles aimed at reducing the risk of ship strikes primarily by regulating the approach distance of vessels. Furthermore in 2017, the Australian Government released the *National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna*. The report aimed at providing a guiding framework for identifying species most at risk of vessel collision, areas where these species are most at risk of vessel collision and appropriate mitigation measures to reduce the risk of vessel collision with marine megafauna (DEE, 2017).

When considering Indo-Pacific bottlenose dolphins in the Swan River, vessel speed, size and movement pattern (dedicated route versus erratic) influence the severity and frequency of collisions. The reaction of an individual animal to an approaching vessel will also influence the possibility of the animal being struck. The chance of an injury being lethal increases significantly as vessel speed increases up to 13-15 knots (24-28 km/h) (Vanderlaan & Taggart, 2007). Nationally, lethal or severe injuries to cetaceans have been primarily associated with vessels over 80 m in length (significantly longer than the ferry) and those travelling at speeds exceeding 14 knots (26 km/h). In contrast, vessels operating at speeds below 10 knots (19 km/h) rarely collide with cetaceans (Vanderlaan & Taggart, 2007).

There is a general lack of data on the incidents of vessel strike and where they occur. However, preliminary assessment shows that many small fauna inhabit some of Australia's busiest waterways with resident groups or local breeding populations often coinciding with a high density of boating activity (Department of the Environment and Energy, 2017). It is expected that the ferries will operate at a speed of up to 20 knots (pending speed exemptions) while in transit in deeper waters (in accordance with the required distance from sensitive infrastructure / other vessels and so on). This speed may increase the possibility of interacting with marine fauna during general operations, particularly given the reduced noise associated with electric ferries and high speed that may not allow the animals time to avoid the vessel.

Artificial Lighting

Following recent consultation with the SRT board the following operational changes have been made in regard to lighting.

The new vessels will be equipped with standard, compliant marine navigation lights, including red port, green starboard, and white all-round lights, providing safe nighttime visibility on the Swan River. This arrangement is consistent with the existing vessel fleet.

Given that the ferries will operate within a busy and well-utilised waterway, they will also be fitted with forward-facing headlights. These headlights are not intended for routine use during nighttime operations. Instead, they serve as a contingency measure, allowing the vessel Master to illuminate and verify potential hazards or objects observed ahead when additional visual confirmation is required. Their use would generally be limited to extreme circumstances where onboard night-vision camera systems are unable to provide a sufficiently clear image.

Specialised accent lighting, similar to the hull illumination featured on vessels such as MV Tricia, is also being considered for the new fleet. This lighting provides a distinctive ambient glow that enhances the vessel's visibility without causing glare or disturbance to passengers, nearby residents, or other river users. The additional illumination assists other waterway users in identifying and navigating safely around the vessel. It should be noted that this lighting does not diminish the Vessel Master's responsibility to operate in accordance with the International Regulations for Preventing Collisions at Sea (COLREGs). The system would utilise high-efficiency, low-lumen marine-grade LED lighting to create a subtle visual effect rather than high-intensity illumination. As the lights are shielded by the vessel's hull and trim, only minimal direct light is projected into the water column. This design helps minimise impacts on the Swan River's ecosystem, including the nocturnal feeding and migratory behaviours of native fish and prawn species.

Indirect impacts

Potential indirect impacts to marine fauna as a result of the Project's operation are summarised below:

- Pollutant and/or waste discharge – Changes to toxicological parameters of receiving water due to waste release. Pollutants from operational vessels (including litter) may lead to chemical toxins leaching into the waterways and ingested by marine fauna leading to sickness or potential deaths.
- Sediment mobilisation – Localised increased turbidity affecting foraging behaviour / food source, smothering of sessile organisms. Changes to one or more of physico-chemical toxicological parameters in the receiving environment due to suspended sediments may impact benthic communities resulting in reduced food source, direct toxicity and avoidance of the area by mobile marine fauna or the growth of unwanted species (i.e., macroalgae out competing seagrass).
- Artificial lighting over water – There is potential for artificial lighting associated with ferry operations to interfere with natural behaviours of marine fauna. Some species are attracted to lights making them more susceptible to predation. However, this is expected to be minimal.
- Scour – localised physical displacement or injury / death of benthic fauna.

5.4.2 Management measures

Proposed mitigation and avoidance measures to manage potential impacts to marine fauna are outlined in Table 10 with a summary presented in Table 11. Further detail and alignment with DBCA WAPC policies and guidance for development within and adjacent to the Swan Canning River DCA presented in Table 12.

A dolphin and bird strike management plan will be developed either as a stand alone document or as an appendix to the draft OEMP. This document will highlight areas of higher concern where, for example where dolphins are more commonly reported such as Matilda Bay and the Narrows Bridge.

Table 10 Management controls for marine fauna

Potential Impact	Design or management measure	Description
Injury or harm to fauna through vessel movements and/or strike	Speed restrictions on operating ferries	- Speed restrictions as per current navigational conditions imposed by Department of Transport in shallow water (8 knots) significantly reduce likelihood of vessel strike on marine fauna, including Indo-Pacific bottlenose dolphins - However, it is assumed that for some 5.5 nautical miles (10.2 km), 8 knot speed restrictions will not apply and / or exemptions may be sought and ferries will operate at speeds above 8 knots (up to 25 knots), to increase feasibility of operation. Crew should maintain continuous look out during these times and reduced speed should be considered (noting that speeds between 12 to 16 knots may increase wave wake) - Any collision to be reported to the necessary authority (e.g., Australian Marine Mammal Centre, DBCA, AMSA, DTMI/PTA).
	Operational route design avoids significant environmental values	The operational ferry route avoids Biologically Important Areas (BIAs), including Marine Parks, and critical habitat for marine fauna species.
	OEMP – waste management	- The draft OEMP will be developed to include integrated waste management procedures to reduce risk of ingestion, entanglement or toxicant exposure from waste items to marine fauna. - Appropriately located litter bins (with securely closing lids) to avoid littering by public - Education boards at terminals and on ferry.
	OEMP – training	- The draft OEMP will include marine mammal awareness training for Ferry Masters and crew to reduce the risk of ferry interaction with marine fauna. - In the instance that sick or injured wildlife is identified, Ferry Masters are required to notify their supervisor via phone call as soon as it is safe to do so. The supervisor will immediately contact the Wildcare Helpline on (08) 9474 9055 and report it as an environmental incident to the PTA. If the sick or injured wildlife is not attributed to operation of the ferry, then the cause should be reported as third party / third party unknown. Reporting information is also detailed in the Ferry OMP.

Potential Impact	Design or management measure	Description
Noise and vibration associated with increased ferry movements impacted marine fauna behaviour	Ferry design	- Electric ferries are predicted to reduce noise impacts to marine fauna compared to traditional diesel-powered ferries. - The vessels will use compliant marine navigation lighting, with forward-facing headlights available only for exceptional hazard identification and low-intensity, shielded accent lighting considered to enhance vessel visibility while minimising glare and impacts to the Swan River environment.
	Speed restrictions on operating ferries	Speed limit restriction to a maximum of 8 knots in shallow water, where practicably possible may reduce associated noise from velocity stream / motor.
Injury or harm to fauna through habitat degradation associated with erosion, pollutants and/or sediment mobilisation.	Management Plans	The draft OEMP will be developed further to include integrated waste management procedures to reduce risk of spills, leakage or inappropriate handling of waste materials.
		Jet nozzle to be maintained at the vertical position in terminal areas to avoid turbulence and scour of riverbed (if practicably possible) thereby reducing displacement of benthos.
		Management of water quality as per Section 5.2 and the OEMP.
		The draft OEMP will manage impacts associated with erosion and sedimentation. To be finalised prior to operation.

5.5 Conservation Reserves

The proposed ferry route does not intersect any Marine Park areas (Figure 2). Indirect impact due to changes in water quality and erosion from wake may occur, 5.1 and wake modelling identified increased wake exposure adjacent to Pelican Point under Cases 2 and 3. While the ferry route does not enter the Swan Estuary Marine Park or Pelican Point Reserve, the potential influence of increased wake energy on shoreline dynamics adjacent to these conservation values should be considered as part of any future speed exemption application.

Management measures for these impacts are discussed in Section 5.1.2 and 5.2.2.

6.0 Development Approval Conditions

Development approval will be subject to relevant conditions that will need to be addressed and signed off by the relevant authority prior to development commencing. In consideration of the relevant policy provisions, as well as likely impacts and required management responses outlined in Table 3 and Table 11 the following draft conditions are anticipated:

1. *All operations are to be undertaken in accordance with the Operational Environmental Management Plan as approved by the Department of Biodiversity, Conservation and Attractions.*

6.1 Summary of Operational Environmental Impacts and Management Controls

A summary of all potential impacts and proposed management controls detailed in the above sections is presented in Table 11.

The Project's alignment with the relevant DBCA and WAPC policies and guidance for development within and adjacent to the Swan Canning River DCA is presented in Table 12.

Table 11 Summary of potential impacts and proposed management controls

Relevant Matter	Potential Impacts	Proposed Management or Mitigation Response
Coastal Erosion and Foreshore	The Project's operational phase has the potential to adversely impact coastal erosion processes, and subsequently the integrity of surrounding foreshore environments including associated habitats and benthic communities, due to the high silt and clay riverbed composition being susceptible to scour and sediment resuspension. However, the coastal processes assessment (Seashore Engineering, 2026) determined that ferry operations are expected to have a minor to negligible impact on coastal processes across the terminal locations. This is due to: - The existing modified foreshore environments and established vessel usage and ferry operations in the area. - Existing coastal processes (e.g. wind waves and sea-level rise) overwhelmingly dominate sediment dynamics compared to (ferry) vessel-generated wake. - Vessel speed restrictions limited to 8 knots in shallow areas, act to reduce wave wakes and are expected to be lower than naturally produced wave wakes generated through ambient wind wave action. Wave wake analysis (INCAT, 2025) also concluded that wake wash from ferries at an operational speed of up to 20 knots, would be less than wind wave heights generated by 20-knot winds. Additionally, review of the DBCA foreshore data (Figure 7) highlights that the highest susceptibility to wave wake impacts is associated with modified shorelines. Given the engineered nature of these areas and the mitigation measures in place, wake wash is not anticipated to result in significant shoreline disturbance and impacts will be minimal, limited to existing shoreline environments.	Vessel design and speed restrictions will minimise impacts associated with coastal processes and erosion, including: - An 8 knots speed restriction in shallow waters will minimise wake and wash in more sensitive areas and will reduce mobilisation of sediments into the water column and scour. - Ferry design (Catamaran) will be light weight with an efficient hull design to minimise water displacement, thereby reducing wave wake. The design will also minimise wash, reducing turbulence (scour) and the mobilisation of sediments into the water column. The draft OEMP will be finalised for approval by DBCA and will include management measures to control impacts associated with sediment mobilisation and shoreline erosion. Impacts to Pelican Point are likely to warrant further consideration as part of any future speed exemption scenario, noting additional modelling and mitigation may be required to limit impacts.
Water Quality	The Project's operational phase is not expected to detrimentally impact water quality. However, potential impacts include: - Changes in water quality as a result of spills and waste released from ferries during operation - Mobilisation of sediments causing decreased light availability to benthic primary producing habitats and smothering sensitive receptors (seagrass). - Mobilisation of sediments causing changes to water toxicant values.	The draft OEMP will be finalised prior to operation in consultation with DBCA and will include measures to manage impacts to water quality, including: - Ferry route and speeds - Pollution controls – it is expected that possible sources of toxicants will be limited to ballast (pending system requirements), antifoulant and ferry cooling / anticorrosion systems and public toilets. - Integrated waste management procedures - Wastewater and litter management and servicing requirements - Fire management - Correct storage of hazardous materials (as applicable). Water quality in the Swan and Canning Estuary is routinely monitored by DBCA. These reports will likely provide a long term data set from which to compare changes over time. Ferries are to operate in accordance with relevant State, Commonwealth and National legislative requirements for the safe operation of the vessels including the International Convention for the Prevention of Pollution from Ships (MARPOL) management planning. Report uncontrolled releases immediately as per Section 3.1.3.

Relevant Matter	Potential Impacts	Proposed Management or Mitigation Response
Benthic Habitat	The operational route does not intersect with mapped BCH, except for Option 2 which intercepts a very small area adjacent to Kwinana Freeway. Ferry operations present a risk of wake wash resulting in sediment mobilisation and a temporary increase in turbidity / suspended particulates. This has the potential to reduce light availability and smothering of sensitive receptors such as seagrass resulting in a change to ecosystem dynamics, loss of habitat and potentially increasing toxicity to sediments impacting infauna and epifaunal communities. Physical disturbance can also release sediment-bound nutrients or contaminants. Sediment pore water (interstitial fluid) can contain high levels of dissolved nutrients and contaminants, that can impact water quality when released. The supply of nutrients can influence the growth of nuisance macroalgae (such as <i>Chaetomorpha linum</i>), phytoplankton and epiphytes (DoW, 2014). Unattached macroalgae can reduce the light availability to seagrass, while epiphyte overgrowth has been implicated as a probable cause of seagrass decline associated with eutrophication (nutrient enrichment) (DoW, 2014). These processes are complex however and the impact on seagrass will differ between species.	BCH mapping has informed design of the Project's operational route to minimise impacts to habitats suitable for ephemeral seagrass establishment and other sensitive environmental values. The use of existing modified shoreline environments has been prioritised as far as reasonably practicable. Vessel design and speed restrictions will minimise impacts associated with erosion and sediment mobilisation, including: • An 8 knot speed in shallow environments will minimise wake wash and turbulence reducing mobilisation of sediments into the water column. • Ferry design (catamaran) is expected to have a shallow draft an efficient hull to minimise wake and turbulence, reducing scour and mobilisation of sediments into the water column. • The ability of manoeuvre vessels at slow speeds reduces scour in shallow areas.
Marine Fauna	The Project's ferry operations have the potential to cause injury or harm to fauna through vessel movements and/or strike. There is also a risk of entrapment or entanglement through waste or debris associated with operational movements. Noise impacts associated with ferry operation have the potential to result in localised and temporary changes to underwater soundscape, effecting marine fauna natural behaviours such as foraging. This includes Indo-Pacific bottlenose dolphins. The environmental noise assessment (SLR, 2026) indicated that under the proposed operational conditions, including a source level equivalent to the current ferry, a speed of 20 knots, and adherence to the current ferry timetable, the threshold levels for PTS and TTS are not exceeded for marine mammals. There is also potential for indirect injury or harm to fauna through habitat degradation associated with erosion, pollutants and/or sediment mobilisation. This includes: • Pollutant and/or waste discharge – Changes to toxicological parameters of receiving water due to waste release. Pollutants from operational vessels (such as waste) may lead to chemical toxins leaching into the waterways and ingested by marine fauna leading to sickness or potential deaths. • Sediment mobilisation – Changes to one or more of physico-chemical, toxicological or water turbidity parameters in the receiving environment due to suspended sediments may create conditions unsuitable for marine fauna to habitation. • Installation of artificial lighting over water – There is potential for artificial lighting associated with ferry operations to interfere with natural behaviours of marine fauna.	Vessel design and speed restrictions will minimise impacts to marine fauna, including: • An 8 knots speed restriction in shallow waters will reduce the risk of vessel strike on marine fauna, including Indo-Pacific bottlenose dolphins. • The 8 knot speed restriction in shallow waters will also minimise wake and wash and reduce mobilisation of TSS into the water column. • The operational ferry route avoids biologically important areas including Conservation Reserves, and critical habitat for marine fauna species. • Ferry design (Catamaran) allows for shallower drafts and smaller wake. The design will also minimise wash and reduce mobilisation of sediments into the water column • Consideration of fauna impacts in lighting design. The draft OEMP will be finalised in consultation with DBCA. This will comprise: • An integrated waste management procedure to reduce risk of ingestion, entanglement or toxicant exposure from waste to marine fauna. • Detail of Ferry Master training to enable safe fauna movement and avoid ferry interaction. In the instance that sick or injured wildlife is identified, Ferry Masters are required to notify their supervisor via phone call as soon as it is safe to do so. The supervisor will immediately contact the Wildcare Helpline on (08) 9474 9055 and report it as an environmental incident to the PTA. If the sick or injured wildlife is not attributed to operation of the ferry, then the cause should be reported as third party / third party unknown. • Pollution controls (spill kits, regular ferry inspections and maintenance and reporting procedures) • Report uncontrolled releases immediately as per Section 3.1.3. • Storage of hazardous materials.

Relevant Matter	Potential Impacts	Proposed Management or Mitigation Response
Waste and Hazardous Materials	The Project's ferry operations have the potential to result in degradation of the river environment and/or harm or fatality to fauna species due to the mis-management of waste and hazardous materials. Risks and potential impacts include: - Inadequate design or number of waste receptables resulting in an increase of waste in the river environment (e.g. rubbish and litter) - Inadequate storage, handling and disposal of waste resulting in an increase of waste in the river environment and/or in transit and/or landfill facility (e.g. rubbish and litter) - Maintenance activities involving the use of hazardous materials and/or cleaning products spilling and adversely impacting the river environment.	A Project specific OEMP will be finalised prior to operations and will outline an integrated waste management system for ferry operations. The OEMP will include encompass control measures including: - Waste receptables designed to be vermin and wind resistant, preventing further distribution. - Daily inspection of terminals and ferries and collection of errant waste. - Daily emptying and disposal of waste from waste receptacles, transport and disposal of waste in accordance with AS standards and to an authorised facility. - Recycling (three bin system) waste disposal opportunities and passenger signage at selected sites. - Selection and use of cleaning chemicals that minimise waste. - Waste to be managed in accordance with contractual requirements, and in accordance with the waste control hierarchy (avoid, reuse, recycle or recover, treat, dispose) and attempts made to actively minimise waste. - Waste is to be removed by a licensed waste service provider and taken to a waste facility for recovery or disposal. - While transporting waste, the vehicle load is to be covered to prevent spillage and loss of waste. The final OEMP will also include the following controls for the storage and handling of hazardous materials: - The storage of hazardous materials is prohibited from occurring on ferries. - The handling of hazardous substances shall be limited to a reasonable quantity required for cleaning or maintenance purposes. - All materials will be managed in accordance with the Proponents internal control processes: - AS 1940:2004 The storage and handling of flammable and combustible liquids, - AS/NZS 4452:1997 Storage and handling of toxic substances, and - AS/NZS 3833:2007 Storage and handling of mixed classes of dangerous goods.
Heritage	<u>Aboriginal Heritage:</u> - The Swan River (ACH-00003536) Aboriginal Cultural Heritage site intersects the entire operational route. Consultation with TO groups indicates that the fauna and shoreline are considered integral parts of the site Therefore, there is a potential risk of operation and maintenance activities impacting on ACH sites through shoreline erosion and fauna strike. - No new Aboriginal sites, places, or objects relevant to the <i>Aboriginal Heritage Act 1972</i> were identified during the completed Archaeological and Ethnographic surveys (AHA, 2025a) (AHA, 2025b) and the archaeological potential of the area is considered low due to the significant history of dredging and modification of the surrounding environment. <u>European Heritage</u> - Ferry operations are not expected to have a direct impact on any European heritage sites.	The Proponent is undergoing engagement and consultation with Traditional Owner representatives and will execute and agree to the terms of the NHSA. Consultation with Traditional Owner representatives will continue to inform the operation of the Project and if required, separate approvals will be sought under the <i>Aboriginal Heritage Act 1972</i>. Vessel design and speed restrictions will minimise impacts to marine fauna, including: - An 8 knots speed restriction in shallow waters will reduce the risk of vessel strike on marine fauna, including Indo-Pacific bottlenose dolphins. - The 8 knot speed restriction in shallow waters will also minimise wake and wash and reduce mobilisation of TSS into the water column. - Ferry design (catamaran) allows for shallower drafts and smaller wake. The design will also minimise wash and reduce mobilisation of sediments into the water column. The draft OEMP will be finalised for approval by DBCA and will include management measures to control impacts associated with sediment mobilisation and shoreline erosion. It will also include detail on Ferry Master training enable safe fauna movement and avoid ferry interaction.

Table 12 Alignment with WAPC and DBCA planning policies

Relevant Policy	Policy Provision	Response – Addressed by this DA
WAPC Policies		
State Planning Policy 2.0: Environment and Natural Resources Policy	(5.1) General Measures Planning strategies, schemes and decision making should: <i>Avoid development that may result in unacceptable environmental damage.</i> <i>Actively seek opportunities for improved environmental outcomes including support for development which provides for environmental restoration or enhancement.</i> <i>Protect significant natural, indigenous and cultural features, including sites and features significant as habitats and for their floral, cultural, built, archaeological, ethnographic, geological, geomorphological, visual or wilderness values.</i> <i>(vii) Take account of the potential for on-site and off-site impacts of land use on the environment, natural resources and natural systems.</i> <i>(x) Support conservation, protection and management of native remnant vegetation where possible, to enhance soil and land quality, water quality, biodiversity, fauna habitat, landscape, amenity values and ecosystem function.</i>	- The proposed ferries and ferry routes have been designed to minimise impacts to benthic habitat and marine fauna, as well as reducing wave wake and consequently foreshore erosion (Section 5.1). This will reduce impacts to marine and foreshore ecology and cultural values. - The draft OEMP will be finalised to address the impacts identified in this document from operation and how these can be minimised (Section 6.1).
	(5.2) Water Resources Planning strategies, schemes and decision making should: (i) Consider mechanisms to protect, manage, conserve and enhance: <i>(a) wetlands of importance, Ramsar wetlands and wetlands identified in any relevant Environmental Protection Policy;</i> <i>(b) waterways;</i> <i>(c) estuaries;</i> <i>(d) marine environments;</i> (iv) Ensure the provision of adequate setbacks between development and the foreshores of wetlands, waterways, estuaries and the coast, in order to maintain or improve the ecological and physical function of water bodies. Such setbacks will aim to maintain the natural drainage function, protect wildlife habitats and landscape values, lessen erosion of banks and verges, and facilitate filtration of sediment and waste associated with surface run-off from adjacent land uses, which may include retention or replacement of riparian vegetation.	- The proposed ferries and ferry routes have been designed to minimise impacts to benthic habitat and marine fauna, as well as reducing wave wake (Sections 5.2.3 and 5.3.2). This will minimise impacts to the Swan-Canning Estuary. - The draft OEMP will be finalised to address the impacts of operation and how these can be minimised (Section 6.1).
	(5.5) Biodiversity Planning strategies, schemes and decision-making should: (i) Consider mechanisms to protect areas of high biodiversity and/or conservation value, including: <i>a. land vested in the Conservation Commission as national park, nature reserve, conservation park or other reserve, and land acquired and managed by the Department of Conservation and Land Management (CALM) pending formal reservation;</i> <i>b. land and waters vested in the Marine Parks and Reserves Authority as marine park, marine nature reserve or marine management area, and areas identified in the Report of the Marine Parks and Reserves Selection Working Group.</i>	Three areas of the Swan Estuary Marine Park are located in relative proximity to the Applecross and Matilda Bay Terminal sites (Alfred Cove, Pelican Point and Milyu). None of these areas are expected to be impacted by the project, however measures to minimise any potential impacts to water quality and Marine Fauna that may have indirect impacts to the Marine Park will be managed through the implementation of the final OEMP. The draft OEMP will be finalised and implemented in consultation with DBCA as a condition on the Development Approval and will ensure operational activities do not result in any erosion and/or discharge of pollutants into the river system and that any adjacent or nearby wildlife habitats are protected (Section 6.1).
State Planning Policy 2.10: Swan-Canning River System	(7.2.1) The dynamic nature of the river, including its waters, floodplain, sustaining vegetation and habitats, should be taken into account when planning land use and development so as to ensure the long-term health and value of the river.	The proposed development has been designed to minimise impact on the natural environment, and while there will be minimal remnant vegetation and BCH impacted by the developments (Sections 5.2.3 and 5.3.2). The draft OEMP discusses operational measures to minimise impact to vegetation and habitats.
	(7.2.4) Fringing vegetation serves an important biological function and adds value to the river ecosystem. There is a general presumption against the clearing of native and other vegetation within the river area unless otherwise determined by a precinct plan or if there is a demonstrated problem such as weed invasion.	
	(7.2.5) The protection and re-establishment of fringing riparian vegetation should be promoted as a means of stabilising riverbanks, providing wildlife habitat, intercepting nutrients, providing shade and improving river water quality.	
	(7.2.6) The protection and re-establishment of wetlands, tributaries and bushland associated with the river should be promoted.	
	(7.3.1) The natural and cultural heritage values of the river should be protected and enhanced.	The PTA is undertaking necessary steps to determine the requirement for separate Aboriginal cultural heritage approvals that are dealt with under separate legislation.
	(7.3.2) Consideration of Aboriginal and European based cultural and natural heritage values should be taken into account when planning and determining proposals within the river area.	

Relevant Policy	Policy Provision	Response – Addressed by this DA
WAPC Policies		
State Planning Policy 2.6: State Coastal Planning Policy	(5.10) Coastal strategies and management plans: (i) Ensure that a rezoning, structure planning, subdivision or development – whichever arises first and is appropriate in scale, a coastal planning strategy or coastal foreshore management plan is prepared and implemented, by the local government and/or proponent, for the coastal foreshore reserve and any abutting freehold land with conservation values of the subject land. (ii) Any structure plan, zoning, subdivision, strata subdivision or development proposal for public purposes, residential, industrial, commercial, tourist, special rural and similar uses on the coast is only approved based on o in conjunction with a current detailed coastal planning strategy or foreshore management plan (whichever is appropriate for the stage and scale of development). (iii) Ensure that the coastal planning strategy or foreshore management plan is developed in consultation with the broad community and relevant public authorities, and achieve the approval of the local land manager and the WAPC if appropriate.	The project does not directly interact with the foreshore or propose any structure planning or land use change. Consequently, a statutory Foreshore Management Plan is not considered to be required under SPP 2.6.
State Planning Policy 2.9: Water	(6.1) Planning and development maintains or enhances water quality and hydrological regimes to protect public health and support healthy ecosystems through the: (i) protection of sensitive water resources and other important environments (ii) protection of existing vegetation and/or restoration of cleared or degraded vegetation, preferably with endemic species. (7.2) Proposals should, in accordance with the Guidelines: (i) minimise export of nutrient and all other contaminants, including sediment, entering water resources. (7.7) Specific area measures: Swan Canning River system (a) maintain and enhance the ecological and hydrological functions of the river system, and demonstrate detrimental impacts have been prevented (b) demonstrate a benefit to the community and a functional need to be located within the river and/or foreshore reserves, where the proposal is located on public land (c) maintain and enhance public access to and along the rivers and its foreshores, including through the establishment of foreshore reserves (d) consider the importance of the river as a strategic water transport network for commercial and recreational use (e) maintain and enhance the natural landscape character and sense of place of the river system.	- The use of an electric ferry reduces the risk of water pollution and impacts to ecosystems by reducing the risk of fuel leaks and spills. - The boat is of a low noise design and speeds will be limited in shallow water to reduce impacts to marine fauna and scour, which can liberate nutrients and potential contaminants from sediments. - The draft OEMP will be finalised to address the impacts of operation, including potential scour and erosion, to minimise impacts to ecosystems and vegetation. Impacts to the hydrological functions of the Estuary are not anticipated.
DBCA Corporate Policy 42: Planning for Land Use, Development and Permitting Affecting the Swan Canning Development Control Area	(5.1) Provide support, advice and decisions which protect and enhance the Swan Canning River system's ecological health. This includes maintaining tributary and stream habitats and their natural drainage functions, reducing nutrient enriched and polluted water inputs from adjacent land uses, minimising erosion of stream banks and protecting wetland ecosystems and associated wildlife habitats. (5.2) Prioritise the protection of threatened flora and fauna and threatened ecological communities. (5.4) Maintain a presumption against proposals which may, either directly or indirectly, unacceptably degrade shallow river flats, foreshore vegetation, fringing wetlands, saltmarshes or tributaries associated with the Swan Canning river system. (5.6) Where a proposal has the potential to contribute long term impacts on the Swan Canning river system, consider the need for a proponent to prepare and implement, as a condition of approval, an Environmental Management System to minimise any potential ongoing environmental impacts of development and use (5.7) Have due regard for the provisions of relevant international and national agreements, State environment and planning legislation, policy, plans and strategies when assessing proposals affecting the ecological health of the Swan Canning river system.	- No direct impacts to Conservation Reserves and BCH are proposed. - No threatened flora or fauna or ecological communities have been identified during the development of this Project. - The draft OEMP will be finalised in consultation with DBCA as a condition on the Development Approval that will ensure construction activities do not result in any erosion and/or discharge of pollutants into the river system and that adjacent and nearby fauna, Conservation Reserves and wildlife habitats are protected during operation.

6.2 Operational Environmental Management Plan

A draft operations management plan has been submitted with this development application. This document is intended to outline the Masters procedural responsibilities in operating a reliable, safe public transport service. Separately the draft OEMP will be finalised for approval by DBCA prior to the commencement of operations. As outlined in Table 11 above, this document will be developed to guide the implementation of the above management measures during operation.

There is no formal DBCA guidance for the content of an OEMP or EMS. The structure and content of the EMS is anticipated to include the following specific management requirements (at a minimum):

- A detailed site map showing:
 - Ferry route and service area
 - Conservation reserves
 - The laydown area and vehicle entry/exit points
 - Protected vegetation and BCH
 - Storage of materials and equipment and sillage pumps
 - Waste receptacles
 - Signage and safety measures to ensure public safety
- A detailed ferry layout showing:
 - Storage of materials and equipment including sillage
 - Waste receptacles
 - Signage and safety measures to ensure public safety
- Incident response measures and procedures including:
 - Mechanisms for complaints and incidents
 - Provision of a spill kit at all times on the project site suitable for containing and clean up any spills
 - Measures to manage fires on board the vessel
 - Measures to document and respond to incidents of damage, pollution or spills within the DCA, including response reporting in Section 3.1.3.
 - Proposed contingency actions if environmental controls are inadequate
 - Procedures to ensure that in the event of an incident, DBCA is notified within 48 hours and all damage is rectified
- Measures to ensure that no waste or any other deleterious matter is allowed to enter the river.

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Appendix A

Sampling and Analysis Plan Implementation Report



Swan River Ferry Expansion

Swan River Water Quality Monitoring September 2025 and Biannual Interpretive Report

Perth Transport Authority

05 December 2025

→ The Power of Commitment



Project name		Swan River Ferry Expansion					
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GHD Pty Ltd | ABN 39 008 488 373

Contact: Solene Lao, Graduate Environmental Scientist | GHD

999 Hay Street, Level 10

Perth, Western Australia 6000, Australia

T +61 8 6222 8222 | **F** +61 8 6222 8555 | **E** permail@ghd.com | **ghd.com**

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Executive summary

The executive summary will be updated upon review of the draft report.

DRAFT

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1. Introduction

The Public Transport Authority of Western Australia (PTA) is the primary supplier of public transport services in Western Australia (WA) and is one three key transport agencies that work to coordinate a smarter, integrated, and optimised network for WA. Future expansion of ferry services at the Swan River is a natural progression to meet the needs of an expanding city, supporting activation of popular, high-density living riverside precincts¹. The PTA is undertaking feasibility studies to identify appropriate development envelopes (DE) for future ferry landings to enable the expansion of the Transperth ferry services (the 'Project'). Six DEs are understood to be considered as future landings comprising:

- Applecross.
- Barrack Street Jetty.
- Elizabeth Quay.
- Ellam Street.
- Matilda Bay (Option 1 and Option 2).

The PTA has identified that contamination is a key environmental issue for the Project, and additional information in the form of monthly baseline water quality data from the Swan River within the DEs is required to identify Contaminants of Potential Concern (CoPC), which may pose risk to human health and/or the environment. Initial consultation between PTA and the Department of Biodiversity, Conservation and Attractions (DBCA) identified that monthly water sampling at the six locations in the Swan River for 12 months (based on a monthly basis) with the potential to increase to 24 months to characterise baseline water quality in the DEs would be required to inform Surface Water Management Plans in the event that future landings proceed to construction and operational phase. In addition to the water quality monitoring within the DEs, a further three 'reference sites' were also included in the water quality monitoring program at the request of DBCA and located within the open waters of the Swan River².

Due to contractual changes aimed at achieving the updated limits of reporting (LORs) as requested by the PTA, a change in laboratories was implemented in September 2025 and will remain in effect moving forward. This report has been prepared to reflect and document those new contract changes.

1.1 Purpose of this report

The purpose of this water quality monitoring and biannual interpretative report is to present the sampling methodology, field parameter profiling results and analytical results for the September water quality monitoring event and based on the outcomes of the water quality monitoring (field profiling and analytical results) completed to date (April 2025 to September 2025) provide recommendations for further action(s) where appropriate, with respect to the Project.

1.2 Objectives

The objectives of this water quality monitoring and biannual interpretative report are to:

- Document the water quality (field parameter profiling and analytical results) at selected locations within the Swan River at discrete depths for the September 2025 monthly monitoring event.
- Prepare a biannual interpretative reporting section which includes the water quality monitoring data (field parameter profiling and analytical results) obtained to date (April 2025 to September 2025) and include recommendations for further action(s) where appropriate, with respect to the Project.
- Contribute to a dataset which at the end of the monitoring period seeks to provide a detailed characterisation of the water quality at the discrete locations to enable a site-specific baseline of the DEs to inform further assessment or development of Surface Water Management Plan(s) for the future landings.

¹ <https://www.pta.wa.gov.au/projects/current-projects/ferry-service-expansion>

² The scope of work agreed between PTA and DBCA has been amended (i.e. locations) since the preparation of the 'Preliminary Site Investigations and Swan River Water Quality Monitoring, S-AOF No. 240661: Part B – Contractors Offer'. However, the total number of samples (15) and the sample profile depth (i.e. surface, mid depth and above river bed) remains consistent.

1.3 Limitations

This report: has been prepared by GHD for Public Transport Authority and may only be used and relied on by Public Transport Authority for the purpose agreed between GHD and Public Transport Authority as set out in Section 1.1 and Section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than Public Transport Authority arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section(s) 1.4 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Public Transport Authority and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Accessibility of documents

If this report is required to be accessible in any other format, this can be provided by GHD upon request and at an additional cost if necessary.

1.4 Assumptions

The following assumptions were made by GHD in the preparation of this report:

- GHD assumes that the information obtained from external sources are correct and up to date and acknowledges that this information may change at any time.
- Relevant third-party information (where referenced) can be relied upon for the purpose of the work.

2. Scope of works

To meet the stated objectives, the scope of the works summarised below was completed for the water quality monitoring program:

- Liaison and mobilisation of GHD personnel and Marine and Freshwater Research Laboratory (MAFRL) vessel and crew to Deep Water Point Reserve located in Mount Pleasant for the September 2025 water quality monitoring event.
- Undertake works in accordance with a project-specific Job Safety and Environmental Assessment (JSEA) and adhere to quality assurance (QA) and quality control (QC) procedures.
- Water quality (field profiling and laboratory analysis) monitoring at nine locations including the six DEs and three reference sites.
- Retrieval of water at discrete sample depths using a Niskin equivalent and sub-sampling (from the Niskin equivalent) for water quality parameters (excluding algal sampling).
- Retrieval of water at discrete sample depths using a hi-flow pump and on-site filtration for preparation of sample papers for subsequent algal identification and quantification.
- Submission of all collected samples to a National Association of Testing Authorities (NATA)-accredited laboratory for analysis.
- Preparation of a water quality monitoring and biannual interpretative report (this report) which will include monitoring methodology and data recorded and collated for the September 2025 monitoring event (Section 4 to 6) and the presentation of observed data trends up to and including the first 6 months of the monitoring period (Section 7).

A detailed methodology for the September water quality monitoring event is provided in Section 4.

3. Site setting

3.1 Site identification

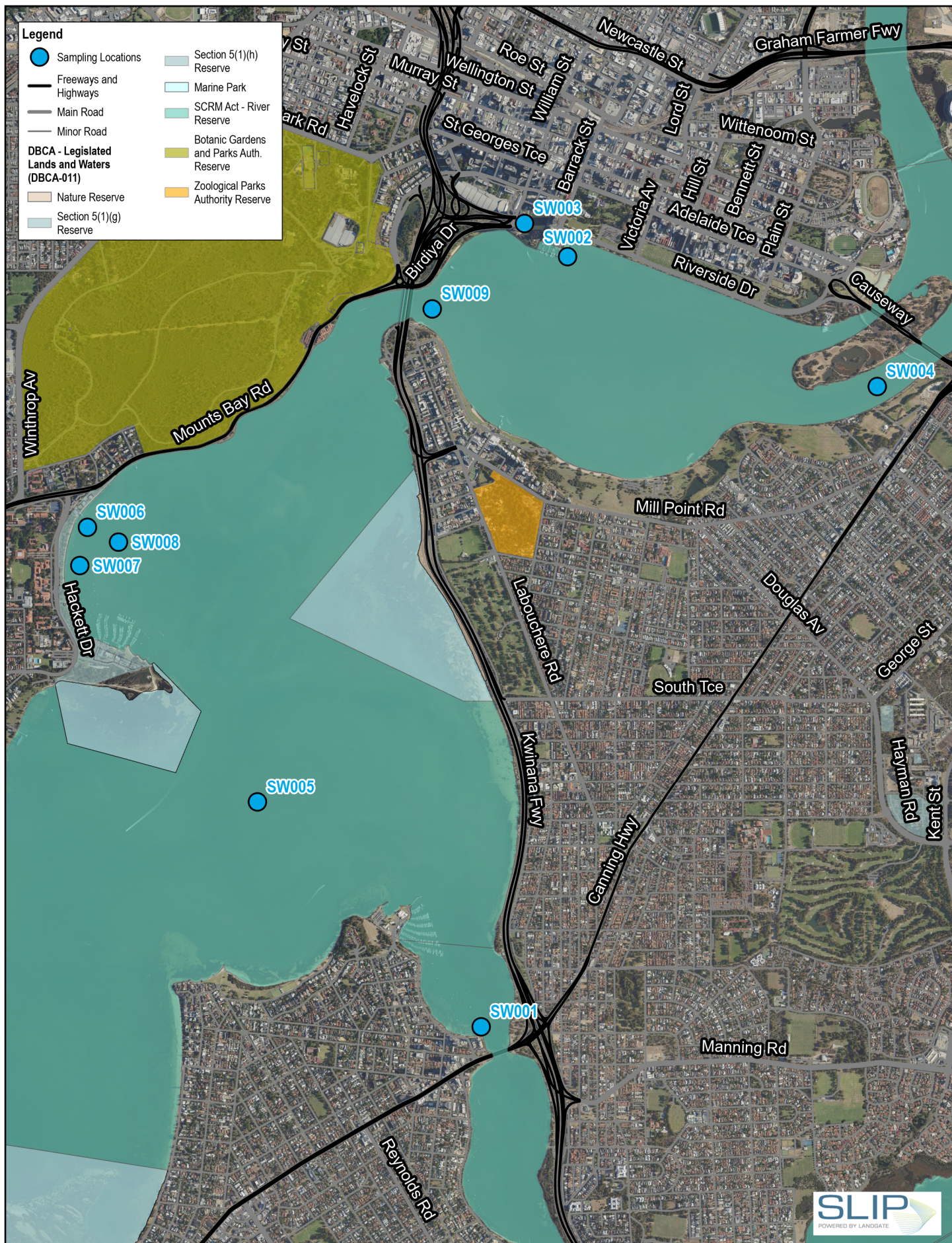
The DEs are located within the overall Swan Canning Riverpark within the Perth Central Business District (CBD), WA and identified in Table 1. The DEs and are also located within the vicinity of three biologically important areas known as 'Swan Estuary Marine Parks' and referred to as:

- Milyu Marine Reserve.
- Pelican Point Marine Reserve.
- Alfred Cove Marine Reserve.

The Marine Reserves are also identified on Figure 1 and further details on the sites identification are summarised in Table 1. Coordinates were obtained using the vessel GPS system for accuracy and therefore offshore locations are recorded in latitude and longitude.

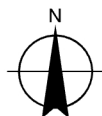
Table 1 Site identification

Sites	Reference	Coordinates		Description
		Latitude and Longitude (degrees, minutes and seconds)		
Development Envelopes				
Applecross	SW001	32° 0'33.58"S	115°51'6.75"E	The waters off the Raffles Waterfront Apartment and Canning Beach Road, north of the Canning Bridge.
Barrack Street Jetty	SW002	31°57'37.51"S	115°51'32.16"E	The waters of the southeastern edge of Barrack Street jetty, east of the Rottne Island ferry terminal.
Elizabeth Quay	SW003	31°57'29.82"S	115°51'20.67"E	The waters between the western Elizabeth Quay promenade and east of the Transperth ferry terminal.
Ellam Street	SW004	31°58'7.94"S	115°52'55.00"E	The waters south of Heirisson Island and north of McCallum Park, southwest of the Boorloo Bridge.
Matilda Bay (Option 1)	SW006	31°58'38.22"S	115°49'22.38"E	The waters east of Matilda Bay Reserve along Hackett Drive and north of the Yacht Club.
Matilda Bay (Option 2)	SW007	31°58'46.95"S	115°49'20.21"E	The waters east of Matilda Bay Reserve along Hackett Drive and north of the Yacht Club, south of Matilda Bay (Option 1).
Reference sites				
Narrows Bridge	SW005	31°57'49.13"S	115°50'55.65"E	The waters east of Narrows Bridge and south of the Rottne Island ferry path.
Matilda Central	SW008	31°58'41.68"S	115°49'30.67"E	The waters east of Matilda Bay Reserve along Hackett Drive and north of the Yacht Club, further east of both Option 1 and 2.
Heathcote	SW009	31°59'41.58"S	115°50'7.26"E	The water between Matilda Bay Reserve peninsula and Applecross jetty, towards the central part of the Swan River.



Paper Size ISO A4
0 0.25 0.5 0.75 1
Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50



Public Transport Authority of Western Australia
Swan River Ferry Expansion
Surface Water Quality Monitoring Report

Project No. 12658388
Revision No. 0
Date 20/06/2025

Sampling Plan

FIGURE 1

4. Methodology

4.1 Guidance documents

The Swan River water quality monitoring event for September 2025 was undertaken with reference to the following relevant standards and guidance documents:

- Australian Standard (1998a) 5667.1 – *Water Quality – Sampling. Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples.*
- Australian Standard (1998b) 5667.6 – *Water Quality – Sampling. Guidance on the Sampling of Rivers and Streams.*
- Australian Standard (1998c) 5667.9 – *Water Quality – Sampling. Guidance on the Sampling of Marine Waters.*
- Department of Water and Environmental Regulation (DWER) 2021. *Contaminated Sites Guidelines: Assessment and management of contaminated Sites.*
- National Environment Protection Council (NEPC). 2013. *National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 No. 1.*
- HEPA (2025) *PFAS National Environmental Management Plan Version 3.0 [PFAS NEMP], Heads of EPA Australia and New Zealand 2025.*

4.2 Site preliminaries

Prior to commencing the fieldwork components of the project, a JSEA (GHD personnel) and a Job Health Assessment (MAFRL team) was prepared and reviewed by PTA (and GHD for the sub-contractor review). A pre-work discussion (toolbox) incorporating a vessel induction (GHD personnel) and all personnel on-site was completed prior to commencing fieldwork activities.

GHD personnel also separately completed various internal vendor assessments and a pre-work assessment prior to commencing fieldwork as part of our internal subcontractor management processes.

4.3 Water (field parameter profiling) methodology

Water field profiling and water sampling was completed by MAFRL aboard its vessel 'Pelagic' on 24 September 2025.

Sampling locations and total depths of water column were recorded by the vessel GPS and bathymetric instruments and the vessel stabilised (anchored) prior to commencing any on-board activities. The vessel was stabilised for approximately 15 minutes prior to deploying any water field profiling and/ or sampling equipment.

Field parameters were collected on a continuous basis using a SeaBird (SBE) 19plus V2 SeaCAT Profiler CTD attached to a steel frame (located 0.5 m from the bottom of the frame) (refer to Plate 1, Appendix E). Field parameters were allowed to stabilise prior to taking readings for:

- Temperature.
- Electrical conductivity (EC).
- pH.
- Turbidity.
- Salinity.
- Chlorophyll (Fluorescence Self-Contained Underwater Fluorescence Apparatus [SCUFA]).
- Dissolved oxygen (DO).
- Oxidation-reduction potential [redox].

Field parameters were recorded for the purpose of reporting 0.5 m below the water surface, 0.5 m above the riverbed and at a mid-point (various according to bathymetric measurement at sample site³).

The field parameters were continuously recorded and representative values at the above depths were recorded and provided in Table C.3, Appendix C. The field profiling equipment was calibrated by MAFRL for the SBE prior to use and the calibration certificate is included in Appendix A.

4.4 Water quality sampling methodology

Surface water quality samples (with the exception of chlorophyll [a, b and c] and phaeophytin a sampling) were collected from 0.5 metres (m) below surface (nomenclature identification 'SUR') and 0.5 m above the riverbed (nomenclature identification 'Above River Bed' [ARB]) utilising a Niskin equivalent sampler which features a non-metallic construction with a manually activated spring closure (Plate 3, Appendix E).

Sample receptacles (excluding chlorophyll [a, b and c] and phaeophytin a) were filled directly from the Niskin equivalent sampler at the base via the stopcock. Once filled, laboratory supplied bottles and containers were immediately placed on ice stored in insulated container. All sample bottles and containers were clearly labelled with a project number, sample identification, sample depth and sample date (e.g GHD-Applecross-202506-GR-SUR). Samples which were required to be filtered for analysis were filtered using a 0.45 microns filter paper during the sampling event (September 2025) and previous monitoring events (April 2025 to August 2025) at the laboratory. Details on the sample handling (filtration and preservation) is provided in Table 2.

Samples for chlorophyll [a, b and c] and phaeophytin a were collected utilising a hi-flow pump at the required depths (0.5 m below surface and 0.5 m ARB) to allow for sufficient quantity to be collected for filtration and subsequent calculation of volume/ quantity estimates. Samples for algae sampling (excluding phytoplankton) were filtered to 0.45 microns in the field. Refer to Plate 4, Appendix D for field filtration equipment. All sample bottles and containers were clearly labelled with a project number, sample identification, sample depth and sample date (e.g. GHD-Applecross-202506-GR-SUR). Samples were submitted to MAFRL on the same day as sampling was completed.

Samples for the identification and enumeration of phytoplankton species [phytoplankton] were collected using the niskin method above, samples were unfiltered and sent to Eurofins I ARL before being sent onward to the specialist laboratory Dalcon Environmental (Dalcon). Samples were preserved with Loguls on arrival at Dalcon and in accordance with holding times for the analysis selected.

Table 2 Primary sample handling (filtration and preservation) September 2025

Analysis	Laboratory contracted for analysis	Sample collection equipment	Filtered prior to analysis (Y/N and comment)
Metals			
Metals (total)	Eurofins	Niskin equivalent	N – Sample unfiltered
Metals (filtered)	Eurofins	Niskin equivalent	Y – Field filtered
Mercury (total)	ALS Environmental	Niskin equivalent	N – Sample unfiltered
Mercury (dissolved)	ALS Environmental	Niskin equivalent	Y – Field filtered
Ions and cations			
Ions and cations	Eurofins	Niskin equivalent	N – Sample unfiltered
Nutrients			
Ammonia	MAFRL	Niskin equivalent	Y – Filtered in the field
Ortho -P	MAFRL	Niskin equivalent	Y – Filtered in the field
NO3 + NO2	MAFRL	Niskin equivalent	Y - Filtered in the field
Total organic nitrogen	MAFRL	Niskin equivalent	Y – Filtered in the field
Total phosphorus	MAFRL	Niskin equivalent	N – Sample unfiltered

³ Bathymetric measurements were obtained using the vessels on board systems prior to sampling to establish an appropriate sample depth.

Analysis	Laboratory contracted for analysis	Sample collection equipment	Filtered prior to analysis (Y/N and comment)
Total nitrogen	MAFRL	Niskin equivalent	N – Sample unfiltered
TKN	MAFRL	Niskin equivalent	Calculated value based on filtered and unfiltered sample (Total organic nitrogen + ammonia)
Algae sampling			
Identification and enumeration of plankton species	Dalton	Niskin equivalent	N – Preserved with loguls on arrival at Dalton within holding time.
Chlorophyll a, b and c	MAFRL	Hi-flow pump at set depth (SUR and ARB)	Y – Filtered in the field
Phaeophytin a	MAFRL	Hi-flow pump at set depth (SUR and ARB)	Y – Filtered in the field
Contamination			
TRH, BTEXN	Eurofins I ARL	Niskin equivalent	N – Sample unfiltered
PAH	ALS Environmental	Niskin equivalent	N – Sample unfiltered
OCPs and PCBs	ALS Environmental	Niskin equivalent	N – Sample unfiltered
TBT and antifoulants	Eurofins I ARL	Niskin equivalent	N – Sample unfiltered
PFAS	Eurofins I ARL	Niskin equivalent	N – Sample unfiltered
Miscellaneous			
Dissolved organic carbon	MAFRL	Niskin equivalent	N – Sample unfiltered
Sulfide	Eurofins I ARL	Niskin equivalent	N – Sample unfiltered
Total Dissolved Solids	Eurofins I ARL	Niskin equivalent	N – Sample unfiltered
Total Suspended Solids	MAFRL	Niskin equivalent	N – Sample unfiltered

Samples were submitted within the designated holding times for each analyte and all samples were accompanied by completed chain of custody (CoC) provided in Appendix B.

Decontamination method and information is provided in Section 5.4.

4.4.1 Quality assurance and control methodology

4.4.1.1 Blind and split duplicates

All primary, blind duplicate and split samples (with the exception of nutrients and algae sampling) were submitted to Eurofins ARL, Australian Laboratory Services (ALS) Environmental and MAFRL. All laboratories are NATA-accredited for the analysis conducted with laboratory certificates are provided in Appendix B.

4.5 Analytical suite

Due to the comprehensive suite required including nutrients and algae sampling (which have a short holding times/ analysis timeframe), the laboratory analysis program has been separated (using MAFRL, Eurofins ARL [and subcontracted Dalton Environmental] and ALS Environmental) to mitigate issues with the short holding times and accommodate the updates to the laboratory LORs.

Samples collected were analysed by Eurofins ARL (and subcontracted Dalton Environmental) for the following suite:

- **Ions and cations:** sulfate, chloride, alkalinity, sodium, potassium, calcium and magnesium.

- **Contamination:** Total recoverable hydrocarbons (TRH), Benzene, toluene, ethylbenzene and xylene (BTEX), Organotin including Tributyltin (TBT) and antifoulants, Per- and polyfluoroalkyl substances (PFAS).
- **Other:** Sulfides and Total dissolved solids (TDS).
- **Algae sampling:** Identification and enumeration of phytoplankton species was subcontracted to Dalcon for analysis.

Samples collected were analysed by ALS Environmental for the following suite:

- **Metals (total and dissolved):** mercury.
- **Contamination:** Polyaromatic hydrocarbons (PAH), Organochlorine pesticides (OCP), incl full speciation, Polychlorinated biphenyls (PCBs).

Samples collected were analysed by MAFRL for the following suite:

- **Nutrients:** total phosphorus, filterable phosphorus, total nitrogen, total oxidised nitrogen, total ammonia, total organic nitrogen (filterable), total Kjeldahl nitrogen.
- **Algae sampling:** Chlorophyll a, b and c and Phaeophytin a.
- **Metals (total and dissolved):** aluminium, arsenic, cadmium, chromium, cobalt, copper, iron, lead, manganese, molybdenum, nickel, selenium, zinc.
- **Other:** Dissolved Organic Carbon (DOC) and Total Suspended Solids (TSS)

4.6 Assessment criteria

Field and analytical data were tabulated and presented with the adopted assessment criteria for the Project sourced from the following guidelines:

- Australian and New Zealand Environment and Conservation Council (ANZECC) & Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality [ANZG]. amended 2018.
- HEPA (2025) PFAS National Environmental Management Plan Version 3.0 [PFAS NEMP], Heads of EPA Australia and New Zealand 2025.

With respect to ANZG 2018 updates, it is noted that most toxicant default guideline values (DGVs) were retained from the ANZECC and ARMCANZ (2000) guidelines, with no changes in DGVs for the CoPC considered in this investigation. The reliability classification of all DGVs from the ANZECC and ARMCANZ (2000) guidelines was updated to reflect the current classification (very high, high, moderate, low, very low or unknown). The classification is based on the number and type of data used to derive the guideline value and the fit of the statistic model (ANZG 2018).

The adopted assessment criteria currently utilised for the Project are ANZG (2018) 95% Loss of Species Protection for freshwater (FW) and marine water (MW) and 99% PFAS NEMP (2025).

5. Quality assurance and quality control

The QA/QC management for the Swan River water quality monitoring event for September 2025 has been undertaken with reference to the guidelines and standards provided in Section 4.6 and is outlined below.

5.1 Sampling and analysis quality control

The type and frequency of surface water samples collected during the water quality monitoring event were consistent with the ASC NEPM (NEPM, 2013) and the PFAS NEMP (HEPA, 2025) and described below:

- **Blind duplicate:** the blind duplicate sample is used to identify the variation in the analyte concentration between samples from the same sampling point and the repeatability of the primary laboratory's analysis.
- **Split duplicate:** the split duplicate sample is collected to identify the variation in the analyte concentration between samples analysed by different laboratories.
- **Field blank:** a field blank sample is used to assess the potential for introduction of contamination from ambient sources in the field during sampling and are collected using laboratory-supplied deionised water.
- **Rinsate blank:** a rinsate blank is used to assess the effectiveness of the equipment decontamination procedures employed in the field and are collected by passing laboratory-supplied deionised water over decontaminated sampling equipment into laboratory-supplied sample containers.
- **Trip blank:** the trip blank is a laboratory prepared blank samples that are included with the primary samples during transportation to the laboratory. They are used to assess whether any contaminants have been introduced into samples as a result of transportation processes.

The quality control sampling and analysis program undertaken is outlined in Table 3.

Table 3 Summary of QAQC analysis

QAQC sample ID	QAQC type	Primary sample ID	Laboratory suite completed	Required QC rates/ actual QC rates
QC01	Blind duplicate	GHD-MatBay2-202509-ARB	As per suite outlined in Section 4.5.	1/1
QC02	Rinsate blank	-	As per suite outlined in Section 4.5.	1/1
QC03	Field blank	-	As per suite outlined in Section 4.5.	1/1
QC04	Blind duplicate (PFAS only)	GHD-MatBay1-202509-SUR	PFAS only	1/1
QC05	Transport blank	-	BTEXN and TRH (C6 – C9)	1/1
QC06	Spilt duplicate	GHD-MatBay2-202509-ARB	As per suite outlined in Section 4.5 excluding chlorinated hydrocarbons, MAH, SVOCs and VOCs)	1/1

5.2 Quality control sample results

5.2.1 Duplicate samples

A quantitative measure of the accuracy of the analytical results reported is made by calculating the relative percentage difference (RPD) between the primary and blind duplicate results in accordance with the procedure described in AS 4482.1 – 2005 (Standards Australia 2005). According to AS 4482.1 – 2005, typical RPDs are expected to range between 30% and 50%; however, this may be higher for organics and low concentrations of analytes. GHD uses 30% as the general trigger level for further review of data quality.

A summary of the RPDs that reported values outside of the acceptable range is provided in Table 4, with all calculated RPDs presented in Table C.1 (Appendix C). Of the 165 RPDs (expected) calculated during this sampling event, 3 were reported as outside of the 30% acceptable range.

Table 4 Summary of RPD exceedances

Primary, duplicate & triplicate field IDs (type)	Analyte	RPD (%)	Primary concentration	Duplicate/ triplicate concentration
GHD-MatBay1-202509-GR-SUR & GHD-QC04 (PFAS Duplicate)	Perfluoropentane sulfonic acid (PFPeS)	67	0.001	0.002
	Perfluorobutanoic acid (PFBA)	40	0.006	0.009
GHD-MatBay2-202509-GR-ARB & GHD-QC01 (Duplicate)	Sum of US EPA PFAS (PFOS + PFOA)	40	0.006	0.004

In most cases, the elevated RPD values are considered to reflect the proximity of the concentrations to the laboratory limit of reporting (LOR) (i.e. concentrations in both the primary and duplicates are less than 10 times the LOR). The greater primary/ duplicate pair concentrations will be considered within future interpretative reporting as a conservative approach to the observed data trends. Therefore, the RPD values reported outside the acceptable range, and the variances in concentrations reported between sample pairs and laboratories do not significantly impact data quality or reliability with respect to the project objectives.

5.2.2 Blank samples results

A rinsate, field and trip blank were analysed for CoPC and presented in Table C.2 in Appendix C. A review of the blank sample results indicates that all analytes were detected at concentrations below the laboratory LOR.

5.3 Laboratory QA/QC procedures

The laboratory's QA/QC assessment details are presented within the laboratory Certificate of Analysis (Appendix B). A review of the laboratory QA/QC assessments indicates the following:

- **Method blanks:** No methods blank outliers were reported.
- **Laboratory duplicate recovery:** No methods blank outliers were reported.
- **Laboratory control spike recovery:** No methods blank outliers were reported excluding those outlined in Table 5.
- **Holding times:** No holding times outliers were reported excluding those outlined in Table 6.
- **Matrix spike recovery:** Matrix spike recovery were all within the appropriate range excluding those outlined in Table 5.
- **Laboratory duplicate and matrix spike frequency:** Laboratory duplicate, and matrix spike frequency were all within the appropriate range excluding those outlined in Table 7.

Table 5 Laboratory duplicate and matrix spike recovery outliers

Quality control sample type	Lab report number	Method	Sample ID / Analyte	Comment
Laboratory Duplicates	EP2515984	EP231A: Perfluoroalkyl Sulfonic Acids	Anonymous/ Perfluorooctane sulfonic acid (PFOS)	MS recovery not determined, background level greater than or equal to 4x spike level
		EP231B: Perfluoroalkyl Carboxylic Acids	Anonymous/ Perfluoropentanoic acid (PFPeA)	MS recovery not determined, background level greater than or equal to 4x spike level
		EP231B: Perfluoroalkyl Carboxylic Acids	Anonymous/ Perfluorohexanoic acid (PFHxA)	MS recovery not determined, background level greater than or equal to 4x spike level
Matrix Spikes		EP231B: Perfluoroalkyl Carboxylic Acids	Anonymous/ Perfluoroheptanoic	MS recovery not determined, background

Quality control sample type	Lab report number	Method	Sample ID / Analyte	Comment
			acid (PFHpA)	level greater than or equal to 4x spike level
		EP231B: Perfluoroalkyl Carboxylic Acids	Anonymous/ Perfluorooctanoic acid (PFOA)	MS recovery not determined, background level greater than or equal to 4x spike level
		EP234A: OP Pesticides	GHD-ElizQuay-202509-GR-ARB/ Chlorpyrifos	Recovery less than lower data quality objective

Table 6 *Holding time outliers*

Lab report number	Sample ID	Method	Extracted date: Due for extraction	Days overdue
EP2515984	GHD-QC06	EP090: Organotin Compounds (Soluble)	02/10/2025: 01/10/2025	1
	GHD-Applecross-202509-GR-SUR GHD-Applecross-202509-GR-ARB GHD-Barrack-202509-GR-SUR GHD-Barrack-202509-GR-ARB GHD-ElizQuay-202509-GR-SUR GHD-ElizQuay-202509-GR-ARB GHD-Ellam-202509-GR-SUR GHD-Ellam-202509-GR-ARB GHD-MatBay1-202509-GR-SUR GHD-MatBay1-202509-GR-ARB GHD-MatBay2-202509-GR-SUR GHD-MatBay2-202509-GR-ARB GHD-6161869-Heathcote-SUR GHD-6164602-MatCentral-SUR GHD-6160262-Nar-SUR GHD-QC01 GHD-QC02 and GHD-QC03	EP131A: Organochlorine Pesticides	03/10/2025: 01/10/2025	2
	Same 18 sample IDs as above	EP131B: PCB's (as Aroclors)	03/10/2025: 01/10/2025	2
	Same 18 sample IDs as above	EP132B: Polynuclear Aromatic Hydrocarbons	03/10/2025: 01/10/2025	2
	Same 18 sample IDs as above	EP132B: Polynuclear Aromatic Hydrocarbons (super trace)	03/10/2025: 01/10/2025	2
	Same 18 sample IDs as above	EP234A: OP Pesticides - Analysis Holding Time Compliance	02/01/2025: 01/10/2025	1

Table 7 *Laboratory duplicate and matrix spike frequency outliers*

Quality control sample type	Lab report number	Method	Rate (Actual/expected)
-----------------------------	-------------------	--------	------------------------

Laboratory Duplicates	EP2515984	EP231X-SUT: Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	8.33/10
Matrix Spikes		EG093-F_LL: Low Level Dissolved Metals in Saline Water Suite A by NEPM 2013 B3 & ALS QC Standard ORC-ICPMS	0/5
		EP090S: Organotin Compounds (Soluble)	0/5
		EP071: TRH Semi volatile Fraction	0/5

Laboratory duplicate and matrix spike recovery outliers involved the use of anonymous samples that were not collected during the field sampling program and were from another program. As such, the results presented are not indicative of the samples collected during the project and are therefore not considered to significantly impact the overall data quality.

Laboratory duplicate and matrix spike frequency outliers are not considered to significantly impact the overall data quality, given the relatively small number of outliers reported.

Holding time outliers were the result of the laboratory extraction after the due date. This was likely the result of a large influx of samples; however, the samples were delivered to the laboratory prior to the holding time breach. These minor laboratory QA/QC outliers are therefore not considered to significantly impact the overall data quality, given the relatively small number of outliers reported.

5.4 Fieldwork quality control

All fieldwork was conducted with reference to AS/NZS 5667.1 and 5667.6, where relevant which facilitated the recovery of samples in a systematic and uniform method for the purpose of obtaining accurate and reliable analytical results. Key QC requirements of these procedures are listed below:

- **Decontamination procedures:** including the use of new disposable gloves for each sampling location, decontamination of non-disposable sampling equipment between each location (where practical and possible, refer to below) and included field filtration for algae sampling and the use of appropriate sampling containers, as provided by the NATA accredited laboratory.
Decontamination procedures for the non-disposal sampling equipment such as the Niskin water sampler included the rinsing of equipment and closure of the mechanisms prior to deployment to the required water depth to reduce (where practically possible) the potential for cross contamination.
Refer to Section 5.2.2 for results of the rinsate sample taken during the monitoring events to assess the potential for cross contamination during sampling. Noting that all results for the rinsate sample were less than the LOR indicating an absence of contamination above the LOR.
- **Sample identification procedures:** collected samples were placed within sample containers of appropriate preservation for the required laboratory analysis. All sample containers were clearly labelled with a project number, sample location and sample date. The sample containers were then transferred to a chilled container (e.g., esky) for sample preservation prior to and during transport to the testing laboratory.
- **Calibration of field equipment:** field equipment was calibrated to ensure the accuracy of measurements taken in the field. Calibration was undertaken by the rental supplier and MARFL staff, and the calibration certificates are provided in Appendix A.
- **CoC information requirements:** CoC forms were completed and forwarded to the testing laboratory accompanying the batch of samples. The signed CoCs are provided in Appendix B.

5.5 QA/QC summary

GHD considers that the field and laboratory QA/QC results are generally within the specified requirements. Therefore, all data is considered valid and of sufficient quality for the purpose of the Project.

6. Results (September 2025)

6.1 Field observations

Field observations are described below, and sampling location details are recorded in Table 8.

On the day of sampling (24 September 2025), the weather was hot and sunny, with a maximum temperature of 30.1 degrees Celsius and recorded a maximum wind gust of 28 km/h generally from the north northeast. High waters were predicted by Bureau of Meteorology (BoM) to peak at 12:53 pm with high water of + 0.79 m and a low water of + 0.71 anticipated at 07:13 am and at + 0.74 m 16:43 pm⁴.

Sample bottles and containers were clearly labelled with a project number, sample identification, sample depth and sample date (e.g. GHD-Applecross-202509-GR-SUR). A description of the nomenclature is provided below:

- '202509' provides the year and month of analysis.
- 'GR' provides confirmation that the sample is a grab sample.
- 'SUR' denotes samples were obtained at 0.5 m below the surface.
- 'MID' denotes samples were obtained at the midpoint between the surface and the measured water column. Noting that the midpoint varies according to tidal fluctuations and therefore total depth of water column.
- 'ARB' denotes samples were obtained at 0.5 m above the riverbed.

Table 8 Surface water monitoring locations and details

Site	Sample location	Sample site and depth ID	Sample depth ⁵ (m from surface)	Sampling time
Development Envelopes				
Applecross	SW001	GHD-Applecross-202509-GR-SUR	0.70	8:44 am
		GHD-Applecross-202509-GR-MID	1.61	
		GHD-Applecross-202509-GR-ARB	3.44	
Barrack Street	SW002	GHD-Barrack-202509-GR-SUR	0.66	13:26 pm
		GHD-Barrack-202509-GR-MID	1.75	
		GHD-Barrack-202509-GR-ARB	2.95	
Elizabeth Quay	SW003	GHD-ElizQuay-202509-GR-SUR	0.69	2:01 pm
		GHD-ElizQuay-202509-GR-MID	1.13	
		GHD-ElizQuay-202509-GR-ARB	1.75	
Ellam Street	SW004	GHD-Ellam-202509-GR-SUR	0.66	12:23 pm
		GHD-Ellam-202509-GR-MID	0.97	
		GHD-Ellam-202509-GR-ARB	1.50	
Matilda Bay (Option 1)	SW006	GHD-MatBay1-202509-GR-SUR	0.69	10:29 am
		GHD-MatBay1-202509-GR-MID	2.20	
		GHD-MatBay1-202509-GR-ARB	4.00	
Matilda Bay (Option 2)	SW007	GHD-MatBay2-202509-GR-SUR	0.68	11:02 am
		GHD-MatBay2-202509-GR-MID	2.51	
		GHD-MatBay2-202509-GR-ARB	4.35	
Reference sites				
Heathcote	SW005	GHD-6161869-Heathcote-SUR	0.70	9:37 am

⁴ Based on the BoM data for Perth (Barrack Street Jetty), which was considered representative of the sampling locations.

⁵ Measured from vessel bathymetric system on day of sampling.

Site	Sample location	Sample site and depth ID	Sample depth ⁵ (m from surface)	Sampling time
		GHD-6161869-Heathcote-MID	3.34	
		GHD-6161869-Heathcote-ARB	5.99	
		GHD-6164602-MatCentral-SUR	0.69	
Matilda Bay Central	SW008	GHD-6164602-MatCentral-MID	2.38	10:06 am
		GHD-6164602-MatCentral-ARB	4.17	
		GHD-6160262-Nar-SUR	0.65	
Narrows Bridge	SW009	GHD-6160262-Nar-MID	1.93	11:49 am
		GHD-6160262-Nar-ARB	3.21	

6.1.1 Field parameters

The field water profiling results have been prepared by MAFRL and are provided in Table C.3, Appendix C.

The field profiling results for fluorescence SCUFA during the September monitoring event was frequently measured at values greater than 9.16 µg/L. This is due to the capability of the SeaBird CDT fluorescence sensor which has an upper monitoring range of 9.16 ug/L. Fluorescence values obtained in the field are qualitative only and laboratory extracted chlorophyll results should be used in the first instance along with correlation with the field measurement, if required for comparison. This is due to the field fluorescence measurement detecting additional types of phytoplankton fluorescence.

Typically, fluorescence SCUFA over 2 µg/L would be considered high in the marine environment and the laboratory results for chlorophyll are typically consistent with the fluorescence sensor values.

6.2 Analytical results

The analytical results are provided in Table C.4 to C.9, Appendix C. Notable exceedances of adopted assessment criteria for 95% Loss of Species Protection for freshwater (FW) and marine water (MW) are summarised in Table 9 below.

All results where the reported LOR was below the adopted assessment criteria value have been left out of the summarised table.

Table 9 Notable exceedances summary

Sample ID	Analyte	Reported value	FW 95% / MW 95% (units as reported) (99% for PFOS)
Applecross (SW01)			
GHD-Applecross-202508-GR-SUR	Aluminium (total)	0.22	0.05 / 0.055
	Copper (total)	0.0029 mg/L	0.0014 / 0.0013 mg/L
	Copper (filtered)	0.0025 mg/L	0.0014 / 0.0013 mg/L
	PFOS	0.016 mg/L	0.00023 / 0.00023 mg/L
GHD-Applecross-202508-GR-ARB	Copper (total)	0.013 mg/L	0.0014 / 0.0013 mg/L
	PFOS	0.0060mg/L	0.00023 / 0.00023 mg/L
Barrack Street (SW02)			
GHD-Barrack-202508-GR-SUR	Aluminium (total)	0.37 mg/L	0.05 / 0.055 mg/L
	Copper (total)	0.0024	0.005 / 0.008 mg/L
	Copper (filtered)	0.0019 mg/L	0.005 / 0.008 mg/L
	PFOS	0.020mg/L	0.00023 / 0.00023 mg/L

Sample ID	Analyte	Reported value	FW 95% / MW 95% (units as reported) (99% for PFOS)
GHD-Barrack-202508-GR-ARB	Aluminium (total)	0.091 mg/L	0.05 / 0.055 mg/L
	PFOS	0.0062 mg/L	0.00023 / 0.00023 mg/L
Elizabeth Quay (SW03)			
GHD-ElizQuay-202508-GR-SUR	Aluminium (total)	0.38 mg/L	0.05 / 0.055 mg/L
	Chromium (total)	0.001 mg/L	0.001 / 0.0044 mg/L
	Copper (total)	0.002 mg/L	0.0014 / 0.0013 mg/L
	Copper (filtered)	0.0018	0.0014 / 0.0013 mg/L
	PFOS	0.018 mg/L	0.00023 / 0.00023 mg/L
GHD-ElizQuay-202508-GR-ARB	Aluminium (total)	0.26 mg/L	0.05 / 0.055 mg/L
	Copper (total)	0.0017 mg/L	0.0014 / 0.0013 mg/L
	Copper (filtered)	0.0014 mg/L	0.0014 / 0.0013 mg/L
	PFOS	0.016 mg/L	0.00023 / 0.00023 mg/L
Ellam Street (SW04)			
GHD-Ellam-202508-GR-SUR	Aluminium (total)	0.53 mg/L	0.01 / 0.055 mg/L
	Chromium (total)	0.001	0.001 / 0.0044 mg/L
	Copper (total)	0.0023 mg/L	0.0014 / 0.0013 mg/L
	Copper (filtered)	0.0018 mg/L	0.0014 / 0.0013 mg/L
	PFOS	0.020 mg/L	0.00023 / 0.00023 mg/L
GHD-Ellam-202508-GR-ARB	Aluminium (total)	0.55 mg/L	0.01 / 0.055 mg/L
	Chromium (total)	0.0011	0.001 / 0.0044 mg/L
	Copper (total)	0.002	0.0014 / 0.0013 mg/L
	Copper (filtered)	0.0018	0.0014 / 0.0013 mg/L
	PFOS	0.0021	0.00023 / 0.00023 mg/L
Matilda Bay 1 (SW06)			
GHD-MatBay1-202508-GR-SUR	Aluminium (total)	0.21 mg/L	0.01 / 0.055 mg/L
	Copper (total)	0.0025 mg/L	0.0014 / 0.0013 mg/L
	Copper (filtered)	0.0022 mg/L	0.0014 / 0.0013 mg/L
	PFOS	0.016 mg/L	0.00023 / 0.00023 mg/L
	PFOS	0.0050 mg/L	0.00023 / 0.00023 mg/L
Matilda Bay2 (SW07)			
GHD-MatBay2-202508-GR-SUR	Aluminium (total)	0.21 mg/L	0.01 / 0.055 mg/L
	Copper (total)	0.0023 mg/L	0.0014 / 0.0013 mg/L
	Copper (filtered)	0.0022 mg/L	0.0014 / 0.0013 mg/L
	PFOS	0.016 mg/L	0.00023 / 0.00023 mg/L
	PFOS	0.0051 mg/L	0.00023 / 0.00023 mg/L
Matilda Bay Central (SW08)			
GHD-6164602-MatCentral-SUR	Aluminium (total)	0.14 mg/L	0.01 / 0.055 mg/L
	Copper (total)	0.0024 mg/L	0.0014 / 0.0013 mg/L
	Copper (filtered)	0.002 mg/L	0.0014 / 0.0013 mg/L
	PFOS	0.016 mg/L	0.00023 / 0.00023 mg/L

Sample ID	Analyte	Reported value	FW 95% / MW 95% (units as reported) (99% for PFOS)
Narrows (SW09)			
GHD-6160262-Nar-SUR	Aluminium (total)	0.56 mg/L	0.01 / 0.055 mg/L
	Chromium (total)	0.001 mg/L	0.001 / 0.0044 mg/L
	Copper (total)	0.0024 mg/L	0.0014 / 0.0013 mg/L
	Copper (filtered)	0.002 mg/L	0.0014 / 0.0013 mg/L
	PFOS	0.019 mg/L	0.00023 / 0.00023 mg/L
Heathcote (SW05)			
GHD-6161869-Heathcote-SUR	Aluminium (total)	0.32 mg/L	0.01 / 0.055 mg/L
	Copper (total & filtered)	0.021 mg/L	0.0014 / 0.0013 mg/L
	PFOS	0.017mg/L	0.00023 / 0.00023 mg/L

PFAS levels (PFOS) exceeded the assessment criteria of PFAS NEMP 2025 Freshwater 99% (0.00023 µg/L) for all sample IDs. Consequently, these results were not tabulated and can be referenced in Table C.8 of Appendix C for further detail.

PFAS (PFOS) concentrations for September 2025 ranged from 0.0050 µg/L to 0.021 µg/L. The highest concentration was recorded at GHD-Ellam Street-202509-GR-ARB (located at 0.5 m above the river bed at Ellam Street (SW04) site.

7. Observed water trends (April - September)

The following section presents the observed water trends for the first 6 months (April to September 2025) of the water quality monitoring program. Due to contractual changes aimed at achieving lower LOR for select laboratory analytes (as requested by the PTA) from September 2025, visual trends for these analytes may suggest a decline in concentrations during the September monitoring event due to the change (lowering) of LOR. For example, prior to September, samples results may have been reported below the LOR value adopted as a conservative approach for the trend assessment. Subsequently, in September, the lower LOR may have enabled detectable concentrations to be reported (albeit below the previous higher LOR) or in the event of concentrations remaining below the LOR, adoption of the new LOR value for the assessment would indicate a visual decline in concentrations, which may not reflect actual conditions.

Accumulative laboratory data (April to September) is provided in Appendix C, and laboratory certificates and documentation relating to the September field activities are presented in Appendix A and Appendix B. Laboratory certificates and documentation relating to the previous monitoring events (April to August) can be found within each monthly Swan River Water Quality Report.

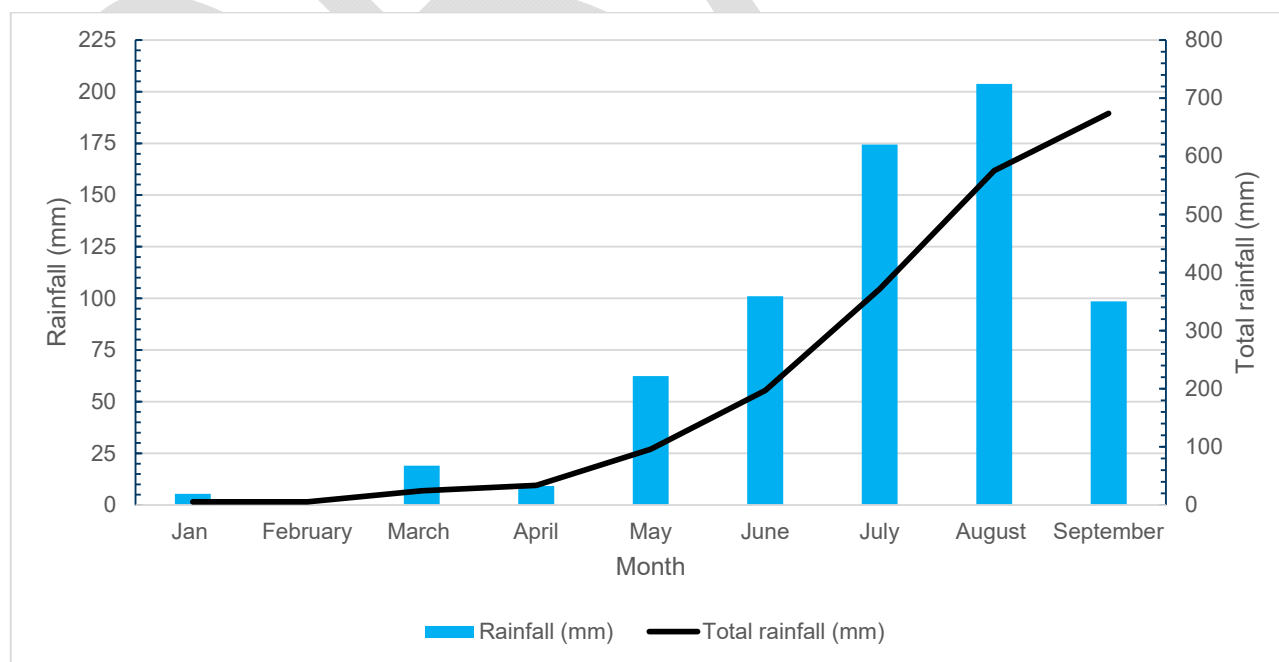
The results of the first 6 months of the monitoring program have been compared to the adopted assessment criteria adopted for the Project and included within Section 4.6.

7.1 Monthly rainfall

A water balance for the project area was not completed for this Project, however it is considered important to document the seasonal changes and fluctuations with regard to rainfall events within the Swan River catchment which may induce discharge directly (or indirectly) to the Swan River (i.e. stormwater drainage, general run-off).

The rainfall data for the Perth metropolitan area (Station reference: 009225⁶) was obtained and plotted on Graph 1 to indicate the potential inputs to the Swan River system over the 6-month monitoring period and highlight any possible trends regarding changes in chemical composition. Based upon the data for the 2025 period to date, total rainfall recorded was 673.8 mm (up to and including September), with the most significant falls occurring within the late winter period (July and August).

Graph in text 1 Monthly rainfall data for the 2025 monitoring period (January to September)



⁶ Data obtained from the Bureau of Meteorology (BoM) on 4/12/025 [Daily Rainfall graph - 009225 - Bureau of Meteorology](#)

7.2 Field parameters (water profiling)

Measurement of field parameters (water profiling) was completed at the surface (SUR) and 0.5 m above the riverbed (ARB) at each monitoring location (refer to Section 6.1 for a detailed description of the sample locations in relation to the Swan River water profile depth). Trend observations for pH, dissolved oxygen (DO), temperature and salinity (PSU) and fluorescence SCUFA are further discussed below.

7.2.1 pH

pH levels recorded during the monthly monitoring events typically remained within the pH range 7.5 to 8.5, except for the month of September where measurements at the surface were considerably higher (approximately pH 8.5 to pH 9.0). Nevertheless, ARB measurements generally remained consistent with April to August 2025 trends (i.e. pH 7.5 to pH 8.5). Graph 2 presents the pH trends and the sampling depth for the monitoring program to date.

An outlier (or exception) was Elizabeth Quay, where pH measurements recorded in September indicated relatively acidic conditions in comparison to other locations and earlier monitoring events (pH 6.43 at the surface and 6.18 at ARB). Variability in pH levels recorded at the Elizabeth Quay site may be attributed to an increase in stormwater discharge or general run-off from the quay side, rainfall (as stormwater discharge) is typically slightly acidic in comparison to the Swan River surface water body.

Significant increases in pH during September across the majority of the other monitoring sites were recorded and minor increases could be attributed to the increase in water temperature within the Swan River (in response to increasing air temperature), as warmer waters typically hold less carbon dioxide, which can increase pH slightly (temperature increases are evident in Graph 4).

7.2.2 Dissolved oxygen

Dissolved oxygen (DO) levels measured during the monthly monitoring events represented the concentration of oxygen gas physically dissolved within the Swan River at the specified depths through the water column. Oxygen enters the water column through atmospheric diffusion (natural sources such as winds and anthropogenic sources such as commercial vessel movements) and metabolic activity of aquatic plants, algae, and phytoplankton.

There are no adopted assessment criteria for freshwater or marine waters for dissolved oxygen available currently. It is noted that the superseded ANZECC (2000) guidelines provide default trigger values for physical and chemical stressors for south-west Australia (refer to Table 3.3.6, ANZECC 2000), which could be utilised as a screening criterion, if adopted for the Project moving forward⁷.

Generally, DO levels were recorded at the lowest across all sites (less than 8.0 mg/L) during the start of the monitoring program, with the lowest values monitored during April and May 2025 regardless of where in the water column the sampling was completed (e.g. SUR or ARB).

Variation in DO with depth was most apparent at sites which typically displayed 'open water' characteristics and deeper water, specifically the reference sites (Heathcote, Narrows Bridge and Matilda Bay Central) and also Matilda Bay (sites 1 and 2). At the time of sampling, shallower sites such as Ellam Street, Elizabeth Quay and Barrack Street reported more consistent DO measurements throughout the water profile. It is also noted that at the Elizabeth Quay and Barrack Street sites, this may also be attributed to the use of the waterway by commercial vessels and ferries, which are likely to actively blend the water column through vessel movements (via engine thrusts and disturbance) and potentially reduce stratification of the water column.

Graph 3 shows the DO trends and the depth of water in which the sample was recorded for the monitoring program to date.

7.2.3 Temperature

Trends in temperature (degrees Celsius) measured during the monthly monitoring events were generally reflective of seasonality, with the lowest temperatures recorded during the cooler winter period. During the cooler months, temperature range throughout the water column was smaller, with cooler surface temperatures recorded

⁷ A default trigger for DO within an estuarine environment for South West Australia is between 90 and 110 % saturation (Table 3.3.6 ANZECC, 2000)

compared to the warmer months (resulting in a greater difference in temperature between SUR and ARB measurements). The exceptions were the highly disturbed Elizabeth Quay and Barrack Street sites where water temperature appeared to increase over the cooler months.

Generally, temperatures recorded in the surface water (SUR) were greater than those recorded at depth (ARB). The magnitude of difference in temperature between the surface and depth appeared to be related to the time of year/ambient temperature (as discussed above), and also the depth of water. For example, Ellam Street, a naturally shallower part of the river, recorded significantly less variance between SUR and ARB measurements, although there may be other contributing factors such as the sheltered location with restricted vessel movements and potentially smaller tidal variance being further from the Swan River estuary mouth. Alternatively, the Narrows Bridge reference site was an exception, with higher temperatures recorded at depth compared to the surface (excepting in September).

Graph 4 shows the temperature trends and the depth of water in which the sample was recorded for the monitoring program to date.

7.2.4 Salinity (PSU)

Salinity was measured in Practical Salinity Unit (PSU) during the monthly monitoring events. PSU is derived from measurements of electrical conductivity, temperature, and pressure rather than direct chemical analysis. 1 PSU can be converted to approximately 1 ppt (parts per thousand).

Salinity was generally consistent and reported between 37,000 and 2,000 PSU during the 6-month monitoring period. Sites with a deeper water profile (i.e., greater than 4 m depth at the time of sampling) presented greater variances between SUR and ARB measurements, with higher salinity generally measured at depth (ARB) and with the greatest variance at Heathcote reference site.

The more disturbed (or accessible) portions of the Swan River such as Elizabeth Quay and Barrack Street presented a lesser change in salinity with depth, most likely attributed to frequent vessel movements and 'blending' of disturbed waters. An exception to the trend was Ellam Street which is relatively inaccessible to vessels, however, is also the shallowest site and therefore the potential for salinity differential is less. Ellam Street is also located the further from the Swan River Estuary mouth and potentially less impacted by tidal (salt water).

In general, salinity measurements were more consistent through the water column in warmer months and more variable in the winter months.

Graph 5 shows the salinity trends and the depth of water in which the sample was recorded for the monitoring program to date.

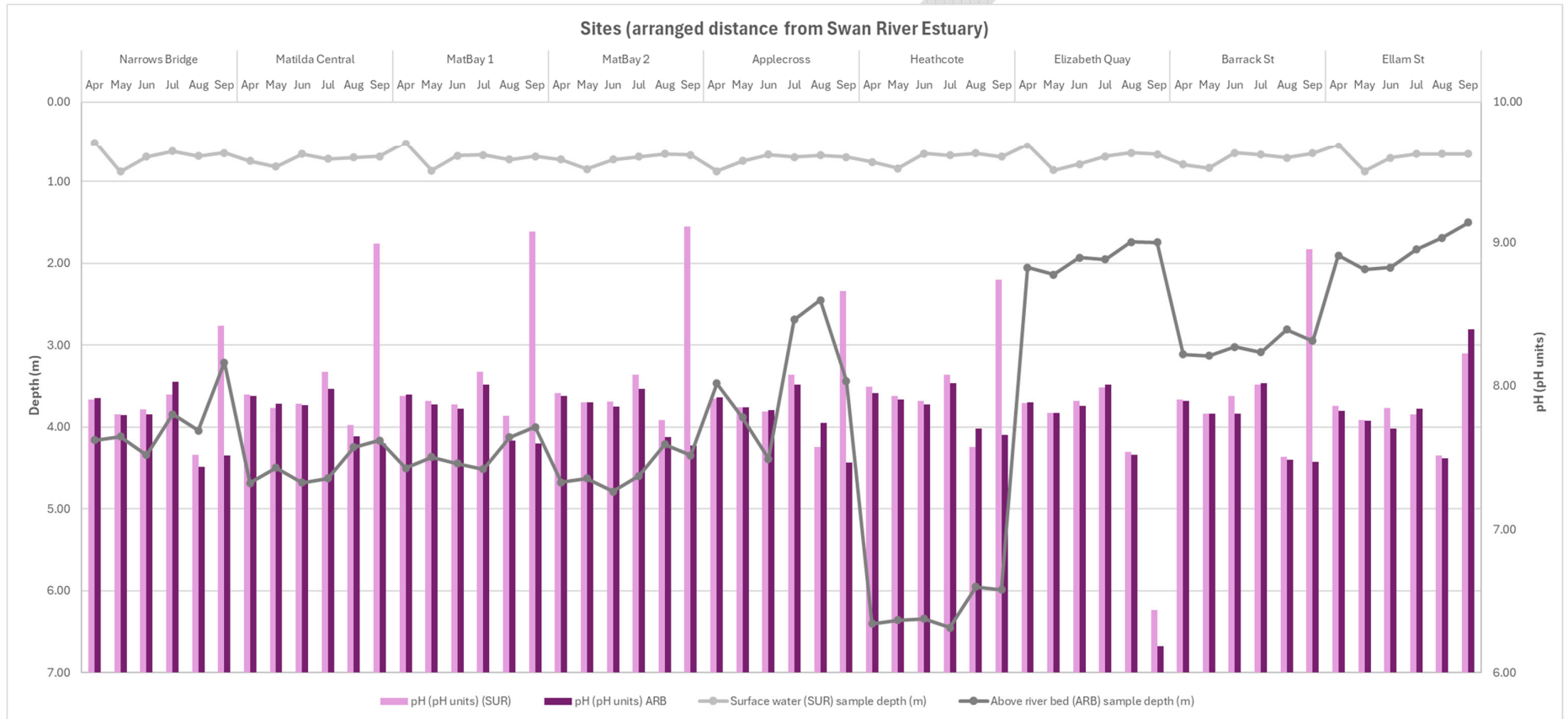
7.2.5 Fluorescence (SCUFA)

Fluorescence was measured using a Self-Contained Underwater Fluorescence Apparatus (SCUFA) to measure field levels of chlorophyll-a. Fluorescence values obtained in the field are qualitative only and laboratory extracted chlorophyll results should be used in the first instance along with correlation with the field measurement, if required for comparison. This is due to the field fluorescence measurement detecting additional types of phytoplankton fluorescence and turbidity.

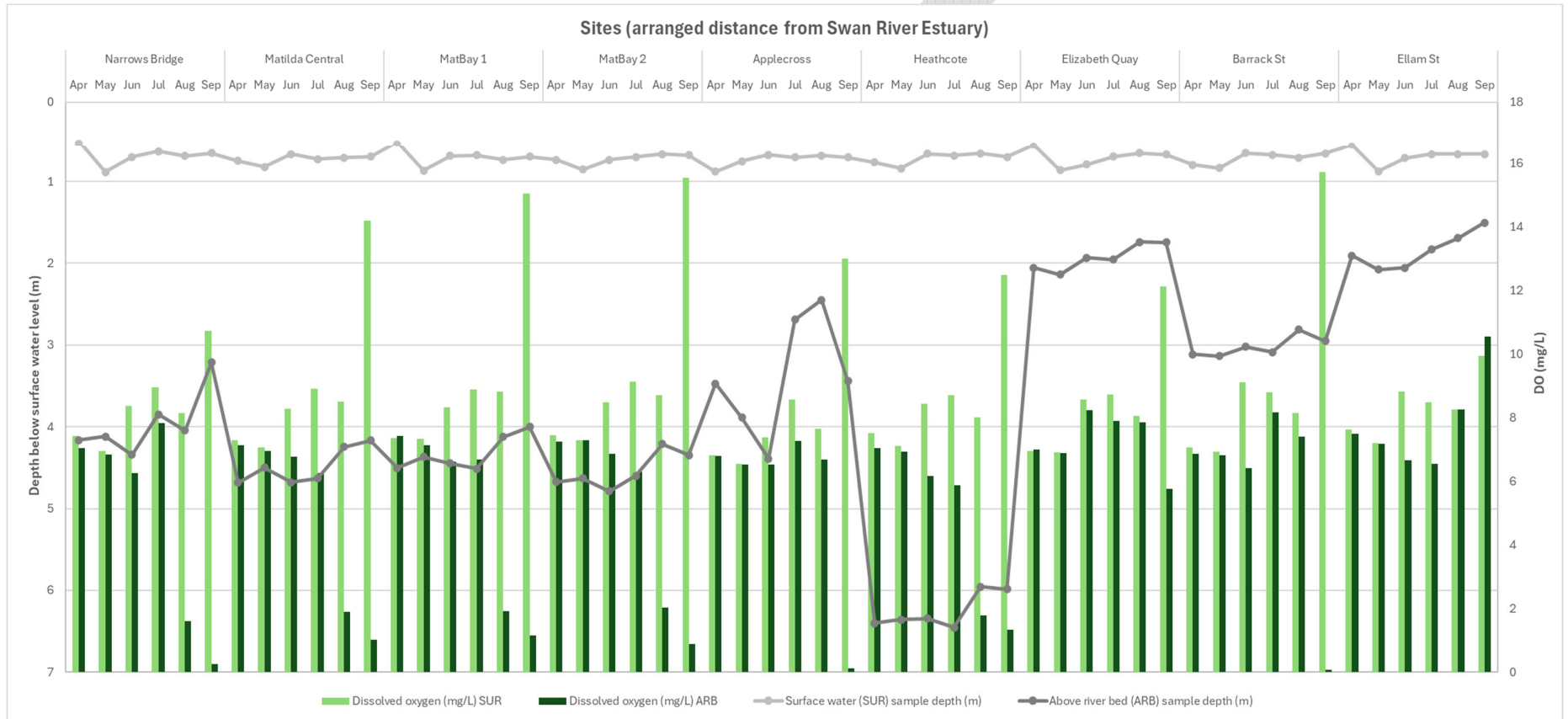
Fluorescence measured at the surface depth interval for most locations typically exceeded the field unit capability for monitoring fluorescence (9.16 ug/L) during most months. Variability in fluorescence recorded within ARB samples were noted with higher results typically recorded at the start of the monitoring program (April and May). This is likely due to higher water temperatures, with the subsequent decline in temperatures over the winter period (June through to August) corresponding with a decline in fluorescence measurements. Fluorescence measurements are expected to increase throughout the remainder of the water monitoring program as water temperatures increase.

Graph 6 shows the fluorescence trends and the depth of water in which the sample was recorded for the monitoring program to date.

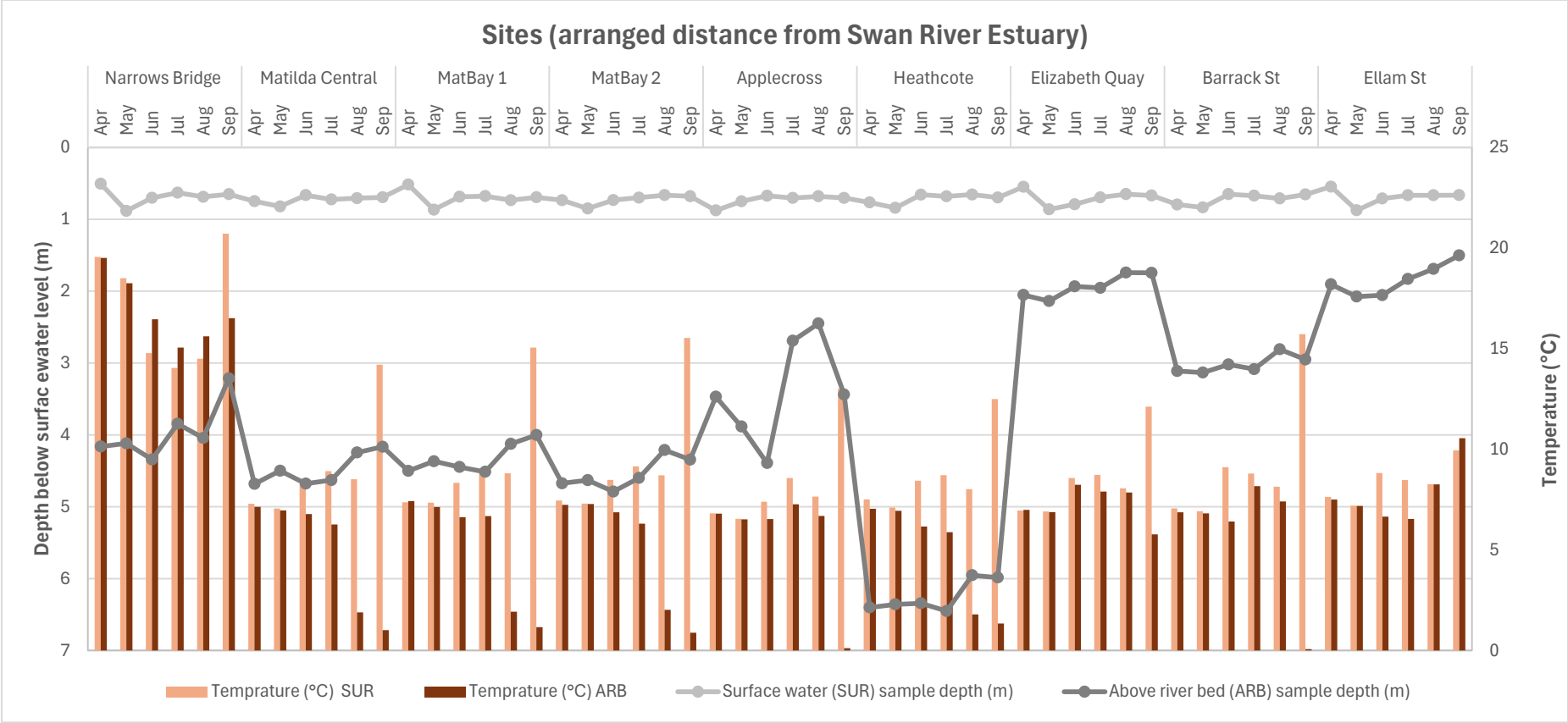
Graph in text 2 pH at all locations and depths



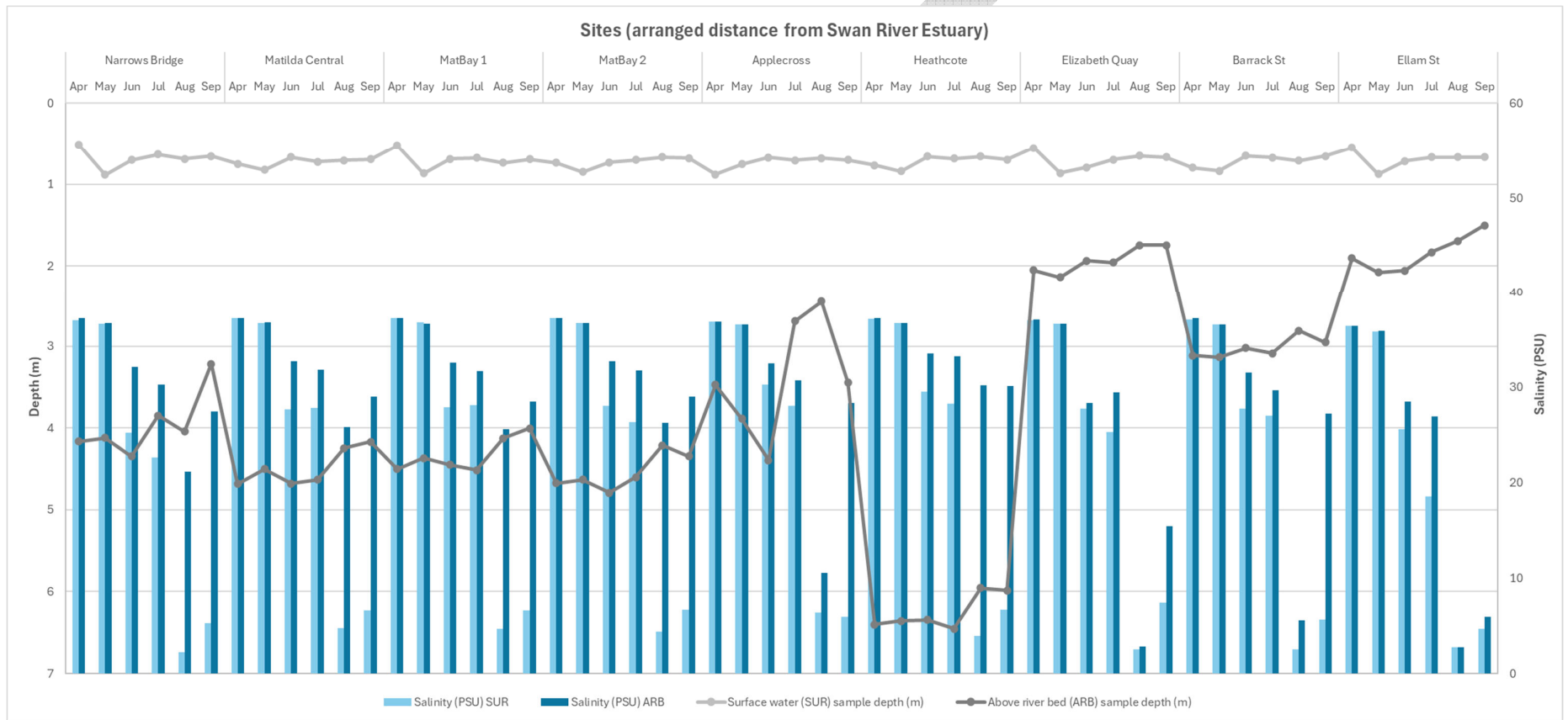
Graph in text 3 Dissolved oxygen levels (mg/L) at all locations and depths



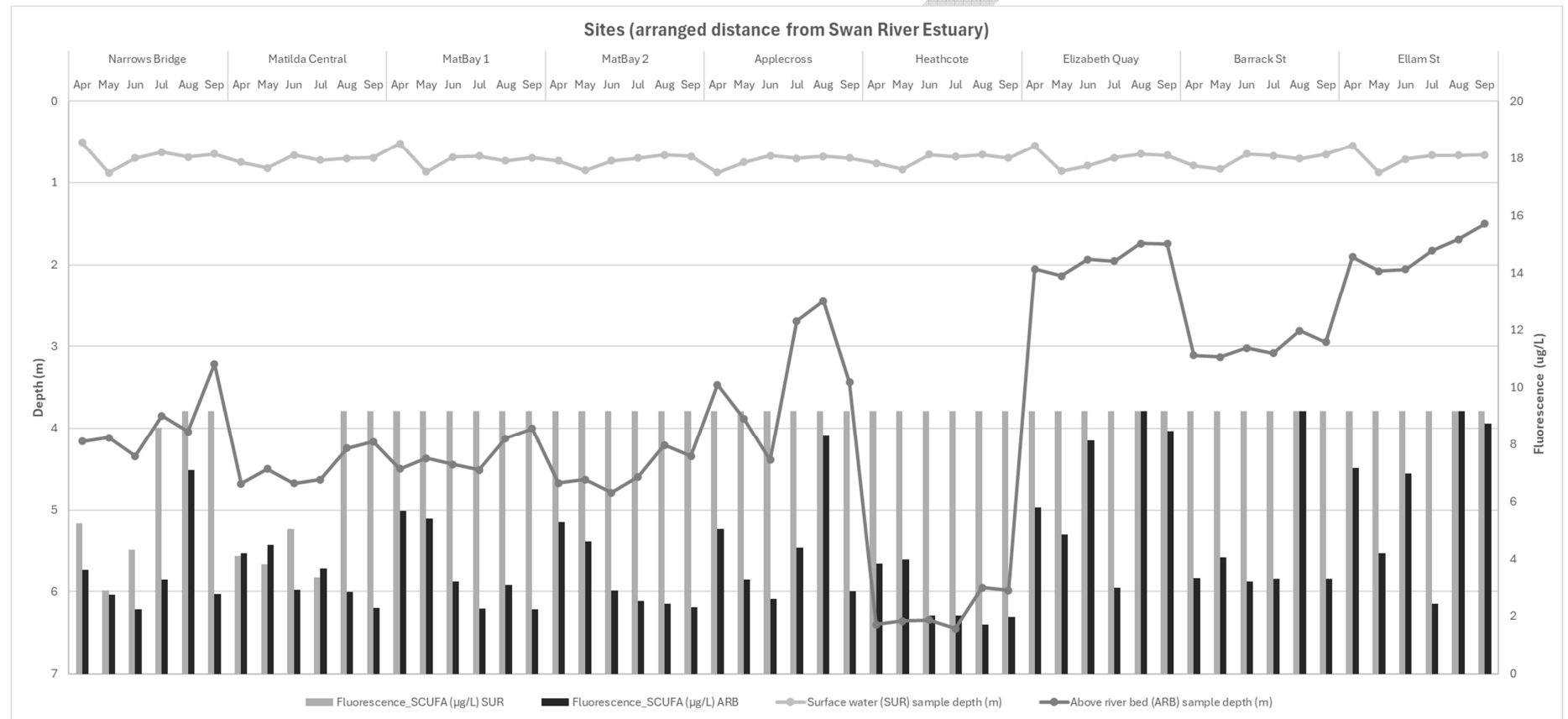
Graph in text 4 Temperature (degrees Celsius) at all locations and depths



Graph in text 5 Salinity (PSU) at all locations and depths



Graph in text 6 Fluorescence at all locations and depths



7.3 Nutrients

Nutrient monitoring included the analysis of the following:

- Ammonia as N.
- Nitrogen (Total Oxidised) (as N).
- Nitrogen (Total).
- Total Kjeldahl Nitrogen (TKN).
- Nitrogen (organic).
- Phosphorus (total).

Trend observations for analytes with adopted assessment criteria available for the Project (i.e. Ammonia as N) and total nutrients (nitrogen and phosphorous) which are considered key nutrients within surface water quality assessment are further discussed below.

7.3.1 Observed select nutrient trends

Nutrients reported (Ammonia as N, total nitrogen, total oxidised nitrogen, total phosphorous and TKN) were observed to generally increase over the winter period (with the exception of Applecross), with a peak in nutrient concentrations observed during the August monitoring event, which is likely attributed to the late winter/ early spring nutrient pluses or flushes. The observed trends for select analytes (ammonia as N, total nitrogen and phosphorous) is further reported below.

Ammonia as N

Ammonia is ubiquitous in the aquatic environment and plays a significant role in the nitrogen cycle. It is formed through animal waste, bushfires, nitrogen fixation reactions, and the decomposition of animals and plants. Ammonia is also a common industrial chemical (e.g. fertiliser) that enters the environment via municipal, industry and agricultural processes (ANZG, 2025).

The adopted assessment criteria for Ammonia as N⁸ was selected based upon an estuarine environment with a pH generally ranging between 7.5 and 8.5 (average value of pH 7.85 in September 2025) due to dependency on temperature, pH and to a lesser extent, ionic strength. Due to the pH range reported and average pH calculated, the more conservative assessment criteria of 910 µg/L for marine/ estuarine waters was adopted in this instance.

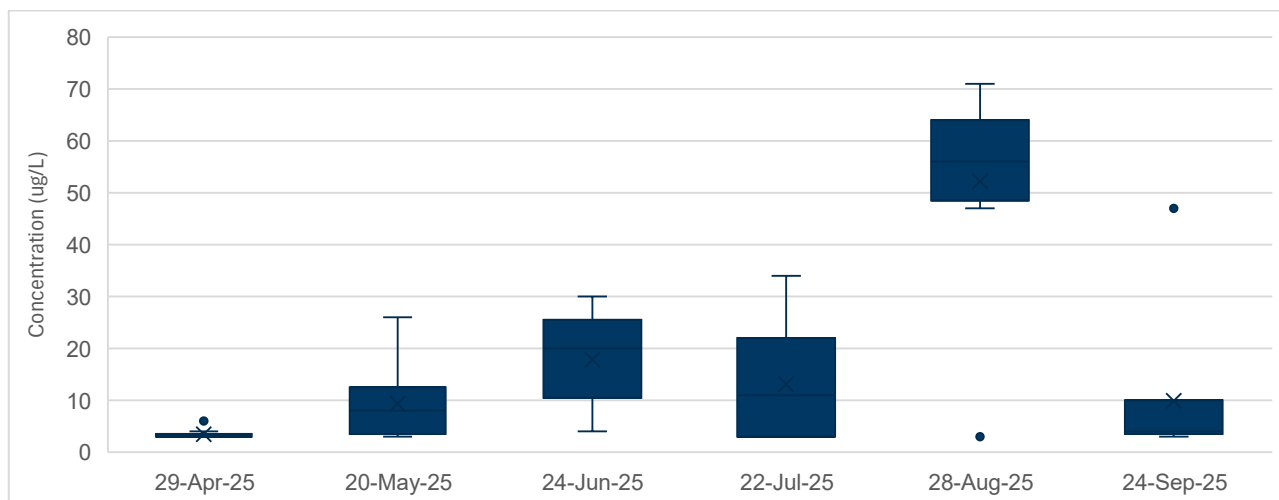
Ammonia as N analysed in the surface water samples (samples identified as SUR) varied from less than the laboratory LOR (3 µg/L) at the three reference sites during April to July 2025 to 71 µg/L at Elizabeth Quay in August 2025. Ammonia as N sampled and analysed for ARB samples presented a more significant and elevated range from 3 µg/L in April at multiple locations (Applecross, Barrack Street and Matilda Bay sites 1 and 2) to 160 µg/L at Matilda Bay 2.

General trend analysis (refer to Graph 7 (SUR samples) and Graph 8 (ARB samples) and Table 10 depict an overall increasing trend during the winter period, with a peak reported during the August 2025 monitoring event. It is important to note that this may not represent the actual peak of Ammonia as N within surface waters but rather represent the maximum values reported during this monthly monitoring program. Results may have further increased (post August monitoring event) and/ or likewise the peak of the winter period may have been between the July and August monitoring event, however it is not possible to determine at this time, with the data sets available.

The results reported to date were below the adopted criteria for Ammonia as N (910 µg/L).

⁸ Ammonia as N comprising un-ionised ammonia (NH₃) and ionised ammonia or ammonium ion (NH₄⁺).

Graph in text 7 Monthly distribution of Ammonia as N (across all SUR locations)



Graph in text 8 Monthly distribution of Ammonia as N (across all ARB locations)

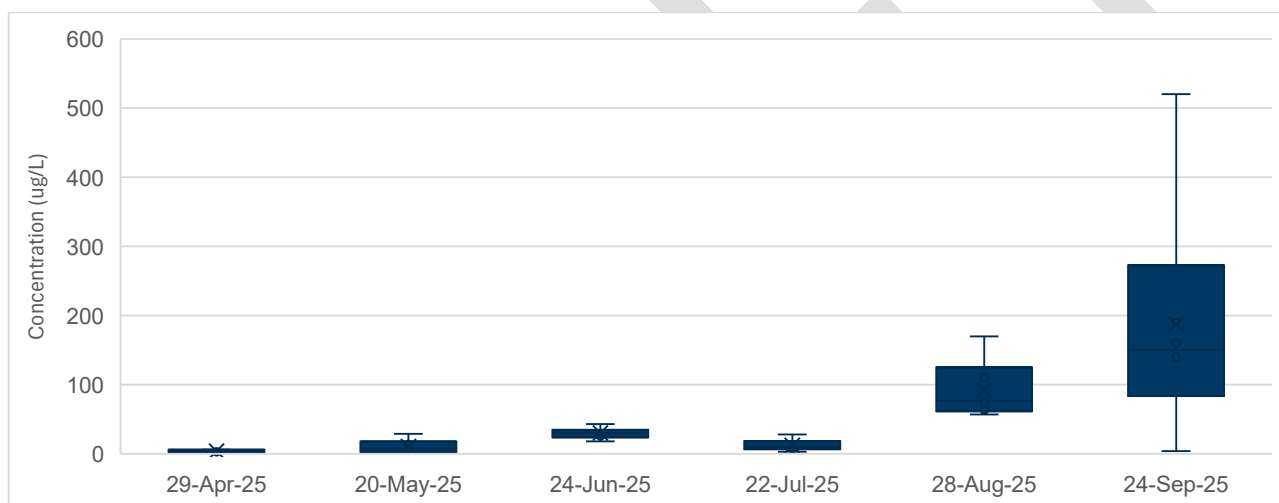


Table 10 Summary of Ammonia as N primary data

Sites	Mean result (µg/L)	Minimum result (µg/L)	Maximum result (µg/L)
Development envelope			
Applecross	13.83	3.0	26.0
Barrack Street	15.67	3.0	62.0
Elizabeth Quay	27.67	6.0	71.0
Ellam Street	18.67	3.0	56.0
Matilda Bay 1	14.00	3.0	47.0
Matilda Bay 2	14.33	3.0	50.0
Reference sites			
Narrows Bridge	20.27	3.0	61.0
Matilda Bay Central	16.33	3.0	54.0
Heathcote	16.83	3.0	66.0

Total nitrogen

There are no adopted assessment criteria for freshwater or marine waters for total nitrogen available at this time. It is noted that the superseded ANZECC (2000) guidelines provide default trigger values for physical and chemical stressors for south-west Australia (refer to Table 3.3.6, ANZECC 2000), which could be utilised as a screening criterion, if adopted for the Project moving forward⁹.

Total nitrogen analysed in the surface water samples (samples identified as SUR) varied from 260 µg/L (Heathcote reference site in May 2025) to 1,800 µg/L at Elizabeth Quay in August 2025. Whilst total nitrogen sampled and analysed at depth (samples identified as ARB) presented a more significant and elevated range from 220 µg/L in July 2025 at Matilda Bay 2 to 1,800 µg/L at Ellam Street in August 2025. The data set recorded a notable increase in total nitrogen concentrations peaked during the August monitoring event (as per Ammonia as N discussed above).

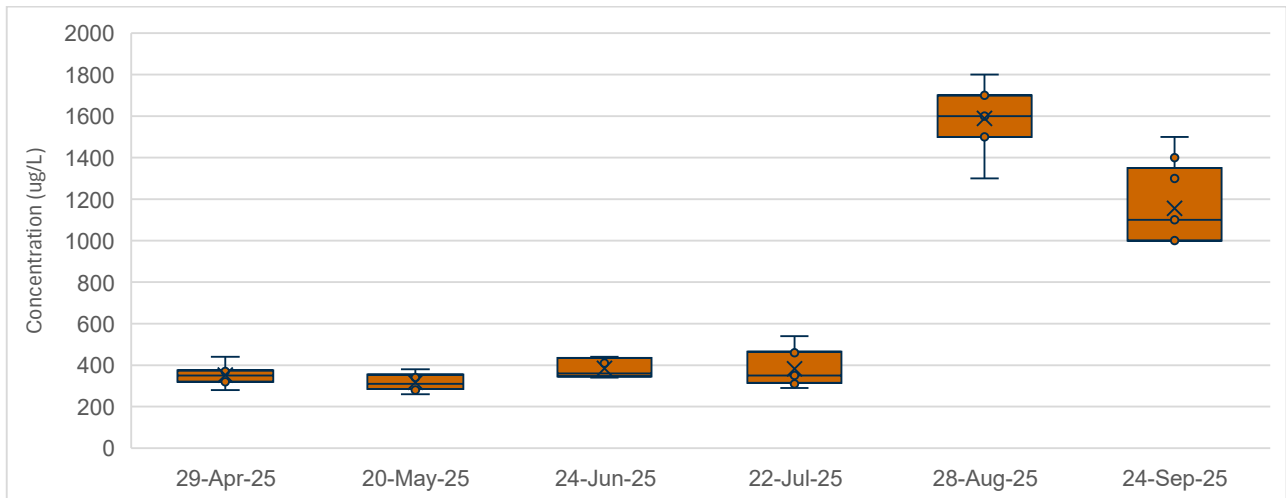
General trend analysis (refer to Graph 9 and Graph 10) and Table 11 depicted an overall increasing trend during the winter period, with a peak reported during the August 2025 monitoring event.

Table 11 Summary of total nitrogen primary data

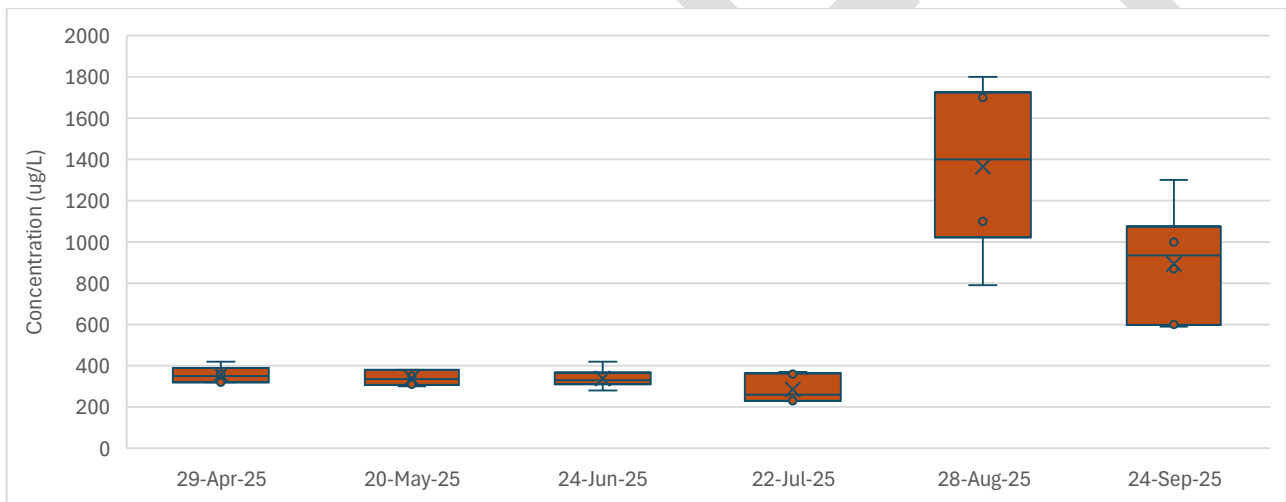
Sites	Mean result (µg/L)	Minimum result (µg/L)	Maximum result (µg/L)
Development envelopes			
Applecross	625.0	260.0	1,500.0
Barrack Street	680.84	260.0	1,700.0
Elizabeth Quay	718.33	350.0	1,800.0
Ellam Street	782.5	320.00	1,800.0
Matilda Bay 1	520.0	230.0	1,500.0
Matilda Bay 2	598.33	290.0	1,600.0
Reference sites			
Narrows Bridge	718.33	360.0	1,600.0
Matilda Bay Central	633.33	290.0	1,500.0
Heathcote	648.33	260.0	1,600.0

⁹ The total nitrogen value within estuarine environment is 750 µg/L and total phosphorous is 30 µg/L.

Graph in text 9 Monthly distribution of total nitrogen (across all SUR locations)



Graph in text 10 Monthly distribution of total nitrogen (across all ARB locations)



Total phosphorous

There are no adopted assessment criteria for freshwater or marine waters for total phosphorous available at this time. It is noted that the superseded ANZECC (2000) guidelines provide default trigger values for physical and chemical stressors for south-west Australia (refer to Table 3.3.6, ANZECC 2000), which could be utilised as a screening criterion, if adopted for the Project moving forward¹⁰.

Total phosphorus analysed in the surface water samples (samples identified as SUR) varied from 22 µg/L (Matilda Bay 1 site in July 2025) to 130 µg/L at Ellam Street in August 2025. Total phosphorous sampled and analysed at depth (samples identified as ARB) presented similar results to the SUR samples with a range from 25 µg/L in July 2025 at Matilda Bay 1 and 2 sites to 130 µg/L at Ellam Street in August 2025. The data set recorded a notable increase in total phosphorus concentrations peaked during the August monitoring event (as per Total Nitrogen and Ammonia as N, as discussed above).

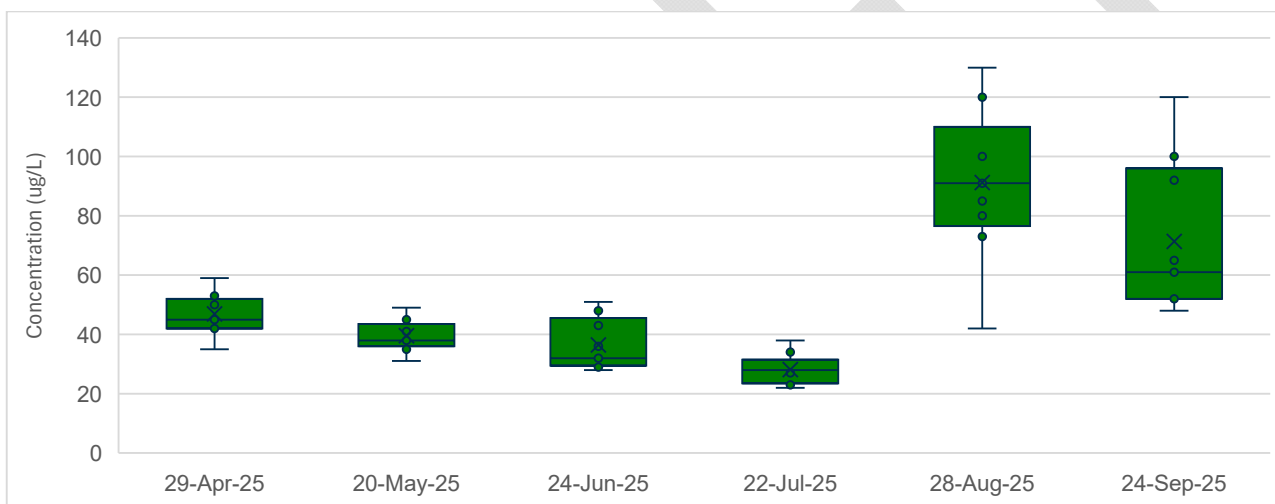
General trend analysis (refer to Graph 11 and Graph 12) and Table 12 depicted an overall increasing trend during the winter period, with a peak reported during the August 2025 monitoring event.

¹⁰ The total nitrogen value within estuarine environment is 750 µg/L and total phosphorous is 30 µg/L.

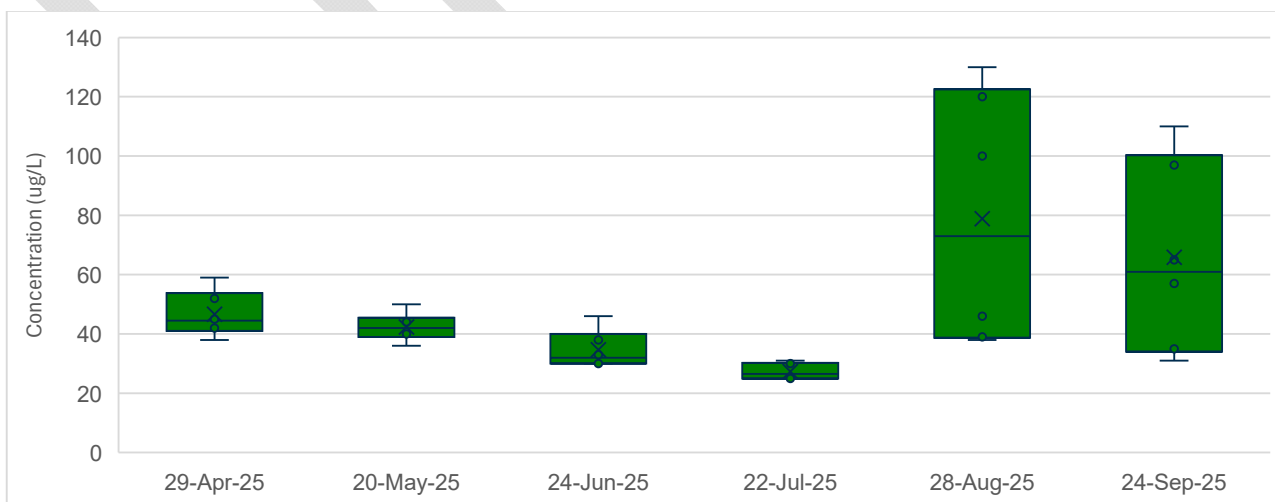
Table 12 Summary of total phosphorus primary data

Sites	Mean result (µg/L)	Minimum result (µg/L)	Maximum result (µg/L)
Development envelopes			
Applecross	46.58	24.0	120.0
Barrack Street	58.5	27.0	120.0
Elizabeth Quay	55.67	30.0	100.0
Ellam Street	67.42	48.0	130.0
Matilda Bay 1	39.17	22.0	80.0
Matilda Bay 2	45.17	23.0	100.0
Reference sites			
Narrows Bridge	52.67	28.0	100.0
Matilda Bay Central	43.17	29.0	73.0
Heathcote	45.17	27.0	85.0

Graph in text 11 Monthly distribution of total phosphorous (across all surface (SUR) locations)



Graph in text 12 Monthly distribution of total phosphorous (across all above river bed (ARB) locations)



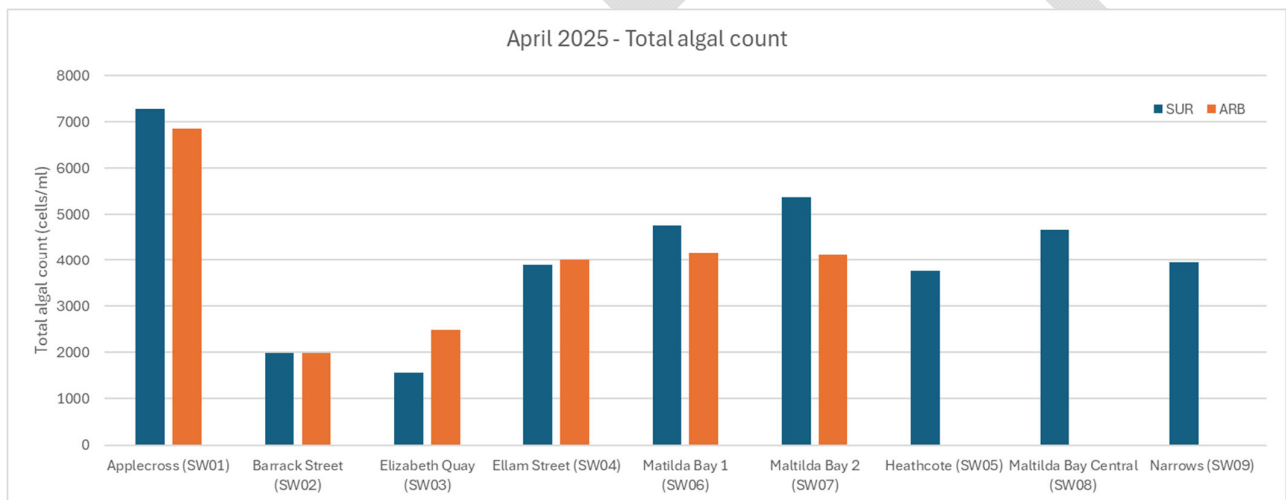
7.4 Algal data

The identification of algal species was completed by Dalcon Environmental for the duration of the monthly monitoring program. A diverse range of species was recorded across the Project area, and these have been recorded within Graphs 13 and Graph 18 and Table 9.1 to 9.5, Appendix C.

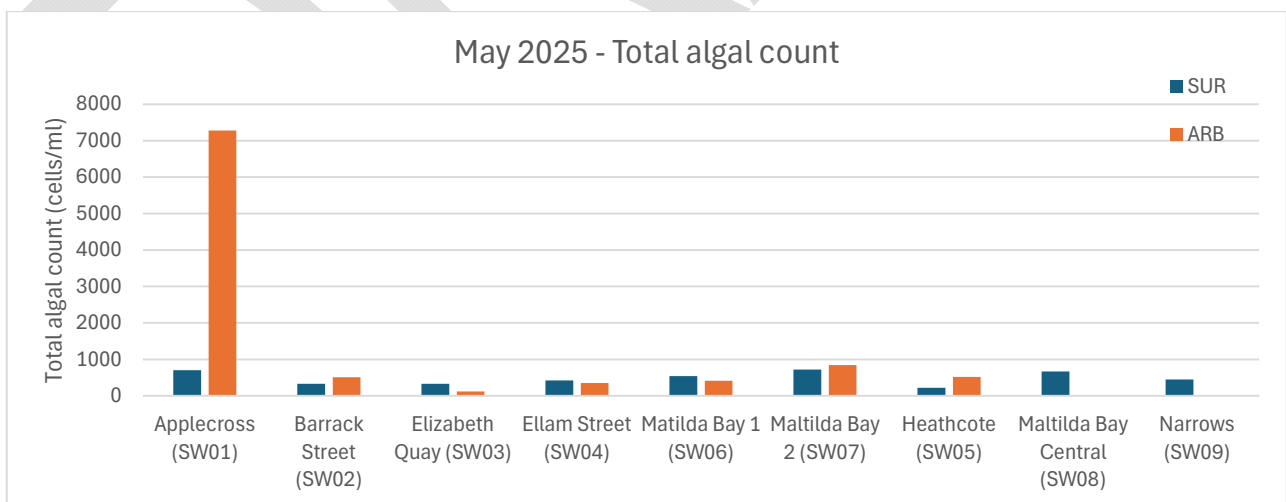
In general, larger algal counts were identified in SUR samples compared to those collected at depth (ARB). SUR samples collected at Barrack St and Elizabeth Quay reported the highest total algal count for September 2025, with comparatively lower levels at reported at other sites (including the reference sites). Of the reference sites, Heathcote and Matilda Bay Central recorded lower levels compared to the development envelope sites, whereas the Narrows site recorded comparable levels for SUR algal counts to those recorded at Applecross, Matilda Bay 1, and Matilda Bay 2.

Bacillariophyceae species generally comprised a large proportion of the algal species identified in the water samples, especially at Applecross (ARB), Ellam St (SUR and ARB), Matilda Bay 1 (SUR), Heathcote (SUR), Narrows (SUR) and Matilda Bay Central (SUR). Coccolithophyceae species were more commonly identified in samples collected at depth (e.g., Applecross ARB, Elizabeth ARB, and Matilda Bay ARB).

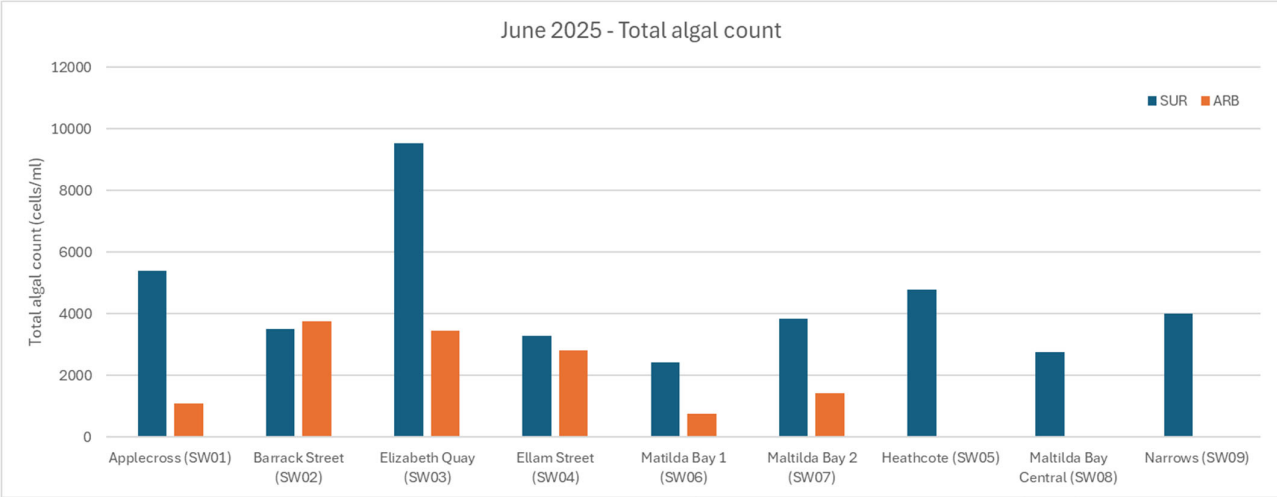
Graph in text 13 Summary of total algal count (April 2025)



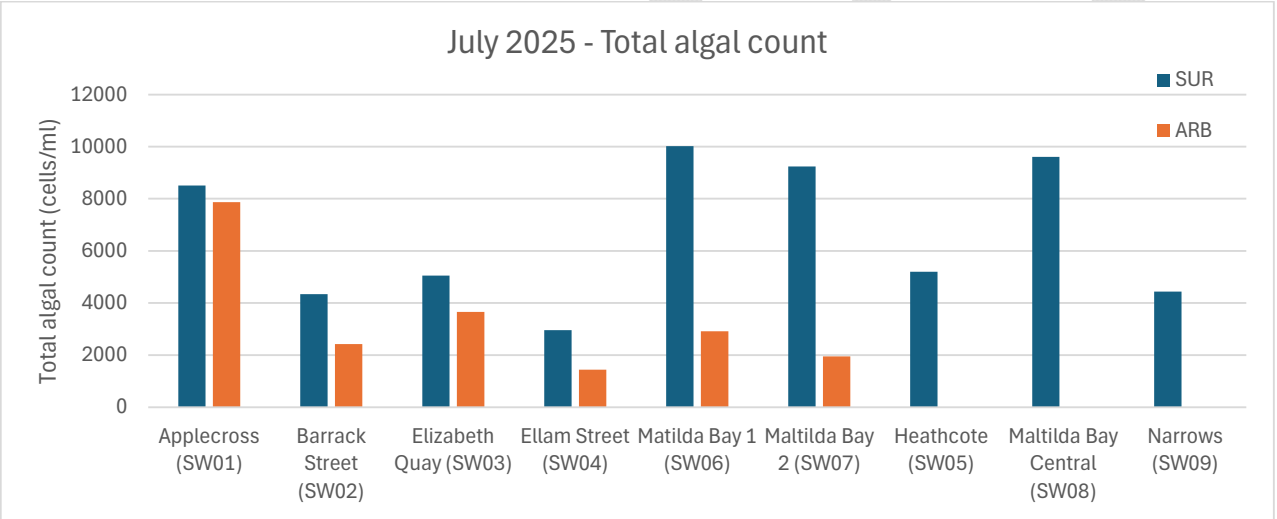
Graph in text 14 Summary of total algal count (May 2025)



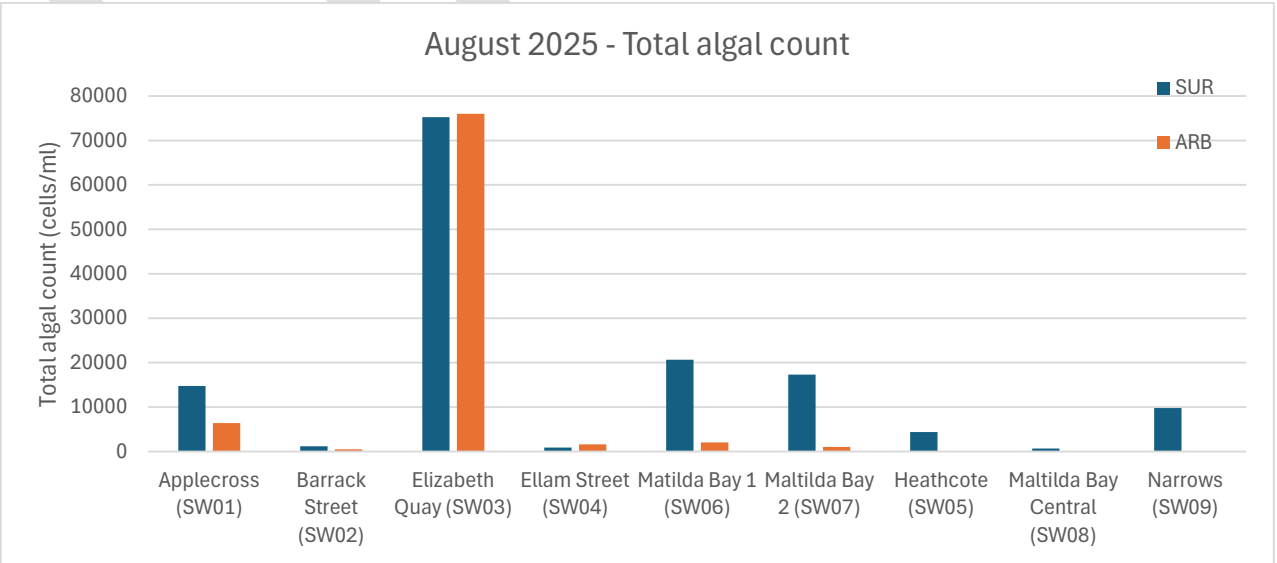
Graph in text 15 Summary of total algal count (June 2025)



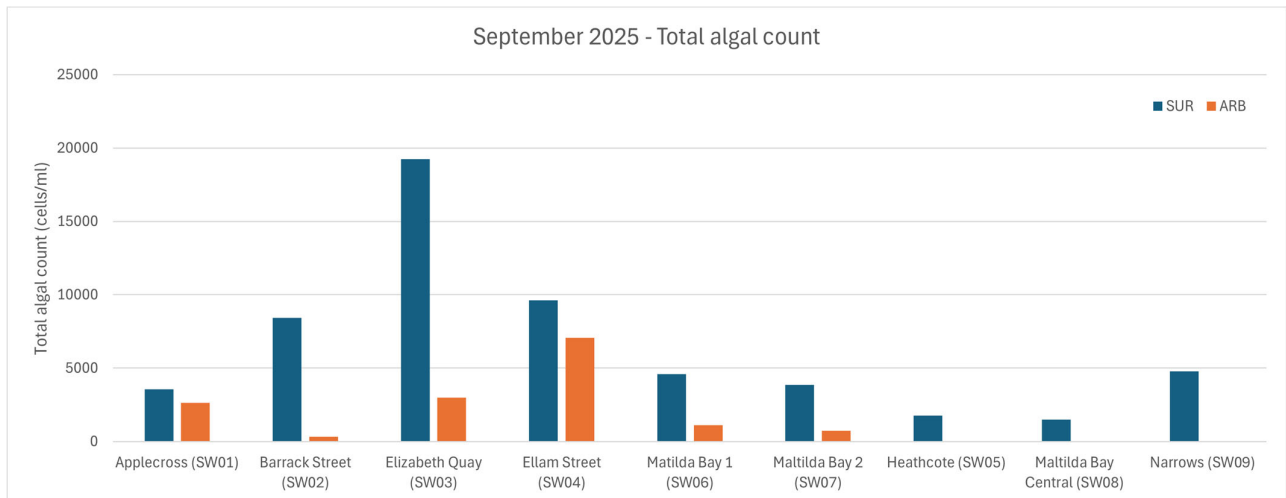
Graph in text 16 Summary of total algal count (July 2025)



Graph in text 17 Summary of total algal count (August 2025)



Graph in text 18 Summary of total algal count (September 2025)



7.5 Metals and organometals

The results presented below represent the data trends over the past 6 months, however it should be noted that due to contractual changes aimed at achieving the updated (lower) limits of reporting (LORs) as requested by the PTA, a change in laboratories was implemented in September 2025 and will remain in effect moving forward. Therefore, data received in September is reported with a lower LOR than previously recorded, which may appear (or indicate) that concentrations have reduced, however this cannot be established with certainty given the previous laboratory LOR.

7.5.1 Aluminium

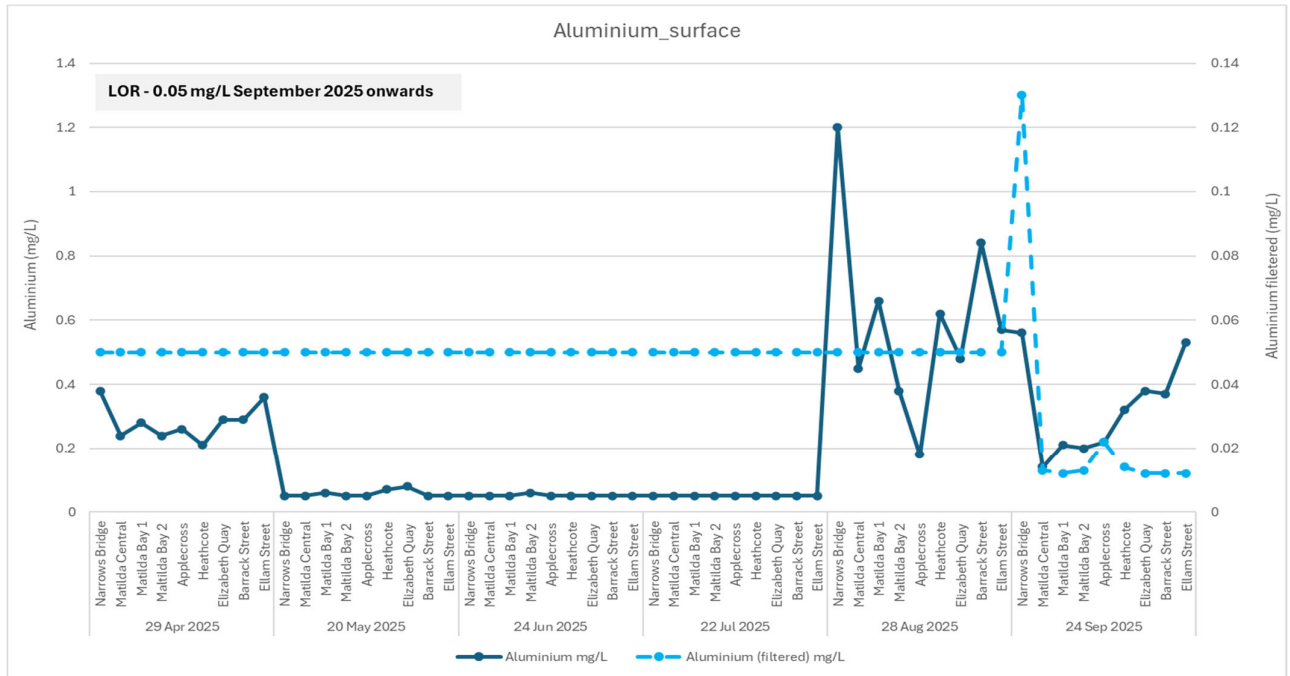
Aluminium (dissolved) concentrations ranged between less than the LOR (<0.05 mg/L and <0.005 mg/L for September 2025) and 0.06 mg/L (Matilda Bay 1, June 2025) for the first six months of the monitoring program, with only one sample (collected at Matilda Bay 1 in June 2025) reporting a concentration above the adopted assessment criterion (0.055 mg/L).

In contrast, aluminium (total) concentrations ranged between less than the LOR (<0.05 mg/L <0.005 mg/L for September 2025) and 0.84 mg/L (Barrack Street, August 2025) for the first six months of the monitoring program, with 52 samples out of 72 samples (72 %) exceeding the adopted assessment criterion (0.055 mg/L).

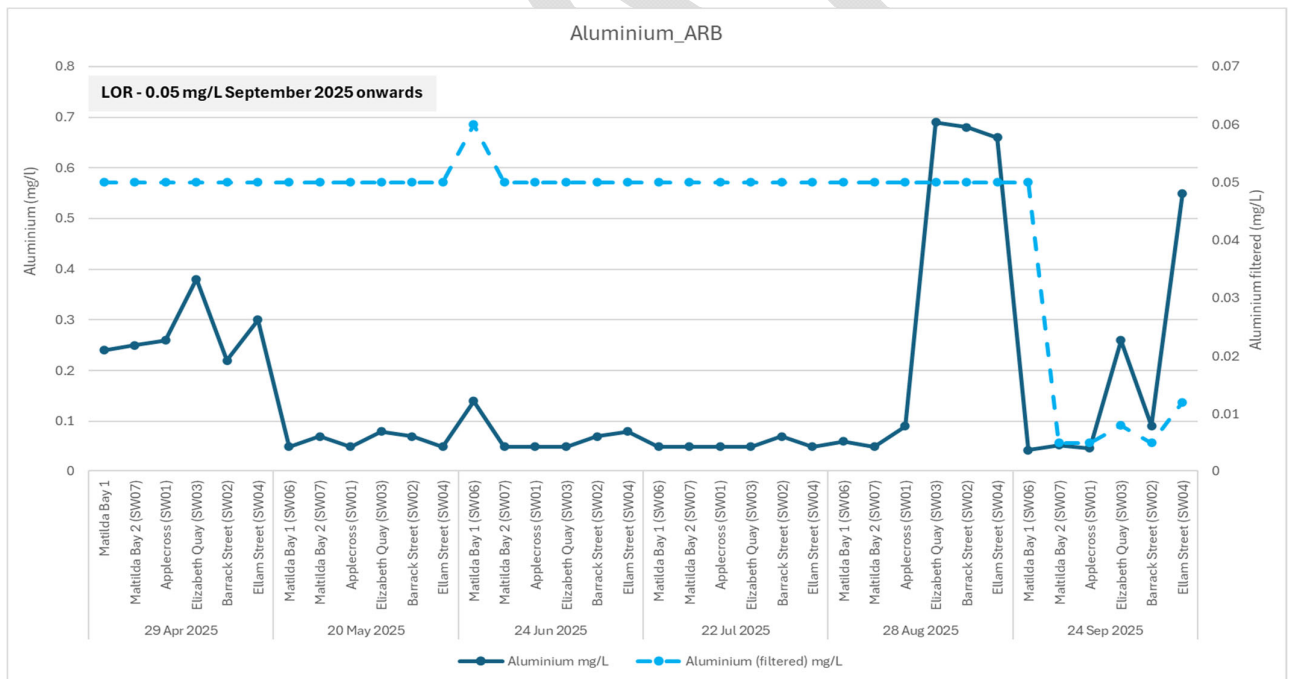
Total aluminium values were generally elevated when compared to dissolved values during the months of April, August and September for all sites including reference sites. The observed trends for aluminium (total and dissolved) are provided in Graph 19 (SUR) and Graph 20 (ARB).

Increased concentrations of aluminium (total and dissolved) may be attributed to increases in winter rainfall events throughout August and September (refer to Graph 1) with the 'flushing' of catchment soils and surfaces. Whilst aluminium is also generally mobilised by changes in pH or acidic conditions, no correlation was observed between field pH measurements and aluminium concentration across the monitoring period.

Graph in text 19 Aluminium (total and filtered) within surface samples



Graph in text 20 Aluminium (total and filtered) within 0.5 m above river bed samples



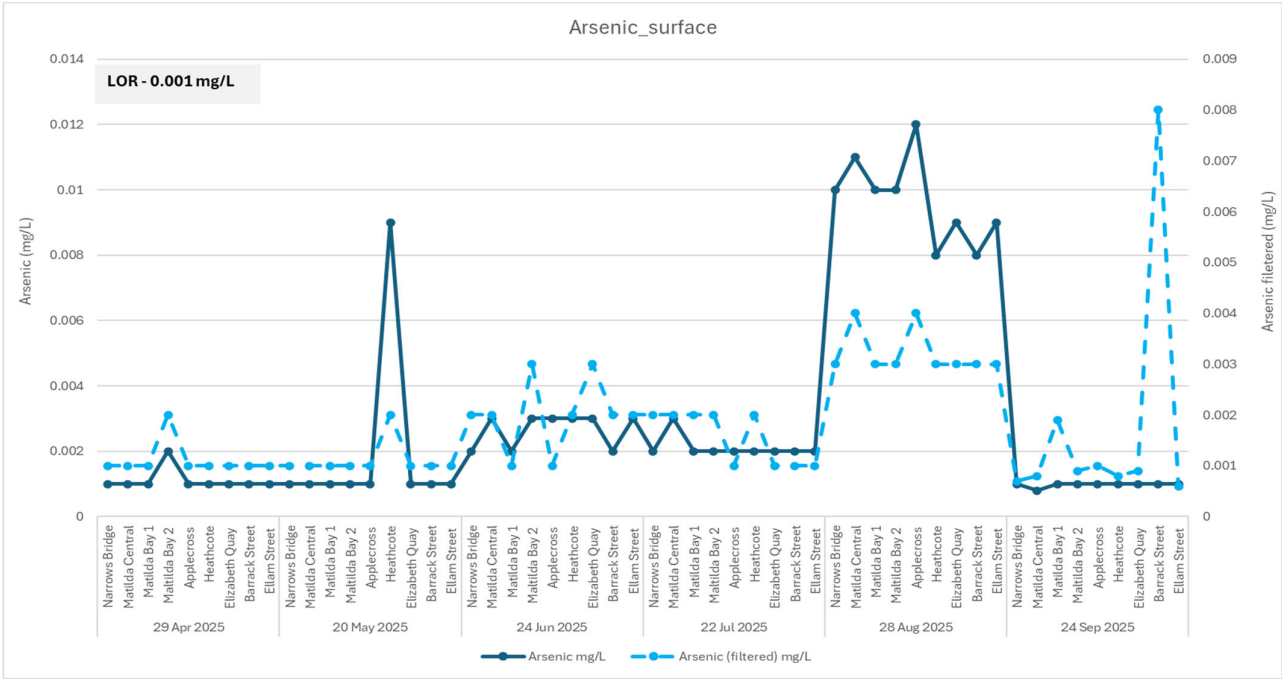
7.5.2 Arsenic

Arsenic (dissolved) concentrations ranged between 0.0006 mg/L (Ellam Street, September 2025) and 0.005 mg/L (Matilda Bay 2, August 2025) for the first six months of the monitoring program, with no samples reporting values exceeding the adopted assessment criteria (0.013 mg/L). Total arsenic appears to correlate to dissolved arsenic concentrations, with the maximum reported concentrations ranging between 0.014 mg/L and 0.016 mg/L (Matilda Bay 1, August 2025 and Matilda Bay 2, August 2025).

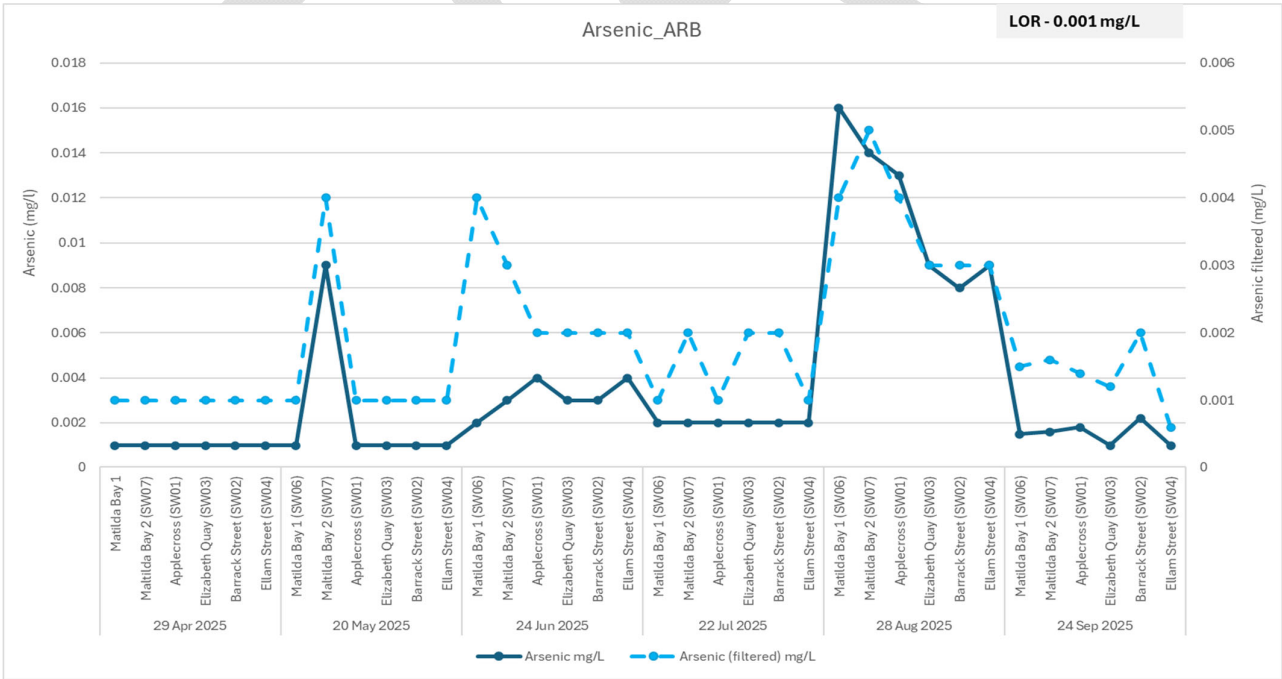
The observed trends for arsenic (total and dissolved) are provided in Graph 21 (SUR) and Graph 22 (ARB).

As per above, the increases in arsenic concentrations are likely to be attributed to increase in rainfall and subsequent flushing of catchment soils and/ or stormwater run-off rather than other factors such as decreases in dissolved oxygen (which are known to increase arsenic solubility) and algal blooms (which are not reflected within the fluorescence results obtained to date).

Graph in text 21 Arsenic (total and filtered) within surface samples



Graph in text 22 Arsenic (total and filtered) within 0.5 m above river bed samples



7.5.3 Cadmium

Cadmium (total) concentration was reported to exceed the most conservative adopted assessment criterion (0.0002 mg/L, marine water) on one occasion (Applecross, June 2025) during the monthly monitoring events. All

remaining samples (SUR and ARB) for cadmium (dissolved and filtered) were below the adopted assessment criterion.

The observed trends for cadmium have not been graphically represented at this time due to the absence of values exceeding the adopted assessment criteria.

7.5.4 Cobalt

Cobalt (total and filtered) concentrations were reported below the adopted assessment criterion (0.001 mg/L, marine water) for all locations during the monthly monitoring events. A lower laboratory LOR (<0.00005 mg/L) was adopted for the September 2025 monitoring event. Concentrations of cobalt (total) ranged between 0.0002 mg/L and 0.00044 mg/L, with dissolved cobalt concentrations generally equal to, or marginally less than the total concentrations reported and ranged between 0.0002 mg/L and 0.00044 mg/L.

The observed trends for cobalt have not been graphically represented at this time due to the absence of values exceeding the adopted assessment criteria.

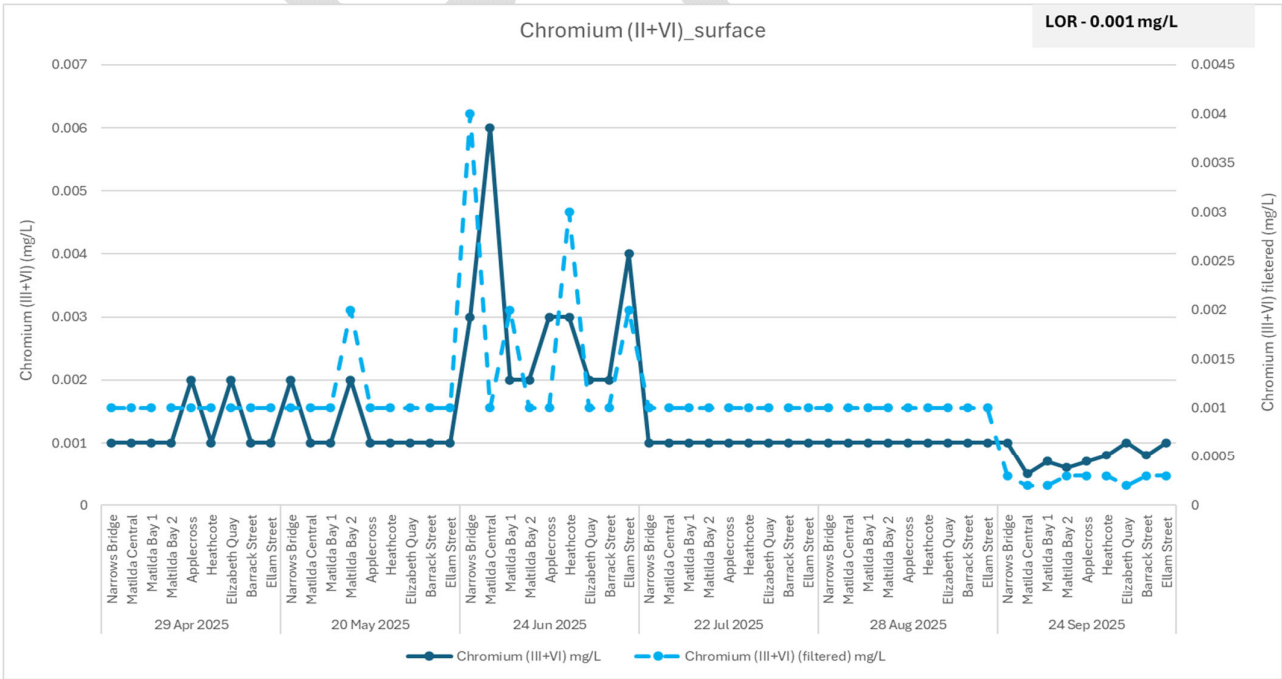
7.5.5 Chromium (III + VI)

Multiple exceedances of the ANZG (freshwater) guidelines were record for total chromium concentrations (total) in samples collected between April and June 2025. In general, the highest concentrations were recorded in samples collected in June 2025. The maximum concentration (0.006 mg/L) recorded in the SUR sample collected at Matilda Bay Central in June 2025, with this concentration also exceeding the ANZG marine water criterion. In general, concentrations recorded in August and September were below the applied guideline values, excepting samples collected from Elizabeth Quay (SUR only), Ellam St, and Narrows Bridge (SUR only).

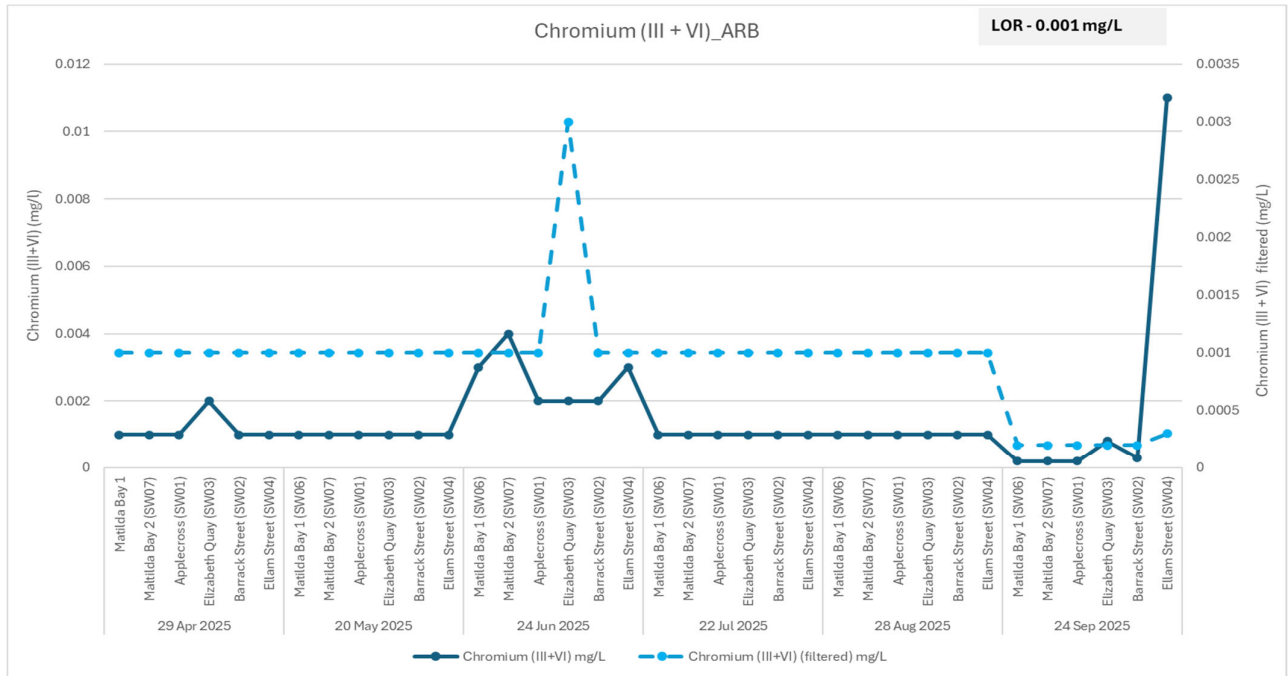
Dissolved chromium concentrations were generally much lower with fewer detectable concentrations reported (above the LOR) and fewer guideline exceedances. Concentrations exceeding the ANZG freshwater criterion (0.001 mg/L) were reported in samples collected in June 2025 from Barrack St (SUR), Elizabeth Quay (SUR and ARB), Ellam St (SUR), Matilda Bay 1 (SUR), Narrows Bridge (SUR), and Heathcote (SUR), and in May 2025 for the SUR sample collected at Matilda Bay 2 (SUR). No exceedances of the marine water criterion were reported.

The observed trends for chromium (total and dissolved) are provided in Graph 23 (SUR) and Graph 24 (ARB).

Graph in text 23 Chromium (total and filtered) within surface samples



Graph in text 24 Cadmium (total and filtered) within 0.5 m above river bed samples



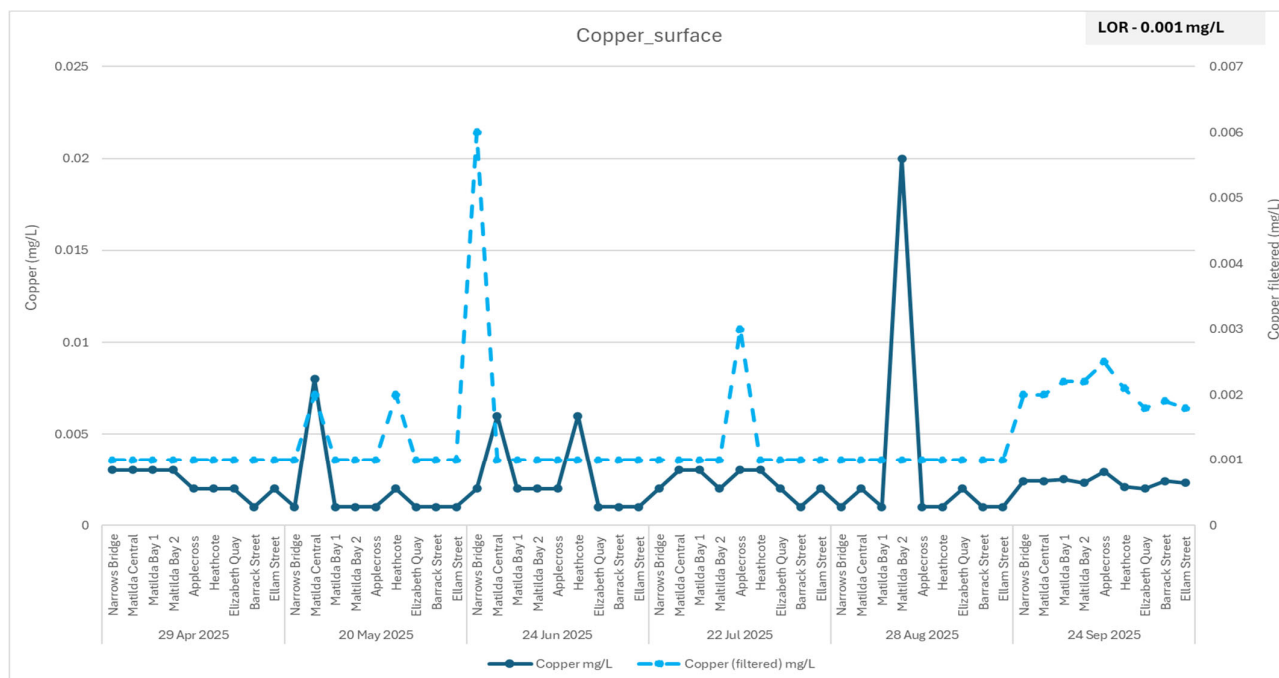
7.5.6 Copper

Copper concentrations (total) exceeded both freshwater and marine species guidelines at all locations for the majority of monitoring events and sampling depths throughout the monitoring program. In contrast, dissolved copper concentrations were predominantly below the LOR (0.001 mg/L) for sampling completed from April to August 2025, except for SUR samples collected at Applecross in July 2025 (0.003 mg/L exceeding both freshwater and marine water ANZG criteria), Matilda Bay Central in May 2025 (0.002 mg/L), Narrows Bridge in June 2025 (0.006 mg/L), and Heathcote in May 2025 (0.002 mg/L), all of which exceeded both freshwater and marine water ANZG criteria.

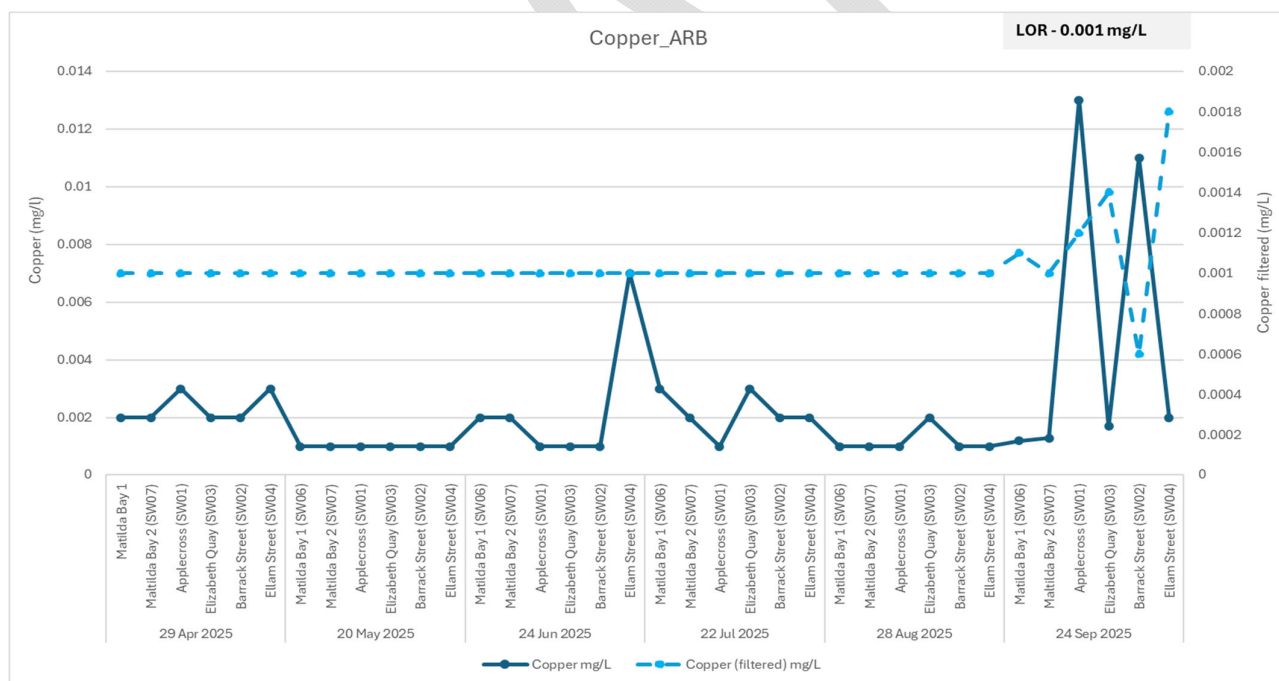
In September 2025, a lower LOR was adopted (0.0002 mg/L), with detectable dissolved copper concentrations reported in all samples, ranging from 0.0006 mg/L (Barrack St, ARB) to 0.0025 (Applecross, SUR). Eleven of the 15 samples collected in September 2025 (73%) recorded dissolved copper concentrations above the freshwater and marine water ANZG criteria. The September monitoring results indicate a substantial increase in copper concentrations, and this should be reviewed following upcoming monitoring rounds to further assess the potential increasing trend.

The observed trends for copper (total and dissolved) are provided in Graph 25 (SUR) and Graph 26 (ARB).

Graph in text 25 Copper (total and filtered) within surface samples



Graph in text 26 Copper (total and filtered) within 0.5 m above river bed samples



7.5.7 Lead

Lead (total) concentrations were reported to exceed the most conservative adopted freshwater assessment criterion (0.0034 mg/L) on one occasion (Elizabeth Quay, August 2025, 0.004 mg/L) during the monthly monitoring events. All remaining samples (SUR and ARB) for lead (dissolved and filtered) were below the adopted assessment criteria.

The observed trends for lead have not been graphically represented at this time due to the absence of values exceeding the adopted assessment criteria.

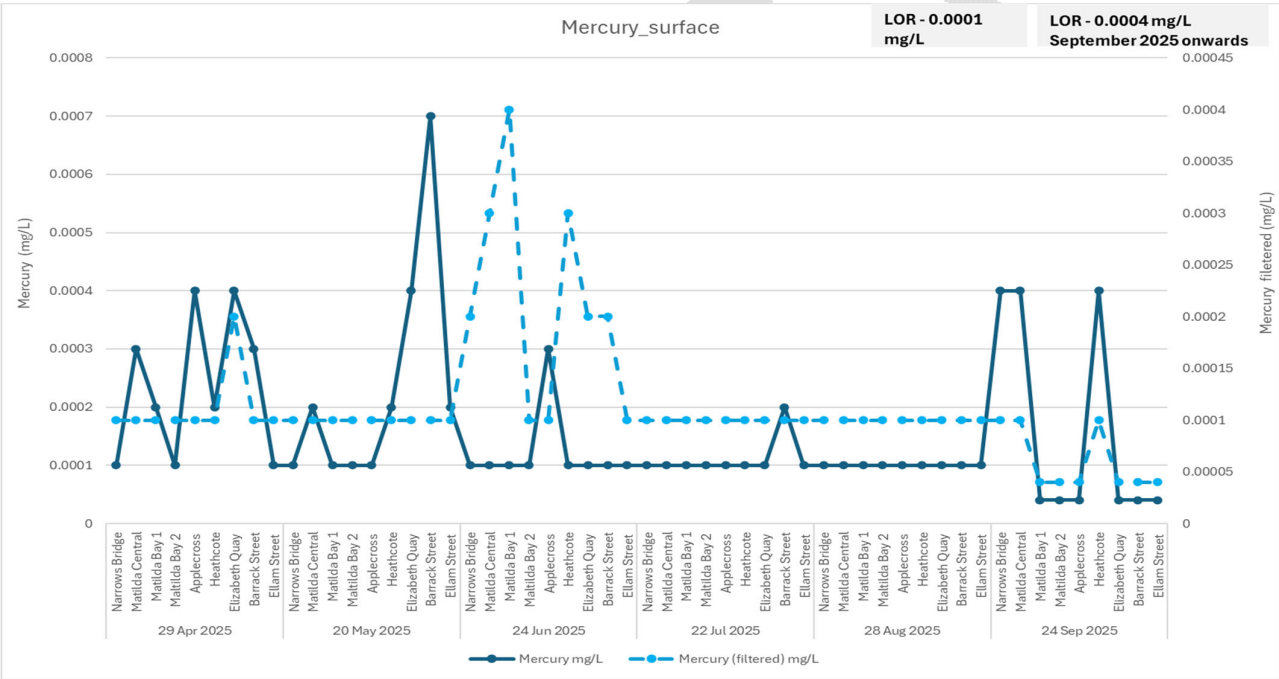
7.5.8 Mercury

Mercury concentrations (total) exceeded the marine water assessment criterion (0.0004 mg/L) in SUR samples collected in April 2025 (Applecross, Barrack St, and Elizabeth Quay) and May 2025 (Elizabeth Quay), with the maximum concentration recorded at Barrack St (0.0007 mg/L) also exceeding the freshwater criterion (0.0006 mg/L). In contrast, dissolved mercury results were primarily below the LOR and below the applied assessment criteria, excepting the SUR and ARB samples collected from Matilda Bay 1 in June 2025 (0.0004 and 0.0005 mg/L, respectively) which exceeded the marine water criterion. Only 19 of the 90 samples (21%) collected throughout the monitoring period recorded detectable concentrations of dissolved mercury (i.e., above the LOR).

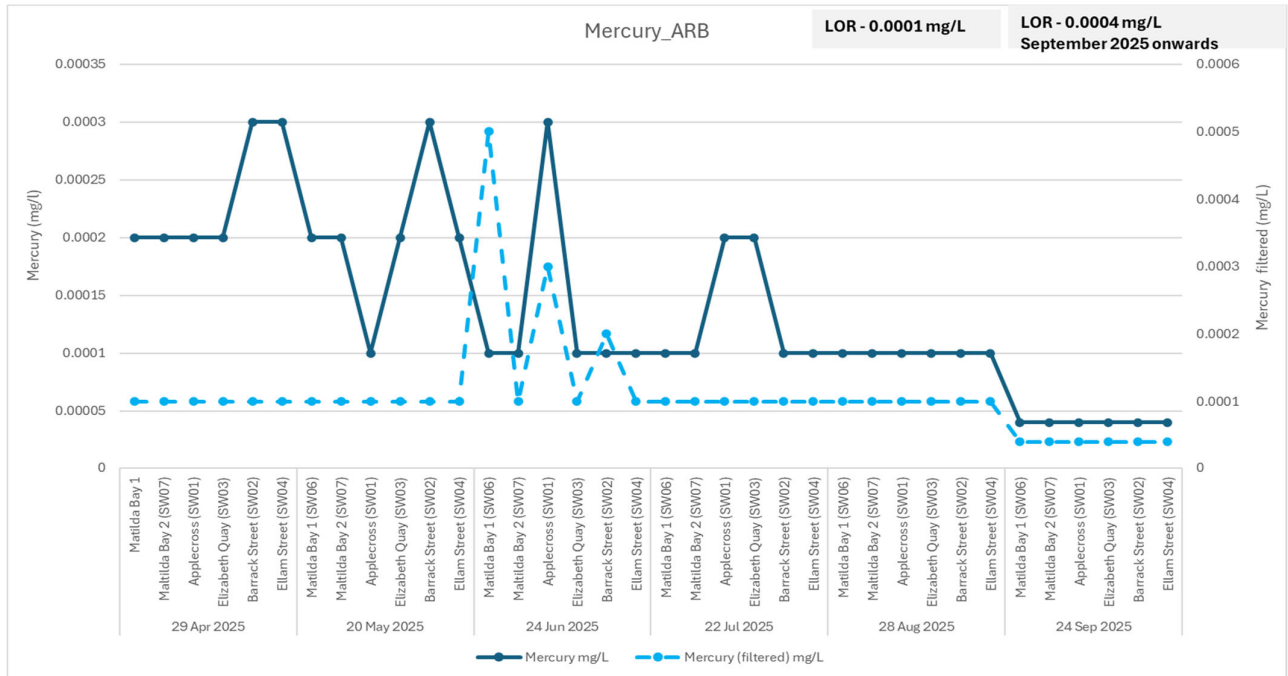
Mercury is unlikely to pose a risk to the river or aquatic life at any of the proposed locations; however, ongoing monitoring is recommended to ensure continued environmental protection.

The observed trends for mercury (total and dissolved) are provided in Graph 27 (SUR) and Graph 28 (ARB).

Graph in text 27 Mercury (total and filtered) within surface samples



Graph in text 28 Mercury (total and filtered) within 0.5 m above river bed samples



7.5.9 Nickel

Nickel (total) concentrations were reported to exceed the most conservative adopted assessment criteria (0.011 mg/L, freshwater) on one occasion (ARB sample collected at Matilda Bay 1, August 2025) during the monthly monitoring events. All remaining samples (SUR and ARB) for nickel (dissolved and filtered) were below the adopted assessment criteria.

The observed trends for nickel have not been graphically represented at this time due to the absence of values exceeding the adopted assessment criteria.

7.5.10 Zinc

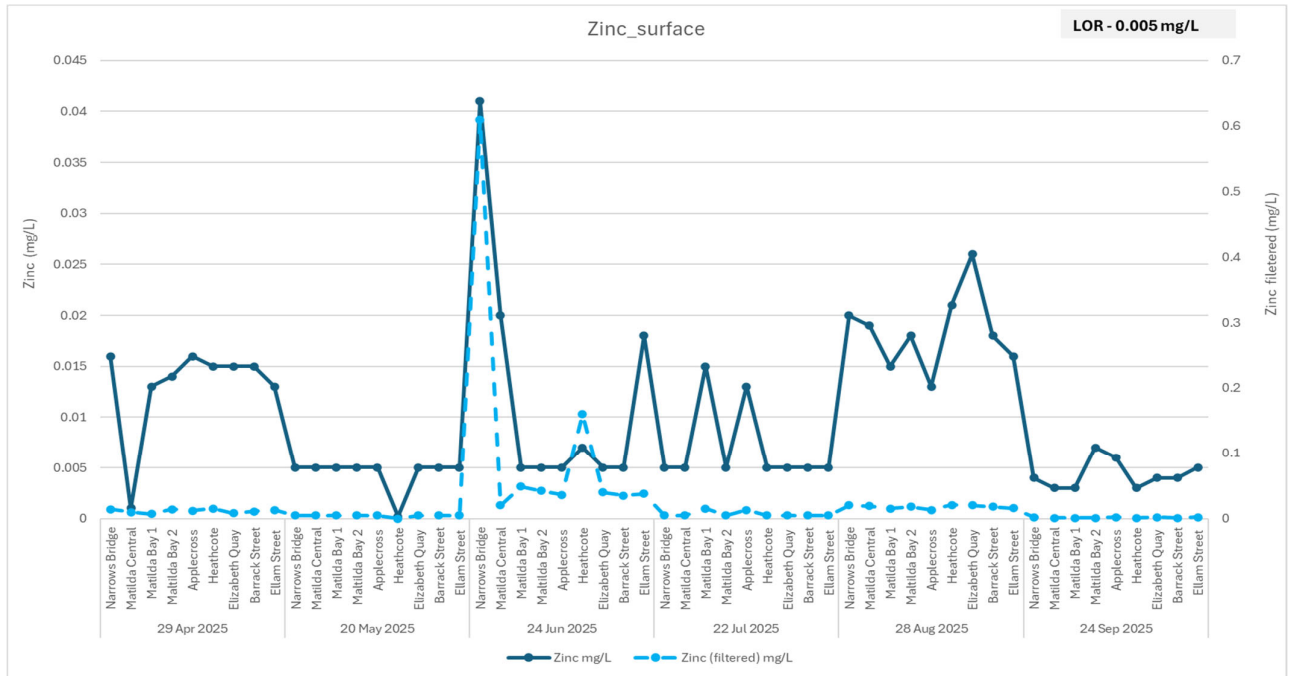
Multiple exceedances of the adopted freshwater and marine water criteria were reported at all sampling locations across the monitoring period for both total and dissolved zinc. Total zinc concentrations ranged from below LOR (0.005 mg/L) to 33 mg/L (Applecross ARB, June 2025) and dissolved zinc concentrations ranged from below LOR (0.005 mg/L) to 0.61 mg/L (Narrows Bridge SUR, June 2025). Concentrations across all monitoring locations were generally highest in April, June, and August monitoring events and lowest in May and September.

Eleven samples collected in June 2025 (Heathcote SUR, Narrows SUR, Matilda Bay 2 SUR, Matilda Bay 1 SUR and ARB, Ellam St SUR, Elizabeth Quay SUR, Barrack St ARB and SUR, and Applecross SUR) recorded higher dissolved zinc concentrations than the corresponding total zinc concentrations. Of these, seven samples recorded guideline exceedances for dissolved concentrations where the corresponding total concentrations were below the LOR. Zinc levels should be closely monitored in upcoming events.

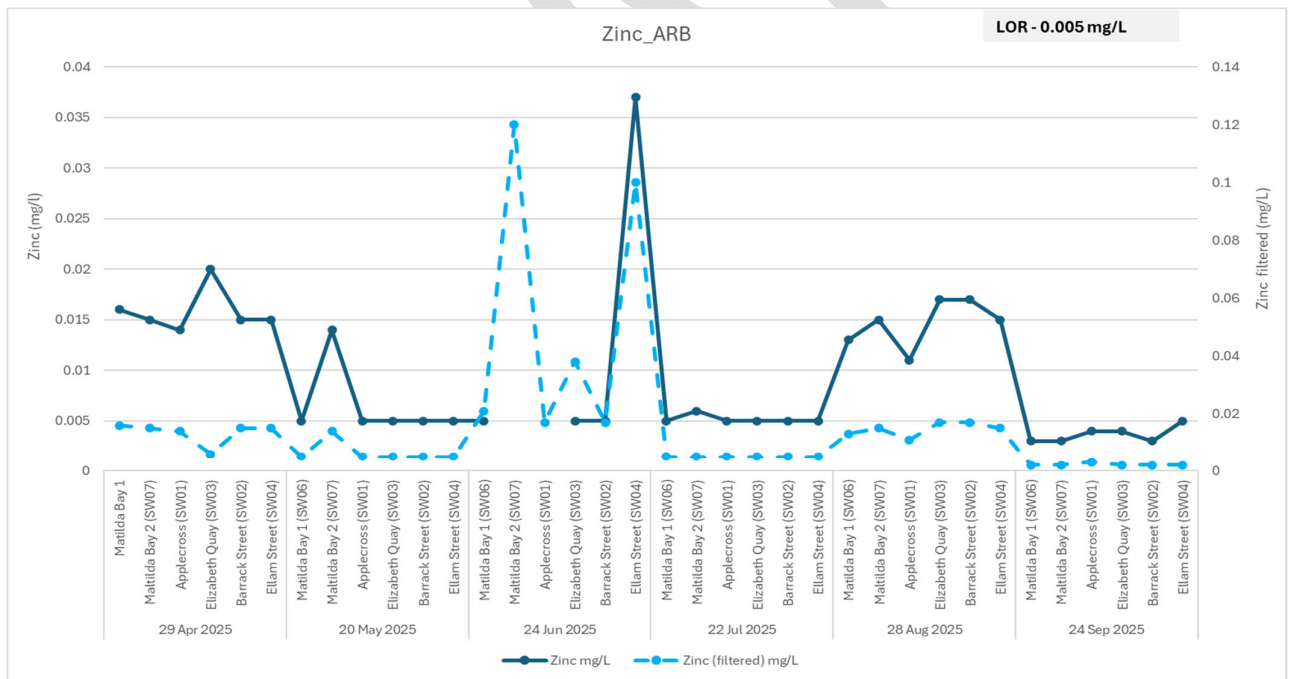
An elevated result of 33mg/L was recorded during the June monitoring event, and this has been excluded from the results table as the result was considered erroneous.

The observed trends for zinc (total and dissolved) are provided in Graph 29 (SUR) and Graph 30 (ARB).

Graph in text 29 Zinc (total and filtered) within surface samples



Graph in text 30 Zinc (total and filtered) within 0.5 m above river bed samples



7.5.11 Organometals

Organometals, specifically dibutyltin, monobutyltin and tributyltin (as Sn) were recorded at concentrations less than the LOR (0.0005 mg/L for dibutyltin and monobutyltin and 2 ng/L for tributyltin (as Sn)). Due to the absence of laboratory detections, the observed trends have not been graphically represented on this occasion.

7.6 Hydrocarbons

7.6.1 TRH and BTEXN

Total Recoverable Hydrocarbons (TRH) and Benzene, Toluene, Ethylbenzene, Xylene and Naphthalene (BTEXN) were reported below the laboratory LOR for all samples analysed. No exceedances of the adopted assessment criteria were recorded for samples collected throughout the monitoring period.

Due to the absence of laboratory detections, the observed trends have not been graphically represented on this occasion.

7.6.2 PAHs

Polycyclic Aromatic Hydrocarbons (PAHs) were reported below the laboratory LOR for all samples analysed (excepting three isolated detections of 2-methylnaphthalene in September 2025) and no results were reported above the adopted assessment criteria, with the exception of anthracene and benzo(a)pyrene in April 2025 where all results were reported below the LOR but the LOR were not sufficiently low to enable comparison with the assessment criteria (i.e., adopted LOR for both analytes were 1 µg/L, compared with criteria of 0.4 µg/L for anthracene and 0.2 µg/L for benzo(a)pyrene). The LOR were lowered for all subsequent monitoring events (0.01 µg/L for May to August 2025 and 0.001 µg/L for September 2025) and all concentrations remained below the LOR for these analytes.

Following a further reduction in LOR (from 0.01 µg/L in May to August 2025 to 0.002 µg/L in September), minor detections (0.003 µg/L, 0.005 µg/L and 0.007 µg/L) of 2-methylnaphthalene were recorded during the September monitoring event for SUR samples collected from Heathcote (SUR), Matilda Bay 2 (SUR), Applecross (respectively). No published assessment criteria were adopted for 2-methylnaphthalene, and the detections are not considered indicative of a deterioration in water quality at these locations compared to earlier monitoring results.

Due to the absence of widespread laboratory detections and guideline exceedances, the observed trends have not been graphically represented on this occasion.

7.6.3 Chlorinated hydrocarbons

Chlorinated hydrocarbons were reported below the laboratory LOR and below the adopted assessment criteria for all samples collected across the monitoring period. Due to the absence of laboratory detections, the observed trends have not been graphically represented on this occasion.

7.7 Semi volatile and volatile organic compounds

Semi volatile and volatile organic compounds were reported below the laboratory LOR and below the adopted assessment criteria for all samples analysed across the monitoring period. Due to the absence of laboratory detections, the observed trends have not been graphically represented on this occasion.

7.8 PCB (total)

Total PCBs were reported below the laboratory LOR (0.00002 mg/L for April to August and 0.000005 mg/L for September and to be adopted going forwards for the project) and below the adopted assessment criteria for all samples collected during the monitoring period. Due to the absence of laboratory detections, the observed trends have not been graphically represented on this occasion.

7.9 Pesticides, herbicides and fungicides

Pesticides, herbicides and fungicides (referred to as organochlorine (OC) pesticides and organophosphate (OP) pesticides) were reported below the laboratory LOR for all samples analysed, with few exceptions (outlined below). With the exception of Endrin, all concentrations of OC/OP pesticides were reported below the adopted assessment criteria. Although no concentrations of Eldrin were detected above the LOR, the LOR adopted for sampling

completed from April to August 2025 (0.01 µg/L) was not sufficiently low to enable comparison with the marine water assessment criterion (0.008 µg/L). The LOR was lowered for the September 2025 sampling event (0.002 µg/L) and sample results continued to report concentrations below the LOR (and below the assessment criterion).

Sporadic, low-level detections of additional OC pesticides (4,4'-DDE, Aldrin, Chlordane, 4,4'-DDD, 4,4'-DDT, Endosulfan I (alpha), Endosulfan II (beta), Endosulfan sulfate, and Oxychlordane) were recorded in samples collected in August 2025 only from Applecross, Barrack St, Elizabeth Quay, and Ellam St. No exceedances of the applied assessment criteria (where available) were recorded.

Due to the absence of laboratory detections, the observed trends have not been graphically represented on this occasion.

7.10 PFAS

Detectable PFAS concentrations were recorded in all samples collected from all monitoring sites across the 6-month monitoring period. The only PFAS constituents for which published ecological marine and freshwater criteria were adopted are Perfluorooctane sulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA). LOR were sufficiently low to enable comparison with these criteria and all PFOA concentrations were recorded below the criteria (19 µg/L). In contrast, all samples reported PFOS concentrations above the criteria (0.00023 µg/L) with concentrations ranging from 0.0042 µg/L (SUR sample collected at Heathcote in May 2025) to 0.023 µg/L (SUR sample collected at Narrows Bridge in July 2025).

Additional PFAS constituents, for which no assessment criteria are applicable, were detected consistently between sample locations and across all or most monitoring events (perfluorohexane sulfonic acid – PFHxS, perfluorohexanoic acid – PFHxA, perfluorobutane sulfonic acid – PFBS, and perfluoropentanoic acid – PFPeA), with other constituents detected more sporadically (perfluoropentane sulfonic acid – PFPeS and perfluorobutanoic acid – PFBA). Total PFAS (sum of all constituents) ranged from 0.0092 µg/L (Heathcote SUR sample collected in May 2025) to 0.055 µg/L (Ellam St ARB sample collected in September 2025).

PFAS concentrations have been variable throughout the monitoring period, with some increase noted in later monitoring events (i.e., June to September 2025) compared to results obtained at the onset of the monitoring program (April and May 2025). This pattern is observable at the reference sites as well as the development envelopes and may reflect seasonal patterns throughout the wider Swan River (possibly due to increased runoff, stormwater, and sediment inputs to the river over the winter period). Further monitoring is considered prudent to understand trends in PFAS concentrations at each of the monitoring sites.

8. Conclusions and recommendations

8.1 Conclusions

The sampling results indicate that while most parameters remained within adopted assessment criteria, several nutrients and metals showed elevated concentrations during specific periods, particularly in the wetter winter months. These exceedances, often linked to seasonal variation and human activity and highlight the importance of ongoing monitoring to detect emerging trends and to assist in the generation of site-specific baseline for the DEs and to inform further assessment or development of Surface Water Management Plan(s) for the future landings.

Nutrient concentrations—including ammonia as N, total oxidised nitrogen (TON), phosphorus, and total Kjeldahl nitrogen (TKN)—showed a marked increase during the August 2025 sampling event across all locations. This rise coincides with a prior rain event, suggesting a potential link to seasonal factors such as increased biological activity, reduced dilution, or stormwater runoff. Elevated nutrient levels were particularly evident at Barrack Street, Elizabeth Quay, and Matilda Bay 2, where anthropogenic influences are likely more pronounced.

The observed exceedances of metal concentrations across several locations and time periods suggest potential environmental stressors that may be linked to both seasonal variation and anthropogenic activities. Elevated levels of metals such as aluminium, copper, zinc, and chromium—especially during warmer months—may be influenced by increased urban runoff or disturbance of sediments due to recreational or construction activities.

Metals such as copper and zinc, which consistently exceeded guideline values, are known to be toxic to aquatic organisms even at low concentrations, affecting fish functions and microbial communities. The presence of filtered metals above guideline thresholds is particularly concerning, as these forms are more bioavailable and can be readily absorbed by aquatic life.

The sporadic exceedances of mercury, nickel, and cadmium highlight the importance of event-based monitoring, especially following rainfall or other environmental disturbances. While some metals remained within acceptable limits, their continued presence in the system warrants precautionary monitoring to detect any emerging trends or cumulative impacts.

8.2 Recommendations

Given the observed exceedances, it is essential to maintain ongoing monitoring and analysis of nutrients, metals, and PFAS across all locations. In contrast, PAHs and OCPs exhibit relatively stable patterns with minimal seasonal variation. The variability observed in key parameters highlights the importance of maintaining a monitoring program to detect emerging risks, support water quality management and protect aquatic ecosystems.

9. References

Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand (ANZECC and ARMCANZ) 2018, Australian and New Zealand Guidelines for Fresh and Marine Water Quality, National Water Quality Management Strategy, Commonwealth of Australia, Canberra.

Department of Water [DoW] 2009, Surface water sampling methods and analysis — technical appendices.

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Heads of EPA Australia and New Zealand (HEPA) 2025, PFAS National Environmental Management Plan, Version 3.0.

National Environment Protection Council (NEPC) 2013, National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1), April 2013.

National Health and Medical Research Council and Natural Resource Management Ministerial Council (NHMRC & NRMMC) 2011, Australian drinking water guidelines, version 3.8 updated September 2022. National Health and Medical Research Council and Natural Resource Management Ministerial Council.

Standards Australia/Standards New Zealand 1998a, Water Quality – Sampling. Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples. Sydney, Wellington: AS/NZS 5667.1:1998.

Standards Australia/Standards New Zealand 1998b, Water Quality – Sampling. Guidance on the Sampling of Rivers and Streams. AS/NZS 5667.6:1998.

Standards Australia/Standards New Zealand 1998c, Water Quality – Sampling. Guidance on the Sampling of Marine Waters. AS/NZS 5667.9:1998.

Appendices

Appendix A

**September calibration certificates for field
profiling**



SBE 19 Plus V2 - 100m (19P-6585) - Salinity, Temperature, DO, pH, Turbidity and Chl a fluorescence sensor check

Client: GHD

Address: 999 Hay Street Perth WA 6000

Job: Perth Transport Authority Project:12658388

Analyst: K. Wienczugow

Date: 23/09/2025

Table 1 Salinity Calibration Check

SBE 19 Plus V2 - 100m	¹ Laboratory Salinity Check Water	² Laboratory SBE 19 Plus Comparison	SBE 19 Plus V2 - 100m	Tolerance ± 0.1 psu	Date Checked / Name
Serial No: 19P-60930-6585	Salinity (psu ± 0.1)	Salinity (psu)	Salinity Reading (psu)	Pass/Fail	
	36.0 ± 0.1	36.042	36.057	Pass	23/09/2025 K.Wienczugow

¹Laboratory salinity check water was prepared by calibrating against IAPSO standard seawater 35.00 psu. ²MAFRL's SBE 19 Plus V2 - 600m CTD was tested as an additional comparative measure.

Table 2 Temperature Calibration Check

SBE 19 Plus V2 - 100m	³ Laboratory Temperature Check	² Laboratory SBE 19 Plus Comparison	SBE 19 Plus V2 - 100m	Tolerance ± 0.1 °C	Date Checked / Name
Serial No: 19P-60930-6585	Temperature (± 0.1 °C)	Temperature (°C)	Temperature Reading (°C)	Pass/Fail	
	20.1 ± 0.1	20.139	20.184	Pass	23/09/2025 K.Wienczugow

³Laboratory temperature check made with a NATA accredited -5.0 to 50.0°C immersion thermometer (Serial number: 0681667). ²MAFRL's SBE 19 Plus V2 - 600m CTD was tested as an additional comparative measure.

Table 3 pH Calibration Check

Model: SBE 18-I	⁴ Laboratory pH Check	SBE 19 Plus V2 - 100m	Tolerance ± 0.1 pH Unit	Date Calibrated / Name
Serial Number: 180797	pH Standard (± 0.01)	pH Reading	Pass/Fail	
	4.00 @ 20°C	4.00	Pass	23/09/2025 K.Wienczugow
	7.02 @ 20°C	7.02	Pass	23/09/2025 K.Wienczugow
	10.06 @ 20°C	10.00	Pass	23/09/2025 K.Wienczugow

⁴pH calibration performed with pH standards according to Sea-Bird Application note 18-1 for pH sensor calibration (Slope = 4.6078, Offset = 2.6194)

Table 4 DO Calibration Check

Model: SBE 43	⁵ Laboratory SBE 19 Comparison	SBE 19 Plus V2 - 100m	Tolerance $\pm 4\%$	Date Checked / Name
Serial Number: 431914	Dissolved Oxygen (%)	Dissolved Oxygen Reading (%)	Pass/Fail	
	102.30	98.45	Pass	23/09/2025 K.Wienczugow

⁵Dissolve Oxygen calibration checked and compared against a cleaned and calibrated SBE 43 DO sensor from MAFRL's SBE 19 Plus V2 - 600m CTD.

Table 5 Turbidity Calibration Check

Model: Turner Designs SCUFA	⁶ Laboratory Turbidity Standard	⁷ SBE 19 Plus V2 - 100m	Tolerance $\pm 5\%$	Date Calibrated / Name
Serial Number: 0033	Turbidity (NTU ± 0.1)	Turbidity Reading (NTU)	Pass/Fail	
	0.0	0.04	Pass	23/09/2025 K.Wienczugow
	5.0	4.94	Pass	23/09/2025 K.Wienczugow
	10.0	9.82	Pass	23/09/2025 K.Wienczugow

⁶Zero NTU standard prepared from 0.2µm filtered deionised distilled water. Freshly prepared primary formazin standard 4000 NTU was diluted for a three point check carried out in a non reflective black plastic bucket.

⁷Average turbidity readings were calculated using Sea Save software taken from Turner Designs SCUFA Flurometer and calibration coefficients were optimised for maximum accuracy within operational range (Range 0-15 NTU) (Scale factor = 3.69, Offset = -0.098).

Signatory:



*Please note this report is not covered by NATA accreditation

Date: 23/09/2025

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SBE 19 Plus V2 - 100m (19P-6585) - Salinity, Temperature, DO, pH, Turbidity and Chl a fluorescence sensor check

Client: GHD

Address: 999 Hay Street Perth WA 6000

Job: Perth Transport Authority Project:12658388

Analyst: K. Wienczugow

Date: 23/09/2025

Table 6 Chlorophyll 'a' - Fluorescence Calibration Check

Model: Turner Designs SCUFA	⁸ Laboratory Zero Standard		⁹ SBE 19 Plus V2 - 100m	Tolerance ±%	Date Checked / Name
Serial Number: 0033			Fluorescence Response (Volts)	Pass/Fail	
	DDI Blank water		0.00	Pass	23/09/2025 K.Wienczugow
	Full response		4.916		

⁸Zero Fluorescence standard prepared from 0.2µm filtered deionised distilled water in black plastic bucket.

⁹Measurements taken with Turner Designs SCUFA Chlorophyll 'a' Fluorescence probe are logged as raw voltage (Range 0-5 Volts) for post processing against field extracted Chlorophyll 'a' samples.

A scale factor = 1.831 has been applied to give approximate Chlorophyll 'a' concentrations equivalent to acetone extracted waters samples.

Signatory:



Date: 23/09/2025

*Please note this report is not covered by NATA accreditation

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Appendix B

**September laboratory certificates and
documentation**



CERTIFICATE OF ANALYSIS

Work Order	: EP2515984	Page	: 1 of 19
Client	: GHD PTY LTD	Laboratory	: Environmental Division Perth
Contact	: MS LOUISE COCKERTON	Contact	: Angel Tam
Address	: 999 HAY STREET PERTH WA, AUSTRALIA 6000	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: +61 08 6222 8222	Telephone	: +61-8-9406 1301
Project	: 12658388	Date Samples Received	: 25-Sep-2025 13:30
Order number	: 12658388	Date Analysis Commenced	: 01-Oct-2025
C-O-C number	: ----	Issue Date	: 10-Oct-2025 11:05
Sampler	: Solene Lao		
Site	: Swan River Ferry Expansion: Swan River Monitoring		
Quote number	: EP25GHDSE0041_V4		
No. of samples received	: 21		
No. of samples analysed	: 21		



Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Alex Rossi	Organic Chemist	Sydney Organics, Smithfield, NSW
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Edwandy Fadjjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA
John Horwood	Organic Supervisor	Perth Organics, Wangara, WA
Kirsty Watson	Senior Chemist - Organics	Brisbane Organics, Stafford, QLD



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP234-LL: Poor matrix spike recovery for Chlorpyrifos due to matrix interferences.
- EG093: Samples containing high levels of sulfate may precipitate barium under the acidic conditions of this method and may therefore bias results low.



Analytical Results

Sub-Matrix: WATER
 (Matrix: WATER)

Sample ID

				GHD-Applecross-2025 09-GR-SUR	GHD-Applecross-2025 09-GR-ARB	GHD-Barrack-202509- GR-SUR	GHD-Barrack-202509- GR-ARB	GHD-ElizQuay-202509- GR-SUR
Sampling date / time				24-Sep-2025 00:00	24-Sep-2025 00:00	24-Sep-2025 00:00	24-Sep-2025 00:00	24-Sep-2025 00:00
Compound	CAS Number	LOR	Unit	EP2515984-001	EP2515984-002	EP2515984-003	EP2515984-004	EP2515984-005
				Result	Result	Result	Result	Result
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.00004	mg/L	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004
EG035T: Total Mercury by FIMS								
Mercury	7439-97-6	0.00004	mg/L	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004
EP131A: Organochlorine Pesticides								
Aldrin	309-00-2	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
alpha-BHC	319-84-6	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
beta-BHC	319-85-7	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
delta-BHC	319-86-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
4,4'-DDD	72-54-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
4,4'-DDE	72-55-9	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
4,4'-DDT	50-29-3	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Dieldrin	60-57-1	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
alpha-Endosulfan	959-98-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
beta-Endosulfan	33213-65-9	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Endosulfan sulfate	1031-07-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
^ Sum of alpha- and beta-Endosulfan	115-29-7	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Endrin	72-20-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Endrin aldehyde	7421-93-4	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Endrin ketone	53494-70-5	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Heptachlor	76-44-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Heptachlor epoxide	1024-57-3	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Hexachlorobenzene (HCB)	118-74-1	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
gamma-BHC (Lindane)	58-89-9	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Methoxychlor	72-43-5	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
cis-Chlordane	5103-71-9	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
trans-Chlordane	5103-74-2	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001



Analytical Results

Sub-Matrix: WATER
 (Matrix: WATER)

Sample ID

				GHD-Applecross-2025 09-GR-SUR	GHD-Applecross-2025 09-GR-ARB	GHD-Barrack-202509- GR-SUR	GHD-Barrack-202509- GR-ARB	GHD-ElizQuay-202509- GR-SUR
Sampling date / time				24-Sep-2025 00:00	24-Sep-2025 00:00	24-Sep-2025 00:00	24-Sep-2025 00:00	24-Sep-2025 00:00
Compound	CAS Number	LOR	Unit	EP2515984-001	EP2515984-002	EP2515984-003	EP2515984-004	EP2515984-005
				Result	Result	Result	Result	Result
EP131A: Organochlorine Pesticides - Continued								
^ Sum of cis- and trans-Chlordane	57-74-9	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Oxychlordane	27304-13-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/5 0-2	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
EP131B: Polychlorinated Biphenyls (as Aroclors)								
Total Polychlorinated biphenyls	----	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Aroclor 1016	12674-11-2	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Aroclor 1221	11104-28-2	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Aroclor 1232	11141-16-5	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Aroclor 1242	53469-21-9	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Aroclor 1248	12672-29-6	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Aroclor 1254	11097-69-1	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Aroclor 1260	11096-82-5	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.004	µg/L	<0.004	<0.004	<0.004	<0.004	<0.004
2-Methylnaphthalene	91-57-6	0.002	µg/L	0.007	<0.002	<0.002	<0.002	<0.002
Acenaphthylene	208-96-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Acenaphthene	83-32-9	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Fluorene	86-73-7	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Phenanthrene	85-01-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Anthracene	120-12-7	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Fluoranthene	206-44-0	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Pyrene	129-00-0	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Benz(a)anthracene	56-55-3	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Chrysene	218-01-9	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
7.12-Dimethylbenz(a)anthracene	57-97-6	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001



Analytical Results

Sub-Matrix: WATER
 (Matrix: WATER)

Sample ID

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	GHD-Applecross-2025 09-GR-SUR	GHD-Applecross-2025 09-GR-ARB	GHD-Barrack-202509- GR-SUR	GHD-Barrack-202509- GR-ARB	GHD-ElizQuay-202509- GR-SUR
Sampling date / time				24-Sep-2025 00:00	24-Sep-2025 00:00	24-Sep-2025 00:00	24-Sep-2025 00:00	24-Sep-2025 00:00	
Compound	CAS Number	LOR	Unit	EP2515984-001	EP2515984-002	EP2515984-003	EP2515984-004	EP2515984-005	
				Result	Result	Result	Result	Result	
EP132B: Polynuclear Aromatic Hydrocarbons - Continued									
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.004	µg/L	<0.004	<0.004	<0.004	<0.004	<0.004	
Benzo(k)fluoranthene	207-08-9	0.004	µg/L	<0.004	<0.004	<0.004	<0.004	<0.004	
Benzo(e)pyrene	192-97-2	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Benzo(a)pyrene	50-32-8	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Perylene	198-55-0	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002	
3-Methylcholanthrene	56-49-5	0.004	µg/L	<0.004	<0.004	<0.004	<0.004	<0.004	
Indeno(1.2.3.cd)pyrene	193-39-5	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002	
Dibenz(a.h)anthracene	53-70-3	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Benzo(g.h.i)perylene	191-24-2	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002	
Coronene	191-07-1	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002	
^ Sum of 16 US EPA Priority PAHs	----	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
^ Benzo(a)pyrene TEQ (zero)	----	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
^ Benzo(a)pyrene TEQ (half LOR)	----	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
^ Benzo(a)pyrene TEQ (LOR)	----	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
EP132B: Polynuclear Aromatic Hydrocarbons (super trace)									
^ Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	0.004	µg/L	<0.004	<0.004	<0.004	<0.004	<0.004	
EP234A: OP Pesticides									
Chlorpyrifos	2921-88-2	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
EP131S: OC Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.002	%	130	112	112	114	117	
EP131T: PCB Surrogate									
Decachlorobiphenyl	2051-24-3	0.010	%	93.3	133	147	144	131	
EP132T: Base/Neutral Extractable Surrogates									
2-Fluorobiphenyl	321-60-8	0.002	%	94.8	100.0	102	97.8	102	
Anthracene-d10	1719-06-8	0.002	%	102	104	112	111	103	
4-Terphenyl-d14	1718-51-0	0.002	%	108	113	123	115	110	



Analytical Results

Sub-Matrix: WATER
 (Matrix: WATER)

Sample ID

				GHD-ElizQuay-202509-GR-ARB	GHD-Elam-202509-GR-SUR	GHD-Elam-202509-GR-ARB	GHD-MatBay1-202509-GR-SUR	GHD-MatBay1-202509-GR-ARB
Sampling date / time				24-Sep-2025 00:00	24-Sep-2025 00:00	24-Sep-2025 00:00	24-Sep-2025 00:00	24-Sep-2025 00:00
Compound	CAS Number	LOR	Unit	EP2515984-006	EP2515984-007	EP2515984-008	EP2515984-009	EP2515984-010
				Result	Result	Result	Result	Result
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.00004	mg/L	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004
EG035T: Total Mercury by FIMS								
Mercury	7439-97-6	0.00004	mg/L	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004
EP131A: Organochlorine Pesticides								
Aldrin	309-00-2	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
alpha-BHC	319-84-6	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
beta-BHC	319-85-7	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
delta-BHC	319-86-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
4,4'-DDD	72-54-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
4,4'-DDE	72-55-9	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
4,4'-DDT	50-29-3	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Dieldrin	60-57-1	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
alpha-Endosulfan	959-98-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
beta-Endosulfan	33213-65-9	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Endosulfan sulfate	1031-07-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
^ Sum of alpha- and beta-Endosulfan	115-29-7	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Endrin	72-20-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Endrin aldehyde	7421-93-4	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Endrin ketone	53494-70-5	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Heptachlor	76-44-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Heptachlor epoxide	1024-57-3	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Hexachlorobenzene (HCB)	118-74-1	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
gamma-BHC (Lindane)	58-89-9	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Methoxychlor	72-43-5	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
cis-Chlordane	5103-71-9	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
trans-Chlordane	5103-74-2	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001



Analytical Results

Sub-Matrix: WATER
 (Matrix: WATER)

Sample ID

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	GHD-ElizQuay-202509-GR-ARB	GHD-Ellam-202509-GR-SUR	GHD-Ellam-202509-GR-ARB	GHD-MatBay1-202509-GR-SUR	GHD-MatBay1-202509-GR-ARB
Sampling date / time					24-Sep-2025 00:00	24-Sep-2025 00:00	24-Sep-2025 00:00	24-Sep-2025 00:00	24-Sep-2025 00:00
Compound	CAS Number	LOR	Unit	EP2515984-006	EP2515984-007	EP2515984-008	EP2515984-009	EP2515984-010	
				Result	Result	Result	Result	Result	
EP131A: Organochlorine Pesticides - Continued									
^ Sum of cis- and trans-Chlordane	57-74-9	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Oxychlordane	27304-13-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002	
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002	
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002	
EP131B: Polychlorinated Biphenyls (as Aroclors)									
Total Polychlorinated biphenyls	----	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	
Aroclor 1016	12674-11-2	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	
Aroclor 1221	11104-28-2	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	
Aroclor 1232	11141-16-5	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	
Aroclor 1242	53469-21-9	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	
Aroclor 1248	12672-29-6	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	
Aroclor 1254	11097-69-1	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	
Aroclor 1260	11096-82-5	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	
EP132B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.004	µg/L	<0.004	<0.004	<0.004	<0.004	<0.004	
2-Methylnaphthalene	91-57-6	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002	
Acenaphthylene	208-96-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002	
Acenaphthene	83-32-9	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002	
Fluorene	86-73-7	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002	
Phenanthrene	85-01-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002	
Anthracene	120-12-7	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Fluoranthene	206-44-0	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Pyrene	129-00-0	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Benz(a)anthracene	56-55-3	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002	
Chrysene	218-01-9	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
7.12-Dimethylbenz(a)anthracene	57-97-6	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001	



Analytical Results

Sub-Matrix: WATER
 (Matrix: WATER)

Sample ID

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	GHD-ElizQuay-202509-GR-ARB	GHD-Ellam-202509-GR-SUR	GHD-Ellam-202509-GR-ARB	GHD-MatBay1-202509-GR-SUR	GHD-MatBay1-202509-GR-ARB
Sampling date / time				24-Sep-2025 00:00	24-Sep-2025 00:00	24-Sep-2025 00:00	24-Sep-2025 00:00	24-Sep-2025 00:00	
Compound	CAS Number	LOR	Unit	EP2515984-006	EP2515984-007	EP2515984-008	EP2515984-009	EP2515984-010	
				Result	Result	Result	Result	Result	
EP132B: Polynuclear Aromatic Hydrocarbons - Continued									
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.004	µg/L	<0.004	<0.004	<0.004	<0.004	<0.004	
Benzo(k)fluoranthene	207-08-9	0.004	µg/L	<0.004	<0.004	<0.004	<0.004	<0.004	
Benzo(e)pyrene	192-97-2	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Benzo(a)pyrene	50-32-8	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Perylene	198-55-0	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002	
3-Methylcholanthrene	56-49-5	0.004	µg/L	<0.004	<0.004	<0.004	<0.004	<0.004	
Indeno(1.2.3.cd)pyrene	193-39-5	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002	
Dibenz(a.h)anthracene	53-70-3	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Benzo(g.h.i)perylene	191-24-2	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002	
Coronene	191-07-1	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002	
^ Sum of 16 US EPA Priority PAHs	----	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
^ Benzo(a)pyrene TEQ (zero)	----	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
^ Benzo(a)pyrene TEQ (half LOR)	----	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
^ Benzo(a)pyrene TEQ (LOR)	----	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
EP132B: Polynuclear Aromatic Hydrocarbons (super trace)									
^ Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	0.004	µg/L	<0.004	<0.004	<0.004	<0.004	<0.004	
EP234A: OP Pesticides									
Chlorpyrifos	2921-88-2	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
EP131S: OC Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.002	%	124	109	115	121	115	
EP131T: PCB Surrogate									
Decachlorobiphenyl	2051-24-3	0.010	%	142	91.1	133	138	140	
EP132T: Base/Neutral Extractable Surrogates									
2-Fluorobiphenyl	321-60-8	0.002	%	101	106	108	105	114	
Anthracene-d10	1719-06-8	0.002	%	107	92.4	112	104	109	
4-Terphenyl-d14	1718-51-0	0.002	%	109	74.8	120	122	116	



Analytical Results

Sub-Matrix: WATER
 (Matrix: WATER)

Sample ID

				GHD-MatBay2-202509-GR-SUR	GHD-MatBay2-202509-GR-ARB	GHD-6161869-Heathco te-SUR	GHD-6164602-MatCent ral-SUR	GHD-6160262-Nar-SU R
Sampling date / time				24-Sep-2025 00:00	24-Sep-2025 00:00	24-Sep-2025 00:00	24-Sep-2025 00:00	24-Sep-2025 00:00
Compound	CAS Number	LOR	Unit	EP2515984-011	EP2515984-012	EP2515984-013	EP2515984-014	EP2515984-015
				Result	Result	Result	Result	Result
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.00004	mg/L	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004
EG035T: Total Mercury by FIMS								
Mercury	7439-97-6	0.00004	mg/L	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004
EP131A: Organochlorine Pesticides								
Aldrin	309-00-2	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
alpha-BHC	319-84-6	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
beta-BHC	319-85-7	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
delta-BHC	319-86-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
4,4'-DDD	72-54-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
4,4'-DDE	72-55-9	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
4,4'-DDT	50-29-3	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Dieldrin	60-57-1	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
alpha-Endosulfan	959-98-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
beta-Endosulfan	33213-65-9	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Endosulfan sulfate	1031-07-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
^ Sum of alpha- and beta-Endosulfan	115-29-7	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Endrin	72-20-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Endrin aldehyde	7421-93-4	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Endrin ketone	53494-70-5	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Heptachlor	76-44-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Heptachlor epoxide	1024-57-3	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Hexachlorobenzene (HCB)	118-74-1	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
gamma-BHC (Lindane)	58-89-9	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Methoxychlor	72-43-5	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
cis-Chlordane	5103-71-9	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
trans-Chlordane	5103-74-2	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001



Analytical Results

Sub-Matrix: WATER
 (Matrix: WATER)

Sample ID

				GHD-MatBay2-202509-GR-SUR	GHD-MatBay2-202509-GR-ARB	GHD-6161869-Heathco te-SUR	GHD-6164602-MatCent ral-SUR	GHD-6160262-Nar-SU R
Sampling date / time				24-Sep-2025 00:00	24-Sep-2025 00:00	24-Sep-2025 00:00	24-Sep-2025 00:00	24-Sep-2025 00:00
Compound	CAS Number	LOR	Unit	EP2515984-011	EP2515984-012	EP2515984-013	EP2515984-014	EP2515984-015
				Result	Result	Result	Result	Result
EP131A: Organochlorine Pesticides - Continued								
^ Sum of cis- and trans-Chlordane	57-74-9	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Oxychlordane	27304-13-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
EP131B: Polychlorinated Biphenyls (as Aroclors)								
Total Polychlorinated biphenyls	----	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Aroclor 1016	12674-11-2	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Aroclor 1221	11104-28-2	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Aroclor 1232	11141-16-5	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Aroclor 1242	53469-21-9	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Aroclor 1248	12672-29-6	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Aroclor 1254	11097-69-1	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Aroclor 1260	11096-82-5	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.004	µg/L	<0.004	<0.004	<0.004	<0.004	<0.004
2-Methylnaphthalene	91-57-6	0.002	µg/L	0.005	<0.002	0.003	<0.002	<0.002
Acenaphthylene	208-96-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Acenaphthene	83-32-9	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Fluorene	86-73-7	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Phenanthrene	85-01-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Anthracene	120-12-7	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Fluoranthene	206-44-0	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Pyrene	129-00-0	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Benz(a)anthracene	56-55-3	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Chrysene	218-01-9	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
7.12-Dimethylbenz(a)anthracene	57-97-6	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001



Analytical Results

Sub-Matrix: WATER
 (Matrix: WATER)

Sample ID

				GHD-MatBay2-202509-GR-SUR	GHD-MatBay2-202509-GR-ARB	GHD-6161869-Heathco te-SUR	GHD-6164602-MatCent ral-SUR	GHD-6160262-Nar-SU R
Sampling date / time				24-Sep-2025 00:00	24-Sep-2025 00:00	24-Sep-2025 00:00	24-Sep-2025 00:00	24-Sep-2025 00:00
Compound	CAS Number	LOR	Unit	EP2515984-011	EP2515984-012	EP2515984-013	EP2515984-014	EP2515984-015
				Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.004	µg/L	<0.004	<0.004	<0.004	<0.004	<0.004
Benzo(k)fluoranthene	207-08-9	0.004	µg/L	<0.004	<0.004	<0.004	<0.004	<0.004
Benzo(e)pyrene	192-97-2	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Benzo(a)pyrene	50-32-8	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Perylene	198-55-0	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
3-Methylcholanthrene	56-49-5	0.004	µg/L	<0.004	<0.004	<0.004	<0.004	<0.004
Indeno(1.2.3.cd)pyrene	193-39-5	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Dibenz(a.h)anthracene	53-70-3	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Benzo(g.h.i)perylene	191-24-2	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Coronene	191-07-1	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
^ Sum of 16 US EPA Priority PAHs	----	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
^ Benzo(a)pyrene TEQ (zero)	----	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
^ Benzo(a)pyrene TEQ (half LOR)	----	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
^ Benzo(a)pyrene TEQ (LOR)	----	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
EP132B: Polynuclear Aromatic Hydrocarbons (super trace)								
^ Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	0.004	µg/L	<0.004	<0.004	<0.004	<0.004	<0.004
EP234A: OP Pesticides								
Chlorpyrifos	2921-88-2	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
EP131S: OC Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.002	%	120	126	134	101	105
EP131T: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.010	%	91.1	144	88.9	120	153
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	0.002	%	114	116	116	97.6	106
Anthracene-d10	1719-06-8	0.002	%	119	112	123	124	113
4-Terphenyl-d14	1718-51-0	0.002	%	115	119	120	112	111



Analytical Results

Sub-Matrix: WATER
 (Matrix: WATER)

Sample ID

				GHD-CanBridge-20250 9-GR-SUR	GHD-CanBridge-20250 9-GR-ARB	GHD-QC01	GHD-QC02	GHD-QC03
Sampling date / time				24-Sep-2025 00:00	24-Sep-2025 00:00	24-Sep-2025 00:00	24-Sep-2025 00:00	24-Sep-2025 00:00
Compound	CAS Number	LOR	Unit	EP2515984-016	EP2515984-017	EP2515984-018	EP2515984-019	EP2515984-020
				Result	Result	Result	Result	Result
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.00004	mg/L	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004
EG035T: Total Mercury by FIMS								
Mercury	7439-97-6	0.00004	mg/L	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004
EP131A: Organochlorine Pesticides								
Aldrin	309-00-2	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
alpha-BHC	319-84-6	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
beta-BHC	319-85-7	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
delta-BHC	319-86-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
4,4'-DDD	72-54-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
4,4'-DDE	72-55-9	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
4,4'-DDT	50-29-3	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Dieldrin	60-57-1	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
alpha-Endosulfan	959-98-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
beta-Endosulfan	33213-65-9	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Endosulfan sulfate	1031-07-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
[^] Sum of alpha- and beta-Endosulfan	115-29-7	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Endrin	72-20-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Endrin aldehyde	7421-93-4	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Endrin ketone	53494-70-5	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Heptachlor	76-44-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Heptachlor epoxide	1024-57-3	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Hexachlorobenzene (HCB)	118-74-1	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
gamma-BHC (Lindane)	58-89-9	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Methoxychlor	72-43-5	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
cis-Chlordane	5103-71-9	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
trans-Chlordane	5103-74-2	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001



Analytical Results

Sub-Matrix: WATER
 (Matrix: WATER)

Sample ID

				GHD-CanBridge-20250 9-GR-SUR	GHD-CanBridge-20250 9-GR-ARB	GHD-QC01	GHD-QC02	GHD-QC03
Sampling date / time				24-Sep-2025 00:00	24-Sep-2025 00:00	24-Sep-2025 00:00	24-Sep-2025 00:00	24-Sep-2025 00:00
Compound	CAS Number	LOR	Unit	EP2515984-016	EP2515984-017	EP2515984-018	EP2515984-019	EP2515984-020
				Result	Result	Result	Result	Result
EP131A: Organochlorine Pesticides - Continued								
^ Sum of cis- and trans-Chlordane	57-74-9	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Oxychlordane	27304-13-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/5 0-2	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
EP131B: Polychlorinated Biphenyls (as Aroclors)								
Total Polychlorinated biphenyls	----	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Aroclor 1016	12674-11-2	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Aroclor 1221	11104-28-2	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Aroclor 1232	11141-16-5	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Aroclor 1242	53469-21-9	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Aroclor 1248	12672-29-6	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Aroclor 1254	11097-69-1	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Aroclor 1260	11096-82-5	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.004	µg/L	<0.004	<0.004	<0.004	<0.004	<0.004
2-Methylnaphthalene	91-57-6	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Acenaphthylene	208-96-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Acenaphthene	83-32-9	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Fluorene	86-73-7	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Phenanthrene	85-01-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Anthracene	120-12-7	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Fluoranthene	206-44-0	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Pyrene	129-00-0	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Benz(a)anthracene	56-55-3	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Chrysene	218-01-9	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
7.12-Dimethylbenz(a)anthracene	57-97-6	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001



Analytical Results

Sub-Matrix: WATER
 (Matrix: WATER)

Sample ID

				GHD-CanBridge-20250 9-GR-SUR	GHD-CanBridge-20250 9-GR-ARB	GHD-QC01	GHD-QC02	GHD-QC03
Sampling date / time				24-Sep-2025 00:00	24-Sep-2025 00:00	24-Sep-2025 00:00	24-Sep-2025 00:00	24-Sep-2025 00:00
Compound	CAS Number	LOR	Unit	EP2515984-016	EP2515984-017	EP2515984-018	EP2515984-019	EP2515984-020
				Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.004	µg/L	<0.004	<0.004	<0.004	<0.004	<0.004
Benzo(k)fluoranthene	207-08-9	0.004	µg/L	<0.004	<0.004	<0.004	<0.004	<0.004
Benzo(e)pyrene	192-97-2	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Benzo(a)pyrene	50-32-8	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Perylene	198-55-0	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
3-Methylcholanthrene	56-49-5	0.004	µg/L	<0.004	<0.004	<0.004	<0.004	<0.004
Indeno(1.2.3.cd)pyrene	193-39-5	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Dibenz(a.h)anthracene	53-70-3	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Benzo(g.h.i)perylene	191-24-2	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Coronene	191-07-1	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
^ Sum of 16 US EPA Priority PAHs	----	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
^ Benzo(a)pyrene TEQ (zero)	----	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
^ Benzo(a)pyrene TEQ (half LOR)	----	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
^ Benzo(a)pyrene TEQ (LOR)	----	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
EP132B: Polynuclear Aromatic Hydrocarbons (super trace)								
^ Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	0.004	µg/L	<0.004	<0.004	<0.004	<0.004	<0.004
EP234A: OP Pesticides								
Chlorpyrifos	2921-88-2	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
EP131S: OC Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.002	%	96.1	120	110	105	82.0
EP131T: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.010	%	149	138	149	133	104
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	0.002	%	103	95.3	100	85.3	98.8
Anthracene-d10	1719-06-8	0.002	%	118	123	119	112	119
4-Terphenyl-d14	1718-51-0	0.002	%	110	117	119	100	111



Analytical Results

Sub-Matrix: WATER
 (Matrix: WATER)

Sample ID

				GHD-QC06	----	----	----	----
Sampling date / time				24-Sep-2025 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EP2515984-021	-----	-----	-----	-----
				Result	----	----	----	----
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS								
Aluminium	7429-90-5	5	µg/L	<5	----	----	----	----
Arsenic	7440-38-2	0.5	µg/L	1.3	----	----	----	----
Chromium	7440-47-3	0.5	µg/L	<0.5	----	----	----	----
Copper	7440-50-8	0.2	µg/L	1.4	----	----	----	----
Cobalt	7440-48-4	0.05	µg/L	0.20	----	----	----	----
Iron	7439-89-6	5	µg/L	24	----	----	----	----
Lead	7439-92-1	0.2	µg/L	<0.2	----	----	----	----
Manganese	7439-96-5	0.5	µg/L	94.1	----	----	----	----
Nickel	7440-02-0	0.5	µg/L	0.8	----	----	----	----
Selenium	7782-49-2	2	µg/L	<2	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	<20	----	----	----	----
C10 - C14 Fraction	----	50	µg/L	<50	----	----	----	----
C15 - C28 Fraction	----	100	µg/L	<100	----	----	----	----
C29 - C36 Fraction	----	50	µg/L	<50	----	----	----	----
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	20	µg/L	<20	----	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	----	----	----	----
>C10 - C16 Fraction	----	100	µg/L	<100	----	----	----	----
>C16 - C34 Fraction	----	100	µg/L	<100	----	----	----	----
>C34 - C40 Fraction	----	100	µg/L	<100	----	----	----	----
^ >C10 - C40 Fraction (sum)	----	100	µg/L	<100	----	----	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L	<100	----	----	----	----
EP080: BTEXN								
Benzene	71-43-2	1	µg/L	<1	----	----	----	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	GHD-QC06	----	----	----	----
Sampling date / time					24-Sep-2025 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EP2515984-021	-----	-----	-----	-----
					Result	----	----	----	----
EP080: BTEXN - Continued									
Toluene	108-88-3	2	µg/L		<2	----	----	----	----
Ethylbenzene	100-41-4	2	µg/L		<2	----	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	----	----	----	----
ortho-Xylene	95-47-6	2	µg/L		<2	----	----	----	----
^ Total Xylenes	-----	2	µg/L		<2	----	----	----	----
^ Sum of BTEX	-----	1	µg/L		<1	----	----	----	----
Naphthalene	91-20-3	5	µg/L		<5	----	----	----	----
EP090: Organotin Compounds (Soluble)									
Tributyltin	56573-85-4	2	ngSn/L		<2	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0005	µg/L		<0.0005	----	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0005	µg/L		<0.0005	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0005	µg/L		0.0022	----	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0005	µg/L		<0.0005	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	µg/L		0.0042	----	----	----	----
Perfluorononane sulfonic acid (PFNS)	68259-12-1	0.0005	µg/L		<0.0005	----	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0005	µg/L		<0.0005	----	----	----	----
Perfluoropropane sulfonic acid (PFPrS)	423-41-6	0.0020	µg/L		<0.0020	----	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.0020	µg/L		<0.0020	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0005	µg/L		<0.0005	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0005	µg/L		0.0011	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0005	µg/L		0.0014	----	----	----	----



Analytical Results

Sub-Matrix: WATER
 (Matrix: WATER)

Sample ID

				GHD-QC06	----	----	----	----
Sampling date / time				24-Sep-2025 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EP2515984-021	-----	-----	-----	-----
				Result	----	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids - Continued								
Perfluorooctanoic acid (PFOA)	335-67-1	0.0005	µg/L	0.0008	----	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.0005	µg/L	<0.0005	----	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.0005	µg/L	<0.0005	----	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0005	µg/L	<0.0005	----	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0005	µg/L	<0.0005	----	----	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0005	µg/L	<0.0005	----	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	µg/L	<0.0005	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0005	µg/L	<0.0005	----	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.001	µg/L	<0.001	----	----	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.001	µg/L	<0.001	----	----	----	----
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.001	µg/L	<0.001	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.001	µg/L	<0.001	----	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0005	µg/L	<0.0005	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0005	µg/L	<0.0005	----	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.001	µg/L	<0.001	----	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.001	µg/L	<0.001	----	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.001	µg/L	<0.001	----	----	----	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	GHD-QC06	----	----	----	----
Sampling date / time					24-Sep-2025 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EP2515984-021	-----	-----	-----	-----
					Result	----	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids - Continued									
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.001	µg/L		<0.001	----	----	----	----
EP231P: PFAS Sums									
^ Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	µg/L		0.0064	----	----	----	----
^ Sum of PFAS (WA DER List)	----	0.0002	µg/L		0.0097	----	----	----	----
^ Sum of PFAS	----	0.0002	µg/L		0.0097	----	----	----	----
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	2	%		117	----	----	----	----
Toluene-D8	2037-26-5	2	%		95.2	----	----	----	----
4-Bromofluorobenzene	460-00-4	2	%		90.3	----	----	----	----
EP090S: Organotin Surrogate									
Tripropylin	----	5	%		86.4	----	----	----	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0005	%		123	----	----	----	----
13C8-PFOA	----	0.0005	%		111	----	----	----	----



Surrogate Control Limits

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP080S: TPH(V)/BTEX Surrogates			
1,2-Dichloroethane-D4	17060-07-0	61	141
Toluene-D8	2037-26-5	73	126
4-Bromofluorobenzene	460-00-4	60	125
EP090S: Organotin Surrogate			
Tripropyltin	----	24	116
EP131S: OC Pesticide Surrogate			
Dibromo-DDE	21655-73-2	41	136
EP131T: PCB Surrogate			
Decachlorobiphenyl	2051-24-3	10	164
EP132T: Base/Neutral Extractable Surrogates			
2-Fluorobiphenyl	321-60-8	70	130
Anthracene-d10	1719-06-8	70	130
4-Terphenyl-d14	1718-51-0	70	130
EP231S: PFAS Surrogate			
13C4-PFOS	----	65	140
13C8-PFOA	----	71	133

Inter-Laboratory Testing

Analysis conducted by ALS Brisbane, NATA accreditation no. 825, site no. 818 (Chemistry / Biology).

(WATER) EP090: Organotin Compounds (Soluble)

(WATER) EP090S: Organotin Surrogate

Analysis conducted by ALS Sydney, NATA accreditation no. 825, site no. 10911 (Chemistry / Biology).

(WATER) EP131A: Organochlorine Pesticides

(WATER) EP131S: OC Pesticide Surrogate

(WATER) EP132B: Polynuclear Aromatic Hydrocarbons

(WATER) EP132B: Polynuclear Aromatic Hydrocarbons (super trace)

(WATER) EP132T: Base/Neutral Extractable Surrogates

(WATER) EP131B: Polychlorinated Biphenyls (as Aroclors)

(WATER) EP131T: PCB Surrogate

(WATER) EP234A: OP Pesticides



QUALITY CONTROL REPORT

Work Order	: EP2515984	Page	: 1 of 15
Client	: GHD PTY LTD	Laboratory	: Environmental Division Perth
Contact	: MS LOUISE COCKERTON	Contact	: Angel Tam
Address	: 999 HAY STREET PERTH WA, AUSTRALIA 6000	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: +61 08 6222 8222	Telephone	: +61-8-9406 1301
Project	: 12658388	Date Samples Received	: 25-Sep-2025
Order number	: 12658388	Date Analysis Commenced	: 01-Oct-2025
C-O-C number	: ----	Issue Date	: 10-Oct-2025
Sampler	: Solene Lao		
Site	: Swan River Ferry Expansion: Swan River Monitoring		
Quote number	: EP25GHDSE0041_V4		
No. of samples received	: 21		
No. of samples analysed	: 21		



Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Alex Rossi	Organic Chemist	Sydney Organics, Smithfield, NSW
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Edwandy Fadjjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA
John Horwood	Organic Supervisor	Perth Organics, Wangara, WA
Kirsty Watson	Senior Chemist - Organics	Brisbane Organics, Stafford, QLD



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot

CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

RPD = Relative Percentage Difference

= Indicates failed QC

* = The final LOR has been raised due to dilution or other sample specific cause; adjusted LOR is shown in brackets. The duplicate ranges for Acceptable RPD% are applied to the final LOR where applicable.

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG035F: Dissolved Mercury by FIMS (QC Lot: 6911887)									
EP2515984-003	GHD-Barrack-202509-GR-SUR	EG035F-LL: Mercury	7439-97-6	0.00004	mg/L	<0.00004	<0.00004	0.0	No Limit
EP2515984-012	GHD-MatBay2-202509-GR-ARB	EG035F-LL: Mercury	7439-97-6	0.00004	mg/L	<0.00004	<0.00004	0.0	No Limit
EG035T: Total Mercury by FIMS (QC Lot: 6911838)									
EP2515984-001	GHD-Applecross-202509-GR-SUR	EG035T-LL: Mercury	7439-97-6	0.00004	mg/L	<0.00004	<0.00004	0.0	No Limit
EP2515984-011	GHD-MatBay2-202509-GR-SUR	EG035T-LL: Mercury	7439-97-6	0.00004	mg/L	<0.00004	<0.00004	0.0	No Limit
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QC Lot: 6903604)									
EP2515950-001	Anonymous	EG093A-F: Lead	7439-92-1	0.2	µg/L	<0.2	<0.2	0.0	No Limit
		EG093A-F: Arsenic	7440-38-2	0.5	µg/L	0.6	0.5	0.0	No Limit
		EG093A-F: Chromium	7440-47-3	0.5	µg/L	0.0365 mg/L	36.8	0.9	0% - 20%
		EG093A-F: Manganese	7439-96-5	0.5	µg/L	5.6	6.0	6.4	0% - 50%
		EG093A-F: Nickel	7440-02-0	0.5	µg/L	12.2	12.4	1.5	0% - 20%
		EG093A-F: Aluminium	7429-90-5	5	µg/L	<5	<5	0.0	No Limit
EP2515984-021	GHD-QC06	EG093A-F: Lead	7439-92-1	0.2	µg/L	<0.2	<0.2	0.0	No Limit
		EG093A-F: Arsenic	7440-38-2	0.5	µg/L	1.3	1.2	8.2	No Limit
		EG093A-F: Chromium	7440-47-3	0.5	µg/L	<0.5	<0.5	0.0	No Limit
		EG093A-F: Manganese	7439-96-5	0.5	µg/L	94.1	95.6	1.6	0% - 20%
		EG093A-F: Nickel	7440-02-0	0.5	µg/L	0.8	0.6	25.6	No Limit

Page : 3 of 15
 Work Order : EP2515984
 Client : GHD PTY LTD
 Project : 12658388



Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QC Lot: 6903604) - continued									
EP2515984-021	GHD-QC06	EG093A-F: Aluminium	7429-90-5	5	µg/L	<5	<5	0.0	No Limit
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QC Lot: 6903605)									
EP2515950-001	Anonymous	EG093B-F: Selenium	7782-49-2	2	µg/L	0.014 mg/L	15	0.0	No Limit
		EG093B-F: Iron	7439-89-6	5	µg/L	<5	<5	0.0	No Limit
EP2515984-021	GHD-QC06	EG093B-F: Selenium	7782-49-2	2	µg/L	<2	<2	0.0	No Limit
		EG093B-F: Iron	7439-89-6	5	µg/L	24	24	0.0	No Limit
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QC Lot: 6903606)									
EP2515984-021	GHD-QC06	EG093-F_LL: Cobalt	7440-48-4	0.05	µg/L	0.20	0.20	0.0	No Limit
		EG093-F_LL: Copper	7440-50-8	0.2	µg/L	1.4	1.4	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 6898064)									
EP2515721-002	Anonymous	EP071: C15 - C28 Fraction	----	100	µg/L	<100	<100	0.0	No Limit
		EP071: C10 - C14 Fraction	----	50	µg/L	<50	<50	0.0	No Limit
		EP071: C29 - C36 Fraction	----	50	µg/L	<50	<50	0.0	No Limit
EP2515998-029	Anonymous	EP071: C15 - C28 Fraction	----	100	µg/L	<100	<100	0.0	No Limit
		EP071: C10 - C14 Fraction	----	50	µg/L	<50	<50	0.0	No Limit
		EP071: C29 - C36 Fraction	----	50	µg/L	<50	<50	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 6898133)									
EP2515984-021	GHD-QC06	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
EP2515993-004	Anonymous	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 6898064)									
EP2515721-002	Anonymous	EP071: >C10 - C16 Fraction	----	100	µg/L	<100	<100	0.0	No Limit
		EP071: >C16 - C34 Fraction	----	100	µg/L	<100	<100	0.0	No Limit
		EP071: >C34 - C40 Fraction	----	100	µg/L	<100	<100	0.0	No Limit
EP2515998-029	Anonymous	EP071: >C10 - C16 Fraction	----	100	µg/L	<100	<100	0.0	No Limit
		EP071: >C16 - C34 Fraction	----	100	µg/L	<100	<100	0.0	No Limit
		EP071: >C34 - C40 Fraction	----	100	µg/L	<100	<100	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 6898133)									
EP2515984-021	GHD-QC06	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.0	No Limit
EP2515993-004	Anonymous	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.0	No Limit
EP080: BTEXN (QC Lot: 6898133)									
EP2515984-021	GHD-QC06	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit



Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP080: BTEXN (QC Lot: 6898133) - continued									
EP2515993-004	Anonymous	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3	2	µg/L	<2	<2	0.0	No Limit
		106-42-3							
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit
EP090: Organotin Compounds (Soluble) (QC Lot: 6902264)									
EP2515984-021	GHD-QC06	EP090S: Tributyltin	56573-85-4	2	ngSn/L	<2	<2	0.0	No Limit
EP131A: Organochlorine Pesticides (super trace) (QC Lot: 6900725)									
EP2515984-001	GHD-Applecross-202509-GR-SUR	EP131A-ST: Aldrin	309-00-2	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP131A-ST: alpha-BHC	319-84-6	0.001 (0.002) *	µg/L	<0.002	<0.002	0.0	No Limit
		EP131A-ST: beta-BHC	319-85-7	0.001 (0.002) *	µg/L	<0.002	<0.002	0.0	No Limit
		EP131A-ST: gamma-BHC (Lindane)	58-89-9	0.001 (0.002) *	µg/L	<0.002	<0.002	0.0	No Limit
		EP131A-ST: cis-Chlordane	5103-71-9	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP131A-ST: trans-Chlordane	5103-74-2	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP131A-ST: delta-BHC	319-86-8	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP131A-ST: 4,4'-DDD	72-54-8	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP131A-ST: 4,4'-DDE	72-55-9	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP131A-ST: 4,4'-DDT	50-29-3	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP131A-ST: Dieldrin	60-57-1	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP131A-ST: alpha-Endosulfan	959-98-8	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP131A-ST: Endosulfan sulfate	1031-07-8	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP131A-ST: beta-Endosulfan	33213-65-9	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP131A-ST: Endrin	72-20-8	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP131A-ST: Endrin ketone	53494-70-5	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP131A-ST: Endrin aldehyde	7421-93-4	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP131A-ST: Heptachlor	76-44-8	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP131A-ST: Heptachlor epoxide	1024-57-3	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP131A-ST: Hexachlorobenzene (HCB)	118-74-1	0.002	µg/L	<0.002	<0.002	0.0	No Limit
EP2515984-011	GHD-MatBay2-202509-GR-SUR	EP131A-ST: Aldrin	309-00-2	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP131A-ST: alpha-BHC	319-84-6	0.001 (0.002) *	µg/L	<0.002	<0.002	0.0	No Limit



Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP131A: Organochlorine Pesticides (super trace) (QC Lot: 6900725) - continued									
EP2515984-011	GHD-MatBay2-202509-GR-SUR	EP131A-ST: beta-BHC	319-85-7	0.001 (0.002) *	µg/L	<0.002	<0.002	0.0	No Limit
		EP131A-ST: gamma-BHC (Lindane)	58-89-9	0.001 (0.002) *	µg/L	<0.002	<0.002	0.0	No Limit
		EP131A-ST: cis-Chlordane	5103-71-9	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP131A-ST: trans-Chlordane	5103-74-2	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP131A-ST: delta-BHC	319-86-8	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP131A-ST: 4,4'-DDD	72-54-8	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP131A-ST: 4,4'-DDE	72-55-9	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP131A-ST: 4,4'-DDT	50-29-3	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP131A-ST: Dieldrin	60-57-1	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP131A-ST: alpha-Endosulfan	959-98-8	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP131A-ST: Endosulfan sulfate	1031-07-8	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP131A-ST: beta-Endosulfan	33213-65-9	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP131A-ST: Endrin	72-20-8	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP131A-ST: Endrin ketone	53494-70-5	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP131A-ST: Endrin aldehyde	7421-93-4	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP131A-ST: Heptachlor	76-44-8	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP131A-ST: Heptachlor epoxide	1024-57-3	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP131A-ST: Hexachlorobenzene (HCB)	118-74-1	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP131A-ST: Methoxychlor	72-43-5	0.002	µg/L	<0.002	<0.002	0.0	No Limit
EP131B: Polychlorinated Biphenyls (as Aroclors) (QC Lot: 6900753)									
EP2515984-001	GHD-Applecross-202509-GR-SUR	EP131B-ST: Aroclor 1254	11097-69-1	0.005	µg/L	<0.005	<0.005	0.0	No Limit
EP2515984-011	GHD-MatBay2-202509-GR-SUR	EP131B-ST: Aroclor 1254	11097-69-1	0.005	µg/L	<0.005	<0.005	0.0	No Limit
EP132B: Polynuclear Aromatic Hydrocarbons (super trace) (QC Lot: 6900724)									
EP2515984-001	GHD-Applecross-202509-GR-SUR	EP132-ST: Anthracene	120-12-7	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP132-ST: Benzo(a)pyrene	50-32-8	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP132-ST: Benzo(e)pyrene	192-97-2	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP132-ST: Chrysene	218-01-9	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP132-ST: Dibenz(a,h)anthracene	53-70-3	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP132-ST: Fluoranthene	206-44-0	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP132-ST: Pyrene	129-00-0	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP132-ST: Sum of 16 US EPA Priority PAHs	----	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP132-ST: Benzo(a)pyrene TEQ (zero)	----	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP132-ST: Benzo(a)pyrene TEQ (half LOR)	----	0.001	µg/L	<0.001	<0.001	0.0	No Limit



Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP132B: Polynuclear Aromatic Hydrocarbons (super trace) (QC Lot: 6900724) - continued									
EP2515984-001	GHD-Applecross-202509-GR-SUR	EP132-ST: Benzo(a)pyrene TEQ (LOR)	----	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP132-ST: Acenaphthene	83-32-9	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP132-ST: Acenaphthylene	208-96-8	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP132-ST: Benz(a)anthracene	56-55-3	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP132-ST: Benzo(g,h,i)perylene	191-24-2	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP132-ST: Coronene	191-07-1	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP132-ST: 7.12-Dimethylbenz(a)anthracene	57-97-6	0.002 (0.001) *	µg/L	<0.001	<0.001	0.0	No Limit
		EP132-ST: Fluorene	86-73-7	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP132-ST: Indeno(1.2.3.cd)pyrene	193-39-5	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP132-ST: 2-Methylnaphthalene	91-57-6	0.002	µg/L	0.007	0.009	32.7	No Limit
		EP132-ST: Phenanthrene	85-01-8	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP132-ST: Perylene	198-55-0	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP132-ST: Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.004	µg/L	<0.004	<0.004	0.0	No Limit
		EP132-ST: Benzo(k)fluoranthene	207-08-9	0.004	µg/L	<0.004	<0.004	0.0	No Limit
		EP132-ST: 3-Methylcholanthrene	56-49-5	0.004	µg/L	<0.004	<0.004	0.0	No Limit
		EP132-ST: Naphthalene	91-20-3	0.004	µg/L	<0.004	<0.004	0.0	No Limit
EP2515984-011	GHD-MatBay2-202509-GR-SUR	EP132-ST: Anthracene	120-12-7	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP132-ST: Benzo(a)pyrene	50-32-8	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP132-ST: Benzo(e)pyrene	192-97-2	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP132-ST: Chrysene	218-01-9	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP132-ST: Dibenz(a,h)anthracene	53-70-3	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP132-ST: Fluoranthene	206-44-0	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP132-ST: Pyrene	129-00-0	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP132-ST: Sum of 16 US EPA Priority PAHs	----	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP132-ST: Benzo(a)pyrene TEQ (zero)	----	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP132-ST: Benzo(a)pyrene TEQ (half LOR)	----	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP132-ST: Benzo(a)pyrene TEQ (LOR)	----	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP132-ST: Acenaphthene	83-32-9	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP132-ST: Acenaphthylene	208-96-8	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP132-ST: Benz(a)anthracene	56-55-3	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP132-ST: Benzo(g,h,i)perylene	191-24-2	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP132-ST: Coronene	191-07-1	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP132-ST: 7.12-Dimethylbenz(a)anthracene	57-97-6	0.002 (0.001) *	µg/L	<0.001	<0.001	0.0	No Limit
		EP132-ST: Fluorene	86-73-7	0.002	µg/L	<0.002	<0.002	0.0	No Limit



Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP132B: Polynuclear Aromatic Hydrocarbons (super trace) (QC Lot: 6900724) - continued									
EP2515984-011	GHD-MatBay2-202509-GR-SUR	EP132-ST: Indeno(1.2.3.cd)pyrene	193-39-5	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP132-ST: 2-Methylnaphthalene	91-57-6	0.002	µg/L	0.005	0.004	0.0	No Limit
		EP132-ST: Phenanthrene	85-01-8	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP132-ST: Perylene	198-55-0	0.002	µg/L	<0.002	<0.002	0.0	No Limit
		EP132-ST: Benzo(b+j)fluoranthene	205-99-2	0.004	µg/L	<0.004	<0.004	0.0	No Limit
		205-82-3							
		EP132-ST: Benzo(k)fluoranthene	207-08-9	0.004	µg/L	<0.004	<0.004	0.0	No Limit
		EP132-ST: 3-Methylcholanthrene	56-49-5	0.004	µg/L	<0.004	<0.004	0.0	No Limit
		EP132-ST: Naphthalene	91-20-3	0.004	µg/L	<0.004	<0.004	0.0	No Limit
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 6899680)									
EP2515984-021	GHD-QC06	EP231X-SUT: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	µg/L	0.0042	0.0050	18.0	0% - 20%
		EP231X-SUT: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0005	µg/L	0.0022	0.0028	24.2	No Limit
		EP231X-SUT: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluorononane sulfonic acid (PFNS)	68259-12-1	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluoropropane sulfonic acid (PFPrS)	423-41-6	0.002	µg/L	<0.0020	<0.0020	0.0	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 6899680)									
EP2515984-021	GHD-QC06	EP231X-SUT: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0005	µg/L	0.0011	0.0016	40.4	No Limit
		EP231X-SUT: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0005	µg/L	0.0014	0.0015	0.0	No Limit
		EP231X-SUT: Perfluorooctanoic acid (PFOA)	335-67-1	0.0005	µg/L	0.0008	0.0009	11.6	No Limit
		EP231X-SUT: Perfluorononanoic acid (PFNA)	375-95-1	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluorodecanoic acid (PFDA)	335-76-2	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit



Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 6899680) - continued									
EP2515984-021	GHD-QC06	EP231X-SUT: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluorobutanoic acid (PFBA)	375-22-4	0.002	µg/L	<0.0020	<0.0020	0.0	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 6899680)									
EP2515984-021	GHD-QC06	EP231X-SUT: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP231X-SUT: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP231X-SUT: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.001	µg/L	<0.001	<0.001	0.0	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 6899680)									
EP2515984-021	GHD-QC06	EP231X-SUT: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP231X-SUT: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP231X-SUT: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP231X-SUT: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.001	µg/L	<0.001	<0.001	0.0	No Limit
EP231P: PFAS Sums (QC Lot: 6899680)									
EP2515984-021	GHD-QC06	EP231X-SUT: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	µg/L	0.0064	0.0078	19.7	0% - 20%
		EP231X-SUT: Sum of PFAS (WA DER List)	----	0.0002	µg/L	0.0097	0.0118	19.5	0% - 20%
		EP231X-SUT: Sum of PFAS	----	0.0002	µg/L	0.0097	0.0118	19.5	0% - 20%
EP234A: OP Pesticides (QC Lot: 6900417)									
EP2515984-004	GHD-Barrack-202509-GR-ARB	EP234-LL: Chlorpyrifos	2921-88-2	0.001	µg/L	<0.001	<0.001	0.0	No Limit
EP2515984-012	GHD-MatBay2-202509-GR-ARB	EP234-LL: Chlorpyrifos	2921-88-2	0.001	µg/L	<0.001	<0.001	0.0	No Limit



Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Acceptable Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EG035F: Dissolved Mercury by FIMS (QCLot: 6911887)								
EG035F-LL: Mercury	7439-97-6	0.00004	mg/L	<0.00004	0.005 mg/L	92.0	85.7	118
EG035T: Total Mercury by FIMS (QCLot: 6911838)								
EG035T-LL: Mercury	7439-97-6	0.00004	mg/L	<0.00004	0.005 mg/L	110	85.4	119
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QCLot: 6903604)								
EG093A-F: Aluminium	7429-90-5	5	µg/L	<5	50 µg/L	103	85.1	114
EG093A-F: Arsenic	7440-38-2	0.5	µg/L	<0.5	10 µg/L	101	83.8	111
EG093A-F: Chromium	7440-47-3	0.5	µg/L	<0.5	10 µg/L	96.5	87.1	112
EG093A-F: Lead	7439-92-1	0.2	µg/L	<0.2	10 µg/L	102	88.6	110
EG093A-F: Manganese	7439-96-5	0.5	µg/L	<0.5	10 µg/L	95.0	86.2	112
EG093A-F: Nickel	7440-02-0	0.5	µg/L	<0.5	10 µg/L	100.0	80.5	115
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QCLot: 6903605)								
EG093B-F: Iron	7439-89-6	5	µg/L	<5	50 µg/L	97.6	86.8	116
EG093B-F: Selenium	7782-49-2	2	µg/L	<2	10 µg/L	91.2	74.0	102
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QCLot: 6903606)								
EG093-F_LL: Copper	7440-50-8	0.2	µg/L	<0.2	10 µg/L	104	83.4	118
EG093-F_LL: Cobalt	7440-48-4	0.05	µg/L	<0.05	10 µg/L	103	80.0	119
EP080/071: Total Petroleum Hydrocarbons (QCLot: 6898064)								
EP071: C10 - C14 Fraction	----	50	µg/L	<50	4771 µg/L	56.1	39.3	103
EP071: C15 - C28 Fraction	----	100	µg/L	<100	8513 µg/L	73.6	47.2	122
EP071: C29 - C36 Fraction	----	50	µg/L	<50	1510 µg/L	82.6	42.5	119
EP080/071: Total Petroleum Hydrocarbons (QCLot: 6898133)								
EP080: C6 - C9 Fraction	----	20	µg/L	<20	360 µg/L	104	73.6	113
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 6898064)								
EP071: >C10 - C16 Fraction	----	100	µg/L	<100	6540 µg/L	62.3	47.0	100
EP071: >C16 - C34 Fraction	----	100	µg/L	<100	7770 µg/L	76.2	46.2	116
EP071: >C34 - C40 Fraction	----	100	µg/L	<100	473 µg/L	90.5	24.7	137
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 6898133)								
EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	450 µg/L	106	73.9	115
EP080: BTEXN (QCLot: 6898133)								
EP080: Benzene	71-43-2	1	µg/L	<1	20 µg/L	105	84.1	114



Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result			Low	High
EP080: BTEXN (QCLot: 6898133) - continued								
EP080: Toluene	108-88-3	2	µg/L	<2	20 µg/L	101	81.0	115
EP080: Ethylbenzene	100-41-4	2	µg/L	<2	20 µg/L	104	84.4	113
EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	40 µg/L	106	84.3	114
EP080: ortho-Xylene	95-47-6	2	µg/L	<2	20 µg/L	104	86.5	111
EP080: Naphthalene	91-20-3	5	µg/L	<5	5 µg/L	86.9	77.0	118
EP090: Organotin Compounds (Soluble) (QCLot: 6902264)								
EP090S: Tributyltin	56573-85-4	2	ngSn/L	<2	147 ngSn/L	57.0	30.7	134
EP131A: Organochlorine Pesticides (super trace) (QCLot: 6900725)								
EP131A-ST: Aldrin	309-00-2	0.001	µg/L	<0.001	0.02 µg/L	80.6	25.2	143
EP131A-ST: alpha-BHC	319-84-6	0.001	µg/L	<0.001	0.02 µg/L	97.3	15.6	149
EP131A-ST: beta-BHC	319-85-7	0.001	µg/L	<0.001	0.02 µg/L	93.8	25.8	141
EP131A-ST: gamma-BHC (Lindane)	58-89-9	0.001	µg/L	<0.001	0.02 µg/L	102	35.0	140
EP131A-ST: delta-BHC	319-86-8	0.002	µg/L	<0.002	0.02 µg/L	78.9	30.1	140
EP131A-ST: cis-Chlordane	5103-71-9	0.001	µg/L	<0.001	0.02 µg/L	122	36.0	136
EP131A-ST: trans-Chlordane	5103-74-2	0.001	µg/L	<0.001	0.02 µg/L	114	36.0	138
EP131A-ST: 4,4'-DDD	72-54-8	0.002	µg/L	<0.002	0.02 µg/L	118	36.0	158
EP131A-ST: 4,4'-DDE	72-55-9	0.002	µg/L	<0.002	0.02 µg/L	107	33.0	127
EP131A-ST: 4,4'-DDT	50-29-3	0.002	µg/L	<0.002	0.02 µg/L	83.3	27.8	149
EP131A-ST: Dieldrin	60-57-1	0.002	µg/L	<0.002	0.02 µg/L	111	30.0	144
EP131A-ST: alpha-Endosulfan	959-98-8	0.002	µg/L	<0.002	0.02 µg/L	113	33.0	133
EP131A-ST: Endosulfan sulfate	1031-07-8	0.002	µg/L	<0.002	0.02 µg/L	83.3	37.0	157
EP131A-ST: beta-Endosulfan	33213-65-9	0.002	µg/L	<0.002	0.02 µg/L	109	40.0	152
EP131A-ST: Endrin	72-20-8	0.002	µg/L	<0.002	0.02 µg/L	105	49.0	155
EP131A-ST: Endrin ketone	53494-70-5	0.002	µg/L	<0.002	0.02 µg/L	118	20.8	143
EP131A-ST: Endrin aldehyde	7421-93-4	0.002	µg/L	<0.002	0.02 µg/L	101	29.0	127
EP131A-ST: Heptachlor	76-44-8	0.002	µg/L	<0.002	0.02 µg/L	108	42.0	152
EP131A-ST: Heptachlor epoxide	1024-57-3	0.002	µg/L	<0.002	0.02 µg/L	120	28.8	139
EP131A-ST: Hexachlorobenzene (HCB)	118-74-1	0.002	µg/L	<0.002	0.02 µg/L	136	18.6	136
EP131A-ST: Methoxychlor	72-43-5	0.002	µg/L	<0.002	0.02 µg/L	105	41.0	159
EP131B: Polychlorinated Biphenyls (as Aroclors) (QCLot: 6900753)								
EP131B-ST: Aroclor 1254	11097-69-1	0.005	µg/L	<0.005	0.00022 µg/L	96.8	61.6	123
EP132B: Polynuclear Aromatic Hydrocarbons (super trace) (QCLot: 6900724)								
EP132-ST: Acenaphthene	83-32-9	0.002	µg/L	<0.002	0.01 µg/L	97.0	70.0	130



Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result			Low	High
EP132B: Polynuclear Aromatic Hydrocarbons (super trace) (QCLot: 6900724) - continued								
EP132-ST: Acenaphthylene	208-96-8	0.002	µg/L	<0.002	0.01 µg/L	98.9	70.0	130
EP132-ST: Anthracene	120-12-7	0.001	µg/L	<0.001	0.01 µg/L	102	70.0	130
EP132-ST: Benz(a)anthracene	56-55-3	0.002	µg/L	<0.002	0.01 µg/L	94.5	70.0	130
EP132-ST: Benzo(a)pyrene	50-32-8	0.001	µg/L	<0.001	0.01 µg/L	91.0	70.0	130
EP132-ST: Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.004	µg/L	<0.004	0.01 µg/L	93.6	70.0	130
EP132-ST: Benzo(e)pyrene	192-97-2	0.001	µg/L	<0.001	0.01 µg/L	93.2	70.0	130
EP132-ST: Benzo(g,h,i)perylene	191-24-2	0.002	µg/L	<0.002	0.01 µg/L	98.3	70.0	130
EP132-ST: Benzo(k)fluoranthene	207-08-9	0.004	µg/L	<0.004	0.01 µg/L	89.9	70.0	130
EP132-ST: Chrysene	218-01-9	0.001	µg/L	<0.001	0.01 µg/L	106	70.0	130
EP132-ST: Coronene	191-07-1	0.002	µg/L	<0.002	0.01 µg/L	93.9	70.0	130
EP132-ST: Dibenzo(a,h)anthracene	53-70-3	0.001	µg/L	<0.001	0.01 µg/L	96.4	70.0	130
EP132-ST: 7,12-Dimethylbenzo(a)anthracene	57-97-6	0.002	µg/L	<0.002	0.01 µg/L	85.5	70.0	130
EP132-ST: Fluoranthene	206-44-0	0.001	µg/L	<0.001	0.01 µg/L	103	70.0	130
EP132-ST: Fluorene	86-73-7	0.002	µg/L	<0.002	0.01 µg/L	94.5	70.0	130
EP132-ST: Indeno(1,2,3-cd)pyrene	193-39-5	0.002	µg/L	<0.002	0.01 µg/L	89.1	70.0	130
EP132-ST: 3-Methylcholanthrene	56-49-5	0.004	µg/L	<0.004	0.01 µg/L	97.4	70.0	130
EP132-ST: 2-Methylnaphthalene	91-57-6	0.002	µg/L	<0.002	0.01 µg/L	91.1	70.0	130
EP132-ST: Naphthalene	91-20-3	0.004	µg/L	<0.004	0.01 µg/L	118	70.0	130
EP132-ST: Phenanthrene	85-01-8	0.002	µg/L	<0.002	0.01 µg/L	108	70.0	130
EP132-ST: Perylene	198-55-0	0.002	µg/L	<0.002	0.01 µg/L	94.3	70.0	130
EP132-ST: Pyrene	129-00-0	0.001	µg/L	<0.001	0.01 µg/L	100	70.0	130
EP132-ST: Sum of 16 US EPA Priority PAHs	----	0.001	µg/L	<0.001	----	----	----	----
EP132-ST: Benzo(a)pyrene TEQ (zero)	----	0.001	µg/L	<0.001	----	----	----	----
EP132-ST: Benzo(a)pyrene TEQ (half LOR)	----	0.001	µg/L	<0.001	----	----	----	----
EP132-ST: Benzo(a)pyrene TEQ (LOR)	----	0.001	µg/L	<0.001	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 6899680)								
EP231X-SUT: Perfluoropropane sulfonic acid (PFPrS)	423-41-6	0.002	µg/L	<0.0020	0.00367 µg/L	101	70.0	130
EP231X-SUT: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0005	µg/L	<0.0005	0.00354 µg/L	102	72.0	130
EP231X-SUT: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0005	µg/L	<0.0005	0.00376 µg/L	108	71.0	127
EP231X-SUT: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0005	µg/L	<0.0005	0.00381 µg/L	83.6	68.0	131
EP231X-SUT: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0005	µg/L	<0.0005	0.00381 µg/L	115	69.0	134
EP231X-SUT: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	µg/L	<0.0002	0.00371 µg/L	94.0	65.0	140
EP231X-SUT: Perfluorononane sulfonic acid (PFNS)	68259-12-1	0.0005	µg/L	<0.0005	0.00384 µg/L	95.0	70.0	130
EP231X-SUT: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0005	µg/L	<0.0005	0.00385 µg/L	81.4	53.0	142



Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result			Low	High
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 6899680)								
EP231X-SUT: Perfluorobutanoic acid (PFBA)	375-22-4	0.002	µg/L	<0.0020	0.02 µg/L	92.4	73.0	129
EP231X-SUT: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0005	µg/L	<0.0005	0.004 µg/L	92.4	72.0	129
EP231X-SUT: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0005	µg/L	<0.0005	0.004 µg/L	103	72.0	129
EP231X-SUT: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0005	µg/L	<0.0005	0.004 µg/L	113	72.0	130
EP231X-SUT: Perfluorooctanoic acid (PFOA)	335-67-1	0.0005	µg/L	<0.0005	0.004 µg/L	91.6	71.0	133
EP231X-SUT: Perfluorononanoic acid (PFNA)	375-95-1	0.0005	µg/L	<0.0005	0.004 µg/L	94.8	69.0	130
EP231X-SUT: Perfluorodecanoic acid (PFDA)	335-76-2	0.0005	µg/L	<0.0005	0.004 µg/L	114	71.0	129
EP231X-SUT: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0005	µg/L	<0.0005	0.004 µg/L	114	69.0	133
EP231X-SUT: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0005	µg/L	<0.0005	0.004 µg/L	84.8	72.0	134
EP231X-SUT: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0005	µg/L	<0.0005	0.004 µg/L	74.0	65.0	144
EP231X-SUT: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	µg/L	<0.0005	0.004 µg/L	106	71.0	132
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 6899680)								
EP231X-SUT: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0005	µg/L	<0.0005	0.004 µg/L	108	67.0	137
EP231X-SUT: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.001	µg/L	<0.001	0.01 µg/L	121	68.0	141
EP231X-SUT: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.001	µg/L	<0.001	0.01 µg/L	97.9	57.9	141
EP231X-SUT: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.001	µg/L	<0.001	0.01 µg/L	108	63.3	134
EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.001	µg/L	<0.001	0.01 µg/L	88.6	60.0	136
EP231X-SUT: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0005	µg/L	<0.0005	0.004 µg/L	88.4	65.0	136
EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0005	µg/L	<0.0005	0.004 µg/L	102	61.0	135
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 6899680)								
EP231X-SUT: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.001	µg/L	<0.001	0.00374 µg/L	93.7	63.0	143
EP231X-SUT: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.001	µg/L	<0.001	0.0038 µg/L	116	64.0	140
EP231X-SUT: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.001	µg/L	<0.001	0.00384 µg/L	104	67.0	138
EP231X-SUT: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.001	µg/L	<0.001	0.00386 µg/L	70.9	53.1	133
EP234A: OP Pesticides (QCLot: 6900417)								
EP234-LL: Chlorpyrifos	2921-88-2	0.001	µg/L	<0.001	0.004 µg/L	109	72.0	134

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG035F: Dissolved Mercury by FIMS (QCLot: 6911887)							
EP2515984-004	GHD-Barrack-202509-GR-ARB	EG035F-LL: Mercury	7439-97-6	0.005 mg/L	99.9	70.0	130
EG035T: Total Mercury by FIMS (QCLot: 6911838)							
EP2515984-002	GHD-Applecross-202509-GR-ARB	EG035T-LL: Mercury	7439-97-6	0.005 mg/L	97.3	70.0	130
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QCLot: 6903604)							
EP2515950-002	Anonymous	EG093A-F: Arsenic	7440-38-2	50 µg/L	113	70.0	130
		EG093A-F: Chromium	7440-47-3	50 µg/L	104	70.0	130
		EG093A-F: Lead	7439-92-1	50 µg/L	105	70.0	130
		EG093A-F: Manganese	7439-96-5	50 µg/L	103	70.0	130
		EG093A-F: Nickel	7440-02-0	50 µg/L	110	70.0	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 6898133)							
EP2515987-001	Anonymous	EP080: C6 - C9 Fraction	----	240 µg/L	95.3	77.0	137
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 6898133)							
EP2515987-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	290 µg/L	93.2	77.0	137
EP080: BTEXN (QCLot: 6898133)							
EP2515987-001	Anonymous	EP080: Benzene	71-43-2	20 µg/L	118	77.0	122
		EP080: Toluene	108-88-3	20 µg/L	115	73.5	126
EP131A: Organochlorine Pesticides (super trace) (QCLot: 6900725)							
EP2515984-002	GHD-Applecross-202509-GR-ARB	EP131A-ST: Aldrin	309-00-2	0.02 µg/L	107	35.8	139
		EP131A-ST: alpha-BHC	319-84-6	0.02 µg/L	138	19.7	153
		EP131A-ST: beta-BHC	319-85-7	0.02 µg/L	110	43.8	136
		EP131A-ST: gamma-BHC (Lindane)	58-89-9	0.02 µg/L	94.0	27.2	147
		EP131A-ST: delta-BHC	319-86-8	0.02 µg/L	88.3	37.4	144
		EP131A-ST: cis-Chlordane	5103-71-9	0.02 µg/L	122	15.4	152
		EP131A-ST: trans-Chlordane	5103-74-2	0.02 µg/L	127	45.1	140
		EP131A-ST: 4,4'-DDD	72-54-8	0.02 µg/L	124	37.5	145
		EP131A-ST: 4,4'-DDE	72-55-9	0.02 µg/L	94.0	30.5	146
		EP131A-ST: 4,4'-DDT	50-29-3	0.02 µg/L	114	31.0	151
		EP131A-ST: Dieldrin	60-57-1	0.02 µg/L	134	34.4	145
		EP131A-ST: alpha-Endosulfan	959-98-8	0.02 µg/L	121	30.2	141
		EP131A-ST: Endosulfan sulfate	1031-07-8	0.02 µg/L	123	19.1	150
		EP131A-ST: beta-Endosulfan	33213-65-9	0.02 µg/L	118	30.3	148
		EP131A-ST: Endrin	72-20-8	0.02 µg/L	115	13.0	165
		EP131A-ST: Endrin ketone	53494-70-5	0.02 µg/L	122	15.1	146
		EP131A-ST: Endrin aldehyde	7421-93-4	0.02 µg/L	103	28.3	134
		EP131A-ST: Heptachlor	76-44-8	0.02 µg/L	143	33.2	148
		EP131A-ST: Heptachlor epoxide	1024-57-3	0.02 µg/L	127	36.0	143
		EP131A-ST: Hexachlorobenzene (HCB)	118-74-1	0.02 µg/L	124	14.0	146

Sub-Matrix: WATER				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP131A: Organochlorine Pesticides (super trace) (QCLot: 6900725) - continued							
EP2515984-002	GHD-Applecross-202509-GR-ARB	EP131A-ST: Methoxychlor	72-43-5	0.02 µg/L	105	34.4	150
EP131B: Polychlorinated Biphenyls (as Aroclors) (QCLot: 6900753)							
EP2515984-003	GHD-Barrack-202509-GR-SUR	EP131B-ST: Aroclor 1254	11097-69-1	0.00022 µg/L	100	61.6	123
EP132B: Polynuclear Aromatic Hydrocarbons (super trace) (QCLot: 6900724)							
EP2515984-001	GHD-Applecross-202509-GR-SUR	EP132-ST: Acenaphthene	83-32-9	0.01 µg/L	115	70.0	130
		EP132-ST: Acenaphthylene	208-96-8	0.01 µg/L	129	70.0	130
		EP132-ST: Anthracene	120-12-7	0.01 µg/L	87.3	70.0	130
		EP132-ST: Benz(a)anthracene	56-55-3	0.01 µg/L	120	70.0	130
		EP132-ST: Benzo(a)pyrene	50-32-8	0.01 µg/L	105	70.0	130
		EP132-ST: Benzo(b+j)fluoranthene	205-99-2	0.01 µg/L	101	70.0	130
			205-82-3				
		EP132-ST: Benzo(e)pyrene	192-97-2	0.01 µg/L	98.2	70.0	130
		EP132-ST: Benzo(g,h,i)perylene	191-24-2	0.01 µg/L	91.8	70.0	130
		EP132-ST: Benzo(k)fluoranthene	207-08-9	0.01 µg/L	91.0	70.0	130
		EP132-ST: Chrysene	218-01-9	0.01 µg/L	98.3	70.0	130
		EP132-ST: Coronene	191-07-1	0.01 µg/L	95.9	70.0	130
		EP132-ST: Dibenz(a,h)anthracene	53-70-3	0.01 µg/L	102	70.0	130
		EP132-ST: 7,12-Dimethylbenz(a)anthracene	57-97-6	0.01 µg/L	94.1	70.0	130
		EP132-ST: Fluoranthene	206-44-0	0.01 µg/L	116	70.0	130
		EP132-ST: Fluorene	86-73-7	0.01 µg/L	109	70.0	130
		EP132-ST: Indeno(1,2,3.cd)pyrene	193-39-5	0.01 µg/L	99.7	70.0	130
		EP132-ST: 3-Methylcholanthrene	56-49-5	0.01 µg/L	123	70.0	130
		EP132-ST: 2-Methylnaphthalene	91-57-6	0.01 µg/L	100	70.0	130
		EP132-ST: Naphthalene	91-20-3	0.01 µg/L	112	70.0	130
		EP132-ST: Phenanthrene	85-01-8	0.01 µg/L	108	70.0	130
		EP132-ST: Perylene	198-55-0	0.01 µg/L	92.2	70.0	130
		EP132-ST: Pyrene	129-00-0	0.01 µg/L	113	70.0	130
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 6899680)							
EP2515998-029	Anonymous	EP231X-SUT: Perfluoropropane sulfonic acid (PFPrS)	423-41-6	0.00367 µg/L	75.8	70.0	130
		EP231X-SUT: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.00355 µg/L	106	70.0	130
		EP231X-SUT: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.00376 µg/L	117	70.0	130
		EP231X-SUT: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.00379 µg/L	111	70.0	130
		EP231X-SUT: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.00381 µg/L	117	70.0	130
		EP231X-SUT: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.00371 µg/L	# Not Determined	70.0	130
		EP231X-SUT: Perfluorononane sulfonic acid (PFNS)	68259-12-1	0.00384 µg/L	110	70.0	130
		EP231X-SUT: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.00385 µg/L	82.7	70.0	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 6899680)							



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 6899680) - continued							
EP2515998-029	Anonymous	EP231X-SUT: Perfluorobutanoic acid (PFBA)	375-22-4	0.02 µg/L	79.8	70.0	130
		EP231X-SUT: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.004 µg/L	# Not Determined	70.0	130
		EP231X-SUT: Perfluorohexanoic acid (PFHxA)	307-24-4	0.004 µg/L	# Not Determined	70.0	130
		EP231X-SUT: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.004 µg/L	# Not Determined	70.0	130
		EP231X-SUT: Perfluorooctanoic acid (PFOA)	335-67-1	0.004 µg/L	# Not Determined	70.0	130
		EP231X-SUT: Perfluorononanoic acid (PFNA)	375-95-1	0.004 µg/L	100	70.0	130
		EP231X-SUT: Perfluorodecanoic acid (PFDA)	335-76-2	0.004 µg/L	119	70.0	130
		EP231X-SUT: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.004 µg/L	126	70.0	130
		EP231X-SUT: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.004 µg/L	70.8	70.0	130
		EP231X-SUT: Perfluorotridecanoic acid (PFTTrDA)	72629-94-8	0.004 µg/L	72.4	70.0	130
		EP231X-SUT: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.004 µg/L	108	70.0	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 6899680)							
EP2515998-029	Anonymous	EP231X-SUT: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.004 µg/L	107	70.0	130
		EP231X-SUT: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.01 µg/L	109	70.0	130
		EP231X-SUT: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.01 µg/L	95.2	70.0	130
		EP231X-SUT: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.01 µg/L	114	70.0	130
		EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.01 µg/L	86.1	70.0	130
		EP231X-SUT: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.004 µg/L	84.4	70.0	130
		EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.004 µg/L	108	70.0	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 6899680)							
EP2515998-029	Anonymous	EP231X-SUT: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.00374 µg/L	101	70.0	130
		EP231X-SUT: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0038 µg/L	126	70.0	130
		EP231X-SUT: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.00384 µg/L	109	70.0	130
		EP231X-SUT: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.00386 µg/L	105	70.0	130
EP234A: OP Pesticides (QCLot: 6900417)							
EP2515984-006	GHD-ElizQuay-202509-GR-ARB	EP234-LL: Chlorpyrifos	2921-88-2	0.004 µg/L	# 17.7	58.0	136



QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EP2515984	Page	: 1 of 11
Client	: GHD PTY LTD	Laboratory	: Environmental Division Perth
Contact	: MS LOUISE COCKERTON	Telephone	: +61-8-9406 1301
Project	: 12658388	Date Samples Received	: 25-Sep-2025
Site	: Swan River Ferry Expansion: Swan River Monitoring	Issue Date	: 10-Oct-2025
Sampler	: Solene Lao	No. of samples received	: 21
Order number	: 12658388	No. of samples analysed	: 21

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO** Method Blank value outliers occur.
- **NO** Duplicate outliers occur.
- **NO** Laboratory Control outliers occur.
- Matrix Spike outliers exist - please see following pages for full details.
- For all regular sample matrices, where applicable to the methodology, **NO** surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- Quality Control Sample Frequency Outliers exist - please see following pages for full details.

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: WATER

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EP231A: Perfluoroalkyl Sulfonic Acids	EP2515998--029	Anonymous	Perfluorooctane sulfonic acid (PFOS)	1763-23-1	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EP231B: Perfluoroalkyl Carboxylic Acids	EP2515998--029	Anonymous	Perfluoropentanoic acid (PFPeA)	2706-90-3	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EP231B: Perfluoroalkyl Carboxylic Acids	EP2515998--029	Anonymous	Perfluorohexanoic acid (PFHxA)	307-24-4	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EP231B: Perfluoroalkyl Carboxylic Acids	EP2515998--029	Anonymous	Perfluoroheptanoic acid (PFHpA)	375-85-9	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EP231B: Perfluoroalkyl Carboxylic Acids	EP2515998--029	Anonymous	Perfluorooctanoic acid (PFOA)	335-67-1	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EP234A: OP Pesticides	EP2515984--006	GHD-ElizQuay-202509-GR-AR	Chlorpyrifos	2921-88-2	17.7 %	58.0-136%	Recovery less than lower data quality objective

Matrix: WATER

Method		Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EP090: Organotin Compounds (Soluble)							
Amber Glass Bottle - Unpreserved GHD-QC06		02-Oct-2025	01-Oct-2025	1	----	----	----
EP131A: Organochlorine Pesticides							
Amber Glass Bottle - Unpreserved GHD-Applecross-202509-GR-SUR, GHD-Applecross-202509-GR-ARB, GHD-Barrack-202509-GR-SUR, GHD-Barrack-202509-GR-ARB, GHD-ElizQuay-202509-GR-SUR, GHD-ElizQuay-202509-GR-ARB, GHD-Ellam-202509-GR-SUR, GHD-Ellam-202509-GR-ARB, GHD-MatBay1-202509-GR-SUR, GHD-MatBay1-202509-GR-ARB, GHD-MatBay2-202509-GR-SUR, GHD-MatBay2-202509-GR-ARB, GHD-6161869-Heathcote-SUR, GHD-6164602-MatCentral-SUR, GHD-6160262-Nar-SUR, GHD-CanBridge-202509-GR-SUR, GHD-CanBridge-202509-GR-ARB, GHD-QC01, GHD-QC02, GHD-QC03		03-Oct-2025	01-Oct-2025	2	----	----	----
EP131B: Polychlorinated Biphenyls (as Aroclors)							

Method	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EP131B: Polychlorinated Biphenyls (as Aroclors) - Analysis Holding Time Compliance						
Amber Glass Bottle - Unpreserved GHD-Applecross-202509-GR-SUR, GHD-Barrack-202509-GR-SUR, GHD-ElizQuay-202509-GR-SUR, GHD-Ellam-202509-GR-SUR, GHD-MatBay1-202509-GR-SUR, GHD-MatBay2-202509-GR-SUR, GHD-6161869-Heathcote-SUR, GHD-6160262-Nar-SUR, GHD-CanBridge-202509-GR-ARB, GHD-QC02, GHD-QC03	GHD-Applecross-202509-GR-ARB, GHD-Barrack-202509-GR-ARB, GHD-ElizQuay-202509-GR-ARB, GHD-Ellam-202509-GR-ARB, GHD-MatBay1-202509-GR-ARB, GHD-MatBay2-202509-GR-ARB, GHD-6164602-MatCentral-SUR, GHD-CanBridge-202509-GR-SUR, GHD-QC01, GHD-QC03	03-Oct-2025	01-Oct-2025	2	----	----
EP132B: Polynuclear Aromatic Hydrocarbons						
Amber Glass Bottle - Unpreserved GHD-Applecross-202509-GR-SUR, GHD-Barrack-202509-GR-SUR, GHD-ElizQuay-202509-GR-SUR, GHD-Ellam-202509-GR-SUR, GHD-MatBay1-202509-GR-SUR, GHD-MatBay2-202509-GR-SUR, GHD-6161869-Heathcote-SUR, GHD-6160262-Nar-SUR, GHD-QC02, GHD-QC03	GHD-Applecross-202509-GR-ARB, GHD-Barrack-202509-GR-ARB, GHD-ElizQuay-202509-GR-ARB, GHD-Ellam-202509-GR-ARB, GHD-MatBay1-202509-GR-ARB, GHD-MatBay2-202509-GR-ARB, GHD-6164602-MatCentral-SUR, GHD-QC01, GHD-QC03	03-Oct-2025	01-Oct-2025	2	----	----
Amber Glass Bottle - Unpreserved GHD-CanBridge-202509-GR-SUR,	GHD-CanBridge-202509-GR-ARB	03-Oct-2025	01-Oct-2025	2	----	----
EP132B: Polynuclear Aromatic Hydrocarbons (super trace)						
Amber Glass Bottle - Unpreserved GHD-Applecross-202509-GR-SUR, GHD-Barrack-202509-GR-SUR, GHD-ElizQuay-202509-GR-SUR, GHD-Ellam-202509-GR-SUR, GHD-MatBay1-202509-GR-SUR, GHD-MatBay2-202509-GR-SUR, GHD-6161869-Heathcote-SUR, GHD-6160262-Nar-SUR, GHD-QC02, GHD-QC03	GHD-Applecross-202509-GR-ARB, GHD-Barrack-202509-GR-ARB, GHD-ElizQuay-202509-GR-ARB, GHD-Ellam-202509-GR-ARB, GHD-MatBay1-202509-GR-ARB, GHD-MatBay2-202509-GR-ARB, GHD-6164602-MatCentral-SUR, GHD-QC01, GHD-QC03	03-Oct-2025	01-Oct-2025	2	----	----
Amber Glass Bottle - Unpreserved GHD-CanBridge-202509-GR-SUR,	GHD-CanBridge-202509-GR-ARB	03-Oct-2025	01-Oct-2025	2	----	----
EP234A: OP Pesticides						



Matrix: **WATER**

Method		Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EP234A: OP Pesticides - Analysis Holding Time Compliance							
Amber Glass Bottle - Unpreserved							
GHD-Applecross-202509-GR-SUR,	GHD-Applecross-202509-GR-ARB,	02-Oct-2025	01-Oct-2025	1	----	----	----
GHD-Barrack-202509-GR-SUR,	GHD-Barrack-202509-GR-ARB,						
GHD-ElizQuay-202509-GR-SUR,	GHD-ElizQuay-202509-GR-ARB,						
GHD-Ellam-202509-GR-SUR,	GHD-Ellam-202509-GR-ARB,						
GHD-MatBay1-202509-GR-SUR,	GHD-MatBay1-202509-GR-ARB,						
GHD-MatBay2-202509-GR-SUR,	GHD-MatBay2-202509-GR-ARB,						
GHD-6161869-Heathcote-SUR,	GHD-6164602-MatCentral-SUR,						
GHD-6160262-Nar-SUR,	GHD-CanBridge-202509-GR-SUR,						
GHD-CanBridge-202509-GR-ARB,	GHD-QC01,						
GHD-QC02,	GHD-QC03						

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type		Count		Rate (%)		Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)						
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	1	12	8.33	10.00	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)						
Low Level Dissolved Metals in Saline Water Suite A by ORC-ICPMS	EG093-F_LL	0	1	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
Organotin Compounds (Soluble)	EP090S	0	6	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	0	20	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for **VOC in soils** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation



Matrix: **WATER**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG035F: Dissolved Mercury by FIMS							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG035F-LL) GHD-Applecross-202509-GR-SUR, GHD-Applecross-202509-GR-ARB, GHD-Barrack-202509-GR-SUR, GHD-Barrack-202509-GR-ARB, GHD-ElizQuay-202509-GR-SUR, GHD-ElizQuay-202509-GR-ARB, GHD-Ellam-202509-GR-SUR, GHD-Ellam-202509-GR-ARB, GHD-MatBay1-202509-GR-SUR, GHD-MatBay1-202509-GR-ARB, GHD-MatBay2-202509-GR-SUR, GHD-MatBay2-202509-GR-ARB, GHD-6161869-Heathcote-SUR, GHD-6164602-MatCentral-SUR, GHD-6160262-Nar-SUR, GHD-CanBridge-202509-GR-SUR, GHD-CanBridge-202509-GR-ARB, GHD-QC01, GHD-QC02, GHD-QC03	24-Sep-2025	----	----	----	07-Oct-2025	22-Oct-2025	✓
EG035T: Total Mercury by FIMS							
Clear HDPE (U-T ORC) - Unfiltered; Lab-acidified (EG035T-LL) GHD-Applecross-202509-GR-SUR, GHD-Applecross-202509-GR-ARB, GHD-Barrack-202509-GR-SUR, GHD-Barrack-202509-GR-ARB, GHD-ElizQuay-202509-GR-SUR, GHD-ElizQuay-202509-GR-ARB, GHD-Ellam-202509-GR-SUR, GHD-Ellam-202509-GR-ARB, GHD-MatBay1-202509-GR-SUR, GHD-MatBay1-202509-GR-ARB, GHD-MatBay2-202509-GR-SUR, GHD-MatBay2-202509-GR-ARB, GHD-6161869-Heathcote-SUR, GHD-6164602-MatCentral-SUR, GHD-6160262-Nar-SUR, GHD-CanBridge-202509-GR-SUR, GHD-CanBridge-202509-GR-ARB, GHD-QC01, GHD-QC02, GHD-QC03	24-Sep-2025	----	----	----	07-Oct-2025	22-Oct-2025	✓
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG093-F_LL) GHD-QC06	24-Sep-2025	----	----	----	03-Oct-2025	23-Mar-2026	✓
EP080/071: Total Petroleum Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP071) GHD-QC06	24-Sep-2025	01-Oct-2025	01-Oct-2025	✓	03-Oct-2025	10-Nov-2025	✓
Amber VOC Vial - Sulfuric Acid (EP080) GHD-QC06	24-Sep-2025	03-Oct-2025	08-Oct-2025	✓	03-Oct-2025	08-Oct-2025	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Amber Glass Bottle - Unpreserved (EP071) GHD-QC06	24-Sep-2025	01-Oct-2025	01-Oct-2025	✓	03-Oct-2025	10-Nov-2025	✓
Amber VOC Vial - Sulfuric Acid (EP080) GHD-QC06	24-Sep-2025	03-Oct-2025	08-Oct-2025	✓	03-Oct-2025	08-Oct-2025	✓
EP080: BTEXN							
Amber VOC Vial - Sulfuric Acid (EP080) GHD-QC06	24-Sep-2025	03-Oct-2025	08-Oct-2025	✓	03-Oct-2025	08-Oct-2025	✓



Matrix: **WATER**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EP090: Organotin Compounds (Soluble)								
Amber Glass Bottle - Unpreserved (EP090S) GHD-QC06	24-Sep-2025	02-Oct-2025	01-Oct-2025	✖	03-Oct-2025	11-Nov-2025	✔	
EP131A: Organochlorine Pesticides								
Amber Glass Bottle - Unpreserved (EP131A-ST) GHD-Applecross-202509-GR-SUR, GHD-Barrack-202509-GR-SUR, GHD-ElizQuay-202509-GR-SUR, GHD-Ellam-202509-GR-SUR, GHD-MatBay1-202509-GR-SUR, GHD-MatBay2-202509-GR-SUR, GHD-6161869-Heathcote-SUR, GHD-6160262-Nar-SUR, GHD-CanBridge-202509-GR-ARB, GHD-QC02, GHD-QC03	24-Sep-2025	03-Oct-2025	01-Oct-2025	✖	07-Oct-2025	12-Nov-2025	✔	
EP131B: Polychlorinated Biphenyls (as Aroclors)								
Amber Glass Bottle - Unpreserved (EP131B-ST) GHD-Applecross-202509-GR-SUR, GHD-Barrack-202509-GR-SUR, GHD-ElizQuay-202509-GR-SUR, GHD-Ellam-202509-GR-SUR, GHD-MatBay1-202509-GR-SUR, GHD-MatBay2-202509-GR-SUR, GHD-6161869-Heathcote-SUR, GHD-6160262-Nar-SUR, GHD-CanBridge-202509-GR-ARB, GHD-QC02, GHD-QC03	24-Sep-2025	03-Oct-2025	01-Oct-2025	✖	07-Oct-2025	12-Nov-2025	✔	
EP132B: Polynuclear Aromatic Hydrocarbons								
Amber Glass Bottle - Unpreserved (EP132-ST) GHD-Applecross-202509-GR-SUR, GHD-Barrack-202509-GR-SUR, GHD-ElizQuay-202509-GR-SUR, GHD-Ellam-202509-GR-SUR, GHD-MatBay1-202509-GR-SUR, GHD-MatBay2-202509-GR-SUR, GHD-6161869-Heathcote-SUR, GHD-6160262-Nar-SUR, GHD-QC02, GHD-QC03	24-Sep-2025	03-Oct-2025	01-Oct-2025	✖	04-Oct-2025	12-Nov-2025	✔	
Amber Glass Bottle - Unpreserved (EP132-ST) GHD-CanBridge-202509-GR-SUR, GHD-CanBridge-202509-GR-ARB	24-Sep-2025	03-Oct-2025	01-Oct-2025	✖	05-Oct-2025	12-Nov-2025	✔	



Matrix: **WATER**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EP132B: Polynuclear Aromatic Hydrocarbons (super trace)								
Amber Glass Bottle - Unpreserved (EP132-ST) GHD-Applecross-202509-GR-SUR, GHD-Barrack-202509-GR-SUR, GHD-ElizQuay-202509-GR-SUR, GHD-Ellam-202509-GR-SUR, GHD-MatBay1-202509-GR-SUR, GHD-MatBay2-202509-GR-SUR, GHD-6161869-Heathcote-SUR, GHD-6160262-Nar-SUR, GHD-QC02,	GHD-Applecross-202509-GR-ARB, GHD-Barrack-202509-GR-ARB, GHD-ElizQuay-202509-GR-ARB, GHD-Ellam-202509-GR-ARB, GHD-MatBay1-202509-GR-ARB, GHD-MatBay2-202509-GR-ARB, GHD-6164602-MatCentral-SUR, GHD-QC01, GHD-QC03	24-Sep-2025	03-Oct-2025	01-Oct-2025	✖	04-Oct-2025	12-Nov-2025	✔
Amber Glass Bottle - Unpreserved (EP132-ST) GHD-CanBridge-202509-GR-SUR,	GHD-CanBridge-202509-GR-ARB	24-Sep-2025	03-Oct-2025	01-Oct-2025	✖	05-Oct-2025	12-Nov-2025	✔
EP231A: Perfluoroalkyl Sulfonic Acids								
HDPE (no PTFE) (EP231X-SUT) GHD-QC06		24-Sep-2025	01-Oct-2025	23-Mar-2026	✔	03-Oct-2025	23-Mar-2026	✔
EP231B: Perfluoroalkyl Carboxylic Acids								
HDPE (no PTFE) (EP231X-SUT) GHD-QC06		24-Sep-2025	01-Oct-2025	23-Mar-2026	✔	03-Oct-2025	23-Mar-2026	✔
EP231C: Perfluoroalkyl Sulfonamides								
HDPE (no PTFE) (EP231X-SUT) GHD-QC06		24-Sep-2025	01-Oct-2025	23-Mar-2026	✔	03-Oct-2025	23-Mar-2026	✔
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
HDPE (no PTFE) (EP231X-SUT) GHD-QC06		24-Sep-2025	01-Oct-2025	23-Mar-2026	✔	03-Oct-2025	23-Mar-2026	✔
EP231P: PFAS Sums								
HDPE (no PTFE) (EP231X-SUT) GHD-QC06		24-Sep-2025	01-Oct-2025	23-Mar-2026	✔	03-Oct-2025	23-Mar-2026	✔
EP234A: OP Pesticides								
Amber Glass Bottle - Unpreserved (EP234-LL) GHD-Applecross-202509-GR-SUR, GHD-Barrack-202509-GR-SUR, GHD-ElizQuay-202509-GR-SUR, GHD-Ellam-202509-GR-SUR, GHD-MatBay1-202509-GR-SUR, GHD-MatBay2-202509-GR-SUR, GHD-6161869-Heathcote-SUR, GHD-6160262-Nar-SUR, GHD-CanBridge-202509-GR-ARB, GHD-QC02,	GHD-Applecross-202509-GR-ARB, GHD-Barrack-202509-GR-ARB, GHD-ElizQuay-202509-GR-ARB, GHD-Ellam-202509-GR-ARB, GHD-MatBay1-202509-GR-ARB, GHD-MatBay2-202509-GR-ARB, GHD-6164602-MatCentral-SUR, GHD-CanBridge-202509-GR-SUR, GHD-QC01, GHD-QC03	24-Sep-2025	02-Oct-2025	01-Oct-2025	✖	02-Oct-2025	11-Nov-2025	✔



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Dissolved Mercury by FIMS - Low Level	EG035F-LL	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Saline Water -Suite A by ORC-ICPMS	EG093A-F	2	15	13.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Saline Water -Suite B by ORC-ICPMS	EG093B-F	2	15	13.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Low Level Dissolved Metals in Saline Water Suite A by ORC-ICPMS	EG093-F_LL	1	1	100.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Organochlorine Pesticides (ADWG, ANZECC)	EP131A-ST	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Organotin Compounds (Soluble)	EP090S	1	6	16.67	10.00	✓	NEPM 2013 B3 & ALS QC Standard
PAH Compounds in Water	EP132-ST	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
PCB's (Ultra-trace) for Catchment Monitoring	EP131B-ST	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	1	12	8.33	10.00	✗	NEPM 2013 B3 & ALS QC Standard
Pesticides by LCMSMS	EP234-LL	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS - Low Level	EG035T-LL	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Dissolved Mercury by FIMS - Low Level	EG035F-LL	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Saline Water -Suite A by ORC-ICPMS	EG093A-F	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Saline Water -Suite B by ORC-ICPMS	EG093B-F	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Low Level Dissolved Metals in Saline Water Suite A by ORC-ICPMS	EG093-F_LL	1	1	100.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Organochlorine Pesticides (ADWG, ANZECC)	EP131A-ST	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Organotin Compounds (Soluble)	EP090S	1	6	16.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
PAH Compounds in Water	EP132-ST	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
PCB's (Ultra-trace) for Catchment Monitoring	EP131B-ST	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	1	12	8.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by LCMSMS	EP234-LL	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS - Low Level	EG035T-LL	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Dissolved Mercury by FIMS - Low Level	EG035F-LL	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Saline Water -Suite A by ORC-ICPMS	EG093A-F	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Saline Water -Suite B by ORC-ICPMS	EG093B-F	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Low Level Dissolved Metals in Saline Water Suite A by ORC-ICPMS	EG093-F_LL	1	1	100.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Organochlorine Pesticides (ADWG, ANZECC)	EP131A-ST	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard



Matrix: **WATER**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification .

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Method Blanks (MB) - Continued							
Organotin Compounds (Soluble)	EP090S	1	6	16.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
PAH Compounds in Water	EP132-ST	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
PCB's (Ultra-trace) for Catchment Monitoring	EP131B-ST	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	1	12	8.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by LCMSMS	EP234-LL	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS - Low Level	EG035T-LL	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Dissolved Mercury by FIMS - Low Level	EG035F-LL	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Saline Water -Suite A by ORC-ICPMS	EG093A-F	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Low Level Dissolved Metals in Saline Water Suite A by ORC-ICPMS	EG093-F_LL	0	1	0.00	5.00	✗	NEPM 2013 B3 & ALS QC Standard
Organochlorine Pesticides (ADWG, ANZECC)	EP131A-ST	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Organotin Compounds (Soluble)	EP090S	0	6	0.00	5.00	✗	NEPM 2013 B3 & ALS QC Standard
PAH Compounds in Water	EP132-ST	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
PCB's (Ultra-trace) for Catchment Monitoring	EP131B-ST	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	1	12	8.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by LCMSMS	EP234-LL	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS - Low Level	EG035T-LL	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	0	20	0.00	5.00	✗	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Dissolved Mercury by FIMS - Low Level	EG035F-LL	WATER	In house: Referenced to APHA 3112 Hg - B (Flow-injection (SnCl ₂)(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3).
Total Mercury by FIMS - Low Level	EG035T-LL	WATER	In house: Referenced to APHA 3112 Hg - B (Flow-injection (SnCl ₂)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the unfiltered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3).
Dissolved Metals in Saline Water -Suite A by ORC-ICPMS	EG093A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020 Samples are 0.45µm filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM Schedule B(3).
Dissolved Metals in Saline Water -Suite B by ORC-ICPMS	EG093B-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020 Samples are 0.45µm filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM Schedule B(3).
Low Level Dissolved Metals in Saline Water Suite A by ORC-ICPMS	EG093-F LL	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM Schedule B(3).
TRH - Semivolatile Fraction	EP071	WATER	In house: Referenced to USEPA SW 846 - 8015 The sample extract is analysed by Capillary GC/FID and quantification is by comparison against an established 5 point calibration curve of n-Alkane standards. This method is compliant with the QC requirements of NEPM Schedule B(3)
TRH Volatiles/BTEX	EP080	WATER	In house: Referenced to USEPA SW 846 - 8260 Water samples are directly purged prior to analysis by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. Alternatively, a sample is equilibrated in a headspace vial and a portion of the headspace determined by GCMS analysis. This method is compliant with the QC requirements of NEPM Schedule B(3)
Organotin Compounds (Soluble)	EP090S	WATER	In house: Referenced to USEPA SW 846 - 8270 Sample extracts are analysed by GC/MS coupled with high volume injection and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3)



Analytical Methods	Method	Matrix	Method Descriptions
Organochlorine Pesticides (ADWG, ANZECC)	EP131A-ST	WATER	In house: Referenced to USEPA method 8081. Samples are extracted into solvent. Extracts analysed by large volume injection gas chromatography with electron capture detection. The method is designed to meet detection requirements of ADWG and ANZECC in clean waters.
PCB's (Ultra-trace) for Catchment Monitoring	EP131B-ST	WATER	In house: Referenced to USEPA Method 3640 (GPC cleanup), 3620 (Florisil), 8081/8082 (GC/μECD/μECD). This method is compliant with NEPM Schedule B(3)
PAH Compounds in Water	EP132-ST	WATER	In house, Samples are extracted into solvent in original containers. Determination by large volume injection GCMS in selected ion monitoring (SIM) mode.
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	WATER	In-house: Analysis of fresh and saline waters by solid phase extraction (SPE) followed by negative mode LC-ESI-MS/MS using MRM and isotope dilution or internal standard quantitation. Isotope dilution standards (where commercially available) and surrogates are added to the sample container. The entire contents are transferred to a weak anion exchange (WAX) solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is combined with an equal volume of reagent water and a portion is filtered for analysis. Data quality objectives for internal standard recoveries are based on US EPA method 1633.
Pesticides by LCMSMS	EP234-LL	WATER	In house: Samples are concentrated using solid phase extraction and eluted with methylene chloride which is evaporated to dryness. Extracts are reconstituted in HPLC mobile phase and analysed by LCMSMS in ESI positive mode.

Preparation Methods	Method	Matrix	Method Descriptions
LCMSMS Pesticide LL Extraction	* EP234-LL-PR	WATER	In house: Samples are extracted in a separatory funnel using methylene chloride.
Separatory Funnel Extraction of Liquids	ORG14	WATER	In house: Referenced to USEPA SW 846 - 3510 100 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM Schedule B(3) . ALS default excludes sediment which may be resident in the container.
Liquid Liquid Extraction (in-bottle - trace) -	ORG14-IB-ST	WATER	In house: A 50 mL of representative portion of a 500 mL sample is discarded. A portion of solvent (less dense than water) is used to extract the sample (horizontal shaker for 30 minutes) and a portion of the extract analysed directly.
Sep. Funnel Extraction of Liquids (Ultra-trace pesticides.)	ORG14-UTP	WATER	In house: Referenced to USEPA 3510 Samples are extracted into dichloromethane, concentrated and exchanged into an appropriate solvent for GPC and florisil cleanup as required. This method is compliant with NEPM Schedule B(3) . ALS default excludes sediment which may be resident in the container.
Volatiles Water Preparation	ORG16-W	WATER	A 5 mL aliquot or 5 mL of a diluted sample is added to a 40 mL VOC vial for purging.
Organotin Sample Preparation	ORG34	WATER	In house. A specified volume of sample is spiked with surrogate, acidified and vacuum filtered. Reagents and solvent are added and the mixture tumbled. The butyltin compounds is derivatisated, extracted and the substitution reaction completed. The extract is transferred to a separatory funnel and further extracted two times with petroleum ether. The resultant extracts are combined and concentrated for analysis.
Solid Phase Extraction (SPE) for PFAS in water	* ORG72	WATER	In-house: Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is combined with an equal volume of reagent water and a portion is filtered for analysis. Method procedures conform to US DoD QSM 5.3, table B-15 requirements.

CHAIN OF CUSTODY RECORD AND ANALYSIS REQUEST				GHD Level 10, 999 Hay Street Perth WA 6000		PO Box 3106 Perth WA 6832		Reception Ph: 08 6222 8222		Page <u>1</u> of <u>1</u>																									
Project No. (as set up in ESdat) 12658388		Site Name (as set up in ESdat) Swan River Ferry Expansion: Swan River Monitoring		Laboratory: ALS		Address: Sample Receipt																													
Laboratory Quote No. EP25GHDSE0041_V4		Turnaround Time Standard (5 days)		Analyses								Remarks																							
Job Manager (Invoice) & GHD accounts louise.cockerton@ghd.com		Email Address (Results) Louise.cockerton@ghd.com Disha.Bhaugreet@ghd.com solene.lao@ghd.com		Sample Matrix: Soil/Solid/Sludge/Water/Air		Type: Bottle/Jar/Vial/Bag/Glass/Plastic		Preservative: Unpreserved/HCl/H2SO4/HNO3/Other		No		Dissolved Mercury (EG035F-LL)		Total Mercury (EG035T-LL)		Super Trace OC Pesticides (EP131A-ST)		Super Trace PCBs (EP131B-ST)		Super Trace PAHs (EP132-ST)		Pesticides (EP234-LL)		PFAS Super Ultra Trace long suite (EP231X-SUT)		Tributyltin (TBT)		TRH and BTEXN		EG033F* Metals filtered - As, Al, Cr, Fe, Pb, Mn, Ni and Se		EG093-F_LL Filtered metals - Co and Cu			
GHD Sample ID		Date		Time		Sample Matrix		Type		Preservative		No		Dissolved Mercury (EG035F-LL)		Total Mercury (EG035T-LL)		Super Trace OC Pesticides (EP131A-ST)		Super Trace PCBs (EP131B-ST)		Super Trace PAHs (EP132-ST)		Pesticides (EP234-LL)		PFAS Super Ultra Trace long suite (EP231X-SUT)		Tributyltin (TBT)		TRH and BTEXN		EG033F* Metals filtered - As, Al, Cr, Fe, Pb, Mn, Ni and Se		EG093-F_LL Filtered metals - Co and Cu	
1	GHD-Applecross-202509-GR-SUR	24-Sep-25		W	3 x G, 2 x P	Various	5	X	X	X	X	X	X	X	X	X																			
2	GHD-Applecross-202509-GR-ARB	24-Sep-25		W	3 x G, 2 x P	Various	5	X	X	X	X	X	X	X	X	X																			
3	GHD-Barrack-202509-GR-SUR	24-Sep-25		W	3 x G, 2 x P	Various	5	X	X	X	X	X	X	X	X	X																			
4	GHD-Barrack-202509-GR-ARB	24-Sep-25		W	3 x G, 2 x P	Various	5	X	X	X	X	X	X	X	X	X																			
5	GHD-ElizQuay-202509-GR-SUR	24-Sep-25		W	3 x G, 2 x P	Various	5	X	X	X	X	X	X	X	X	X																			
6	GHD-ElizQuay-202509-GR-ARB	24-Sep-25		W	3 x G, 2 x P	Various	5	X	X	X	X	X	X	X	X	X																			
7	GHD-Ellam-202509-GR-SUR	24-Sep-25		W	3 x G, 2 x P	Various	5	X	X	X	X	X	X	X	X	X																			
8	GHD-Ellam-202509-GR-ARB	24-Sep-25		W	3 x G, 2 x P	Various	5	X	X	X	X	X	X	X	X	X																			
9	GHD-MatBay1-202509-GR-SUR	24-Sep-25		W	3 x G, 2 x P	Various	5	X	X	X	X	X	X	X	X	X																			
10	GHD-MatBay1-202509-GR-ARB	24-Sep-25		W	3 x G, 2 x P	Various	5	X	X	X	X	X	X	X	X	X																			
11	GHD-MatBay2-202509-GR-SUR	24-Sep-25		W	3 x G, 2 x P	Various	5	X	X	X	X	X	X	X	X	X																			
12	GHD-MatBay2-202509-GR-ARB	24-Sep-25		W	3 x G, 2 x P	Various	5	X	X	X	X	X	X	X	X	X																			
13	GHD-6161869-Heathcote-SUR	24-Sep-25		W	3 x G, 2 x P	Various	5	X	X	X	X	X	X	X	X	X																			
14	GHD-6164602-MatCentral-SUR	24-Sep-25		W	3 x G, 2 x P	Various	5	X	X	X	X	X	X	X	X	X																			
15	GHD-6160262-Nar-SUR	24-Sep-25		W	3 x G, 2 x P	Various	5	X	X	X	X	X	X	X	X	X																			
16	GHD-CanBridge-202509-GR-SUR	24-Sep-25		W	3 x G, 2 x P	Various	5	X	X	X	X	X	X	X	X	X																			
17	GHD-CanBridge-202509-GR-ARB	24-Sep-25		W	3 x G, 2 x P	Various	5	X	X	X	X	X	X	X	X	X																			
18	GHD-QC01	24-Sep-25		W	3 x G, 2 x P	Various	5	X	X	X	X	X	X	X	X	X																			
19	GHD-QC02	24-Sep-25		W	3 x G, 2 x P	Various	5	X	X	X	X	X	X	X	X	X																			
20	GHD-QC03	24-Sep-25		W	3 x G, 2 x P	Various	5	X	X	X	X	X	X	X	X	X																			
21	GHD-QC06	24-Sep-25		W	2 x P, 2 x PFAS, 1 x 2 x G, 2 x V	Various	9										X	X	X	X	X	X													
Sampled by: S Lao				Date/Time: 24/09/2025				Relinquished by: S Lao				Date/Time: 24/09/2025																							
Requested by:				Date/Time:				Relinquished by:				Date/Time: 1330 25/9																							

Environmental Division
Perth
Work Order Reference
EP2515984



Telephone : + 61-8-9406 1301

PH

GHD Pty Ltd WA
999 Hay Street Perth
Perth
WA 6004

Attention: Louise Cockerton

Report 1272659-W
Project name SWAN RIVER FERRY EXPANSION: SWAN RIVER MONITORING
Project ID 12658388
Received Date Sep 25, 2025

Client Sample ID			GHD-APPLECROSS-202509-GR-SUR	GHD-APPLECROSS-202509-GR-ARB	GHD-BARRACK-202509-GR-SUR	GHD-BARRACK-202509-GR-ARB
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			L25-Se0078933	L25-Se0078934	L25-Se0078935	L25-Se0078936
Date Sampled			Sep 24, 2025	Sep 24, 2025	Sep 24, 2025	Sep 24, 2025
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C10-C14	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C15-C28	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04
TRH C29-C36	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04
TRH C10-C36 (Total)	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04
BTEX						
Benzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Toluene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Xylenes - Total*	0.003	mg/L	< 0.003	< 0.003	< 0.003	< 0.003
4-Bromofluorobenzene (surr.)	1	%	88	88	90	88
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene ^{N02}	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
TRH >C10-C16 less Naphthalene (F2) ^{*N01}	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C6-C10	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C6-C10 less BTEX (F1) ^{N04}	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
TRH >C10-C16	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH >C16-C34	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C34-C40	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C10-C40 (total)*	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
Organotins in Water						
Monobutyl tin as Sn*	5	ng/L	< 5	< 5	< 5	< 5
Dibutyl tin as Sn*	5	ng/L	< 5	< 5	< 5	< 5
Tributyl tin as Sn*	2	ng/L	< 2	< 2	< 2	< 2
Chloride	5	mg/L	3500	14000	3300	14000
Conductivity (at 25 °C)	10	uS/cm	11000	41000	11000	42000
Sulfate (as SO4)	1	mg/L	480	2000	410	1900
Sulphide (as S)	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
Total Dissolved Solids Dried at 180 °C ± 2 °C	5	mg/L	6700	24000	6400	25000

Client Sample ID			GHD-APPLECROSS-202509-GR-SUR	GHD-APPLECROSS-202509-GR-ARB	GHD-BARRACK-202509-GR-SUR	GHD-BARRACK-202509-GR-ARB
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			L25-Se0078933	L25-Se0078934	L25-Se0078935	L25-Se0078936
Date Sampled			Sep 24, 2025	Sep 24, 2025	Sep 24, 2025	Sep 24, 2025
Test/Reference	LOR	Unit				
Alkalinity (speciated)						
Bicarbonate Alkalinity (as CaCO ₃)	5	mg/L	96	130	97	120
Carbonate Alkalinity (as CaCO ₃)	5	mg/L	< 5	< 5	< 5	< 5
Hydroxide Alkalinity (as CaCO ₃)	5	mg/L	< 5	< 5	< 5	< 5
Total Alkalinity (as CaCO ₃)	5	mg/L	96	130	97	120
Eurofins Suite B11C: Na/K/Ca/Mg						
Calcium	0.5	mg/L	97	350	99	360
Magnesium	0.5	mg/L	260	1100	280	1100
Potassium	0.5	mg/L	83	310	59	330
Sodium	0.5	mg/L	2600	9000	2200	9500
Perfluoroalkyl sulfonamido substances- Trace						
Perfluorooctane sulfonamide (FOSA) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol(N-MeFOSE) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
13C8-FOSA (surr.)	1	%	24	70	82	74
D3-N-MeFOSA (surr.)	1	%	22	25	16	22
D5-N-EtFOSA (surr.)	1	%	27	18	11	14
D7-N-MeFOSE (surr.)	1	%	12	47	42	45
D9-N-EtFOSE (surr.)	1	%	11	46	38	41
D5-N-EtFOSAA (surr.)	1	%	34	55	64	57
D3-N-MeFOSAA (surr.)	1	%	37	54	67	57
Perfluoroalkyl carboxylic acids (PFCAs) - Trace						
Perfluorobutanoic acid (PFBA) ^{N11}	0.005	ug/L	0.008	< 0.005	0.011	< 0.005
Perfluoropentanoic acid (PFPeA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluorohexanoic acid (PFHxA) ^{N11}	0.001	ug/L	0.007	0.002	0.005	0.002
Perfluoroheptanoic acid (PFHpA) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
Perfluorooctanoic acid (PFOA) ^{N11}	0.001	ug/L	0.005	0.001	0.003	0.001
Perfluorononanoic acid (PFNA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluorodecanoic acid (PFDA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluorotridecanoic acid (PFTriDA) ^{N15}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluoroundecanoic acid (PFUnDA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluorododecanoic acid (PFDoDA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluorotetradecanoic acid (PFTeDA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
13C4-PFBA (surr.)	1	%	^J 25	^J 18	^J 39	^J 22
13C5-PFPeA (surr.)	1	%	^J 19	^J 37	^J 23	^J 39
13C5-PFHxA (surr.)	1	%	^J 33	56	^J 44	59
13C4-PFHpA (surr.)	1	%	^J 39	74	57	74
13C8-PFOA (surr.)	1	%	^J 48	85	68	88
13C5-PFNA (surr.)	1	%	53	82	83	86
13C6-PFDA (surr.)	1	%	53	75	85	80
13C2-PFUnDA (surr.)	1	%	^J 43	64	86	65

Client Sample ID			GHD-APPLECROSS-202509-GR-SUR	GHD-APPLECROSS-202509-GR-ARB	GHD-BARRACK-202509-GR-SUR	GHD-BARRACK-202509-GR-ARB
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			L25-Se0078933	L25-Se0078934	L25-Se0078935	L25-Se0078936
Date Sampled			Sep 24, 2025	Sep 24, 2025	Sep 24, 2025	Sep 24, 2025
Test/Reference	LOR	Unit				
Perfluoroalkyl carboxylic acids (PFCAs) - Trace						
13C2-PFDoDA (surr.)	1	%	^J -34	57	68	53
13C2-PFTeDA (surr.)	1	%	^J -15	^J -39	^J -27	^J -25
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)- Trace						
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
13C2-4:2 FTSA (surr.)	1	%	54	83	77	85
13C2-6:2 FTSA (surr.)	1	%	80	109	117	115
13C2-8:2 FTSA (surr.)	1	%	82	76	127	88
13C2-10:2 FTSA (surr.)	1	%	43	57	68	52
Perfluoroalkyl sulfonic acids (PFSA)- Ultra trace						
Perfluorobutanesulfonic acid (PFBS) ^{N11}	0.001	ug/L	0.002	< 0.001	0.002	< 0.001
Perfluorononanesulfonic acid (PFNS) ^{*N15}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluorooctanesulfonic acid (PFOS) ^{N11}	0.0001	ug/L	0.016	0.0060	0.020	0.0062
Perfluoropropanesulfonic acid (PFPrS) ^{*N15}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluoropentanesulfonic acid (PFPeS) ^{N15}	0.001	ug/L	0.001	< 0.001	0.002	< 0.001
Perfluorohexanesulfonic acid (PFHxS) ^{N11}	0.001	ug/L	0.009	0.003	0.011	0.003
Perfluoroheptanesulfonic acid (PFHpS) ^{N15}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluorodecanesulfonic acid (PFDS) ^{N15}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
13C3-PFBS (surr.)	1	%	^J -45	76	66	83
18O2-PFHxS (surr.)	1	%	62	105	100	108
13C8-PFOS (surr.)	1	%	62	84	110	92
PFASs Summations						
Sum (PFHxS + PFOS)*	0.001	ug/L	0.025	0.009	0.031	0.0092
Sum of enHealth PFAS (PFHxS + PFOS + PFOA)*	0.001	ug/L	0.03	0.01	0.034	0.0102
Sum of PFASs (n=30)*	0.005	ug/L	0.048	0.012	0.054	0.012
Sum of US EPA PFAS (PFOS + PFOA)*	0.001	ug/L	0.021	0.007	0.023	0.007
Sum of WA DWER PFAS (n=10)*	0.005	ug/L	0.047	0.012	0.052	0.0122

Client Sample ID			GHD-ELIZQUAY-202509-GR-SUR	GHD-ELIZQUAY-202509-GR-ARB	GHD-ELLAM-202509-GR-SUR	GHD-ELLAM-202509-GR-ARB
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			L25-Se0078937	L25-Se0078938	L25-Se0078939	L25-Se0078940
Date Sampled			Sep 24, 2025	Sep 24, 2025	Sep 24, 2025	Sep 24, 2025
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C10-C14	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C15-C28	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04
TRH C29-C36	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04
TRH C10-C36 (Total)	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04

Client Sample ID			GHD-ELIZQUAY-202509-GR-SUR	GHD-ELIZQUAY-202509-GR-ARB	GHD-ELLAM-202509-GR-SUR	GHD-ELLAM-202509-GR-ARB
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			L25-Se0078937	L25-Se0078938	L25-Se0078939	L25-Se0078940
Date Sampled			Sep 24, 2025	Sep 24, 2025	Sep 24, 2025	Sep 24, 2025
Test/Reference	LOR	Unit				
BTEX						
Benzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Toluene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Xylenes - Total*	0.003	mg/L	< 0.003	< 0.003	< 0.003	< 0.003
4-Bromofluorobenzene (surr.)	1	%	91	90	89	88
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene ^{N02}	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
TRH >C10-C16 less Naphthalene (F2) ^{*N01}	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C6-C10	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C6-C10 less BTEX (F1) ^{N04}	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
TRH >C10-C16	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH >C16-C34	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C34-C40	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C10-C40 (total)*	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
Organotins in Water						
Monobutyl tin as Sn*	5	ng/L	< 5	< 5	< 5	< 5
Dibutyl tin as Sn*	5	ng/L	< 5	< 5	< 5	< 5
Tributyl tin as Sn*	2	ng/L	< 2	< 2	< 2	< 2
Chloride	5	mg/L	4200	5200	2600	2500
Conductivity (at 25 °C)	10	uS/cm	13000	16000	8100	8200
Sulfate (as SO4)	1	mg/L	500	730	260	290
Sulphide (as S)	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
Total Dissolved Solids Dried at 180 °C ± 2 °C	5	mg/L	7800	9400	4900	4900
Alkalinity (speciated)						
Bicarbonate Alkalinity (as CaCO3)	5	mg/L	100	94	93	93
Carbonate Alkalinity (as CaCO3)	5	mg/L	< 5	< 5	< 5	< 5
Hydroxide Alkalinity (as CaCO3)	5	mg/L	< 5	< 5	< 5	< 5
Total Alkalinity (as CaCO3)	5	mg/L	100	94	93	93
Eurofins Suite B11C: Na/K/Ca/Mg						
Calcium	0.5	mg/L	100	140	80	83
Magnesium	0.5	mg/L	280	390	210	210
Potassium	0.5	mg/L	63	94	29	29
Sodium	0.5	mg/L	2200	3100	1500	1500
Perfluoroalkyl sulfonamido substances- Trace						
Perfluorooctane sulfonamide (FOSA) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol(N-MeFOSE) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005

Client Sample ID			GHD-ELIZQUAY-202509-GR-SUR	GHD-ELIZQUAY-202509-GR-ARB	GHD-ELLAM-202509-GR-SUR	GHD-ELLAM-202509-GR-ARB
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			L25-Se0078937	L25-Se0078938	L25-Se0078939	L25-Se0078940
Date Sampled			Sep 24, 2025	Sep 24, 2025	Sep 24, 2025	Sep 24, 2025
Test/Reference	LOR	Unit				
Perfluoroalkyl sulfonamido substances- Trace						
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
13C8-FOSA (surr.)	1	%	80	80	^J -36	^J -13
D3-N-MeFOSA (surr.)	1	%	35	23	^J -25	^J -32
D5-N-EtFOSA (surr.)	1	%	27	15	^J -27	^J -27
D7-N-MeFOSE (surr.)	1	%	49	41	^J -13	^J -33
D9-N-EtFOSE (surr.)	1	%	45	36	37	47
D5-N-EtFOSAA (surr.)	1	%	66	62	^J -18	^J -15
D3-N-MeFOSAA (surr.)	1	%	65	62	^J -21	^J -19
Perfluoroalkyl carboxylic acids (PFCAs) - Trace						
Perfluorobutanoic acid (PFBA) ^{N11}	0.005	ug/L	0.009	0.008	0.006	0.007
Perfluoropentanoic acid (PFPeA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	0.005	0.005
Perfluorohexanoic acid (PFHxA) ^{N11}	0.001	ug/L	0.005	0.005	0.004	0.005
Perfluoroheptanoic acid (PFHpA) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
Perfluorooctanoic acid (PFOA) ^{N11}	0.001	ug/L	0.003	0.003	0.003	0.003
Perfluorononanoic acid (PFNA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluorodecanoic acid (PFDA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluorotridecanoic acid (PFTTrDA) ^{N15}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluoroundecanoic acid (PFUnDA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluorododecanoic acid (PFDoDA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluorotetradecanoic acid (PFTeDA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
13C4-PFBA (surr.)	1	%	^J -14	^J -14	^J -11	^J -11
13C5-PFPeA (surr.)	1	%	^J -27	^J -29	^J -13	^J -15
13C5-PFHxA (surr.)	1	%	^J -48	52	^J -19	^J -21
13C4-PFHpA (surr.)	1	%	61	66	^J -23	^J -26
13C8-PFOA (surr.)	1	%	77	79	^J -25	^J -32
13C5-PFNA (surr.)	1	%	82	87	^J -28	^J -31
13C6-PFDA (surr.)	1	%	85	89	^J -19	^J -20
13C2-PFUnDA (surr.)	1	%	80	77	^J -10	^J -8.9
13C2-PFDoDA (surr.)	1	%	63	59	^J -18	^J -18
13C2-PFTeDA (surr.)	1	%	^J -34	^J -22	^J -10	^J -10
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)- Trace						
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
13C2-4:2 FTSA (surr.)	1	%	89	85	^J -41	^J -47
13C2-6:2 FTSA (surr.)	1	%	121	158	87	97
13C2-8:2 FTSA (surr.)	1	%	113	116	63	61
13C2-10:2 FTSA (surr.)	1	%	64	62	^J -13	^J -158
Perfluoroalkyl sulfonic acids (PFSAs)- Ultra trace						
Perfluorobutanesulfonic acid (PFBS) ^{N11}	0.001	ug/L	0.002	0.002	0.002	0.002
Perfluorononanesulfonic acid (PFNS) ^{*N15}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluorooctanesulfonic acid (PFOS) ^{N11}	0.0001	ug/L	0.018	0.016	0.020	0.021
Perfluoropropanesulfonic acid (PFPrS) ^{*N15}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001

Client Sample ID			GHD-ELIZQUAY-202509-GR-SUR	GHD-ELIZQUAY-202509-GR-ARB	GHD-ELLAM-202509-GR-SUR	GHD-ELLAM-202509-GR-ARB
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			L25-Se0078937	L25-Se0078938	L25-Se0078939	L25-Se0078940
Date Sampled			Sep 24, 2025	Sep 24, 2025	Sep 24, 2025	Sep 24, 2025
Test/Reference	LOR	Unit				
Perfluoroalkyl sulfonic acids (PFASs)- Ultra trace						
Perfluoropentanesulfonic acid (PFPeS) ^{N15}	0.001	ug/L	0.002	0.002	0.001	0.001
Perfluorohexanesulfonic acid (PFHxS) ^{N11}	0.001	ug/L	0.011	0.009	0.012	0.012
Perfluoroheptanesulfonic acid (PFHpS) ^{N15}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluorodecanesulfonic acid (PFDS) ^{N15}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
13C3-PFBS (surr.)	1	%	75	79	J-54	J-30
18O2-PFHxS (surr.)	1	%	102	114	J-35	J-39
13C8-PFOS (surr.)	1	%	104	113	J-25	J-26
PFASs Summations						
Sum (PFHxS + PFOS)*	0.001	ug/L	0.029	0.025	0.032	0.033
Sum of enHealth PFAS (PFHxS + PFOS + PFOA)*	0.001	ug/L	0.032	0.028	0.035	0.036
Sum of PFASs (n=30)*	0.005	ug/L	0.050	0.045	0.053	0.056
Sum of US EPA PFAS (PFOS + PFOA)*	0.001	ug/L	0.021	0.019	0.023	0.024
Sum of WA DWER PFAS (n=10)*	0.005	ug/L	0.048	0.043	0.052	0.055

Client Sample ID			GHD-MATBAY1-202509-GR-SUR	GHD-MATBAY1-202509-GR-ARB	GHD-MATBAY2-202509-GR-SUR	GHD-MATBAY2-202509-GR-ARB
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			L25-Se0078941	L25-Se0078942	L25-Se0078943	L25-Se0078944
Date Sampled			Sep 24, 2025	Sep 24, 2025	Sep 24, 2025	Sep 24, 2025
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C10-C14	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C15-C28	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04
TRH C29-C36	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04
TRH C10-C36 (Total)	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04
BTEX						
Benzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Toluene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Xylenes - Total*	0.003	mg/L	< 0.003	< 0.003	< 0.003	< 0.003
4-Bromofluorobenzene (surr.)	1	%	93	91	91	89
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene ^{N02}	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
TRH >C10-C16 less Naphthalene (F2)* ^{N01}	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C6-C10	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C6-C10 less BTEX (F1)* ^{N04}	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
TRH >C10-C16	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH >C16-C34	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C34-C40	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C10-C40 (total)*	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05

Client Sample ID			GHD-MATBAY1-202509-GR-SUR	GHD-MATBAY1-202509-GR-ARB	GHD-MATBAY2-202509-GR-SUR	GHD-MATBAY2-202509-GR-ARB
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			L25-Se0078941	L25-Se0078942	L25-Se0078943	L25-Se0078944
Date Sampled			Sep 24, 2025	Sep 24, 2025	Sep 24, 2025	Sep 24, 2025
Test/Reference	LOR	Unit				
Organotins in Water						
Monobutyl tin as Sn*	5	ng/L	< 5	< 5	< 5	< 5
Dibutyl tin as Sn*	5	ng/L	< 5	< 5	< 5	< 5
Tributyl tin as Sn*	2	ng/L	< 2	< 2	< 2	< 2
Chloride	5	mg/L	3800	16000	3700	15000
Conductivity (at 25 °C)	10	uS/cm	12000	43000	12000	42000
Sulfate (as SO ₄)	1	mg/L	460	2100	440	2100
Sulphide (as S)	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
Total Dissolved Solids Dried at 180 °C ± 2 °C	5	mg/L	6900	26000	7100	25000
Alkalinity (speciated)						
Bicarbonate Alkalinity (as CaCO ₃)	5	mg/L	84	110	88	110
Carbonate Alkalinity (as CaCO ₃)	5	mg/L	6.4	< 5	< 5	< 5
Hydroxide Alkalinity (as CaCO ₃)	5	mg/L	< 5	< 5	< 5	< 5
Total Alkalinity (as CaCO ₃)	5	mg/L	90	110	88	110
Eurofins Suite B11C: Na/K/Ca/Mg						
Calcium	0.5	mg/L	100	350	100	360
Magnesium	0.5	mg/L	280	1100	270	1100
Potassium	0.5	mg/L	64	310	64	320
Sodium	0.5	mg/L	2200	9000	2100	9300
Perfluoroalkyl sulfonamido substances- Trace						
Perfluorooctane sulfonamide (FOSA) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol(N-MeFOSE) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
13C8-FOSA (surr.)	1	%	45	65	31	27
D3-N-MeFOSA (surr.)	1	%	14	21	7.0	23
D5-N-EtFOSA (surr.)	1	%	10	15	4.0	15
D7-N-MeFOSE (surr.)	1	%	16	35	9.0	16
D9-N-EtFOSE (surr.)	1	%	12	31	7.0	12
D5-N-EtFOSAA (surr.)	1	%	33	52	32	23
D3-N-MeFOSAA (surr.)	1	%	35	55	36	26
Perfluoroalkyl carboxylic acids (PFCAs) - Trace						
Perfluorobutanoic acid (PFBA) ^{N11}	0.005	ug/L	0.006	< 0.005	0.006	< 0.005
Perfluoropentanoic acid (PFPeA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluorohexanoic acid (PFHxA) ^{N11}	0.001	ug/L	0.005	0.002	0.005	0.002
Perfluoroheptanoic acid (PFHpA) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
Perfluorooctanoic acid (PFOA) ^{N11}	0.001	ug/L	0.003	< 0.001	0.003	0.001
Perfluorononanoic acid (PFNA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluorodecanoic acid (PFDA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluorotridecanoic acid (PFTrDA) ^{N15}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluoroundecanoic acid (PFUnDA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001

Client Sample ID			GHD-MATBAY1-202509-GR-SUR	GHD-MATBAY1-202509-GR-ARB	GHD-MATBAY2-202509-GR-SUR	GHD-MATBAY2-202509-GR-ARB
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			L25-Se0078941	L25-Se0078942	L25-Se0078943	L25-Se0078944
Date Sampled			Sep 24, 2025	Sep 24, 2025	Sep 24, 2025	Sep 24, 2025
Test/Reference	LOR	Unit				
Perfluoroalkyl carboxylic acids (PFCAs) - Trace						
Perfluorododecanoic acid (PFDoDA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluorotetradecanoic acid (PFTeDA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
13C4-PFBA (surr.)	1	%	^J 4.0	^J 46	^J 6.0	^J 24
13C5-PFPeA (surr.)	1	%	^J 25	^J 49	^J 24	^J 34
13C5-PFHxA (surr.)	1	%	^J 44	68	^J 37	^J 46
13C4-PFHpA (surr.)	1	%	53	86	51	55
13C8-PFOA (surr.)	1	%	62	90	58	56
13C5-PFNA (surr.)	1	%	61	85	61	^J 45
13C6-PFDA (surr.)	1	%	51	73	52	^J 35
13C2-PFUnDA (surr.)	1	%	^J 42	59	^J 38	^J 23
13C2-PFDoDA (surr.)	1	%	^J 24	^J 40	^J 17	^J 13
13C2-PFTeDA (surr.)	1	%	^J 6.0	^J 17	^J 3.0	^J 5.0
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)- Trace						
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
13C2-4:2 FTSA (surr.)	1	%	75	92	64	65
13C2-6:2 FTSA (surr.)	1	%	119	113	101	60
13C2-8:2 FTSA (surr.)	1	%	69	84	95	42
13C2-10:2 FTSA (surr.)	1	%	30	43	23	16
Perfluoroalkyl sulfonic acids (PFASs)- Ultra trace						
Perfluorobutanesulfonic acid (PFBS) ^{N11}	0.001	ug/L	0.002	< 0.001	0.002	< 0.001
Perfluorononanesulfonic acid (PFNS) ^{*N15}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluorooctanesulfonic acid (PFOS) ^{N11}	0.0001	ug/L	0.016	0.0050	0.016	0.0051
Perfluoropropanesulfonic acid (PFPrS) ^{*N15}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluoropentanesulfonic acid (PFPeS) ^{N15}	0.001	ug/L	0.001	< 0.001	0.002	< 0.001
Perfluorohexanesulfonic acid (PFHxS) ^{N11}	0.001	ug/L	0.009	0.003	0.009	0.003
Perfluoroheptanesulfonic acid (PFHpS) ^{N15}	0.001	ug/L	0.001	< 0.001	0.001	< 0.001
Perfluorodecanesulfonic acid (PFDS) ^{N15}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
13C3-PFBS (surr.)	1	%	66	98	56	61
18O2-PFHxS (surr.)	1	%	78	111	78	58
13C8-PFOS (surr.)	1	%	57	81	64	35
PFASs Summations						
Sum (PFHxS + PFOS)*	0.001	ug/L	0.025	0.008	0.025	0.0081
Sum of enHealth PFAS (PFHxS + PFOS + PFOA)*	0.001	ug/L	0.028	0.008	0.028	0.0091
Sum of PFASs (n=30)*	0.005	ug/L	0.043	0.010	0.044	0.011
Sum of US EPA PFAS (PFOS + PFOA)*	0.001	ug/L	0.019	0.005	0.019	0.006
Sum of WA DWER PFAS (n=10)*	0.005	ug/L	0.041	0.01	0.041	0.0111

Client Sample ID			GHD-6161869- HEATHCOTE- SUR	GHD-6164602- MATCENTRAL- SUR	GHD-6160262- NAR-SUR	GHD-CANBRIDGE- 202509-GR- SUR
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			L25-Se0078945	L25-Se0078946	L25-Se0078947	L25-Se0078948
Date Sampled			Sep 24, 2025	Sep 24, 2025	Sep 24, 2025	Sep 24, 2025
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C10-C14	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C15-C28	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04
TRH C29-C36	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04
TRH C10-C36 (Total)	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04
BTEX						
Benzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Toluene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Xylenes - Total*	0.003	mg/L	< 0.003	< 0.003	< 0.003	< 0.003
4-Bromofluorobenzene (surr.)	1	%	91	87	88	89
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene ^{N02}	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
TRH >C10-C16 less Naphthalene (F2) ^{*N01}	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C6-C10	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C6-C10 less BTEX (F1) ^{N04}	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
TRH >C10-C16	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH >C16-C34	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C34-C40	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C10-C40 (total)*	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
Organotins in Water						
Monobutyl tin as Sn*	5	ng/L	< 5	< 5	< 5	< 5
Dibutyl tin as Sn*	5	ng/L	< 5	< 5	< 5	< 5
Tributyl tin as Sn*	2	ng/L	< 2	< 2	< 2	< 2
Chloride	5	mg/L	3700	3700	2800	3500
Conductivity (at 25 °C)	10	uS/cm	12000	12000	8700	11000
Sulfate (as SO4)	1	mg/L	440	440	310	440
Sulphide (as S)	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
Total Dissolved Solids Dried at 180 °C ± 2 °C	5	mg/L	6900	7000	5200	6600
Alkalinity (speciated)						
Bicarbonate Alkalinity (as CaCO3)	5	mg/L	91	91	91	91
Carbonate Alkalinity (as CaCO3)	5	mg/L	< 5	< 5	< 5	< 5
Hydroxide Alkalinity (as CaCO3)	5	mg/L	< 5	< 5	< 5	< 5
Total Alkalinity (as CaCO3)	5	mg/L	91	91	91	91
Eurofins Suite B11C: Na/K/Ca/Mg						
Calcium	0.5	mg/L	100	100	79	96
Magnesium	0.5	mg/L	290	280	210	250
Potassium	0.5	mg/L	63	62	40	67
Sodium	0.5	mg/L	2200	2200	1600	2000

Client Sample ID			GHD-6161869- HEATHCOTE- SUR	GHD-6164602- MATCENTRAL- SUR	GHD-6160262- NAR-SUR	GHD-CANBRIDGE- 202509-GR- SUR
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			L25-Se0078945	L25-Se0078946	L25-Se0078947	L25-Se0078948
Date Sampled			Sep 24, 2025	Sep 24, 2025	Sep 24, 2025	Sep 24, 2025
Test/Reference	LOR	Unit				
Perfluoroalkyl sulfonamido substances- Trace						
Perfluorooctane sulfonamide (FOSA) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol(N-MeFOSE) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
13C8-FOSA (surr.)	1	%	18	52	28	38
D3-N-MeFOSA (surr.)	1	%	6.0	30	19	12
D5-N-EtFOSA (surr.)	1	%	7.0	25	16	13
D7-N-MeFOSE (surr.)	1	%	8.0	26	16	15
D9-N-EtFOSE (surr.)	1	%	8.0	22	14	15
D5-N-EtFOSAA (surr.)	1	%	22	47	22	48
D3-N-MeFOSAA (surr.)	1	%	20	47	24	48
Perfluoroalkyl carboxylic acids (PFCAs) - Trace						
Perfluorobutanoic acid (PFBA) ^{N11}	0.005	ug/L	< 0.005	0.005	0.006	0.006
Perfluoropentanoic acid (PFPeA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluorohexanoic acid (PFHxA) ^{N11}	0.001	ug/L	0.005	0.005	0.005	0.008
Perfluoroheptanoic acid (PFHpA) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
Perfluorooctanoic acid (PFOA) ^{N11}	0.001	ug/L	0.003	0.003	0.003	0.005
Perfluorononanoic acid (PFNA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluorodecanoic acid (PFDA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluorotridecanoic acid (PFTeDA) ^{N15}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluoroundecanoic acid (PFUnDA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluorododecanoic acid (PFDoDA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluorotetradecanoic acid (PFTeDA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
13C4-PFBA (surr.)	1	%	^J 6.0	^J 4.0	^J 10	^J 8.0
13C5-PFPeA (surr.)	1	%	^J 18	^J 17	^J 16	^J 25
13C5-PFHxA (surr.)	1	%	^J 27	^J 28	^J 25	^J 39
13C4-PFHpA (surr.)	1	%	^J 34	^J 36	^J 29	50
13C8-PFOA (surr.)	1	%	^J 36	^J 43	^J 32	56
13C5-PFNA (surr.)	1	%	^J 33	55	^J 32	65
13C6-PFDA (surr.)	1	%	^J 26	61	^J 30	66
13C2-PFUnDA (surr.)	1	%	^J 21	52	^J 26	55
13C2-PFDoDA (surr.)	1	%	^J 16	^J 34	^J 20	^J 32
13C2-PFTeDA (surr.)	1	%	^J 10	^J 13	^J 11	^J 13
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)- Trace						
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001

Client Sample ID			GHD-6161869- HEATHCOTE- SUR	GHD-6164602- MATCENTRAL- SUR	GHD-6160262- NAR-SUR	GHD-CANBRIDGE- 202509-GR- SUR
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			L25-Se0078945	L25-Se0078946	L25-Se0078947	L25-Se0078948
Date Sampled			Sep 24, 2025	Sep 24, 2025	Sep 24, 2025	Sep 24, 2025
Test/Reference	LOR	Unit				
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)- Trace						
13C2-4:2 FTSA (surr.)	1	%	46	46	42	66
13C2-6:2 FTSA (surr.)	1	%	63	78	60	105
13C2-8:2 FTSA (surr.)	1	%	40	89	45	106
13C2-10:2 FTSA (surr.)	1	%	21	43	25	43
Perfluoroalkyl sulfonic acids (PFASs)- Ultra trace						
Perfluorobutanesulfonic acid (PFBS) ^{N11}	0.001	ug/L	0.002	0.002	0.002	0.003
Perfluorononanesulfonic acid (PFNS) ^{*N15}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluorooctanesulfonic acid (PFOS) ^{N11}	0.0001	ug/L	0.017	0.016	0.019	0.017
Perfluoropropanesulfonic acid (PFPrS) ^{*N15}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluoropentanesulfonic acid (PFPeS) ^{N15}	0.001	ug/L	0.002	0.002	0.002	0.002
Perfluorohexanesulfonic acid (PFHxS) ^{N11}	0.001	ug/L	0.009	0.010	0.011	0.010
Perfluoroheptanesulfonic acid (PFHpS) ^{N15}	0.001	ug/L	0.001	< 0.001	0.001	0.001
Perfluorodecanesulfonic acid (PFDS) ^{N15}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
13C3-PFBS (surr.)	1	%	40	38	32	53
18O2-PFHxS (surr.)	1	%	51	57	42	74
13C8-PFOS (surr.)	1	%	31	64	30	77
PFASs Summations						
Sum (PFHxS + PFOS)*	0.001	ug/L	0.026	0.026	0.03	0.027
Sum of enHealth PFAS (PFHxS + PFOS + PFOA)*	0.001	ug/L	0.029	0.029	0.033	0.032
Sum of PFASs (n=30)*	0.005	ug/L	0.039	0.043	0.049	0.052
Sum of US EPA PFAS (PFOS + PFOA)*	0.001	ug/L	0.020	0.019	0.022	0.022
Sum of WA DWER PFAS (n=10)*	0.005	ug/L	0.036	0.041	0.046	0.049

Client Sample ID			GHD-CANBRIDGE- 202509-GR- ARB	GHD-QC01	GHD-QC02	GHD-QC03
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			L25-Se0078949	L25-Se0078950	L25-Se0078951	L25-Se0078952
Date Sampled			Sep 24, 2025	Sep 24, 2025	Sep 24, 2025	Sep 24, 2025
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C10-C14	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C15-C28	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04
TRH C29-C36	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04
TRH C10-C36 (Total)	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04
BTEX						
Benzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Toluene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Xylenes - Total*	0.003	mg/L	< 0.003	< 0.003	< 0.003	< 0.003
4-Bromofluorobenzene (surr.)	1	%	90	95	89	90

Client Sample ID			GHD-CANBRIDGE-202509-GR-ARB	GHD-QC01	GHD-QC02	GHD-QC03
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			L25-Se0078949	L25-Se0078950	L25-Se0078951	L25-Se0078952
Date Sampled			Sep 24, 2025	Sep 24, 2025	Sep 24, 2025	Sep 24, 2025
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene ^{N02}	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
TRH >C10-C16 less Naphthalene (F2) ^{*N01}	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C6-C10	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C6-C10 less BTEX (F1) ^{N04}	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
TRH >C10-C16	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH >C16-C34	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C34-C40	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C10-C40 (total)*	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
Organotins in Water						
Monobutyl tin as Sn*	5	ng/L	< 5	< 5	< 5	< 5
Dibutyl tin as Sn*	5	ng/L	< 5	< 5	< 5	< 5
Tributyl tin as Sn*	2	ng/L	< 2	< 2	< 2	< 2
Chloride	5	mg/L	16000	15000	< 5	< 5
Conductivity (at 25 °C)	10	uS/cm	44000	42000	< 10	< 10
Sulfate (as SO4)	1	mg/L	2100	2100	< 1	< 1
Sulphide (as S)	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
Total Dissolved Solids Dried at 180 °C ± 2 °C	5	mg/L	26000	25000	< 5	< 5
Alkalinity (speciated)						
Bicarbonate Alkalinity (as CaCO3)	5	mg/L	120	110	< 5	< 5
Carbonate Alkalinity (as CaCO3)	5	mg/L	< 5	< 5	< 5	< 5
Hydroxide Alkalinity (as CaCO3)	5	mg/L	< 5	< 5	< 5	< 5
Total Alkalinity (as CaCO3)	5	mg/L	120	110	< 5	< 5
Eurofins Suite B11C: Na/K/Ca/Mg						
Calcium	0.5	mg/L	370	360	< 0.5	< 0.5
Magnesium	0.5	mg/L	1200	1200	< 0.5	< 0.5
Potassium	0.5	mg/L	400	380	< 0.5	< 0.5
Sodium	0.5	mg/L	10000	10000	< 0.5	< 0.5
Perfluoroalkyl sulfonamido substances- Trace						
Perfluorooctane sulfonamide (FOSA) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol(N-MeFOSE) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
13C8-FOSA (surr.)	1	%	53	24	23	22
D3-N-MeFOSA (surr.)	1	%	15	13	3.0	3.0
D5-N-EtFOSA (surr.)	1	%	9.0	11	2.0	2.0
D7-N-MeFOSE (surr.)	1	%	27	15	11	9.0
D9-N-EtFOSE (surr.)	1	%	23	14	9.0	6.0
D5-N-EtFOSAA (surr.)	1	%	45	19	19	31
D3-N-MeFOSAA (surr.)	1	%	47	22	24	38

Client Sample ID			GHD-CANBRIDGE-202509-GR-ARB	GHD-QC01	GHD-QC02	GHD-QC03
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			L25-Se0078949	L25-Se0078950	L25-Se0078951	L25-Se0078952
Date Sampled			Sep 24, 2025	Sep 24, 2025	Sep 24, 2025	Sep 24, 2025
Test/Reference	LOR	Unit				
Perfluoroalkyl carboxylic acids (PFCAs) - Trace						
Perfluorobutanoic acid (PFBA) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
Perfluoropentanoic acid (PFPeA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluorohexanoic acid (PFHxA) ^{N11}	0.001	ug/L	0.002	0.002	< 0.001	< 0.001
Perfluoroheptanoic acid (PFHpA) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
Perfluorooctanoic acid (PFOA) ^{N11}	0.001	ug/L	0.001	< 0.001	< 0.001	< 0.001
Perfluorononanoic acid (PFNA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluorodecanoic acid (PFDA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluorotridecanoic acid (PFTeDA) ^{N15}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluoroundecanoic acid (PFUnDA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluorododecanoic acid (PFDoDA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluorotetradecanoic acid (PFTeDA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
13C4-PFBA (surr.)	1	%	^J -36	^J -17	^J -44	^J -49
13C5-PFPeA (surr.)	1	%	^J -41	^J -23	106	81
13C5-PFHxA (surr.)	1	%	55	^J -29	87	79
13C4-PFHpA (surr.)	1	%	66	^J -30	82	79
13C8-PFOA (surr.)	1	%	66	^J -28	74	68
13C5-PFNA (surr.)	1	%	65	^J -25	55	68
13C6-PFDA (surr.)	1	%	62	^J -23	^J -29	51
13C2-PFUnDA (surr.)	1	%	^J -46	^J -19	^J -10	^J -34
13C2-PFDoDA (surr.)	1	%	^J -32	^J -15	^J -3.0	^J -19
13C2-PFTeDA (surr.)	1	%	^J -8.0	^J -11	^J -1.0	^J -6.0
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)- Trace						
1H,1H,2H,2H-perfluorohexanesulfonic acid (4:2 FTSA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
1H,1H,2H,2H-perfluorooctanesulfonic acid(6:2 FTSA) ^{N11}	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
1H,1H,2H,2H-perfluorodecanesulfonic acid (8:2 FTSA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
1H,1H,2H,2H-perfluorododecanesulfonic acid (10:2 FTSA) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
13C2-4:2 FTSA (surr.)	1	%	87	30	119	83
13C2-6:2 FTSA (surr.)	1	%	79	34	87	74
13C2-8:2 FTSA (surr.)	1	%	60	32	41	53
13C2-10:2 FTSA (surr.)	1	%	31	17	5.0	25
Perfluoroalkyl sulfonic acids (PFSA)- Ultra trace						
Perfluorobutanesulfonic acid (PFBS) ^{N11}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluorononanesulfonic acid (PFNS) ^{*N15}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluorooctanesulfonic acid (PFOS) ^{N11}	0.0001	ug/L	0.0051	0.0044	< 0.0001	< 0.0001
Perfluoropropanesulfonic acid (PFPrS) ^{*N15}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluoropentanesulfonic acid (PFPeS) ^{N15}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluorohexanesulfonic acid (PFHxS) ^{N11}	0.001	ug/L	0.002	0.003	< 0.001	< 0.001
Perfluoroheptanesulfonic acid (PFHpS) ^{N15}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluorodecanesulfonic acid (PFDS) ^{N15}	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
13C3-PFBS (surr.)	1	%	70	^J -35	93	87
18O2-PFHxS (surr.)	1	%	75	30	51	70
13C8-PFOS (surr.)	1	%	63	25	15	53

Client Sample ID			GHD-CANBRIDGE-202509-GR-ARB	GHD-QC01	GHD-QC02	GHD-QC03
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			L25-Se0078949	L25-Se0078950	L25-Se0078951	L25-Se0078952
Date Sampled			Sep 24, 2025	Sep 24, 2025	Sep 24, 2025	Sep 24, 2025
Test/Reference	LOR	Unit				
PFASs Summations						
Sum (PFHxS + PFOS)*	0.001	ug/L	0.0071	0.0074	< 0.001	< 0.001
Sum of enHealth PFAS (PFHxS + PFOS + PFOA)*	0.001	ug/L	0.0081	0.0074	< 0.001	< 0.001
Sum of PFASs (n=30)*	0.005	ug/L	0.010	0.009	< 0.005	< 0.005
Sum of US EPA PFAS (PFOS + PFOA)*	0.001	ug/L	0.006	0.004	< 0.001	< 0.001
Sum of WA DWER PFAS (n=10)*	0.005	ug/L	0.0101	0.0094	< 0.005	< 0.005

Client Sample ID			GHD-QC04	GHD-QC05	GHD-QC06
Sample Matrix			Water	Water	Water
Eurofins Sample No.			L25-Se0078953	L25-Se0078954	L25-Se0078955
Date Sampled			Sep 24, 2025	Sep 24, 2025	Sep 24, 2025
Test/Reference	LOR	Unit			
Total Recoverable Hydrocarbons - 1999 NEPM Fractions					
TRH C6-C9	0.02	mg/L	-	< 0.02	-
BTEX					
Benzene	0.001	mg/L	-	< 0.001	-
Toluene	0.001	mg/L	-	< 0.001	-
Ethylbenzene	0.001	mg/L	-	< 0.001	-
m&p-Xylenes	0.002	mg/L	-	< 0.002	-
o-Xylene	0.001	mg/L	-	< 0.001	-
Xylenes - Total*	0.003	mg/L	-	< 0.003	-
4-Bromofluorobenzene (surr.)	1	%	-	88	-
Perfluoroalkyl sulfonamido substances- Trace					
Perfluorooctane sulfonamide (FOSA) ^{N11}	0.005	ug/L	< 0.005	-	-
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA) ^{N11}	0.005	ug/L	< 0.005	-	-
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA) ^{N11}	0.005	ug/L	< 0.005	-	-
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol(N-MeFOSE) ^{N11}	0.005	ug/L	< 0.005	-	-
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE) ^{N11}	0.005	ug/L	< 0.005	-	-
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA) ^{N11}	0.005	ug/L	< 0.005	-	-
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA) ^{N11}	0.005	ug/L	< 0.005	-	-
13C8-FOSA (surr.)	1	%	70	-	-
D3-N-MeFOSA (surr.)	1	%	19	-	-
D5-N-EtFOSA (surr.)	1	%	14	-	-
D7-N-MeFOSE (surr.)	1	%	45	-	-
D9-N-EtFOSE (surr.)	1	%	43	-	-
D5-N-EtFOSAA (surr.)	1	%	58	-	-
D3-N-MeFOSAA (surr.)	1	%	59	-	-
Perfluoroalkyl carboxylic acids (PFCAs) - Trace					
Perfluorobutanoic acid (PFBA) ^{N11}	0.005	ug/L	0.009	-	-
Perfluoropentanoic acid (PFPeA) ^{N11}	0.001	ug/L	< 0.001	-	-
Perfluorohexanoic acid (PFHxA) ^{N11}	0.001	ug/L	0.005	-	-
Perfluoroheptanoic acid (PFHpA) ^{N11}	0.005	ug/L	< 0.005	-	-
Perfluorooctanoic acid (PFOA) ^{N11}	0.001	ug/L	0.003	-	-

Client Sample ID			GHD-QC04	GHD-QC05	GHD-QC06
Sample Matrix			Water	Water	Water
Eurofins Sample No.			L25-Se0078953	L25-Se0078954	L25-Se0078955
Date Sampled			Sep 24, 2025	Sep 24, 2025	Sep 24, 2025
Test/Reference	LOR	Unit			
Perfluoroalkyl carboxylic acids (PFCAs) - Trace					
Perfluorononanoic acid (PFNA) ^{N11}	0.001	ug/L	< 0.001	-	-
Perfluorodecanoic acid (PFDA) ^{N11}	0.001	ug/L	< 0.001	-	-
Perfluorotridecanoic acid (PFTTrDA) ^{N15}	0.001	ug/L	< 0.001	-	-
Perfluoroundecanoic acid (PFUnDA) ^{N11}	0.001	ug/L	< 0.001	-	-
Perfluorododecanoic acid (PFDoDA) ^{N11}	0.001	ug/L	< 0.001	-	-
Perfluorotetradecanoic acid (PFTeDA) ^{N11}	0.001	ug/L	< 0.001	-	-
13C4-PFBA (surr.)	1	%	^J 22	-	-
13C5-PFPeA (surr.)	1	%	^J 16	-	-
13C5-PFHxA (surr.)	1	%	^J 33	-	-
13C4-PFHpA (surr.)	1	%	^J 42	-	-
13C8-PFOA (surr.)	1	%	^J 50	-	-
13C5-PFNA (surr.)	1	%	62	-	-
13C6-PFDA (surr.)	1	%	74	-	-
13C2-PFUnDA (surr.)	1	%	75	-	-
13C2-PFDoDA (surr.)	1	%	60	-	-
13C2-PFTeDA (surr.)	1	%	^J 31	-	-
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)- Trace					
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA) ^{N11}	0.001	ug/L	< 0.001	-	-
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA) ^{N11}	0.005	ug/L	< 0.005	-	-
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA) ^{N11}	0.001	ug/L	< 0.001	-	-
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA) ^{N11}	0.001	ug/L	< 0.001	-	-
13C2-4:2 FTSA (surr.)	1	%	58	-	-
13C2-6:2 FTSA (surr.)	1	%	89	-	-
13C2-8:2 FTSA (surr.)	1	%	115	-	-
13C2-10:2 FTSA (surr.)	1	%	69	-	-
Perfluoroalkyl sulfonic acids (PFSA)- Ultra trace					
Perfluorobutanesulfonic acid (PFBS) ^{N11}	0.001	ug/L	0.002	-	-
Perfluorononanesulfonic acid (PFNS) ^{*N15}	0.001	ug/L	< 0.001	-	-
Perfluorooctanesulfonic acid (PFOS) ^{N11}	0.0001	ug/L	0.015	-	-
Perfluoropropanesulfonic acid (PFPrS) ^{*N15}	0.001	ug/L	< 0.001	-	-
Perfluoropentanesulfonic acid (PFPeS) ^{N15}	0.001	ug/L	0.002	-	-
Perfluorohexanesulfonic acid (PFHxS) ^{N11}	0.001	ug/L	0.010	-	-
Perfluoroheptanesulfonic acid (PFHpS) ^{N15}	0.001	ug/L	< 0.001	-	-
Perfluorodecanesulfonic acid (PFDS) ^{N15}	0.001	ug/L	< 0.001	-	-
13C3-PFBS (surr.)	1	%	^J 42	-	-
18O2-PFHxS (surr.)	1	%	66	-	-
13C8-PFOS (surr.)	1	%	85	-	-
PFASs Summations					
Sum (PFHxS + PFOS)*	0.001	ug/L	0.025	-	-
Sum of enHealth PFAS (PFHxS + PFOS + PFOA)*	0.001	ug/L	0.028	-	-
Sum of PFASs (n=30)*	0.005	ug/L	0.046	-	-
Sum of US EPA PFAS (PFOS + PFOA)*	0.001	ug/L	0.018	-	-
Sum of WA DWER PFAS (n=10)*	0.005	ug/L	0.044	-	-
BTEX and Naphthalene					
Naphthalene ^{N02}	0.001	mg/L	-	< 0.001	-

Client Sample ID			GHD-QC04	GHD-QC05	GHD-QC06
Sample Matrix			Water	Water	Water
Eurofins Sample No.			L25-Se0078953	L25-Se0078954	L25-Se0078955
Date Sampled			Sep 24, 2025	Sep 24, 2025	Sep 24, 2025
Test/Reference	LOR	Unit			
Total Recoverable Hydrocarbons					
TRH C6-C10	0.02	mg/L	-	< 0.02	-
TRH C6-C10 less BTEX (F1) ^{N04}	0.02	mg/L	-	< 0.02	-
OCOP in Water					
Aldrin	0.001	ug/L	-	-	< 0.001
alpha-BHC (HCH)	0.001	ug/L	-	-	< 0.001
beta-BHC (HCH)	0.001	ug/L	-	-	< 0.001
delta-BHC (HCH)	0.001	ug/L	-	-	< 0.001
Bifenthrin	0.05	ug/L	-	-	< 0.05
Bromophos Ethyl	0.005	ug/L	-	-	< 0.005
Chlordane	0.002	ug/L	-	-	< 0.002
Chlorothalonil	0.01	ug/L	-	-	< 0.01
Chlorpyrifos	0.005	ug/L	-	-	< 0.005
Diazinon	0.01	ug/L	-	-	< 0.01
Dieldrin	0.001	ug/L	-	-	< 0.001
Endosulfan I	0.001	ug/L	-	-	< 0.001
Endosulfan II	0.001	ug/L	-	-	< 0.001
Endosulfan Sulfate	0.001	ug/L	-	-	< 0.001
Endrin	0.01	ug/L	-	-	< 0.01
Ethion	0.01	ug/L	-	-	< 0.01
Fenitrothion	0.01	ug/L	-	-	< 0.01
Fipronil	0.02	ug/L	-	-	< 0.02
Hexachlorobenzene (HCB)	0.001	ug/L	-	-	< 0.001
Heptachlor Epoxide	0.001	ug/L	-	-	< 0.001
Heptachlor	0.001	ug/L	-	-	< 0.001
Lindane	0.001	ug/L	-	-	< 0.001
Malathion	0.01	ug/L	-	-	< 0.01
Methoxychlor	0.02	ug/L	-	-	< 0.02
o.p-DDT	0.001	ug/L	-	-	< 0.001
Oxychlordane	0.001	ug/L	-	-	< 0.001
p.p-DDD	0.001	ug/L	-	-	< 0.001
p.p-DDE	0.001	ug/L	-	-	< 0.001
p.p-DDT	0.001	ug/L	-	-	< 0.001
Parathion Ethyl	0.02	ug/L	-	-	< 0.02
Parathion Methyl	0.02	ug/L	-	-	< 0.02
Trifluralin	0.01	ug/L	-	-	< 0.01
Vinclozolin	0.02	ug/L	-	-	< 0.02
Low Level PAH in Water					
Naphthalene	0.01	ug/L	-	-	< 0.01
2-Methylnaphthalene	0.01	ug/L	-	-	< 0.01
Acenaphthylene	0.01	ug/L	-	-	< 0.01
Acenaphthene	0.01	ug/L	-	-	< 0.01
Fluorene	0.01	ug/L	-	-	< 0.01
Phenanthrene	0.01	ug/L	-	-	< 0.01
Anthracene	0.01	ug/L	-	-	< 0.01
Fluoranthene	0.01	ug/L	-	-	< 0.01
Pyrene	0.01	ug/L	-	-	< 0.01
Benz(a)anthracene	0.01	ug/L	-	-	< 0.01
Chrysene	0.01	ug/L	-	-	< 0.01
Benzo(b)fluoranthene	0.01	ug/L	-	-	< 0.01

Client Sample ID			GHD-QC04	GHD-QC05	GHD-QC06
Sample Matrix			Water	Water	Water
Eurofins Sample No.			L25-Se0078953	L25-Se0078954	L25-Se0078955
Date Sampled			Sep 24, 2025	Sep 24, 2025	Sep 24, 2025
Test/Reference	LOR	Unit			
Low Level PAH in Water					
Benzo(k)fluoranthene	0.01	ug/L	-	-	< 0.01
Benzo(a)pyrene	0.01	ug/L	-	-	< 0.01
Indeno(1.2.3-c.d)pyrene	0.02	ug/L	-	-	< 0.02
Dibenz(a.h)anthracene	0.02	ug/L	-	-	< 0.02
Benzo(ghi)perylene	0.02	ug/L	-	-	< 0.02
Total PAHs*	0.02	ug/L	-	-	< 0.02
PCB in Water					
PCB	0.02	ug/L	-	-	< 0.02

FINAL

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
BTEX	Welshpool	Sep 26, 2025	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Welshpool	Sep 26, 2025	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
BTEX and Naphthalene	Welshpool	Sep 26, 2025	7 Day
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons	Welshpool	Sep 26, 2025	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 1999 NEPM Fractions	Welshpool	Sep 26, 2025	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Welshpool	Sep 26, 2025	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Organotins in Water	Welshpool	Sep 26, 2025	7 Days
- Method: ARL100 - Organotins in Water			
Sulphide (as S)	Melbourne	Sep 30, 2025	7 Days
- Method: LTM-INO-4011 Suphide			
Eurofins Suite B11C: Na/K/Ca/Mg	Welshpool	Sep 26, 2025	180 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
OCOP in Water	Welshpool	Sep 26, 2025	7 Days
- Method: ARL No. 002 - OCOP and PCB in Water			
Low Level PAH in Water	Welshpool	Sep 26, 2025	14 Days
- Method: ARL005 - Polycyclic Aromatic Hydrocarbons in Water			
PCB in Water	Welshpool	Sep 26, 2025	14 Days
- Method: ARL002 - OCOP and PCB in Water			
Chloride	Welshpool	Sep 26, 2025	28 Days
- Method: ARL305 - Chloride in Water by Discrete Analyser			
Sulfate (as SO₄)	Welshpool	Sep 26, 2025	28 Days
- Method: ARL301 - Sulfate in Water by Discrete Analyser			
Alkalinity (speciated)	Welshpool	Sep 26, 2025	14 Days
- Method: LTM-INO-4250 Alkalinity by Electrometric Titration			
Conductivity (at 25 °C)	Welshpool	Sep 26, 2025	28 Days
- Method: LTM-INO-4030 Conductivity			
Total Dissolved Solids Dried at 180 °C ± 2 °C	Welshpool	Sep 26, 2025	7 Days
- Method: ARL No. 017 - Total Dissolved Solids			
Perfluoroalkyl sulfonamido substances- Trace	Welshpool	Sep 26, 2025	28 Days
- Method: Method ARL0510_ARL0511 PFAS in aqueous & solid samples by LC-MS/MS			
Perfluoroalkyl carboxylic acids (PFCAs) - Trace	Welshpool	Sep 26, 2025	28 Days
- Method: Method ARL0510_ARL0511 PFAS in aqueous & solid samples by LC-MS/MS			
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Trace	Welshpool	Sep 26, 2025	28 Days
- Method: Method ARL0510_ARL0511 PFAS in aqueous & solid samples by LC-MS/MS			
Perfluoroalkyl sulfonic acids (PFSAs)- Ultra trace	Welshpool	Sep 26, 2025	28 Days
- Method: Method ARL0510_ARL0511 PFAS in aqueous & solid samples by LC-MS/MS (ultra trace)			

**Eurofins ARL Pty Ltd**

ABN: 91 05 0159 898

Perth
46-48 Banksia Road
Welshpool
WA 6106
+61 8 6253 4444
NATA# 2377
Site# 2370 & 2554

Eurofins Environment Testing Australia Pty Ltd

ABN: 50 005 085 521

Melbourne
6 Monterey Road
Dandenong South
VIC 3175
+61 3 8564 5000
NATA# 1261
Site# 1254

Geelong
19/8 Lewalan Street
Grovedale
VIC 3216
+61 3 8564 5000
NATA# 1261
Site# 25403

Sydney
179 Magowar Road
Girraween
NSW 2145
+61 2 9900 8400
NATA# 1261
Site# 18217

Canberra
Unit 1,2 Dacre Street
Mitchell
ACT 2911
+61 2 6113 8091
NATA# 1261
Site# 25466

Brisbane
1/21 Smallwood Place
Murarrie
QLD 4172
+61 7 3902 4600
NATA# 1261
Site# 20794 & 2780

Newcastle
1/2 Frost Drive
Mayfield West
NSW 2304
+61 2 4968 8448
NATA# 1261
Site# 25079

web: www.eurofins.com.au

email: EnviroSales@eurofinsanz.com

Company Name: GHD Pty Ltd WA
Address: 999 Hay Street Perth
Perth
WA 6004

Project Name: SWAN RIVER FERRY EXPANSION: SWAN RIVER MONITORING

Order No.:
Report #: 1272659
Phone: 08 6222 8222
Fax: 08 9429 6555

Received: Sep 25, 2025 7:31 AM
Due: Oct 3, 2025
Priority: 5 Day
Contact Name: Louise Cockerton

Eurofins Analytical Services Manager : Natalie Hill

Sample Detail						Algae	Sulphide (as S)	Eurofins Suite B1	BTEXN and Volatile TRH	Eurofins Suite B11C: Na/K/Ca/Mg	OC in Water	Organofins in Water	Low Level PAH in Water	PCB in Water	Total Dissolved Solids (TDS)	Eurofins Suite B11E	Per- and Polyfluoroalkyl Substances (PFASs) - Ultra Trace
Perth Laboratory - NATA # 2377 Site # 2370 & 2554								X	X	X	X	X	X	X	X	X	X
Melbourne Laboratory - NATA # 1261 Site # 1254							X										
External Laboratory						X											
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID												
1	GHD-APPLECROS S-202509-GR-SUR	Sep 24, 2025		Water	L25-Se0078933	X	X	X		X		X			X	X	X
2	GHD-APPLECROS S-202509-GR-ARB	Sep 24, 2025		Water	L25-Se0078934	X	X	X		X		X			X	X	X
3	GHD-BARRACK-202509-GR-SUR	Sep 24, 2025		Water	L25-Se0078935	X	X	X		X		X			X	X	X
4	GHD-BARRACK-202509-GR-ARB	Sep 24, 2025		Water	L25-Se0078936	X	X	X		X		X			X	X	X
5	GHD-ELIZQUAY-	Sep 24, 2025		Water	L25-Se0078937	X	X	X		X		X			X	X	X

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Eurofins Environment Testing Australia Pty Ltd

ABN: 50 005 085 521

Melbourne
6 Monterey Road
Dandenong South
VIC 3175
+61 3 8564 5000
NATA# 1261
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Geelong
19/8 Lewalan Street
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VIC 3216
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Eurofins Analytical Services Manager : Natalie Hill

Sample Detail						Algae	Sulphide (as S)	Eurofins Suite B1	BTEXN and Volatile TRH	Eurofins Suite B1IC: Na/K/Ca/Mg	OC in Water	Organofins in Water	Low Level PAH in Water	PCB in Water	Total Dissolved Solids (TDS)	Eurofins Suite B1IE	Per- and Polyfluoroalkyl Substances (PFASs) - Ultra Trace
Perth Laboratory - NATA # 2377 Site # 2370 & 2554								X	X	X	X	X	X	X	X	X	X
Melbourne Laboratory - NATA # 1261 Site # 1254							X										
External Laboratory						X											
	202509-GR-SUR																
6	GHD-ELIZQUAY-202509-GR-ARB	Sep 24, 2025		Water	L25-Se0078938	X	X	X		X		X			X	X	X
7	GHD-ELLAM-202509-GR-SUR	Sep 24, 2025		Water	L25-Se0078939	X	X	X		X		X			X	X	X
8	GHD-ELLAM-202509-GR-ARB	Sep 24, 2025		Water	L25-Se0078940	X	X	X		X		X			X	X	X
9	GHD-MATBAY1-202509-GR-SUR	Sep 24, 2025		Water	L25-Se0078941	X	X	X		X		X			X	X	X
10	GHD-MATBAY1-202509-GR-ARB	Sep 24, 2025		Water	L25-Se0078942	X	X	X		X		X			X	X	X

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Perth Laboratory - NATA # 2377 Site # 2370 & 2554								X	X	X	X	X	X	X	X	X	X
Melbourne Laboratory - NATA # 1261 Site # 1254							X										
External Laboratory						X											
11	GHD-MATBAY2-202509-GR-SUR	Sep 24, 2025		Water	L25-Se0078943	X	X	X		X		X			X	X	X
12	GHD-MATBAY2-202509-GR-ARB	Sep 24, 2025		Water	L25-Se0078944	X	X	X		X		X			X	X	X
13	GHD-6161869-HEATHCOTE-SUR	Sep 24, 2025		Water	L25-Se0078945	X	X	X		X		X			X	X	X
14	GHD-6164602-MATCENTRAL-SUR	Sep 24, 2025		Water	L25-Se0078946	X	X	X		X		X			X	X	X
15	GHD-6160262-NAR-SUR	Sep 24, 2025		Water	L25-Se0078947	X	X	X		X		X			X	X	X
16	GHD-	Sep 24, 2025		Water	L25-Se0078948	X	X	X		X		X			X	X	X

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NATA# 1261
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Perth Laboratory - NATA # 2377 Site # 2370 & 2554								X	X	X	X	X	X	X	X	X	X
Melbourne Laboratory - NATA # 1261 Site # 1254							X										
External Laboratory						X											
	CANBRIDGE-202509-GR-SUR																
17	GHD-CANBRIDGE-202509-GR-ARB	Sep 24, 2025		Water	L25-Se0078949	X	X	X		X		X			X	X	X
18	GHD-QC01	Sep 24, 2025		Water	L25-Se0078950	X	X	X		X		X			X	X	X
19	GHD-QC02	Sep 24, 2025		Water	L25-Se0078951	X	X	X		X		X			X	X	X
20	GHD-QC03	Sep 24, 2025		Water	L25-Se0078952	X	X	X		X		X			X	X	X
21	GHD-QC04	Sep 24, 2025		Water	L25-Se0078953												X
22	GHD-QC05	Sep 24, 2025		Water	L25-Se0078954				X								
23	GHD-QC06	Sep 24, 2025		Water	L25-Se0078955						X		X	X			
Test Counts						20	20	20	1	20	1	20	1	1	20	20	21

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follow guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013. They are included in this QC report where applicable. Additional QC data may be available on request.
2. Unless otherwise stated, all soil/sediment/solid results are reported on a dry weight basis.
3. Unless otherwise stated, all biota/food results are reported on a wet weight basis on the edible portion.
4. For CEC results where the sample's origin is unknown or environmentally contaminated, the results should be used advisedly.
5. Actual LORs are matrix dependent. Quoted LORs may be raised where sample extracts are diluted due to interferences.
6. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds where annotated.
7. SVOC analysis on waters is performed on homogenised, unfiltered samples unless noted otherwise.
8. Samples were analysed on an 'as received' basis.
9. Information identified in this report with **blue** colour indicates data provided by customers that may have an impact on the results.
10. This report replaces any interim results previously issued.

Holding Times

Please refer to the 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours before sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and despite any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the sampling date; therefore, compliance with these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether, the holding time is seven days; however, for all other VOCs, such as BTEX or C6-10 TRH, the holding time is 14 days.

Units

mg/kg: milligrams per kilogram	mg/L: milligrams per litre	ppm: parts per million
µg/L: micrograms per litre	ppb: parts per billion	%: Percentage
org/100 mL: Organisms per 100 millilitres	NTU: Nephelometric Turbidity Units	MPN/100 mL: Most Probable Number of organisms per 100 millilitres
CFU: Colony Forming Unit	Colour: Pt-Co Units (CU)	

Terms

APHA	American Public Health Association
CEC	Cation Exchange Capacity
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where moisture has been determined on a solid sample, the result is expressed on a dry weight basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples, these are performed on laboratory-certified clean sands and in the case of water samples, these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC represents the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a similar compound to the analyte target is reported as percentage recovery. See below for acceptance criteria.
TBTO	Tributyltin oxide (<i>bis</i> -tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment; however, free tributyltin was measured, and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 6.0
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should only be used as a guide and may be different when site-specific Sampling Analysis and Quality Plan (SAQP) have been implemented.

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30%; however, the following acceptance guidelines are equally applicable:

Results <10 times the LOR:	No Limit
Results between 10-20 times the LOR:	RPD must lie between 0-50%
Results >20 times the LOR:	RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range, not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%, VOC recoveries 50 – 150%

PFAS field samples containing surrogate recoveries above the QC limit designated in QSM 6.0, where no positive PFAS results have been reported or reviewed, and no data was affected.

QC Data General Comments

1. Where a result is reported as less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown are not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery, the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results, a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data; thus, it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Total Dissolved Solids Dried at 180 °C ± 2 °C	mg/L	< 5			5	Pass	
Method Blank							
Perfluoroalkyl sulfonamido substances- Trace							
Perfluorooctane sulfonamide (FOSA)	ug/L	< 0.005			0.005	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	ug/L	< 0.005			0.005	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	ug/L	< 0.005			0.005	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol(N-MeFOSE)	ug/L	< 0.005			0.005	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)	ug/L	< 0.005			0.005	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	ug/L	< 0.005			0.005	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	ug/L	< 0.005			0.005	Pass	
Method Blank							
Perfluoroalkyl carboxylic acids (PFCAs) - Trace							
Perfluorobutanoic acid (PFBA)	ug/L	< 0.005			0.005	Pass	
Perfluoropentanoic acid (PFPeA)	ug/L	< 0.001			0.001	Pass	
Perfluorohexanoic acid (PFHxA)	ug/L	< 0.001			0.001	Pass	
Perfluoroheptanoic acid (PFHpA)	ug/L	< 0.005			0.005	Pass	
Perfluorooctanoic acid (PFOA)	ug/L	< 0.001			0.001	Pass	
Perfluorononanoic acid (PFNA)	ug/L	< 0.001			0.001	Pass	
Perfluorodecanoic acid (PFDA)	ug/L	< 0.001			0.001	Pass	
Perfluorotridecanoic acid (PFTTrDA)	ug/L	< 0.001			0.001	Pass	
Perfluoroundecanoic acid (PFUnDA)	ug/L	< 0.001			0.001	Pass	
Perfluorododecanoic acid (PFDoDA)	ug/L	< 0.001			0.001	Pass	
Perfluorotetradecanoic acid (PFTeDA)	ug/L	< 0.001			0.001	Pass	
Method Blank							
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)- Trace							
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	ug/L	< 0.001			0.001	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)	ug/L	< 0.005			0.005	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	ug/L	< 0.001			0.001	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	ug/L	< 0.001			0.001	Pass	
Method Blank							
Perfluoroalkyl sulfonic acids (PFSA)- Ultra trace							
Perfluorobutanesulfonic acid (PFBS)	ug/L	< 0.001			0.001	Pass	
Perfluorononanesulfonic acid (PFNS)*	ug/L	< 0.001			0.001	Pass	
Perfluoropropanesulfonic acid (PFPrS)*	ug/L	< 0.001			0.001	Pass	
Perfluoropentanesulfonic acid (PFPeS)	ug/L	< 0.001			0.001	Pass	
Perfluorohexanesulfonic acid (PFHxS)	ug/L	< 0.001			0.001	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	ug/L	< 0.001			0.001	Pass	
Perfluorodecanesulfonic acid (PFDS)	ug/L	< 0.001			0.001	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	mg/L	< 0.02			0.02	Pass	
Method Blank							
BTEX							
Benzene	mg/L	< 0.001			0.001	Pass	
Toluene	mg/L	< 0.001			0.001	Pass	
Ethylbenzene	mg/L	< 0.001			0.001	Pass	
m&p-Xylenes	mg/L	< 0.002			0.002	Pass	
o-Xylene	mg/L	< 0.001			0.001	Pass	
Xylenes - Total*	mg/L	< 0.003			0.003	Pass	
Method Blank							

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	mg/L	< 0.001			0.001	Pass	
TRH C6-C10	mg/L	< 0.02			0.02	Pass	
Method Blank							
Eurofins Suite B11C: Na/K/Ca/Mg							
Calcium	mg/L	< 0.5			0.5	Pass	
Magnesium	mg/L	< 0.5			0.5	Pass	
Potassium	mg/L	< 0.5			0.5	Pass	
Sodium	mg/L	< 0.5			0.5	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	mg/L	< 0.02			0.02	Pass	
Method Blank							
BTEX							
Benzene	mg/L	< 0.001			0.001	Pass	
Toluene	mg/L	< 0.001			0.001	Pass	
Ethylbenzene	mg/L	< 0.001			0.001	Pass	
m&p-Xylenes	mg/L	< 0.002			0.002	Pass	
o-Xylene	mg/L	< 0.001			0.001	Pass	
Xylenes - Total*	mg/L	< 0.003			0.003	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	mg/L	< 0.001			0.001	Pass	
TRH C6-C10	mg/L	< 0.02			0.02	Pass	
Method Blank							
Sulphide (as S)	mg/L	< 0.1			0.1	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	mg/L	< 0.02			0.02	Pass	
Method Blank							
BTEX							
Benzene	mg/L	< 0.001			0.001	Pass	
Toluene	mg/L	< 0.001			0.001	Pass	
Ethylbenzene	mg/L	< 0.001			0.001	Pass	
m&p-Xylenes	mg/L	< 0.002			0.002	Pass	
o-Xylene	mg/L	< 0.001			0.001	Pass	
Xylenes - Total*	mg/L	< 0.003			0.003	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	mg/L	< 0.001			0.001	Pass	
TRH C6-C10	mg/L	< 0.02			0.02	Pass	
Method Blank							
Sulphide (as S)	mg/L	< 0.1			0.1	Pass	
Method Blank							
Eurofins Suite B11C: Na/K/Ca/Mg							
Calcium	mg/L	< 0.5			0.5	Pass	
Magnesium	mg/L	< 0.5			0.5	Pass	
Potassium	mg/L	< 0.5			0.5	Pass	
Sodium	mg/L	< 0.5			0.5	Pass	
Method Blank							
Sulfate (as SO4)	mg/L	< 1			1	Pass	
Method Blank							
Eurofins Suite B11C: Na/K/Ca/Mg							
Calcium	mg/L	< 0.5			0.5	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Magnesium	mg/L	< 0.5			0.5	Pass	
Potassium	mg/L	< 0.5			0.5	Pass	
Sodium	mg/L	< 0.5			0.5	Pass	
Method Blank							
Sulphide (as S)	mg/L	< 0.1			0.1	Pass	
Method Blank							
Eurofins Suite B11C: Na/K/Ca/Mg							
Calcium	mg/L	< 0.5			0.5	Pass	
Magnesium	mg/L	< 0.5			0.5	Pass	
Potassium	mg/L	< 0.5			0.5	Pass	
Sodium	mg/L	< 0.5			0.5	Pass	
Method Blank							
Eurofins Suite B11C: Na/K/Ca/Mg							
Calcium	mg/L	< 0.5			0.5	Pass	
Magnesium	mg/L	< 0.5			0.5	Pass	
Potassium	mg/L	< 0.5			0.5	Pass	
Sodium	mg/L	< 0.5			0.5	Pass	
Method Blank							
OCOP in Water							
Aldrin	ug/L	< 0.001			0.001	Pass	
alpha-BHC (HCH)	ug/L	< 0.001			0.001	Pass	
beta-BHC (HCH)	ug/L	< 0.001			0.001	Pass	
delta-BHC (HCH)	ug/L	< 0.001			0.001	Pass	
Bifenthrin	ug/L	< 0.05			0.05	Pass	
Bromophos Ethyl	ug/L	< 0.005			0.005	Pass	
Chlordane	ug/L	< 0.002			0.002	Pass	
Chlorothalonil	ug/L	< 0.01			0.01	Pass	
Chlorpyrifos	ug/L	< 0.005			0.005	Pass	
Diazinon	ug/L	< 0.01			0.01	Pass	
Dieldrin	ug/L	< 0.001			0.001	Pass	
Endosulfan I	ug/L	< 0.001			0.001	Pass	
Endosulfan II	ug/L	< 0.001			0.001	Pass	
Endosulfan Sulfate	ug/L	< 0.001			0.001	Pass	
Endrin	ug/L	< 0.01			0.01	Pass	
Ethion	ug/L	< 0.01			0.01	Pass	
Fenitrothion	ug/L	< 0.01			0.01	Pass	
Fipronil	ug/L	< 0.02			0.02	Pass	
Hexachlorobenzene (HCB)	ug/L	< 0.001			0.001	Pass	
Heptachlor Epoxide	ug/L	< 0.001			0.001	Pass	
Heptachlor	ug/L	< 0.001			0.001	Pass	
Lindane	ug/L	< 0.001			0.001	Pass	
Malathion	ug/L	< 0.01			0.01	Pass	
Methoxychlor	ug/L	< 0.02			0.02	Pass	
o.p-DDT	ug/L	< 0.001			0.001	Pass	
Oxychlordane	ug/L	< 0.001			0.001	Pass	
p.p-DDD	ug/L	< 0.001			0.001	Pass	
p.p-DDE	ug/L	< 0.001			0.001	Pass	
p.p-DDT	ug/L	< 0.001			0.001	Pass	
Parathion Ethyl	ug/L	< 0.02			0.02	Pass	
Parathion Methyl	ug/L	< 0.02			0.02	Pass	
Trifluralin	ug/L	< 0.01			0.01	Pass	
Vinclozolin	ug/L	< 0.02			0.02	Pass	
Method Blank							
Low Level PAH in Water							

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Naphthalene	ug/L	< 0.01			0.01	Pass	
2-Methylnaphthalene	ug/L	< 0.01			0.01	Pass	
Acenaphthylene	ug/L	< 0.01			0.01	Pass	
Acenaphthene	ug/L	< 0.01			0.01	Pass	
Fluorene	ug/L	< 0.01			0.01	Pass	
Phenanthrene	ug/L	< 0.01			0.01	Pass	
Anthracene	ug/L	< 0.01			0.01	Pass	
Fluoranthene	ug/L	< 0.01			0.01	Pass	
Pyrene	ug/L	< 0.01			0.01	Pass	
Benz(a)anthracene	ug/L	< 0.01			0.01	Pass	
Chrysene	ug/L	< 0.01			0.01	Pass	
Benzo(b)fluoranthene	ug/L	< 0.01			0.01	Pass	
Benzo(k)fluoranthene	ug/L	< 0.01			0.01	Pass	
Benzo(a)pyrene	ug/L	< 0.01			0.01	Pass	
Indeno(1.2.3-c.d)pyrene	ug/L	< 0.02			0.02	Pass	
Dibenz(a,h)anthracene	ug/L	< 0.02			0.02	Pass	
Benzo(ghi)perylene	ug/L	< 0.02			0.02	Pass	
Total PAHs*	ug/L	< 0.02			0.02	Pass	
Method Blank							
PCB in Water							
PCB	ug/L	< 0.02			0.02	Pass	
LCS - % Recovery							
Perfluoroalkyl sulfonamido substances- Trace							
Perfluorooctane sulfonamide (FOSA)	%	87			50-150	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	%	83			50-150	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	%	86			50-150	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol(N-MeFOSE)	%	86			50-150	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)	%	86			50-150	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	%	83			50-150	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	%	92			50-150	Pass	
LCS - % Recovery							
Perfluoroalkyl carboxylic acids (PFCAs) - Trace							
Perfluorobutanoic acid (PFBA)	%	85			50-150	Pass	
Perfluoropentanoic acid (PFPeA)	%	81			50-150	Pass	
Perfluorohexanoic acid (PFHxA)	%	93			50-150	Pass	
Perfluoroheptanoic acid (PFHpA)	%	90			50-150	Pass	
Perfluorooctanoic acid (PFOA)	%	90			50-150	Pass	
Perfluorononanoic acid (PFNA)	%	87			50-150	Pass	
Perfluorodecanoic acid (PFDA)	%	92			50-150	Pass	
Perfluorotridecanoic acid (PFTeDA)	%	106			50-150	Pass	
Perfluoroundecanoic acid (PFUnDA)	%	92			50-150	Pass	
Perfluorododecanoic acid (PFDoDA)	%	92			50-150	Pass	
Perfluorotetradecanoic acid (PFTeDA)	%	93			50-150	Pass	
LCS - % Recovery							
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)- Trace							
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	%	93			50-150	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)	%	105			50-150	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	%	102			50-150	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	%	89			50-150	Pass	
LCS - % Recovery							
Perfluoroalkyl sulfonic acids (PFSA)- Ultra trace							
Perfluorobutanesulfonic acid (PFBS)	%	89			50-150	Pass	
Perfluorononanesulfonic acid (PFNS)*	%	80			50-150	Pass	
Perfluorooctanesulfonic acid (PFOS)	%	83			50-150	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Perfluoropropanesulfonic acid (PFPrS)*	%	71			50-150	Pass	
Perfluoropentanesulfonic acid (PFPeS)	%	85			50-150	Pass	
Perfluorohexanesulfonic acid (PFHxS)	%	88			50-150	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	%	86			50-150	Pass	
Perfluorodecanesulfonic acid (PFDS)	%	76			50-150	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	%	98			70-130	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	113			70-130	Pass	
Toluene	%	102			70-130	Pass	
Ethylbenzene	%	95			70-130	Pass	
m&p-Xylenes	%	103			70-130	Pass	
o-Xylene	%	92			70-130	Pass	
Xylenes - Total*	%	99			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	%	75			70-130	Pass	
TRH C6-C10	%	97			70-130	Pass	
LCS - % Recovery							
Eurofins Suite B11C: Na/K/Ca/Mg							
Calcium	%	102			80-120	Pass	
Magnesium	%	104			80-120	Pass	
Potassium	%	102			80-120	Pass	
Sodium	%	104			80-120	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	%	76			70-130	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	115			70-130	Pass	
Toluene	%	112			70-130	Pass	
Ethylbenzene	%	107			70-130	Pass	
m&p-Xylenes	%	116			70-130	Pass	
o-Xylene	%	104			70-130	Pass	
Xylenes - Total*	%	112			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	%	91			70-130	Pass	
TRH C6-C10	%	102			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	%	92			70-130	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	114			70-130	Pass	
Toluene	%	101			70-130	Pass	
Ethylbenzene	%	97			70-130	Pass	
m&p-Xylenes	%	104			70-130	Pass	
o-Xylene	%	96			70-130	Pass	
Xylenes - Total*	%	101			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Naphthalene	%	82			70-130	Pass	
TRH C6-C10	%	92			70-130	Pass	
LCS - % Recovery							
Eurofins Suite B11C: Na/K/Ca/Mg							
Calcium	%	103			80-120	Pass	
Magnesium	%	103			80-120	Pass	
Potassium	%	100			80-120	Pass	
Sodium	%	104			80-120	Pass	
LCS - % Recovery							
Eurofins Suite B11C: Na/K/Ca/Mg							
Calcium	%	101			80-120	Pass	
Magnesium	%	114			80-120	Pass	
Potassium	%	117			80-120	Pass	
Sodium	%	110			80-120	Pass	
LCS - % Recovery							
Eurofins Suite B11C: Na/K/Ca/Mg							
Calcium	%	97			80-120	Pass	
Magnesium	%	99			80-120	Pass	
Potassium	%	94			80-120	Pass	
Sodium	%	94			80-120	Pass	
LCS - % Recovery							
Eurofins Suite B11C: Na/K/Ca/Mg							
Calcium	%	87			80-120	Pass	
Magnesium	%	101			80-120	Pass	
Potassium	%	98			80-120	Pass	
Sodium	%	97			80-120	Pass	
LCS - % Recovery							
OCOP in Water							
Aldrin	%	99			60-120	Pass	
alpha-BHC (HCH)	%	104			60-120	Pass	
beta-BHC (HCH)	%	90			60-120	Pass	
delta-BHC (HCH)	%	104			60-120	Pass	
Bifenthrin	%	94			60-120	Pass	
Bromophos Ethyl	%	85			60-120	Pass	
Chlordane	%	95			60-120	Pass	
Chlorpyrifos	%	91			60-120	Pass	
Dieldrin	%	101			60-120	Pass	
Endosulfan I	%	85			60-120	Pass	
Endosulfan II	%	88			60-120	Pass	
Endosulfan Sulfate	%	105			60-120	Pass	
Endrin	%	102			60-120	Pass	
Fipronil	%	99			60-120	Pass	
Hexachlorobenzene (HCB)	%	99			60-120	Pass	
Heptachlor Epoxide	%	85			60-120	Pass	
Heptachlor	%	96			60-120	Pass	
Lindane	%	111			60-120	Pass	
Malathion	%	101			60-120	Pass	
Methoxychlor	%	110			60-120	Pass	
o.p-DDT	%	101			60-120	Pass	
Oxychlordane	%	120			60-120	Pass	
p.p-DDD	%	109			60-120	Pass	
p.p-DDE	%	107			60-120	Pass	
p.p-DDT	%	100			60-120	Pass	
Parathion Ethyl	%	86			60-120	Pass	

Test				Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Trifluralin				%	103			60-120	Pass	
Vinclozolin				%	80			60-120	Pass	
LCS - % Recovery										
Low Level PAH in Water										
Naphthalene				%	85			60-120	Pass	
2-Methylnaphthalene				%	100			60-120	Pass	
Acenaphthylene				%	100			60-120	Pass	
Acenaphthene				%	105			60-120	Pass	
Fluorene				%	105			60-120	Pass	
Phenanthrene				%	100			60-120	Pass	
Anthracene				%	90			60-120	Pass	
Fluoranthene				%	85			60-120	Pass	
Pyrene				%	90			60-120	Pass	
Benz(a)anthracene				%	110			60-120	Pass	
Chrysene				%	100			60-120	Pass	
Benzo(b)fluoranthene				%	110			60-120	Pass	
Benzo(k)fluoranthene				%	100			60-120	Pass	
Benzo(a)pyrene				%	105			60-120	Pass	
Indeno(1.2.3-c.d)pyrene				%	90			60-120	Pass	
Dibenz(a,h)anthracene				%	110			60-120	Pass	
Benzo(ghi)perylene				%	100			60-120	Pass	
Test	Lab Sample ID	QA Source		Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery										
Eurofins Suite B11C: Na/K/Ca/Mg					Result 1					
Calcium	L25-Se0079499	NCP		%	78			75-125	Pass	
Magnesium	L25-Se0079499	NCP		%	92			75-125	Pass	
Potassium	L25-Se0079499	NCP		%	113			75-125	Pass	
Spike - % Recovery										
Total Recoverable Hydrocarbons - 1999 NEPM Fractions					Result 1					
TRH C6-C9	L25-Se0078934	CP		%	113			70-130	Pass	
Spike - % Recovery										
BTEX					Result 1					
Benzene	L25-Se0078934	CP		%	117			70-130	Pass	
Toluene	L25-Se0078934	CP		%	104			70-130	Pass	
Ethylbenzene	L25-Se0078934	CP		%	98			70-130	Pass	
m&p-Xylenes	L25-Se0078934	CP		%	110			70-130	Pass	
o-Xylene	L25-Se0078934	CP		%	95			70-130	Pass	
Xylenes - Total*	L25-Se0078934	CP		%	105			70-130	Pass	
Spike - % Recovery										
Total Recoverable Hydrocarbons - 2013 NEPM Fractions					Result 1					
Naphthalene	L25-Se0078934	CP		%	80			70-130	Pass	
TRH C6-C10	L25-Se0078934	CP		%	111			70-130	Pass	
Spike - % Recovery										
					Result 1					
Chloride	L25-Se0078939	CP		%	106			70-130	Pass	
Sulfate (as SO4)	L25-Se0078939	CP		%	107			70-130	Pass	
Spike - % Recovery										
Eurofins Suite B11C: Na/K/Ca/Mg					Result 1					
Sodium	L25-Se0083933	NCP		%	76			75-125	Pass	
Spike - % Recovery										
Total Recoverable Hydrocarbons - 1999 NEPM Fractions					Result 1					
TRH C6-C9	L25-Se0078944	CP		%	83			70-130	Pass	
TRH C10-C14	L25-Se0078944	CP		%	108			70-130	Pass	
Spike - % Recovery										

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
BTEX				Result 1					
Benzene	L25-Se0078944	CP	%	100			70-130	Pass	
Toluene	L25-Se0078944	CP	%	81			70-130	Pass	
Ethylbenzene	L25-Se0078944	CP	%	74			70-130	Pass	
m&p-Xylenes	L25-Se0078944	CP	%	86			70-130	Pass	
o-Xylene	L25-Se0078944	CP	%	75			70-130	Pass	
Xylenes - Total*	L25-Se0078944	CP	%	82			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
Naphthalene	L25-Se0078944	CP	%	88			70-130	Pass	
TRH C6-C10	L25-Se0078944	CP	%	82			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
TRH >C10-C16	L25-Se0078944	CP	%	111			70-130	Pass	
Spike - % Recovery									
OCOP in Water				Result 1					
Aldrin	L25-Se0082405	NCP	%	102			60-120	Pass	
alpha-BHC (HCH)	L25-Se0082405	NCP	%	111			60-120	Pass	
beta-BHC (HCH)	L25-Se0082405	NCP	%	99			60-120	Pass	
delta-BHC (HCH)	L25-Se0082405	NCP	%	106			60-120	Pass	
Bifenthrin	L25-Se0082405	NCP	%	96			60-120	Pass	
Bromophos Ethyl	L25-Se0082405	NCP	%	87			60-120	Pass	
Chlordane	L25-Se0082405	NCP	%	98			60-120	Pass	
Chlorpyrifos	L25-Se0082405	NCP	%	114			60-120	Pass	
Diazinon	L25-Se0049208	NCP	%	109			60-120	Pass	
Dieldrin	L25-Se0082405	NCP	%	100			60-120	Pass	
Endosulfan I	L25-Se0082405	NCP	%	87			60-120	Pass	
Endosulfan II	L25-Se0082405	NCP	%	89			60-120	Pass	
Endosulfan Sulfate	L25-Se0082405	NCP	%	94			60-120	Pass	
Endrin	L25-Se0082405	NCP	%	103			60-120	Pass	
Fipronil	L25-Se0082405	NCP	%	102			60-120	Pass	
Hexachlorobenzene (HCB)	L25-Se0082405	NCP	%	116			60-120	Pass	
Heptachlor Epoxide	L25-Se0082405	NCP	%	87			60-120	Pass	
Heptachlor	L25-Se0082405	NCP	%	94			60-120	Pass	
Lindane	L25-Se0082405	NCP	%	118			60-120	Pass	
Malathion	L25-Se0082405	NCP	%	96			60-120	Pass	
Methoxychlor	L25-Se0082405	NCP	%	88			60-120	Pass	
o,p-DDT	L25-Se0082405	NCP	%	100			60-120	Pass	
Oxychlordane	L25-Se0082405	NCP	%	89			60-120	Pass	
p,p-DDD	L25-Se0082405	NCP	%	84			60-120	Pass	
p,p-DDE	L25-Se0082405	NCP	%	109			60-120	Pass	
p,p-DDT	L25-Se0082405	NCP	%	87			60-120	Pass	
Parathion Ethyl	L25-Se0082405	NCP	%	85			60-120	Pass	
Trifluralin	L25-Se0082405	NCP	%	99			60-120	Pass	
Vinclozolin	L25-Se0082405	NCP	%	97			60-120	Pass	
Spike - % Recovery									
Low Level PAH in Water				Result 1					
Naphthalene	L25-Se0082405	NCP	%	110			60-120	Pass	
2-Methylnaphthalene	L25-Se0082405	NCP	%	110			60-120	Pass	
Acenaphthylene	L25-Se0082405	NCP	%	110			60-120	Pass	
Acenaphthene	L25-Se0082405	NCP	%	100			60-120	Pass	
Fluorene	L25-Se0082405	NCP	%	120			60-120	Pass	
Phenanthrene	L25-Se0082405	NCP	%	110			60-120	Pass	
Anthracene	L25-Se0082405	NCP	%	87			60-120	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Fluoranthene	L25-Se0082405	NCP	%	93			60-120	Pass	
Pyrene	L25-Se0082405	NCP	%	100			60-120	Pass	
Benz(a)anthracene	L25-Se0082405	NCP	%	100			60-120	Pass	
Chrysene	L25-Se0082405	NCP	%	80			60-120	Pass	
Benzo(b)fluoranthene	L25-Se0082405	NCP	%	85			60-120	Pass	
Benzo(k)fluoranthene	L25-Se0082405	NCP	%	100			60-120	Pass	
Benzo(a)pyrene	L25-Se0082405	NCP	%	100			60-120	Pass	
Indeno(1.2.3-c.d)pyrene	L25-Se0082405	NCP	%	90			60-120	Pass	
Dibenz(a,h)anthracene	L25-Se0082405	NCP	%	85			60-120	Pass	
Benzo(ghi)perylene	L25-Se0082405	NCP	%	90			60-120	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C6-C9	L25-Se0078933	CP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
TRH C10-C14	L25-Se0076649	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
TRH C15-C28	L25-Se0076649	NCP	mg/L	< 0.04	< 0.04	<1	30%	Pass	
TRH C29-C36	L25-Se0076649	NCP	mg/L	< 0.04	< 0.04	<1	30%	Pass	
Duplicate									
BTEX				Result 1	Result 2	RPD			
Benzene	L25-Se0078933	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Toluene	L25-Se0078933	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Ethylbenzene	L25-Se0078933	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
m&p-Xylenes	L25-Se0078933	CP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
o-Xylene	L25-Se0078933	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Xylenes - Total*	L25-Se0078933	CP	mg/L	< 0.003	< 0.003	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
Naphthalene	L25-Se0078933	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
TRH C6-C10	L25-Se0078933	CP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
TRH >C10-C16	L25-Se0076649	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
TRH >C16-C34	L25-Se0076649	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
TRH >C34-C40	L25-Se0076649	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
Duplicate									
Organotins in Water				Result 1	Result 2	RPD			
Monobutyl tin as Sn*	L25-Se0040626	NCP	ng/L	< 5	< 5	<1	30%	Pass	
Dibutyl tin as Sn*	L25-Se0040626	NCP	ng/L	< 5	< 5	<1	30%	Pass	
Tributyl tin as Sn*	L25-Se0040626	NCP	ng/L	< 2	< 2	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Conductivity (at 25 °C)	L25-Se0075662	NCP	uS/cm	540	530	<1	30%	Pass	
Total Dissolved Solids Dried at 180 °C ± 2 °C	L25-Se0075662	NCP	mg/L	320	320	<1	30%	Pass	
Duplicate									
Eurofins Suite B11C: Na/K/Ca/Mg				Result 1	Result 2	RPD			
Calcium	L25-Se0078933	CP	mg/L	97	93	5.0	30%	Pass	
Magnesium	L25-Se0078933	CP	mg/L	260	240	5.0	30%	Pass	
Potassium	L25-Se0078933	CP	mg/L	83	80	4.0	30%	Pass	
Sodium	L25-Se0078933	CP	mg/L	2600	2400	7.0	30%	Pass	

Duplicate								
Perfluoroalkyl sulfonamido substances- Trace				Result 1	Result 2	RPD		
Perfluorooctane sulfonamide (FOSA)	L25-Oc0006448	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	L25-Oc0006448	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	L25-Oc0006448	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol(N-MeFOSE)	L25-Oc0006448	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)	L25-Oc0006448	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	L25-Oc0006448	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	L25-Oc0006448	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Duplicate								
Perfluoroalkyl carboxylic acids (PFCAs) - Trace				Result 1	Result 2	RPD		
Perfluorobutanoic acid (PFBA)	L25-Oc0006448	NCP	ug/L	0.013	0.013	5.0	30%	Pass
Perfluoropentanoic acid (PFPeA)	L25-Oc0006448	NCP	ug/L	0.027	0.024	13	30%	Pass
Perfluorohexanoic acid (PFHxA)	L25-Oc0006448	NCP	ug/L	0.014	0.015	7.0	30%	Pass
Perfluoroheptanoic acid (PFHpA)	L25-Oc0006448	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Perfluorooctanoic acid (PFOA)	L25-Oc0006448	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorononanoic acid (PFNA)	L25-Oc0006448	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorodecanoic acid (PFDA)	L25-Oc0006448	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorotridecanoic acid (PFTTrDA)	L25-Oc0006448	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoroundecanoic acid (PFUnDA)	L25-Oc0006448	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorododecanoic acid (PFDoDA)	L25-Oc0006448	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorotetradecanoic acid (PFTeDA)	L25-Oc0006448	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)- Trace				Result 1	Result 2	RPD		
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	L25-Oc0006448	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)	L25-Oc0006448	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	L25-Oc0006448	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	L25-Oc0006448	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
Perfluoroalkyl sulfonic acids (PFSA)- Ultra trace				Result 1	Result 2	RPD		
Perfluorobutanesulfonic acid (PFBS)	L25-Oc0006448	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorononanesulfonic acid (PFNS)*	L25-Oc0006448	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorooctanesulfonic acid (PFOS)	L25-Oc0006448	NCP	ug/L	0.0004	0.0005	<1	30%	Pass
Perfluoropropanesulfonic acid (PFPrS)*	L25-Oc0006448	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoropentanesulfonic acid (PFPeS)	L25-Oc0006448	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorohexanesulfonic acid (PFHxS)	L25-Oc0006448	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoroheptanesulfonic acid (PFHpS)	L25-Oc0006448	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorodecanesulfonic acid (PFDS)	L25-Oc0006448	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass

Duplicate								
Organotins in Water				Result 1	Result 2	RPD		
Monobutyl tin as Sn*	L25-Se0005480	NCP	ng/L	< 5	< 5	<1	30%	Pass
Dibutyl tin as Sn*	L25-Se0005480	NCP	ng/L	< 5	< 5	<1	30%	Pass
Tributyl tin as Sn*	L25-Se0005480	NCP	ng/L	< 2	< 2	<1	30%	Pass
Duplicate								
Perfluoroalkyl sulfonamido substances- Trace				Result 1	Result 2	RPD		
Perfluorooctane sulfonamide (FOSA)	L25-Se0078934	CP	ug/L	< 0.005	< 0.005	<1	30%	Pass
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	L25-Se0078934	CP	ug/L	< 0.005	< 0.005	<1	30%	Pass
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	L25-Se0078934	CP	ug/L	< 0.005	< 0.005	<1	30%	Pass
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol(N-MeFOSE)	L25-Se0078934	CP	ug/L	< 0.005	< 0.005	<1	30%	Pass
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)	L25-Se0078934	CP	ug/L	< 0.005	< 0.005	<1	30%	Pass
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	L25-Se0078934	CP	ug/L	< 0.005	< 0.005	<1	30%	Pass
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	L25-Se0078934	CP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Duplicate								
Perfluoroalkyl carboxylic acids (PFCAs) - Trace				Result 1	Result 2	RPD		
Perfluorobutanoic acid (PFBA)	L25-Se0078934	CP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Perfluoropentanoic acid (PFPeA)	L25-Se0078934	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorohexanoic acid (PFHxA)	L25-Se0078934	CP	ug/L	0.002	0.002	5.0	30%	Pass
Perfluoroheptanoic acid (PFHpA)	L25-Se0078934	CP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Perfluorooctanoic acid (PFOA)	L25-Se0078934	CP	ug/L	0.001	0.001	9.0	30%	Pass
Perfluorononanoic acid (PFNA)	L25-Se0078934	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorodecanoic acid (PFDA)	L25-Se0078934	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorotridecanoic acid (PFTrDA)	L25-Se0078934	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoroundecanoic acid (PFUnDA)	L25-Se0078934	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorododecanoic acid (PFDoDA)	L25-Se0078934	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorotetradecanoic acid (PFTeDA)	L25-Se0078934	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)- Trace				Result 1	Result 2	RPD		
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	L25-Se0078934	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)	L25-Se0078934	CP	ug/L	< 0.005	< 0.005	<1	30%	Pass
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	L25-Se0078934	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	L25-Se0078934	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
Perfluoroalkyl sulfonic acids (PFSA)- Ultra trace				Result 1	Result 2	RPD		
Perfluorobutanesulfonic acid (PFBS)	L25-Se0078934	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorononanesulfonic acid (PFNS)*	L25-Se0078934	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorooctanesulfonic acid (PFOS)	L25-Se0078934	CP	ug/L	0.0060	0.0060	<1	30%	Pass
Perfluoropropanesulfonic acid (PFPrS)*	L25-Se0078934	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass

Duplicate								
Perfluoroalkyl sulfonic acids (PFASs)- Ultra trace				Result 1	Result 2	RPD		
Perfluoropentanesulfonic acid (PFPeS)	L25-Se0078934	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorohexanesulfonic acid (PFHxS)	L25-Se0078934	CP	ug/L	0.003	0.003	<1	30%	Pass
Perfluoroheptanesulfonic acid (PFHpS)	L25-Se0078934	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorodecanesulfonic acid (PFDS)	L25-Se0078934	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
Perfluoroalkyl sulfonamido substances- Trace				Result 1	Result 2	RPD		
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	L25-Oc0006469	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	L25-Oc0006469	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)	L25-Oc0006469	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Duplicate								
Perfluoroalkyl carboxylic acids (PFCAs) - Trace				Result 1	Result 2	RPD		
Perfluorobutanoic acid (PFBA)	L25-Oc0006469	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Perfluoropentanoic acid (PFPeA)	L25-Oc0006469	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorohexanoic acid (PFHxA)	L25-Oc0006469	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoroheptanoic acid (PFHpA)	L25-Oc0006469	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Perfluorooctanoic acid (PFOA)	L25-Oc0006469	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorononanoic acid (PFNA)	L25-Oc0006469	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorodecanoic acid (PFDA)	L25-Oc0006469	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorotridecanoic acid (PFTrDA)	L25-Oc0006469	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoroundecanoic acid (PFUnDA)	L25-Oc0006469	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorododecanoic acid (PFDoDA)	L25-Oc0006469	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorotetradecanoic acid (PFTeDA)	L25-Oc0006469	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)- Trace				Result 1	Result 2	RPD		
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	L25-Oc0006469	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)	L25-Oc0006469	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	L25-Oc0006469	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	L25-Oc0006469	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
Perfluoroalkyl sulfonic acids (PFASs)- Ultra trace				Result 1	Result 2	RPD		
Perfluorobutanesulfonic acid (PFBS)	L25-Oc0006469	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorononanesulfonic acid (PFNS)*	L25-Oc0006469	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorooctanesulfonic acid (PFOS)	L25-Oc0006469	NCP	ug/L	0.0009	0.0009	4.0	30%	Pass
Perfluoropropanesulfonic acid (PFPrS)*	L25-Oc0006469	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoropentanesulfonic acid (PFPeS)	L25-Oc0006469	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorohexanesulfonic acid (PFHxS)	L25-Oc0006469	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoroheptanesulfonic acid (PFHpS)	L25-Oc0006469	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorodecanesulfonic acid (PFDS)	L25-Oc0006469	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass

Duplicate								
Perfluoroalkyl sulfonamido substances- Trace				Result 1	Result 2	RPD		
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	L25-JI0050683	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	L25-JI0050683	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)	L25-JI0010126	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Duplicate								
Perfluoroalkyl carboxylic acids (PFCAs) - Trace				Result 1	Result 2	RPD		
Perfluorobutanoic acid (PFBA)	L25-Au0013381	NCP	ug/L	0.13	0.13	4.0	30%	Pass
Perfluoropentanoic acid (PFPeA)	L25-Au0013381	NCP	ug/L	0.051	0.053	3.0	30%	Pass
Perfluorohexanoic acid (PFHxA)	L25-Au0013381	NCP	ug/L	0.11	0.11	2.0	30%	Pass
Perfluoroheptanoic acid (PFHpA)	L25-JI0050683	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Perfluorooctanoic acid (PFOA)	L25-JI0010126	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorononanoic acid (PFNA)	L25-JI0010126	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorodecanoic acid (PFDA)	L25-JI0010126	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorotridecanoic acid (PFTrDA)	L25-JI0010126	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoroundecanoic acid (PFUnDA)	L25-JI0010126	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorododecanoic acid (PFDoDA)	L25-JI0010126	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorotetradecanoic acid (PFTeDA)	L25-JI0010126	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)- Trace				Result 1	Result 2	RPD		
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	L25-JI0010126	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)	L25-JI0008332	NCP	ug/L	0.11	0.12	7.0	30%	Pass
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	L25-JI0010126	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	L25-JI0010126	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
Perfluoroalkyl sulfonic acids (PFSA)- Ultra trace				Result 1	Result 2	RPD		
Perfluorobutanesulfonic acid (PFBS)	L25-Au0013381	NCP	ug/L	0.079	0.086	9.0	30%	Pass
Perfluorononanesulfonic acid (PFNS)*	L25-JI0010126	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorooctanesulfonic acid (PFOS)	L25-JI0008332	NCP	ug/L	0.31	0.31	<1	30%	Pass
Perfluoropropanesulfonic acid (PFPrS)*	L25-JI0010126	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoropentanesulfonic acid (PFPeS)	L25-JI0010126	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorohexanesulfonic acid (PFHxS)	L25-JI0023793	NCP	ug/L	0.049	0.050	1.0	30%	Pass
Perfluoroheptanesulfonic acid (PFHpS)	L25-JI0010126	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorodecanesulfonic acid (PFDS)	L25-JI0010126	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
Perfluoroalkyl sulfonamido substances- Trace				Result 1	Result 2	RPD		
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	L25-Se0072371	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	L25-Se0072371	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)	L25-JI0050683	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass

Duplicate								
Perfluoroalkyl carboxylic acids (PFCAs) - Trace				Result 1	Result 2	RPD		
Perfluorobutanoic acid (PFBA)	L25-Au0014753	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Perfluoropentanoic acid (PFPeA)	L25-JI0008332	NCP	ug/L	0.17	0.15	10	30%	Pass
Perfluorohexanoic acid (PFHxA)	L25-Au0014753	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoroheptanoic acid (PFHpA)	L25-Se0072371	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Perfluorooctanoic acid (PFOA)	L25-JI0050683	NCP	ug/L	0.001	0.001	17	30%	Pass
Perfluorononanoic acid (PFNA)	L25-JI0050683	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorodecanoic acid (PFDA)	L25-JI0050683	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorotridecanoic acid (PFTrDA)	L25-JI0050683	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoroundecanoic acid (PFUnDA)	L25-JI0050683	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorododecanoic acid (PFDoDA)	L25-JI0050683	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorotetradecanoic acid (PFTeDA)	L25-JI0050683	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)- Trace				Result 1	Result 2	RPD		
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	L25-JI0050683	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)	L25-JI0080080	NCP	ug/L	0.14	0.13	6.0	30%	Pass
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	L25-JI0050683	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	L25-JI0050683	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
Perfluoroalkyl sulfonic acids (PFSA)- Ultra trace				Result 1	Result 2	RPD		
Perfluorobutanesulfonic acid (PFBS)	L25-Au0014753	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorononanesulfonic acid (PFNS)*	L25-JI0050683	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorooctanesulfonic acid (PFOS)	L25-JI0050683	NCP	ug/L	0.0020	0.0023	14	30%	Pass
Perfluoropropanesulfonic acid (PFPrS)*	L25-JI0050683	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoropentanesulfonic acid (PFPeS)	L25-JI0050683	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorohexanesulfonic acid (PFHxS)	L25-JI0010126	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoroheptanesulfonic acid (PFHpS)	L25-JI0050683	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorodecanesulfonic acid (PFDS)	L25-JI0050683	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
				Result 1	Result 2	RPD		
Chloride	L25-Se0078938	CP	mg/L	5200	5100	1.0	30%	Pass
Sulfate (as SO4)	L25-Se0078938	CP	mg/L	730	710	2.0	30%	Pass
Duplicate								
Perfluoroalkyl sulfonamido substances- Trace				Result 1	Result 2	RPD		
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	L25-Au0077812	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	L25-Au0077812	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)	L25-JI0007019	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass

Duplicate								
Perfluoroalkyl carboxylic acids (PFCAs) - Trace				Result 1	Result 2	RPD		
Perfluorobutanoic acid (PFBA)	L25-Au0013528	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Perfluoropentanoic acid (PFPeA)	L25-Jl0050683	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorohexanoic acid (PFHxA)	L25-Jn0039401	NCP	ug/L	0.069	0.068	1.0	30%	Pass
Perfluoroheptanoic acid (PFHpA)	L25-Au0077812	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Perfluorooctanoic acid (PFOA)	L25-Jl0007019	NCP	ug/L	0.008	0.009	<1	30%	Pass
Perfluorononanoic acid (PFNA)	L25-Jl0007019	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorodecanoic acid (PFDA)	L25-Jl0007019	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorotridecanoic acid (PFTTrDA)	L25-Jl0007019	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoroundecanoic acid (PFUnDA)	L25-Jl0007019	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorododecanoic acid (PFDoDA)	L25-Jl0007019	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorotetradecanoic acid (PFTeDA)	L25-Jl0007019	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)- Trace				Result 1	Result 2	RPD		
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	L25-Jl0007019	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)	L25-Jl0033263	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	L25-Jl0007019	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	L25-Jl0007019	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
Perfluoroalkyl sulfonic acids (PFSAs)- Ultra trace				Result 1	Result 2	RPD		
Perfluorobutanesulfonic acid (PFBS)	L25-Au0013528	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorononanesulfonic acid (PFNS)*	L25-Jl0007019	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorooctanesulfonic acid (PFOS)	L25-Au0013528	NCP	ug/L	0.0001	0.0001	<1	30%	Pass
Perfluoropropanesulfonic acid (PFPrS)*	L25-Jl0007019	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoropentanesulfonic acid (PFPeS)	L25-Jl0007019	NCP	ug/L	0.001	0.002	6.0	30%	Pass
Perfluorohexanesulfonic acid (PFHxS)	L25-Au0014753	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoroheptanesulfonic acid (PFHpS)	L25-Jl0007019	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorodecanesulfonic acid (PFDS)	L25-Jl0007019	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
Perfluoroalkyl sulfonamido substances- Trace				Result 1	Result 2	RPD		
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)	L25-Oc0008856	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Duplicate								
Perfluoroalkyl carboxylic acids (PFCAs) - Trace				Result 1	Result 2	RPD		
Perfluorobutanoic acid (PFBA)	L25-Oc0008856	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Perfluoropentanoic acid (PFPeA)	L25-Oc0008856	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorohexanoic acid (PFHxA)	L25-Oc0008856	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorooctanoic acid (PFOA)	L25-Oc0008856	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorononanoic acid (PFNA)	L25-Oc0008856	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorodecanoic acid (PFDA)	L25-Oc0008856	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorotridecanoic acid (PFTTrDA)	L25-Oc0008856	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass

Duplicate								
Perfluoroalkyl carboxylic acids (PFCAs) - Trace				Result 1	Result 2	RPD		
Perfluoroundecanoic acid (PFUnDA)	L25-Oc0008856	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorododecanoic acid (PFDoDA)	L25-Oc0008856	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorotetradecanoic acid (PFTeDA)	L25-Oc0008856	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)- Trace				Result 1	Result 2	RPD		
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	L25-Oc0008856	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	L25-Oc0008856	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	L25-Oc0008856	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
Perfluoroalkyl sulfonic acids (PFSAs)- Ultra trace				Result 1	Result 2	RPD		
Perfluorobutanesulfonic acid (PFBS)	L25-Oc0008856	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorononanesulfonic acid (PFNS)*	L25-Oc0008856	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoropropanesulfonic acid (PFPrS)*	L25-Oc0008856	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoropentanesulfonic acid (PFPeS)	L25-Oc0008856	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorohexanesulfonic acid (PFHxS)	L25-Oc0008856	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoroheptanesulfonic acid (PFHpS)	L25-Oc0008856	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorodecanesulfonic acid (PFDS)	L25-Oc0008856	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
				Result 1	Result 2	RPD		
Sulphide (as S)	L25-Se0078940	CP	mg/L	< 0.1	< 0.1	<1	30%	Pass
Duplicate								
Perfluoroalkyl sulfonamido substances- Trace				Result 1	Result 2	RPD		
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	L25-Oc0011247	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	L25-Oc0011247	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)	L25-Jl0007239	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Duplicate								
Perfluoroalkyl carboxylic acids (PFCAs) - Trace				Result 1	Result 2	RPD		
Perfluorobutanoic acid (PFBA)	L25-Jl0008332	NCP	ug/L	0.060	0.062	2.0	30%	Pass
Perfluoropentanoic acid (PFPeA)	L25-Au0036958	NCP	ug/L	0.040	0.062	2.0	30%	Pass
Perfluorohexanoic acid (PFHxA)	L25-Jh0069322	NCP	ug/L	0.052	0.051	2.0	30%	Pass
Perfluoroheptanoic acid (PFHpA)	L25-Oc0011247	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Perfluorooctanoic acid (PFOA)	L25-Jl0007239	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorononanoic acid (PFNA)	L25-Jl0007239	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorodecanoic acid (PFDA)	L25-Jl0007239	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorotridecanoic acid (PFTrDA)	L25-Jl0007239	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoroundecanoic acid (PFUnDA)	L25-Jl0007239	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorododecanoic acid (PFDoDA)	L25-Jl0007239	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorotetradecanoic acid (PFTeDA)	L25-Jl0007239	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass

Duplicate								
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)- Trace				Result 1	Result 2	RPD		
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	L25-JI0007239	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)	L25-Jn0069126	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	L25-JI0007239	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	L25-JI0007239	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
Perfluoroalkyl sulfonic acids (PFSA)- Ultra trace				Result 1	Result 2	RPD		
Perfluorobutanesulfonic acid (PFBS)	L25-Se0072371	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorononanesulfonic acid (PFNS)*	L25-JI0007239	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorooctanesulfonic acid (PFOS)	L25-Au0036995	NCP	ug/L	0.025	0.024	4.0	30%	Pass
Perfluoropropanesulfonic acid (PFPrS)*	L25-JI0007239	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoropentanesulfonic acid (PFPeS)	L25-JI0007239	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorohexanesulfonic acid (PFHxS)	L25-JI0007019	NCP	ug/L	0.008	0.010	1.0	30%	Pass
Perfluoroheptanesulfonic acid (PFHpS)	L25-JI0007239	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorodecanesulfonic acid (PFDS)	L25-JI0007239	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
Perfluoroalkyl sulfonamido substances- Trace				Result 1	Result 2	RPD		
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	L25-JI0031700	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	L25-JI0031700	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)	L25-Au0034980	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Duplicate								
Perfluoroalkyl carboxylic acids (PFCAs) - Trace				Result 1	Result 2	RPD		
Perfluorobutanoic acid (PFBA)	L25-JI0007239	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Perfluoropentanoic acid (PFPeA)	L25-JI0080080	NCP	ug/L	0.12	0.11	1.0	30%	Pass
Perfluorohexanoic acid (PFHxA)	L25-Se0072371	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoroheptanoic acid (PFHpA)	L25-JI0031700	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Perfluorooctanoic acid (PFOA)	L25-Au0034980	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorononanoic acid (PFNA)	L25-Au0034980	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorodecanoic acid (PFDA)	L25-Au0034980	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorotridecanoic acid (PFTrDA)	L25-Au0034980	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoroundecanoic acid (PFUnDA)	L25-Au0034980	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorododecanoic acid (PFDoDA)	L25-Au0034980	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorotetradecanoic acid (PFTeDA)	L25-Au0034980	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass

Duplicate								
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)- Trace				Result 1	Result 2	RPD		
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	L25-Au0034980	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)	L25-Jl0035451	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	L25-Au0034980	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	L25-Au0034980	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
Perfluoroalkyl sulfonic acids (PFSA)- Ultra trace				Result 1	Result 2	RPD		
Perfluorobutanesulfonic acid (PFBS)	L25-Au0017458	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorononanesulfonic acid (PFNS)*	L25-Au0034980	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorooctanesulfonic acid (PFOS)	L25-Jn0069126	NCP	ug/L	0.011	0.010	2.0	30%	Pass
Perfluoropropanesulfonic acid (PFPrS)*	L25-Au0034980	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoropentanesulfonic acid (PFPeS)	L25-Au0034980	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorohexanesulfonic acid (PFHxS)	L25-Jl0080080	NCP	ug/L	0.13	0.13	1.0	30%	Pass
Perfluoroheptanesulfonic acid (PFHpS)	L25-Au0034980	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorodecanesulfonic acid (PFDS)	L25-Au0034980	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD		
TRH C6-C9	L25-Se0078943	CP	mg/L	< 0.02	< 0.02	<1	30%	Pass
TRH C10-C14	L25-Se0078943	CP	mg/L	< 0.02	< 0.02	<1	30%	Pass
TRH C15-C28	L25-Se0078943	CP	mg/L	< 0.04	< 0.04	<1	30%	Pass
TRH C29-C36	L25-Se0078943	CP	mg/L	< 0.04	< 0.04	<1	30%	Pass
Duplicate								
BTX				Result 1	Result 2	RPD		
Benzene	L25-Se0078943	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Toluene	L25-Se0078943	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Ethylbenzene	L25-Se0078943	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
m&p-Xylenes	L25-Se0078943	CP	mg/L	< 0.002	< 0.002	<1	30%	Pass
o-Xylene	L25-Se0078943	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Xylenes - Total*	L25-Se0078943	CP	mg/L	< 0.003	< 0.003	<1	30%	Pass
Duplicate								
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD		
Naphthalene	L25-Se0078943	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
TRH C6-C10	L25-Se0078943	CP	mg/L	< 0.02	< 0.02	<1	30%	Pass
Duplicate								
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD		
TRH >C10-C16	L25-Se0078943	CP	mg/L	< 0.02	< 0.02	<1	30%	Pass
TRH >C16-C34	L25-Se0078943	CP	mg/L	< 0.05	< 0.05	<1	30%	Pass
TRH >C34-C40	L25-Se0078943	CP	mg/L	< 0.05	< 0.05	<1	30%	Pass
Duplicate								
Organotin in Water				Result 1	Result 2	RPD		
Monobutyl tin as Sn*	L25-Se0036917	NCP	ng/L	< 5	< 5	<1	30%	Pass
Dibutyl tin as Sn*	L25-Se0036917	NCP	ng/L	< 5	< 5	<1	30%	Pass
Tributyl tin as Sn*	L25-Se0036917	NCP	ng/L	< 2	< 2	<1	30%	Pass

Duplicate								
				Result 1	Result 2	RPD		
Conductivity (at 25 °C)	L25-Se0080931	NCP	uS/cm	500	500	<1	30%	Pass
Total Dissolved Solids Dried at 180 °C ± 2 °C	L25-Se0080931	NCP	mg/L	300	300	<1	30%	Pass
Duplicate								
Perfluoroalkyl sulfonamido substances- Trace				Result 1	Result 2	RPD		
Perfluorooctane sulfonamide (FOSA)	L25-Oc0011217	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	L25-Oc0011217	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	L25-Oc0011217	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol(N-MeFOSE)	L25-Oc0011217	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)	L25-Oc0011217	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	L25-Oc0011217	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	L25-Oc0011217	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Duplicate								
Perfluoroalkyl carboxylic acids (PFCAs) - Trace				Result 1	Result 2	RPD		
Perfluorobutanoic acid (PFBA)	L25-Oc0011217	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Perfluoropentanoic acid (PFPeA)	L25-Oc0011217	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorohexanoic acid (PFHxA)	L25-Oc0011217	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoroheptanoic acid (PFHpA)	L25-Oc0011217	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Perfluorooctanoic acid (PFOA)	L25-Oc0011217	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorononanoic acid (PFNA)	L25-Oc0011217	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorodecanoic acid (PFDA)	L25-Oc0011217	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorotridecanoic acid (PFTrDA)	L25-Oc0011217	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoroundecanoic acid (PFUnDA)	L25-Oc0011217	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorododecanoic acid (PFDoDA)	L25-Oc0011217	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorotetradecanoic acid (PFTeDA)	L25-Oc0011217	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)- Trace				Result 1	Result 2	RPD		
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	L25-Oc0011217	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)	L25-Oc0011217	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	L25-Oc0011217	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	L25-Oc0011217	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
Perfluoroalkyl sulfonic acids (PFSA)- Ultra trace				Result 1	Result 2	RPD		
Perfluorobutanesulfonic acid (PFBS)	L25-Oc0011217	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorononanesulfonic acid (PFNS)*	L25-Oc0011217	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorooctanesulfonic acid (PFOS)	L25-Oc0011217	NCP	ug/L	0.0001	0.0001	<1	30%	Pass
Perfluoropropanesulfonic acid (PFPrS)*	L25-Oc0011217	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass

Duplicate								
Perfluoroalkyl sulfonic acids (PFASs)- Ultra trace				Result 1	Result 2	RPD		
Perfluoropentanesulfonic acid (PFPeS)	L25-Oc0011217	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorohexanesulfonic acid (PFHxS)	L25-Oc0011217	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoroheptanesulfonic acid (PFHpS)	L25-Oc0011217	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorodecanesulfonic acid (PFDS)	L25-Oc0011217	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
Organotins in Water				Result 1	Result 2	RPD		
Monobutyl tin as Sn*	L25-Au0070915	NCP	ng/L	< 5	< 5	<1	30%	Pass
Dibutyl tin as Sn*	L25-Au0070915	NCP	ng/L	< 5	< 5	<1	30%	Pass
Tributyl tin as Sn*	L25-Au0070915	NCP	ng/L	< 2	< 2	<1	30%	Pass
Duplicate								
Perfluoroalkyl sulfonamido substances- Trace				Result 1	Result 2	RPD		
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	L25-Jl0023793	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	L25-Jl0023793	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)	L25-Oc0015304	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Duplicate								
Perfluoroalkyl carboxylic acids (PFCAs) - Trace				Result 1	Result 2	RPD		
Perfluorobutanoic acid (PFBA)	L25-Oc0015304	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Perfluoropentanoic acid (PFPeA)	L25-Oc0015304	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorohexanoic acid (PFHxA)	L25-Oc0015304	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoroheptanoic acid (PFHpA)	L25-Jl0023793	NCP	ug/L	0.009	0.008	13	30%	Pass
Perfluorooctanoic acid (PFOA)	L25-Oc0015304	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorononanoic acid (PFNA)	L25-Oc0015304	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorodecanoic acid (PFDA)	L25-Oc0015304	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorotridecanoic acid (PFTrDA)	L25-Oc0015304	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoroundecanoic acid (PFUnDA)	L25-Oc0015304	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorododecanoic acid (PFDoDA)	L25-Oc0015304	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorotetradecanoic acid (PFTeDA)	L25-Oc0015304	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)- Trace				Result 1	Result 2	RPD		
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	L25-Oc0015304	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)	L25-Jl0023793	NCP	ug/L	0.023	0.025	8.0	30%	Pass
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	L25-Oc0015304	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	L25-Oc0015304	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
Perfluoroalkyl sulfonic acids (PFASs)- Ultra trace				Result 1	Result 2	RPD		
Perfluorobutanesulfonic acid (PFBS)	L25-Oc0015304	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorononanesulfonic acid (PFNS)*	L25-Oc0015304	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorooctanesulfonic acid (PFOS)	L25-Jl0023793	NCP	ug/L	0.045	0.045	<1	30%	Pass
Perfluoropropanesulfonic acid (PFPrS)*	L25-Oc0015304	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass

Duplicate								
Perfluoroalkyl sulfonic acids (PFASs)- Ultra trace				Result 1	Result 2	RPD		
Perfluoropentanesulfonic acid (PFPeS)	L25-Oc0015304	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorohexanesulfonic acid (PFHxS)	L25-Oc0015304	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoroheptanesulfonic acid (PFHpS)	L25-Oc0015304	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorodecanesulfonic acid (PFDS)	L25-Oc0015304	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
				Result 1	Result 2	RPD		
Sulphide (as S)	L25-Se0078945	CP	mg/L	< 0.1	< 0.1	<1	30%	Pass
Duplicate								
Perfluoroalkyl sulfonamido substances- Trace				Result 1	Result 2	RPD		
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	L25-Jl0010126	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	L25-Jl0010126	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)	L25-Jl0023793	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Duplicate								
Perfluoroalkyl carboxylic acids (PFCAs) - Trace				Result 1	Result 2	RPD		
Perfluorobutanoic acid (PFBA)	L25-Jl0023793	NCP	ug/L	0.018	0.018	1.0	30%	Pass
Perfluoropentanoic acid (PFPeA)	L25-Jl0023793	NCP	ug/L	0.006	0.005	9.0	30%	Pass
Perfluorohexanoic acid (PFHxA)	L25-Jl0023793	NCP	ug/L	0.011	0.012	6.0	30%	Pass
Perfluoroheptanoic acid (PFHpA)	L25-Jl0010126	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Perfluorooctanoic acid (PFOA)	L25-Jl0023793	NCP	ug/L	0.031	0.031	2.0	30%	Pass
Perfluorononanoic acid (PFNA)	L25-Jl0023793	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorodecanoic acid (PFDA)	L25-Jl0023793	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorotridecanoic acid (PFTrDA)	L25-Jl0023793	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoroundecanoic acid (PFUnDA)	L25-Jl0023793	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorododecanoic acid (PFDoDA)	L25-Jl0023793	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorotetradecanoic acid (PFTeDA)	L25-Jl0023793	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)- Trace				Result 1	Result 2	RPD		
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	L25-Jl0023793	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)	L25-Jl0010126	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	L25-Jl0023793	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	L25-Jl0023793	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
Perfluoroalkyl sulfonic acids (PFASs)- Ultra trace				Result 1	Result 2	RPD		
Perfluorobutanesulfonic acid (PFBS)	L25-Jl0023793	NCP	ug/L	0.012	0.012	1.0	30%	Pass
Perfluorononanesulfonic acid (PFNS)*	L25-Jl0023793	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorooctanesulfonic acid (PFOS)	L25-Jl0010126	NCP	ug/L	0.0001	0.0001	<1	30%	Pass
Perfluoropropanesulfonic acid (PFPrS)*	L25-Jl0023793	NCP	ug/L	0.004	0.004	11	30%	Pass
Perfluoropentanesulfonic acid (PFPeS)	L25-Jl0023793	NCP	ug/L	0.006	0.006	<1	30%	Pass

Duplicate								
Perfluoroalkyl sulfonic acids (PFASs)- Ultra trace				Result 1	Result 2	RPD		
Perfluorohexanesulfonic acid (PFHxS)	L25-JI0023977	NCP	ug/L	0.15	0.18	2.0	30%	Pass
Perfluoroheptanesulfonic acid (PFHpS)	L25-JI0023793	NCP	ug/L	0.003	0.003	<1	30%	Pass
Perfluorodecanesulfonic acid (PFDS)	L25-JI0023793	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
Perfluoroalkyl sulfonamido substances- Trace				Result 1	Result 2	RPD		
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	L25-JI0008332	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	L25-JI0008332	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)	L25-Au0014753	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Duplicate								
Perfluoroalkyl carboxylic acids (PFCAs) - Trace				Result 1	Result 2	RPD		
Perfluorobutanoic acid (PFBA)	L25-JI0010126	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Perfluoropentanoic acid (PFPeA)	L25-JI0010126	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorohexanoic acid (PFHxA)	L25-JI0010126	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoroheptanoic acid (PFHpA)	L25-JI0008332	NCP	ug/L	0.059	0.057	4.0	30%	Pass
Perfluorooctanoic acid (PFOA)	L25-Au0014753	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorononanoic acid (PFNA)	L25-Au0014753	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorodecanoic acid (PFDA)	L25-Au0014753	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorotridecanoic acid (PFTTrDA)	L25-Au0014753	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoroundecanoic acid (PFUnDA)	L25-Au0014753	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorododecanoic acid (PFDoDA)	L25-Au0014753	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorotetradecanoic acid (PFTeDA)	L25-Au0014753	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)- Trace				Result 1	Result 2	RPD		
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	L25-Au0014753	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)	L25-JI0050683	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	L25-Au0014753	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	L25-Au0014753	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
Perfluoroalkyl sulfonic acids (PFASs)- Ultra trace				Result 1	Result 2	RPD		
Perfluorobutanesulfonic acid (PFBS)	L25-JI0010126	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorononanesulfonic acid (PFNS)*	L25-Au0014753	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorooctanesulfonic acid (PFOS)	L25-Au0014753	NCP	ug/L	0.0002	0.0003	<1	30%	Pass
Perfluoropropanesulfonic acid (PFPrS)*	L25-Au0014753	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoropentanesulfonic acid (PFPeS)	L25-Au0014753	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorohexanesulfonic acid (PFHxS)	L25-Au0013381	NCP	ug/L	0.075	0.079	5.0	30%	Pass
Perfluoroheptanesulfonic acid (PFHpS)	L25-Au0014753	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorodecanesulfonic acid (PFDS)	L25-Au0014753	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass

Duplicate								
Perfluoroalkyl sulfonamido substances- Trace				Result 1	Result 2	RPD		
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	L25-JI0033263	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	L25-JI0033263	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)	L25-Au0013528	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Duplicate								
Perfluoroalkyl carboxylic acids (PFCAs) - Trace				Result 1	Result 2	RPD		
Perfluorobutanoic acid (PFBA)	L25-JI0050683	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Perfluoropentanoic acid (PFPeA)	L25-Au0014753	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorohexanoic acid (PFHxA)	L25-JI0050683	NCP	ug/L	0.002	0.002	12	30%	Pass
Perfluoroheptanoic acid (PFHpA)	L25-JI0033263	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Perfluorooctanoic acid (PFOA)	L25-Au0013528	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorononanoic acid (PFNA)	L25-Au0013528	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorodecanoic acid (PFDA)	L25-Au0013528	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorotridecanoic acid (PFTTrDA)	L25-Au0013528	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoroundecanoic acid (PFUnDA)	L25-Au0013528	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorododecanoic acid (PFDoDA)	L25-Au0013528	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorotetradecanoic acid (PFTeDA)	L25-Au0013528	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)- Trace				Result 1	Result 2	RPD		
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	L25-Au0013528	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)	L25-Se0072371	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	L25-Au0013528	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	L25-Au0013528	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
Perfluoroalkyl sulfonic acids (PFSA)- Ultra trace				Result 1	Result 2	RPD		
Perfluorobutanesulfonic acid (PFBS)	L25-JI0050683	NCP	ug/L	0.002	0.002	13	30%	Pass
Perfluorononanesulfonic acid (PFNS)*	L25-Au0013528	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorooctanesulfonic acid (PFOS)	L25-Jn0039401	NCP	ug/L	0.11	0.11	3.0	30%	Pass
Perfluoropropanesulfonic acid (PFPrS)*	L25-Au0013528	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoropentanesulfonic acid (PFPeS)	L25-Au0013528	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorohexanesulfonic acid (PFHxS)	L25-JI0008332	NCP	ug/L	0.17	0.16	<1	30%	Pass
Perfluoroheptanesulfonic acid (PFHpS)	L25-Au0013528	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorodecanesulfonic acid (PFDS)	L25-Au0013528	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
				Result 1	Result 2	RPD		
Chloride	L25-Se0078948	CP	mg/L	3500	3500	1.0	30%	Pass
Sulfate (as SO4)	L25-Se0078948	CP	mg/L	440	410	6.0	30%	Pass

Duplicate								
Perfluoroalkyl sulfonamido substances- Trace				Result 1	Result 2	RPD		
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	L25-Au0036995	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	L25-Au0036995	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)	L25-Au0017541	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Duplicate								
Perfluoroalkyl carboxylic acids (PFCAs) - Trace				Result 1	Result 2	RPD		
Perfluorobutanoic acid (PFBA)	L25-JI0007019	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Perfluoropentanoic acid (PFPeA)	L25-Au0013528	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorohexanoic acid (PFHxA)	L25-Au0013528	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoroheptanoic acid (PFHpA)	L25-Au0036995	NCP	ug/L	0.006	0.006	8.0	30%	Pass
Perfluorooctanoic acid (PFOA)	L25-Au0017541	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorononanoic acid (PFNA)	L25-Au0017541	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorodecanoic acid (PFDA)	L25-Au0017541	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorotridecanoic acid (PFTrDA)	L25-Au0017541	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoroundecanoic acid (PFUnDA)	L25-Au0017541	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorododecanoic acid (PFDoDA)	L25-Au0017541	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorotetradecanoic acid (PFTeDA)	L25-Au0017541	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)- Trace				Result 1	Result 2	RPD		
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	L25-Au0017541	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)	L25-Au0077812	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	L25-Au0017541	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	L25-Au0017541	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
Perfluoroalkyl sulfonic acids (PFSAs)- Ultra trace				Result 1	Result 2	RPD		
Perfluorobutanesulfonic acid (PFBS)	L25-JI0007019	NCP	ug/L	0.002	0.002	<1	30%	Pass
Perfluorononanesulfonic acid (PFNS)*	L25-Au0017541	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorooctanesulfonic acid (PFOS)	L25-JI0080080	NCP	ug/L	0.21	0.16	23	30%	Pass
Perfluoropropanesulfonic acid (PFPrS)*	L25-Au0017541	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoropentanesulfonic acid (PFPeS)	L25-Au0017541	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorohexanesulfonic acid (PFHxS)	L25-JI0050683	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoroheptanesulfonic acid (PFHpS)	L25-Au0017541	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorodecanesulfonic acid (PFDS)	L25-Au0017541	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
Perfluoroalkyl sulfonamido substances- Trace				Result 1	Result 2	RPD		
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	L25-Se0039284	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	L25-Se0039284	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)	L25-JI0008332	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass

Duplicate								
Perfluoroalkyl carboxylic acids (PFCAs) - Trace				Result 1	Result 2	RPD		
Perfluorobutanoic acid (PFBA)	L25-Au0017541	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Perfluoropentanoic acid (PFPeA)	L25-Jl0007019	NCP	ug/L	0.001	0.001	17	30%	Pass
Perfluorohexanoic acid (PFHxA)	L25-Jl0007019	NCP	ug/L	0.002	0.003	4.0	30%	Pass
Perfluoroheptanoic acid (PFHpA)	L25-Se0039284	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Perfluorooctanoic acid (PFOA)	L25-Jl0008332	NCP	ug/L	0.014	0.012	13	30%	Pass
Perfluorononanoic acid (PFNA)	L25-Jl0008332	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorodecanoic acid (PFDA)	L25-Jl0008332	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorotridecanoic acid (PFTTrDA)	L25-Jl0008332	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoroundecanoic acid (PFUnDA)	L25-Jl0008332	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorododecanoic acid (PFDoDA)	L25-Jl0008332	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorotetradecanoic acid (PFTeDA)	L25-Jl0008332	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)- Trace				Result 1	Result 2	RPD		
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	L25-Jl0008332	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)	L25-Au0036995	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	L25-Jl0008332	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	L25-Jl0008332	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
Perfluoroalkyl sulfonic acids (PFSA)- Ultra trace				Result 1	Result 2	RPD		
Perfluorobutanesulfonic acid (PFBS)	L25-Au0017541	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorononanesulfonic acid (PFNS)*	L25-Jl0008332	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorooctanesulfonic acid (PFOS)	L25-Se0072371	NCP	ug/L	0.0025	0.0026	4.0	30%	Pass
Perfluoropropanesulfonic acid (PFPrS)*	L25-Jl0008332	NCP	ug/L	0.006	0.006	7.0	30%	Pass
Perfluoropentanesulfonic acid (PFPeS)	L25-Jl0008332	NCP	ug/L	0.019	0.017	12	30%	Pass
Perfluorohexanesulfonic acid (PFHxS)	L25-Jn0039401	NCP	ug/L	0.11	0.13	12	30%	Pass
Perfluoroheptanesulfonic acid (PFHpS)	L25-Jl0008332	NCP	ug/L	0.025	0.023	8.0	30%	Pass
Perfluorodecanesulfonic acid (PFDS)	L25-Jl0008332	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
Perfluoroalkyl sulfonamido substances- Trace				Result 1	Result 2	RPD		
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	L25-Jn0069126	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	L25-Jn0069126	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)	L25-Se0072371	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Duplicate								
Perfluoroalkyl carboxylic acids (PFCAs) - Trace				Result 1	Result 2	RPD		
Perfluorobutanoic acid (PFBA)	L25-Jn0069322	NCP	ug/L	0.053	0.053	1.0	30%	Pass
Perfluoropentanoic acid (PFPeA)	L25-Au0017541	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorohexanoic acid (PFHxA)	L25-Au0017541	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoroheptanoic acid (PFHpA)	L25-Jn0069126	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Perfluorooctanoic acid (PFOA)	L25-Se0072371	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass

Duplicate								
Perfluoroalkyl carboxylic acids (PFCAs) - Trace				Result 1	Result 2	RPD		
Perfluorononanoic acid (PFNA)	L25-Se0072371	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorodecanoic acid (PFDA)	L25-Se0072371	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorotridecanoic acid (PFTrDA)	L25-Se0072371	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoroundecanoic acid (PFUnDA)	L25-Se0072371	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorododecanoic acid (PFDoDA)	L25-Se0072371	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorotetradecanoic acid (PFTeDA)	L25-Se0072371	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)- Trace				Result 1	Result 2	RPD		
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	L25-Se0072371	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)	L25-Se0039284	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	L25-Se0072371	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	L25-Se0072371	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
Perfluoroalkyl sulfonic acids (PFSA)- Ultra trace				Result 1	Result 2	RPD		
Perfluorobutanesulfonic acid (PFBS)	L25-JI0008332	NCP	ug/L	0.018	0.016	14	30%	Pass
Perfluorononanesulfonic acid (PFNS)*	L25-Se0072371	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorooctanesulfonic acid (PFOS)	L25-JI0033263	NCP	ug/L	0.0037	0.0038	3.0	30%	Pass
Perfluoropropanesulfonic acid (PFPrS)*	L25-Se0072371	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoropentanesulfonic acid (PFPeS)	L25-Se0072371	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorohexanesulfonic acid (PFHxS)	L25-Au0013528	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoroheptanesulfonic acid (PFHpS)	L25-Se0072371	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorodecanesulfonic acid (PFDS)	L25-Se0072371	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
Eurofins Suite B11C: Na/K/Ca/Mg				Result 1	Result 2	RPD		
Calcium	L25-Se0078951	CP	mg/L	< 0.5	< 0.5	<1	30%	Pass
Magnesium	L25-Se0078951	CP	mg/L	< 0.5	< 0.5	<1	30%	Pass
Potassium	L25-Se0078951	CP	mg/L	< 0.5	< 0.5	<1	30%	Pass
Sodium	L25-Se0078951	CP	mg/L	< 0.5	1.0	1.0	30%	Pass
Duplicate								
Perfluoroalkyl sulfonamido substances- Trace				Result 1	Result 2	RPD		
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	L25-JI0035451	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	L25-JI0035451	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)	L25-Au0017458	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Duplicate								
Perfluoroalkyl carboxylic acids (PFCAs) - Trace				Result 1	Result 2	RPD		
Perfluorobutanoic acid (PFBA)	L25-Se0072371	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Perfluoropentanoic acid (PFPeA)	L25-Jn0069322	NCP	ug/L	0.18	0.18	1.0	30%	Pass
Perfluorohexanoic acid (PFHxA)	L25-JI0008332	NCP	ug/L	0.089	0.090	<1	30%	Pass
Perfluoroheptanoic acid (PFHpA)	L25-JI0035451	NCP	ug/L	< 0.005	0.005	2.0	30%	Pass

Duplicate									
Perfluoroalkyl carboxylic acids (PFCAs) - Trace					Result 1	Result 2	RPD		
Perfluorooctanoic acid (PFOA)	L25-Au0017458	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorononanoic acid (PFNA)	L25-Au0017458	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorodecanoic acid (PFDA)	L25-Au0017458	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorotridecanoic acid (PFTTrDA)	L25-Au0017458	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluoroundecanoic acid (PFUnDA)	L25-Au0017458	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorododecanoic acid (PFDoDA)	L25-Au0017458	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorotetradecanoic acid (PFTeDA)	L25-Au0017458	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Duplicate									
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)- Trace					Result 1	Result 2	RPD		
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	L25-Au0017458	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)	L25-Oc0011247	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	L25-Au0017458	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	L25-Au0017458	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Duplicate									
Perfluoroalkyl sulfonic acids (PFSA)- Ultra trace					Result 1	Result 2	RPD		
Perfluorobutanesulfonic acid (PFBS)	L25-Jl0007239	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorononanesulfonic acid (PFNS)*	L25-Au0017458	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorooctanesulfonic acid (PFOS)	L25-Se0039284	NCP	ug/L	< 0.0001	0.0001	<1	30%	Pass	
Perfluoropropanesulfonic acid (PFPrS)*	L25-Au0017458	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluoropentanesulfonic acid (PFPeS)	L25-Au0017458	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorohexanesulfonic acid (PFHxS)	L25-Au0017541	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	L25-Au0017458	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorodecanesulfonic acid (PFDS)	L25-Au0017458	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Duplicate									
Eurofins Suite B11C: Na/K/Ca/Mg					Result 1	Result 2	RPD		
Calcium	L25-Se0078952	CP	mg/L	< 0.5	< 0.5	<1	30%	Pass	
Magnesium	L25-Se0078952	CP	mg/L	< 0.5	< 0.5	<1	30%	Pass	
Potassium	L25-Se0078952	CP	mg/L	< 0.5	< 0.5	<1	30%	Pass	
Sodium	L25-Se0078952	CP	mg/L	< 0.5	1.3	8.0	30%	Pass	
Duplicate									
Perfluoroalkyl sulfonamido substances- Trace					Result 1	Result 2	RPD		
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	L25-Au0077810	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	L25-Au0077810	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)	L25-Jl0033263	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass	

Duplicate								
Perfluoroalkyl carboxylic acids (PFCAs) - Trace				Result 1	Result 2	RPD		
Perfluorobutanoic acid (PFBA)	L25-Au0017458	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Perfluoropentanoic acid (PFPeA)	L25-Se0072371	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorohexanoic acid (PFHxA)	L25-Jl0007239	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoroheptanoic acid (PFHpA)	L25-Au0077810	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Perfluorooctanoic acid (PFOA)	L25-Jl0033263	NCP	ug/L	0.002	0.002	<1	30%	Pass
Perfluorononanoic acid (PFNA)	L25-Jl0033263	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorodecanoic acid (PFDA)	L25-Jl0033263	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorotridecanoic acid (PFTrDA)	L25-Jl0033263	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoroundecanoic acid (PFUnDA)	L25-Jl0033263	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorododecanoic acid (PFDoDA)	L25-Jl0033263	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorotetradecanoic acid (PFTeDA)	L25-Jl0033263	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)- Trace				Result 1	Result 2	RPD		
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	L25-Jl0033263	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)	L25-Jl0031700	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	L25-Jl0033263	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	L25-Jl0033263	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
Perfluoroalkyl sulfonic acids (PFSA)- Ultra trace				Result 1	Result 2	RPD		
Perfluorobutanesulfonic acid (PFBS)	L25-Au0034980	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorononanesulfonic acid (PFNS)*	L25-Jl0033263	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorooctanesulfonic acid (PFOS)	L25-Oc0011247	NCP	ug/L	0.0001	< 0.0001	<1	30%	Pass
Perfluoropropanesulfonic acid (PFPrS)*	L25-Jl0033263	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoropentanesulfonic acid (PFPeS)	L25-Jl0033263	NCP	ug/L	0.002	0.002	<1	30%	Pass
Perfluorohexanesulfonic acid (PFHxS)	L25-Se0072371	NCP	ug/L	0.004	0.004	2.0	30%	Pass
Perfluoroheptanesulfonic acid (PFHpS)	L25-Jl0033263	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorodecanesulfonic acid (PFDS)	L25-Jl0033263	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
Perfluoroalkyl sulfonamido substances- Trace				Result 1	Result 2	RPD		
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	L25-Oc0006458	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	L25-Oc0006458	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)	L25-Oc0006458	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Duplicate								
Perfluoroalkyl carboxylic acids (PFCAs) - Trace				Result 1	Result 2	RPD		
Perfluorobutanoic acid (PFBA)	L25-Oc0006458	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Perfluoropentanoic acid (PFPeA)	L25-Oc0006458	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorohexanoic acid (PFHxA)	L25-Oc0006458	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoroheptanoic acid (PFHpA)	L25-Oc0006458	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Perfluorooctanoic acid (PFOA)	L25-Oc0006458	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass

Duplicate								
Perfluoroalkyl carboxylic acids (PFCAs) - Trace				Result 1	Result 2	RPD		
Perfluorononanoic acid (PFNA)	L25-Oc0006458	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorodecanoic acid (PFDA)	L25-Oc0006458	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorotridecanoic acid (PFTrDA)	L25-Oc0006458	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoroundecanoic acid (PFUnDA)	L25-Oc0006458	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorododecanoic acid (PFDoDA)	L25-Oc0006458	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorotetradecanoic acid (PFTeDA)	L25-Oc0006458	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)- Trace				Result 1	Result 2	RPD		
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	L25-Oc0006458	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)	L25-Oc0006458	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	L25-Oc0006458	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	L25-Oc0006458	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
Perfluoroalkyl sulfonic acids (PFSA)- Ultra trace				Result 1	Result 2	RPD		
Perfluorobutanesulfonic acid (PFBS)	L25-Oc0006458	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorononanesulfonic acid (PFNS)*	L25-Oc0006458	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorooctanesulfonic acid (PFOS)	L25-Oc0006458	NCP	ug/L	0.0017	0.0017	<1	30%	Pass
Perfluoropropanesulfonic acid (PFPrS)*	L25-Oc0006458	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoropentanesulfonic acid (PFPeS)	L25-Oc0006458	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorohexanesulfonic acid (PFHxS)	L25-Oc0006458	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluoroheptanesulfonic acid (PFHpS)	L25-Oc0006458	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Perfluorodecanesulfonic acid (PFDS)	L25-Oc0006458	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
OCOP in Water				Result 1	Result 2	RPD		
Aldrin	L25-Se0078955	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass
alpha-BHC (HCH)	L25-Se0078955	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass
beta-BHC (HCH)	L25-Se0078955	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass
delta-BHC (HCH)	L25-Se0078955	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Bifenthrin	L25-Se0078955	CP	ug/L	< 0.05	< 0.05	<1	30%	Pass
Bromophos Ethyl	L25-Se0078955	CP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Chlordane	L25-Se0078955	CP	ug/L	< 0.002	< 0.002	<1	30%	Pass
Chlorothalonil	L25-Se0078955	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass
Chlorpyrifos	L25-Se0078955	CP	ug/L	< 0.005	< 0.005	<1	30%	Pass
Diazinon	L25-Se0078955	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass
Dieldrin	L25-Se0078955	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Endosulfan I	L25-Se0078955	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Endosulfan II	L25-Se0078955	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Endosulfan Sulfate	L25-Se0078955	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Endrin	L25-Se0078955	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass
Ethion	L25-Se0078955	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass
Fenitrothion	L25-Se0078955	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass

Duplicate								
OCOP in Water				Result 1	Result 2	RPD		
Fipronil	L25-Se0078955	CP	ug/L	< 0.02	< 0.02	<1	30%	Pass
Hexachlorobenzene (HCB)	L25-Se0078955	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Heptachlor Epoxide	L25-Se0078955	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Heptachlor	L25-Se0078955	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Lindane	L25-Se0078955	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Malathion	L25-Se0078955	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass
Methoxychlor	L25-Se0078955	CP	ug/L	< 0.02	< 0.02	<1	30%	Pass
o,p-DDT	L25-Se0078955	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Oxychlorane	L25-Se0078955	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass
p,p-DDD	L25-Se0078955	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass
p,p-DDE	L25-Se0078955	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass
p,p-DDT	L25-Se0078955	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass
Parathion Ethyl	L25-Se0078955	CP	ug/L	< 0.02	< 0.02	<1	30%	Pass
Parathion Methyl	L25-Se0078955	CP	ug/L	< 0.02	< 0.02	<1	30%	Pass
Trifluralin	L25-Se0078955	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass
Vinclozolin	L25-Se0078955	CP	ug/L	< 0.02	< 0.02	<1	30%	Pass
Duplicate								
Low Level PAH in Water				Result 1	Result 2	RPD		
Naphthalene	L25-Se0078955	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass
2-Methylnaphthalene	L25-Se0078955	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass
Acenaphthylene	L25-Se0078955	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass
Acenaphthene	L25-Se0078955	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass
Fluorene	L25-Se0078955	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass
Phenanthrene	L25-Se0078955	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass
Anthracene	L25-Se0078955	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass
Fluoranthene	L25-Se0078955	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass
Pyrene	L25-Se0078955	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass
Benz(a)anthracene	L25-Se0078955	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass
Chrysene	L25-Se0078955	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass
Benzo(b)fluoranthene	L25-Se0078955	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass
Benzo(k)fluoranthene	L25-Se0078955	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass
Benzo(a)pyrene	L25-Se0078955	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass
Indeno(1.2.3-c.d)pyrene	L25-Se0078955	CP	ug/L	< 0.02	< 0.02	<1	30%	Pass
Dibenz(a,h)anthracene	L25-Se0078955	CP	ug/L	< 0.02	< 0.02	<1	30%	Pass
Benzo(ghi)perylene	L25-Se0078955	CP	ug/L	< 0.02	< 0.02	<1	30%	Pass

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
J-	If the percent recoveries were less than the lower control limit, qualify detects for the analyte in associated samples as estimated with a negative bias J-.
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
N11	Isotope dilution is used for calibration of each native compound for which an exact labelled analogue is available (Isotope Dilution Quantitation). The isotopically labelled analogues allow identification and recovery correction of the concentration of the associated native PFAS compounds.
N15	Where the native PFAS compound does not have labelled analogue then the quantification is made using the Extracted Internal Standard Analyte with the closest retention time to the analyte and no recovery correction has been made (Internal Standard Quantitation).

Authorised by:

Douglas Todd	Senior Analyst-Organic
Douglas Todd	Senior Analyst-PFAS
Luke Holt	Senior Analyst-Inorganic
Patrick Patfield	Senior Analyst-Organic
Patrick Patfield	Senior Analyst-PFAS
Patrick Patfield	Senior Analyst-Volatile
Sam Becker	Senior Analyst-Inorganic
Sean Sangster	Senior Analyst-Metal

Kim Rodgers
General Manager

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request

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CLIENT DETAILS

Contact Client Address
Doug Todd
EUROFINS
46-48 Banksia Road
Welshpool
WA 6106

Telephone (08) 6253 4444
Mobile (08) 6253 4450
Email envirosamplewa@eurofinsanz.com; env

Project GHD
Samples 20
Date Received 26/09/2025

Principal Laboratory Address
Stuart Hellenen
Dalcon Environmental
Dalcon Environmental
Unit 6-7
279 Lord Street
Perth, WA 6000

Telephone +61 1300 145 562
Email stuart.hellenen@dalconenvironmental.com.au

Dalcon Environmental Reference DE03596
Report Number DE03596.R0
Date Reported 15/10/2025

COMMENTS

Accredited for compliance with ISO/IEC 17025 - Testing.
NATA accredited laboratory 20077.

These results apply only to the sample(s) as received and tested.
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SIGNATORY

Dr Stuart Hellenen
Principal/Senior Scientist

CLIENT DETAILS

Contact Client Address
Doug Todd
EUROFINS
46-48 Banksia Road
Welshpool
WA 6106

Telephone (08) 6253 4444
Mobile (08) 6253 4450
Email envirosamplewa@eurofinsanz.com; env

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Stuart Hellenen
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Dalcon Environmental Reference DE03596
Report Number DE03596.R0
Date Reported 15/10/2025

LABORATORY COMMENTS

Sample received unpreserved and chilled. Sample integrity intact.
Sample preserved with Lugol's Iodine by Dalcon Environmental upon receipt.
Sample analysed using method DE-AM-01. Limit of Reporting = 10 cells ml⁻¹

Suffix (PT) = potential toxin producer
Suffix (O) = potential producer of odour-causing compounds
Suffix (unknown) = unidentifiable to genus level

Where (PT) or (O) is indicated next to a genus, it should be noted that not all (and, in most cases, only a few) species within that genus are responsible for producing these compounds.

OTHER COMMENTS

PO Number: AU0144208167

Sample Description:
DE03596.1 - DE03596.20: Sample clear and colourless.

Sample Notes:
DE03596.19 - DE03596.20: No algal cells were detected during analysis.

SAMPLE DETAILS

DE Sample Number	DE03596.1	DE03596.2	DE03596.3
Sample Type	Estuarine	Estuarine	Estuarine
Client Sample Desc.	Applecross-GR-SUR	Applecross-GR-ARB	Barrack-GR-SUR
Sample Date	25/09/2025	25/09/2025	25/09/2025

Test Method: DE-AM-01

Analysis Date	3/10/2025	3/10/2025	3/10/2025
Chamber Type	SRC	SRC	SRC
Chamber Volume	1ml	1ml	1ml
Concentration Factor	NA	NA	NA
Units	cells ml ⁻¹	cells ml ⁻¹	cells ml ⁻¹
LOR	10 cell ml ⁻¹	10 cell ml ⁻¹	10 cell ml ⁻¹

Analytical Results

Taxon	Abund.	%	Abund.	%	Abund.	%
Bacillariophyceae	1330	37.25	2510	71.92	230	2.73
Amphora spp	20	0.56	10	0.29		
Chaetoceros spp	500	14.01	2400	68.77		
Cocconeis spp						
Cylindrotheca closterium					90	1.07
Entomoneis spp						
Melosira spp						
Navicula spp						
Nitzschia obtusa						
Skeletonema spp	210	5.88				
Thalassiosira pseudonana	550	15.41	100	2.87	10	0.12
Thalassiosira spp	50	1.40			130	1.55
Chlorodendrophyceae						
Tetraselmis spp						
Chlorophyceae						
Chlamydomonas spp						
Monoraphidium spp						
Chrysophyceae	230	6.44				
Chrysophytes (unknown)	230	6.44				
Coccolithophyceae			60	1.72		
Chrysochromulina spp						
Haptophytes (unknown)			60	1.72		
Cryptophyceae	20	0.56	30	0.86	40	0.48
Hillea spp	20	0.56	30	0.86		
Rhodomonas spp					40	0.48
Cyanophyceae					8020	95.36
Planktolyngbya contorta (t)						
Pseudanabaena acicularis (t)					20	0.24
Pseudanabaena spp (t)						
Raphidiopsis raciborskii (PT)					8000	95.12
Dinophyceae	1790	50.14	40	1.15	120	1.43
cf. Peridiniella danica	10	0.28				
Diplopsalis spp						
Gymnodinium spp						
Gyrodinium spp	360	10.08	10	0.29	50	0.59
Heterocapsa spp						
Kryptoperidinium triquetrum	460	12.89	10	0.29	10	0.12
Oxyrrhis marina						
Prorocentrum cordatum (PT)	90	2.52				
Prorocentrum spp						
Scrippsiella spp	870	24.37	20	0.57	60	0.71
Euglenophyceae						
Eutreptiella marina						
Nephroselmidaceae						
cf Nephroselmis spp						
Prasinophyceae	200	5.60	400	11.46		
Prasinophytes (unknown)	200	5.60	400	11.46		

SAMPLE DETAILS

DE Sample Number	DE03596.1	DE03596.2	DE03596.3
Sample Type	Estuarine	Estuarine	Estuarine
Client Sample Desc.	Applecross-GR-SUR	Applecross-GR-ARB	Barrack-GR-SUR
Sample Date	25/09/2025	25/09/2025	25/09/2025

Test Method: DE-AM-01

Analysis Date	3/10/2025	3/10/2025	3/10/2025
Chamber Type	SRC	SRC	SRC
Chamber Volume	1ml	1ml	1ml
Concentration Factor	NA	NA	NA
Units	cells ml ⁻¹	cells ml ⁻¹	cells ml ⁻¹
LOR	10 cell ml ⁻¹	10 cell ml ⁻¹	10 cell ml ⁻¹

Analytical Results

Taxon	Abund.	%	Abund.	%	Abund.	%
Telonemea			450	12.89		
Telonema spp			450	12.89		
TOTAL (All Taxa)	3570	100	3490	100	8410	100

SAMPLE DETAILS

DE Sample Number	DE03572.4	DE03572.5	DE03572.6
Sample Type	Estuarine	Estuarine	Estuarine
Client Sample Desc.	Barrack-GR-ARB	ElizQuay-GR-SUR	ElizQuay-GR-ARB
Sample Date	25/09/2025	25/09/2025	25/09/2025

Test Method: DE-AM-01

Analysis Date	3/10/2025	6/10/2025	6/10/2025
Chamber Type	SRC	SRC	SRC
Chamber Volume	1ml	1ml	1ml
Concentration Factor	NA	NA	NA
Units	cells ml ⁻¹	cells ml ⁻¹	cells ml ⁻¹
LOR	10 cell ml ⁻¹	10 cell ml ⁻¹	10 cell ml ⁻¹

Analytical Results

Taxon	Abund.	%	Abund.	%	Abund.	%
Bacillariophyceae	30	8.33	2640	13.71	1290	43.29
Amphora spp						
Chaetoceros spp			1700	8.83	1000	33.56
Cocconeis spp						
Cylindrotheca closterium	20	5.56	350	1.82	100	3.36
Entomoneis spp			10	0.05	10	0.34
Melosira spp			50	0.26		
Navicula spp						
Nitzschia obtusa						
Skeletonema spp			30	0.16	70	2.35
Thalassiosira pseudonana						
Thalassiosira spp	10	2.78	500	2.60	110	3.69
Chlorodendrophyceae	20	5.56	140	0.73	150	5.03
Tetraselmis spp	20	5.56	140	0.73	150	5.03
Chlorophyceae			20	0.10	10	0.34
Chlamydomonas spp						
Monoraphidium spp			20	0.10	10	0.34
Chrysophyceae	20	5.56	10	0.05	10	0.34
Chrysophytes (unknown)	20	5.56	10	0.05	10	0.34
Coccolithophyceae	200	55.56	100	0.52	400	13.42
Chrysochromulina spp						
Haptophytes (unknown)	200	55.56	100	0.52	400	13.42
Cryptophyceae			60	0.31	110	3.69
Hillea spp			60	0.31	110	3.69
Rhodomonas spp						
Cyanophyceae			15510	80.53	150	5.03
Planktolyngbya contorta (t)			10	0.05		
Pseudanabaena acicularis (t)						
Pseudanabaena spp (t)					10	0.34
Raphidiopsis raciborskii (PT)			15500	80.48	140	4.70
Dinophyceae	30	8.33	120	0.62	120	4.03
cf. Peridiniella danica						
Diplopsalis spp			10	0.05		
Gymnodinium spp						
Gyrodinium spp	10	2.78	50	0.26	80	2.68
Heterocapsa spp						
Kryptoperidinium triquetrum			30	0.16	40	1.34
Oxyrrhis marina	10	2.78				
Prorocentrum cordatum (PT)	10	2.78				
Prorocentrum spp			10	0.05		
Scrippsiella spp			20	0.10		
Euglenophyceae						
Eutreptiella marina						
Nephroselmidaceae			30	0.16	30	1.01
cf Nephroselmis spp			30	0.16	30	1.01
Prasinophyceae	40	11.11	600	3.12	700	23.49
Prasinophytes (unknown)	40	11.11	600	3.12	700	23.49

SAMPLE DETAILS

DE Sample Number	DE03572.4	DE03572.5	DE03572.6
Sample Type	Estuarine	Estuarine	Estuarine
Client Sample Desc.	Barrack-GR-ARB	ElizQuay-GR-SUR	ElizQuay-GR-ARB
Sample Date	25/09/2025	25/09/2025	25/09/2025

Test Method: DE-AM-01

Analysis Date	3/10/2025	6/10/2025	6/10/2025
Chamber Type	SRC	SRC	SRC
Chamber Volume	1ml	1ml	1ml
Concentration Factor	NA	NA	NA
Units	cells ml ⁻¹	cells ml ⁻¹	cells ml ⁻¹
LOR	10 cell ml ⁻¹	10 cell ml ⁻¹	10 cell ml ⁻¹

Analytical Results

Taxon	Abund.	%	Abund.	%	Abund.	%
Telonemea	20	5.56	30	0.16	10	0.34
Telonema spp	20	5.56	30	0.16	10	0.34
TOTAL (All Taxa)	360	100	19260	100	2980	100

SAMPLE DETAILS

DE Sample Number	DE03572.7	DE03572.8	DE03572.9
Sample Type	Estuarine	Estuarine	Estuarine
Client Sample Desc.	Ellam-GR-SUR	Ellam-GR-ARB	MatBay1-GR-SUR
Sample Date	25/09/2025	25/09/2025	25/09/2025

Test Method: DE-AM-01

Analysis Date	6/10/2025	6/10/2025	9/10/2025
Chamber Type	SRC	SRC	SRC
Chamber Volume	1ml	1ml	1ml
Concentration Factor	NA	NA	NA
Units	cells ml ⁻¹	cells ml ⁻¹	cells ml ⁻¹
LOR	10 cell ml ⁻¹	10 cell ml ⁻¹	10 cell ml ⁻¹

Analytical Results

Taxon	Abund.	%	Abund.	%	Abund.	%
Bacillariophyceae	9040	94.07	6240	88.14	3550	77.17
Amphora spp						
Chaetoceros spp	2600	27.06	1600	22.60	3400	73.91
Cocconeis spp						
Cylindrotheca closterium	6200	64.52	4500	63.56		
Entomoneis spp			10	0.14		
Melosira spp						
Navicula spp	10	0.10				
Nitzschia obtusa	20	0.21				
Skeletonema spp						
Thalassiosira pseudonana	10	0.10			20	0.43
Thalassiosira spp	200	2.08	130	1.84	130	2.83
Chlorodendrophyceae						
Tetraselmis spp						
Chlorophyceae			10	0.14	60	1.30
Chlamydomonas spp			10	0.14	40	0.87
Monoraphidium spp					20	0.43
Chrysophyceae	10	0.10			10	0.22
Chrysophytes (unknown)	10	0.10			10	0.22
Coccolithophyceae						
Chrysochromulina spp						
Haptophytes (unknown)						
Cryptophyceae	20	0.21			200	4.35
Hillea spp	20	0.21			200	4.35
Rhodomonas spp						
Cyanophyceae			10	0.14		
Planktolyngbya contorta (t)			10	0.14		
Pseudanabaena acicularis (t)						
Pseudanabaena spp (t)						
Raphidiopsis raciborskii (PT)						
Dinophyceae	240	2.50	200	2.82	470	10.22
cf. Peridiniella danica						
Diplopsalis spp						
Gymnodinium spp					20	0.43
Gyrodinium spp	50	0.52	30	0.42	90	1.96
Heterocapsa spp	10	0.10	10	0.14	10	0.22
Kryptoperidinium triquetrum	10	0.10			30	0.65
Oxyrrhis marina						
Prorocentrum cordatum (PT)					260	5.65
Prorocentrum spp						
Scrippsiella spp	170	1.77	160	2.26	60	1.30
Euglenophyceae			10	0.14		
Eutreptiella marina			10	0.14		
Nephroselmidaceae			10	0.14	10	0.22
cf Nephroselmis spp			10	0.14	10	0.22
Prasinophyceae	300	3.12	600	8.47	300	6.52
Prasinophytes (unknown)	300	3.12	600	8.47	300	6.52

SAMPLE DETAILS

DE Sample Number	DE03572.7	DE03572.8	DE03572.9
Sample Type	Estuarine	Estuarine	Estuarine
Client Sample Desc.	Ellam-GR-SUR	Ellam-GR-ARB	MatBay1-GR-SUR
Sample Date	25/09/2025	25/09/2025	25/09/2025

Test Method: DE-AM-01

Analysis Date	6/10/2025	6/10/2025	9/10/2025
Chamber Type	SRC	SRC	SRC
Chamber Volume	1ml	1ml	1ml
Concentration Factor	NA	NA	NA
Units	cells ml ⁻¹	cells ml ⁻¹	cells ml ⁻¹
LOR	10 cell ml ⁻¹	10 cell ml ⁻¹	10 cell ml ⁻¹

Analytical Results

Taxon	Abund.	%	Abund.	%	Abund.	%
Telonemea						
Telonema spp						
TOTAL (All Taxa)	9610	100	7080	100	4600	100

SAMPLE DETAILS

DE Sample Number	DE03572.10	DE03572.11	DE03572.12
Sample Type	Estuarine	Estuarine	Estuarine
Client Sample Desc.	MatBay1-GR-ARB	MatBay2-GR-SUR	MatBay2-GR-ARB
Sample Date	25/09/2025	25/09/2025	25/09/2025

Test Method: DE-AM-01

Analysis Date	9/10/2025	9/10/2025	9/10/2025
Chamber Type	SRC	SRC	SRC
Chamber Volume	1ml	1ml	1ml
Concentration Factor	NA	NA	NA
Units	cells ml ⁻¹	cells ml ⁻¹	cells ml ⁻¹
LOR	10 cell ml ⁻¹	10 cell ml ⁻¹	10 cell ml ⁻¹

Analytical Results

Taxon	Abund.	%	Abund.	%	Abund.	%
Bacillariophyceae	60	5.45	450	11.69	150	20.83
Amphora spp						
Chaetoceros spp						
Cocconeis spp			350	9.09	20	2.78
Cylindrotheca closterium						
Entomoneis spp						
Melosira spp						
Navicula spp						
Nitzschia obtusa						
Skeletonema spp					110	15.28
Thalassiosira pseudonana	10	0.91				
Thalassiosira spp	50	4.55	100	2.60	20	2.78
Chlorodendrophyceae			200	5.19		
Tetraselmis spp			200	5.19		
Chlorophyceae			10	0.26		
Chlamydomonas spp			10	0.26		
Monoraphidium spp						
Chrysophyceae						
Chrysophytes (unknown)						
Coccolithophyceae	500	45.45	200	5.19	10	1.39
Chrysochromulina spp						
Haptophytes (unknown)	500	45.45	200	5.19	10	1.39
Cryptophyceae	20	1.82	30	0.78	400	55.56
Hillea spp	20	1.82	30	0.78	400	55.56
Rhodomonas spp						
Cyanophyceae						
Planktolyngbya contorta (t)						
Pseudanabaena acicularis (t)						
Pseudanabaena spp (t)						
Raphidiopsis raciborskii (PT)						
Dinophyceae	50	4.55	2940	76.36	60	8.33
cf. Peridiniella danica						
Diplopsalis spp						
Gymnodinium spp						
Gyrodinium spp	40	3.64	20	0.52	60	8.33
Heterocapsa spp						
Kryptoperidinium triquetrum			200	5.19		
Oxyrrhis marina						
Prorocentrum cordatum (PT)			70	1.82		
Prorocentrum spp						
Scrippsiella spp	10	0.91	2650	68.83		
Euglenophyceae						
Eutreptiella marina						
Nephroselmidaceae						
cf Nephroselmis spp						
Prasinophyceae	450	40.91	10	0.26	100	13.89
Prasinophytes (unknown)	450	40.91	10	0.26	100	13.89

SAMPLE DETAILS

DE Sample Number	DE03572.10	DE03572.11	DE03572.12
Sample Type	Estuarine	Estuarine	Estuarine
Client Sample Desc.	MatBay1-GR-ARB	MatBay2-GR-SUR	MatBay2-GR-ARB
Sample Date	25/09/2025	25/09/2025	25/09/2025

Test Method: DE-AM-01

Analysis Date	9/10/2025	9/10/2025	9/10/2025
Chamber Type	SRC	SRC	SRC
Chamber Volume	1ml	1ml	1ml
Concentration Factor	NA	NA	NA
Units	cells ml ⁻¹	cells ml ⁻¹	cells ml ⁻¹
LOR	10 cell ml ⁻¹	10 cell ml ⁻¹	10 cell ml ⁻¹

Analytical Results

Taxon	Abund.	%	Abund.	%	Abund.	%
Telonemea	20	1.82	10	0.26		
Telonema spp	20	1.82	10	0.26		
TOTAL (All Taxa)	1100	100	3850	100	720	100

SAMPLE DETAILS

DE Sample Number	DE03572.13	DE03572.14	DE03572.15
Sample Type	Estuarine	Estuarine	Estuarine
Client Sample Desc.	Heathcote-SUR	MatCentral-SUR	NAR-SUR
Sample Date	25/09/2025	25/09/2025	25/09/2025

Test Method: DE-AM-01

Analysis Date	10/10/2025	10/10/2025	10/10/2025
Chamber Type	SRC	SRC	SRC
Chamber Volume	1ml	1ml	1ml
Concentration Factor	NA	NA	NA
Units	cells ml ⁻¹	cells ml ⁻¹	cells ml ⁻¹
LOR	10 cell ml ⁻¹	10 cell ml ⁻¹	10 cell ml ⁻¹

Analytical Results

Taxon	Abund.	%	Abund.	%	Abund.	%
Bacillariophyceae	920	51.98	1210	80.67	4350	90.63
Amphora spp						
Chaetoceros spp	600	33.90	1000	66.67	1600	33.33
Cocconeis spp					10	0.21
Cylindrotheca closterium	20	1.13	10	0.67	2200	45.83
Entomoneis spp						
Melosira spp						
Navicula spp						
Nitzschia obtusa						
Skeletonema spp					240	5.00
Thalassiosira pseudonana			100	6.67		
Thalassiosira spp	300	16.95	100	6.67	300	6.25
Chlorodendrophyceae	10	0.56			40	0.83
Tetraselmis spp	10	0.56			40	0.83
Chlorophyceae			20	1.33	60	1.25
Chlamydomonas spp			20	1.33	60	1.25
Monoraphidium spp						
Chrysophyceae					10	0.21
Chrysophytes (unknown)					10	0.21
Coccolithophyceae	60	3.39	100	6.67		
Chrysochromulina spp						
Haptophytes (unknown)	60	3.39	100	6.67		
Cryptophyceae	40	2.26			300	6.25
Hillea spp	40	2.26			300	6.25
Rhodomonas spp						
Cyanophyceae	420	23.73				
Planktolyngbya contorta (t)						
Pseudanabaena acicularis (t)						
Pseudanabaena spp (t)						
Raphidiopsis raciborskii (PT)	420	23.73				
Dinophyceae	320	18.08	160	10.67	40	0.83
cf. Peridiniella danica						
Diplopsalis spp						
Gymnodinium spp						
Gyrodinium spp	60	3.39	40	2.67	10	0.21
Heterocapsa spp						
Kryptoperidinium triquetrum	20	1.13	10	0.67		
Oxyrrhis marina						
Prorocentrum cordatum (PT)	20	1.13				
Prorocentrum spp						
Scrippsiella spp	220	12.43	110	7.33	30	0.63
Euglenophyceae						
Eutreptiella marina						
Nephroselmidaceae						
cf Nephroselmis spp						
Prasinophyceae			10	0.67		
Prasinophytes (unknown)			10	0.67		

SAMPLE DETAILS

DE Sample Number	DE03572.13	DE03572.14	DE03572.15
Sample Type	Estuarine	Estuarine	Estuarine
Client Sample Desc.	Heathcote-SUR	MatCentral-SUR	NAR-SUR
Sample Date	25/09/2025	25/09/2025	25/09/2025

Test Method: DE-AM-01

Analysis Date	10/10/2025	10/10/2025	10/10/2025
Chamber Type	SRC	SRC	SRC
Chamber Volume	1ml	1ml	1ml
Concentration Factor	NA	NA	NA
Units	cells ml ⁻¹	cells ml ⁻¹	cells ml ⁻¹
LOR	10 cell ml ⁻¹	10 cell ml ⁻¹	10 cell ml ⁻¹

Analytical Results

Taxon	Abund.	%	Abund.	%	Abund.	%
Telonemea						
Telonema spp						
TOTAL (All Taxa)	1770	100	1500	100	4800	100

SAMPLE DETAILS

DE Sample Number	DE03572.16	DE03572.17	DE03572.18
Sample Type	Estuarine	Estuarine	Estuarine
Client Sample Desc.	CanBridge-GR-SUR	CanBridge-GR-ARB	QC01
Sample Date	25/09/2025	25/09/2025	25/09/2025

Test Method: DE-AM-01

Analysis Date	10/10/2025	13/10/2025	13/10/2025
Chamber Type	SRC	SRC	SRC
Chamber Volume	1ml	1ml	1ml
Concentration Factor	NA	NA	NA
Units	cells ml ⁻¹	cells ml ⁻¹	cells ml ⁻¹
LOR	10 cell ml ⁻¹	10 cell ml ⁻¹	10 cell ml ⁻¹

Analytical Results

Taxon	Abund.	%	Abund.	%	Abund.	%
Bacillariophyceae	1530	52.04	50	15.15	360	28.35
Amphora spp						
Chaetoceros spp	550	18.71				
Cocconeis spp						
Cylindrotheca closterium						
Entomoneis spp						
Melosira spp						
Navicula spp						
Nitzschia obtusa						
Skeletonema spp	280	9.52			360	28.35
Thalassiosira pseudonana	700	23.81	10	3.03		
Thalassiosira spp			40	12.12		
Chlorodendrophyceae						
Tetraselmis spp						
Chlorophyceae	10	0.34				
Chlamydomonas spp						
Monoraphidium spp	10	0.34				
Chrysophyceae	30	1.02				
Chrysophytes (unknown)	30	1.02				
Coccolithophyceae	100	3.40	10	3.03	540	42.52
Chrysochromulina spp					40	3.15
Haptophytes (unknown)	100	3.40	10	3.03	500	39.37
Cryptophyceae			40	12.12	10	0.79
Hillea spp			40	12.12	10	0.79
Rhodomonas spp						
Cyanophyceae						
Planktolyngbya contorta (t)						
Pseudanabaena acicularis (t)						
Pseudanabaena spp (t)						
Raphidiopsis raciborskii (PT)						
Dinophyceae	1240	42.18				
cf. Peridiniella danica						
Diplopsalis spp						
Gymnodinium spp						
Gyrodinium spp	30	1.02				
Heterocapsa spp						
Kryptoperidinium triquetrum						
Oxyrrhis marina						
Prorocentrum cordatum (PT)	10	0.34				
Prorocentrum spp						
Scrippsiella spp	1200	40.82				
Euglenophyceae						
Eutreptiella marina						
Nephroselmidaceae	10	0.34			10	0.79
cf Nephroselmis spp	10	0.34			10	0.79
Prasinophyceae	20	0.68	30	9.09	150	11.81
Prasinophytes (unknown)	20	0.68	30	9.09	150	11.81

SAMPLE DETAILS

DE Sample Number	DE03572.16	DE03572.17	DE03572.18
Sample Type	Estuarine	Estuarine	Estuarine
Client Sample Desc.	CanBridge-GR-SUR	CanBridge-GR-ARB	QC01
Sample Date	25/09/2025	25/09/2025	25/09/2025

Test Method: DE-AM-01

Analysis Date	10/10/2025	13/10/2025	13/10/2025
Chamber Type	SRC	SRC	SRC
Chamber Volume	1ml	1ml	1ml
Concentration Factor	NA	NA	NA
Units	cells ml ⁻¹	cells ml ⁻¹	cells ml ⁻¹
LOR	10 cell ml ⁻¹	10 cell ml ⁻¹	10 cell ml ⁻¹

Analytical Results

Taxon	Abund.	%	Abund.	%	Abund.	%
Telonemea			200	60.61	200	15.75
Telonema spp			200	60.61	200	15.75
TOTAL (All Taxa)	2940	100	330	100	1270	100

SAMPLE DETAILS

DE Sample Number	DE03572.19	DE03572.20
Sample Type	Estuarine	Estuarine
Client Sample Desc.	QC02	QC03
Sample Date	25/09/2025	25/09/2025

Test Method: DE-AM-01

Analysis Date	13/10/2025	13/10/2025
Chamber Type	SRC	SRC
Chamber Volume	1ml	1ml
Concentration Factor	NA	NA
Units	cells ml ⁻¹	cells ml ⁻¹
LOR	10 cell ml ⁻¹	10 cell ml ⁻¹

Analytical Results

Taxon	Abund.	%	Abund.	%		
Bacillariophyceae						
Amphora spp						
Chaetoceros spp						
Cocconeis spp						
Cylindrotheca closterium						
Entomoneis spp						
Melosira spp						
Navicula spp						
Nitzschia obtusa						
Skeletonema spp						
Thalassiosira pseudonana						
Thalassiosira spp						
Chlorodendrophyceae						
Tetraselmis spp						
Chlorophyceae						
Chlamydomonas spp						
Monoraphidium spp						
Chrysophyceae						
Chrysophytes (unknown)						
Coccolithophyceae						
Chrysochromulina spp						
Haptophytes (unknown)						
Cryptophyceae						
Hillea spp						
Rhodomonas spp						
Cyanophyceae						
Planktolyngbya contorta (t)						
Pseudanabaena acicularis (t)						
Pseudanabaena spp (t)						
Raphidiopsis raciborskii (PT)						
Dinophyceae						
cf. Peridiniella danica						
Diplopsalis spp						
Gymnodinium spp						
Gyrodinium spp						
Heterocapsa spp						
Kryptoperidinium triquetrum						
Oxyrrhis marina						
Prorocentrum cordatum (PT)						
Prorocentrum spp						
Scrippsiella spp						
Euglenophyceae						
Eutreptiella marina						
Nephroselmidaceae						
cf Nephroselmis spp						
Prasinophyceae						
Prasinophytes (unknown)						

SAMPLE DETAILS

DE Sample Number	DE03572.19	DE03572.20
Sample Type	Estuarine	Estuarine
Client Sample Desc.	QC02	QC03
Sample Date	25/09/2025	25/09/2025

Test Method: DE-AM-01

Analysis Date	13/10/2025	13/10/2025
Chamber Type	SRC	SRC
Chamber Volume	1ml	1ml
Concentration Factor	NA	NA
Units	cells ml ⁻¹	cells ml ⁻¹
LOR	10 cell ml ⁻¹	10 cell ml ⁻¹

Analytical Results

Taxon	Abund.	%	Abund.	%		
Telonemea						
Telonema spp						
TOTAL (All Taxa)						



Marine and Freshwater Research Laboratory

Tel: 08 93602907 Address: 90 South St, Murdoch, WA, 6150



Accreditation Number: 10603
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WATER QUALITY DATA

Contact: Louise Cockerrton
Customer: GHD
Address: Level 10, 999 Hay St, Perth WA 6000

Date of Issue: 16/10/2025
Date Received: 24/09/2025
Our Reference: GHD25-8
Your Reference: 12658388

METHOD SAMPLE CODE	Sampling Date	Sample Type	2000 AMMONIA µg.N/L	4100 ORTHO-P µg.P/L	2100 NO3+NO2 µg.N/L	2700 TOTAL-DN µg.N/L	2700-2000-2100 TOTAL-ORGANIC N (filterable) µg.N/L	4700 TOTAL-P µg.P/L	2700 TOTAL-N µg.N/L	2700-2100 TKN calculated µg.N/L
Reporting Limit			<3	<2	<2	<50	<50	<5	<50	<50
Analysis Date			26/09/2025	26/09/2025	26/09/2025	10/10/2025	10/10/2025	10/10/2025	10/10/2025	10/10/2025
File			25092601-100201	25092601	25092601-100201	25101001	25101001-092601-100201	25101001	25101001-1601	25101001-1601-092601-100201
Apple SUR	24/09/2025	Estuarine	4	24	11	700	690	120	1500	1500
Apple ARB	24/09/2025	Estuarine	110	31	37	620	470	57	870	840
CanBridge SUR	24/09/2025	Estuarine	5	15	17	680	660	110	1400	1400
CanBridge ARB	24/09/2025	Estuarine	440	72	48	780	290	100	870	820
Heath SUR	24/09/2025	Estuarine	10	19	14	750	730	65	1100	1100
Mat Central SUR	24/09/2025	Estuarine	4	17	<2	840	840	48	1000	1000
Mat Bay 1 SUR	24/09/2025	Estuarine	3	17	<2	770	770	52	1000	1000
Mat Bay 1 ARB	24/09/2025	Estuarine	140	23	98	510	270	31	590	490
Mat Bay 2 SUR	24/09/2025	Estuarine	3	12	<2	750	740	100	1400	1400
Mat Bay 2 ARB	24/09/2025	Estuarine	160	28	99	550	280	35	600	500
Nar SUR	24/09/2025	Estuarine	10	19	120	880	750	61	1100	1000
Ellam SUR	24/09/2025	Estuarine	4	21	120	930	800	92	1300	1200
Ellam ARB	24/09/2025	Estuarine	4	22	110	930	820	97	1300	1200
Barrack SUR	24/09/2025	Estuarine	4	20	19	490	470	52	1000	990
Barrack ARB	24/09/2025	Estuarine	520	62	17	850	320	110	1000	980
Eliz SUR	24/09/2025	Estuarine	47	21	61	840	730	52	1000	970
Eliz ARB	24/09/2025	Estuarine	190	35	45	880	640	65	1000	970
QC01 Dup	24/09/2025	Estuarine	180	30	97	570	290	37	700	600
QC02 Field Blank	24/09/2025	Freshwater	<3	<2	<2	<50	<50	<5	<50	<50
QC03 Rinsate Blank	24/09/2025	Freshwater	<3	<2	<2	<50	<50	<5	<50	<50

Note: "TOTAL-ORGANIC N (filterable)" and "TKN calculated" are outside the scope of accreditation. Both methods are calculated using accredited results.

For results for compliance purposes uncertainty of measurement (MU) will sometimes affect the interpretation whether the result passes or fails the compliance limit.

Tables for measurement uncertainty are available online at www.mafri.murdoch.edu.au

Signatory: Lirong Han
Date: 16/10/2025

The results only apply to the sample tested.
Spare test items will be held for two months unless otherwise requested.

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Marine and Freshwater Research Laboratory

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WATER QUALITY DATA

Contact: Louise Cockerrton
Customer: GHD
Address: Level 10, 999 Hay St, Perth WA 6000

Date of Issue: 16/10/2025
Date Received: 24/09/2025
Our Reference: GHD25-8
Your Reference: 12658388

METHOD SAMPLE CODE	Sampling Date	Sample Type	6000 NPDOC mg.C/L	3020 CHLORO 'a' µg/L	3020 CHLORO 'b' µg/L	3020 CHLORO 'c' µg/L	3000 CHLOROPHYLL'a' µg/L	3000 PHAEOPHYTIN'a' µg/L	2540D TSS mg/L
Reporting Limit			<0.5	<0.1	<0.1	<0.1	<0.1	<0.2	<1
Analysis Date File			15/10/2025 25101501	25/09/2025 25092501	25/09/2025 25092501	25/09/2025 25092501	25/09/2025 25092501	25/09/2025 25092501	24/09/2025 250924
Apple SUR	24/09/2025	Estuarine	10	100	<0.1	35	96	1.7	11
Apple ARB	24/09/2025	Estuarine	4.2	5.8	<0.1	2.0	3.5	3.6	4
CanBridge SUR	24/09/2025	Estuarine	10	62	<0.1	20	59	1.2	10
CanBridge ARB	24/09/2025	Estuarine	3.5	2.5	<0.1	0.8	1.0	2.5	4
Heath SUR	24/09/2025	Estuarine	12	43	<0.1	14	41	0.3	8
Mat Central SUR	24/09/2025	Estuarine	11	41	<0.1	14	39	1.3	7
Mat Bay 1 SUR	24/09/2025	Estuarine	12	34	<0.1	11	31	3.0	6
Mat Bay 1 ARB	24/09/2025	Estuarine	3.2	4.3	<0.1	1.4	2.6	2.8	4
Mat Bay 2 SUR	24/09/2025	Estuarine	12	120	<0.1	40	120	3.0	18
Mat Bay 2 ARB	24/09/2025	Estuarine	3.4	8.0	<0.1	2.7	5.2	4.4	5
Nar SUR	24/09/2025	Estuarine	11	35	<0.1	10	33	2.6	8
Ellam SUR	24/09/2025	Estuarine	12	53	<0.1	18	50	1.4	11
Ellam ARB	24/09/2025	Estuarine	12	16	<0.1	3.9	12	4.9	10
Barrack SUR	24/09/2025	Estuarine	11	49	<0.1	16	46	2.3	10
Barrack ARB	24/09/2025	Estuarine	3.8	3.7	<0.1	1.2	1.9	2.8	6
Eliz SUR	24/09/2025	Estuarine	10	22	<0.1	5.0	20	2.0	7
Eliz ARB	24/09/2025	Estuarine	8.2	10	<0.1	2.3	8.0	3.3	7
QC01 Dup	24/09/2025	Estuarine	3.3	4.3	<0.1	1.4	2.5	2.9	4
QC02 Field Blank	24/09/2025	Freshwater	<0.5						
QC03 Rinsate Blank	24/09/2025	Freshwater	<0.5						

Signatory: Lirong Han
Date: 16/10/2025

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WATER QUALITY DATA

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Customer: GHD
Address: Level 10, 999 Hay St, Perth WA 6000

Date of Issue: 16/10/2025
Date Received: 24/09/2025
Our Reference: GHD25-8
Your Reference: 12658388

METHOD SAMPLE CODE	Sampling Date	Sample Type	MS001 Filtered Al µg/L	MS001 Filtered Cr µg/L	MS001 Filtered Mn µg/L	MS001 Filtered Fe µg/L	MS001 Filtered Co µg/L	MS001 Filtered Ni µg/L	MS001 Filtered Cu µg/L
Reporting Limit			<5	<0.2	<0.5	<1	<0.05	<0.3	<0.2
Analysis Date File			7/10/2025 25100701	7/10/2025 25100701	7/10/2025 25100701	7/10/2025 25100701	7/10/2025 25100701	7/10/2025 25100701	7/10/2025 25100701
Apple SUR	24/09/2025	Estuarine	22	0.3	16	110	0.20	0.8	2.5
Apple ARB	24/09/2025	Estuarine	5	<0.2	200	35	0.26	0.6	1.2
CanBridge SUR	24/09/2025	Estuarine	22	0.3	29	110	0.20	0.7	2.2
CanBridge ARB	24/09/2025	Estuarine	<5	<0.2	360	68	0.31	0.5	0.6
Heath SUR	24/09/2025	Estuarine	14	0.3	38	150	0.25	1.0	2.1
Mat Central SUR	24/09/2025	Estuarine	13	0.2	23	120	0.24	1.0	2.0
Mat Bay 1 SUR	24/09/2025	Estuarine	12	0.2	18	110	0.23	1.0	2.2
Mat Bay 1 ARB	24/09/2025	Estuarine	<5	<0.2	160	9	0.23	0.5	1.1
Mat Bay 2 SUR	24/09/2025	Estuarine	13	0.3	20	110	0.26	1.0	2.2
Mat Bay 2 ARB	24/09/2025	Estuarine	<5	<0.2	190	7	0.26	0.5	1.0
Nar SUR	24/09/2025	Estuarine	13	0.3	56	200	0.31	1.1	2.0
Ellam SUR	24/09/2025	Estuarine	12	0.3	68	220	0.32	1.1	1.8
Ellam ARB	24/09/2025	Estuarine	12	0.3	68	220	0.35	1.1	1.8
Barrack SUR	24/09/2025	Estuarine	12	0.3	59	170	0.30	1.1	1.9
Barrack ARB	24/09/2025	Estuarine	<5	<0.2	530	190	0.44	0.5	0.6
Eliz SUR	24/09/2025	Estuarine	12	0.2	120	180	0.32	0.9	1.8
Eliz ARB	24/09/2025	Estuarine	8	0.2	270	130	0.38	0.9	1.4
QC01 Dup	24/09/2025	Estuarine	<5	<0.2	180	7	0.25	0.6	0.9
QC02 Field Blank	24/09/2025	Freshwater	<5	<0.2	<0.5	<1	<0.05	<0.3	<0.2
QC03 Rinsate Blank	24/09/2025	Freshwater	<5	<0.2	<0.5	<1	<0.05	<0.3	<0.2
QC06	24/09/2025	Estuarine							

Signatory: Lirong Han
Date: 16/10/2025

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Contact: Louise Cockerrton
Customer: GHD
Address: Level 10, 999 Hay St, Perth WA 6000

Date of Issue: 16/10/2025
Date Received: 24/09/2025
Our Reference: GHD25-8
Your Reference: 12658388

METHOD SAMPLE CODE	Sampling Date	Sample Type	MS001 Filtered Zn µg/L	MS001 Filtered As µg/L	MS001 Filtered Se µg/L	MS001 Filtered Cd µg/L	MS001 Filtered Pb µg/L	ICP006 Hg mg/L
Reporting Limit			<1	<0.5	<1	<0.1	<0.1	<0.0001
Analysis Date File			7/10/2025 25100701	7/10/2025 25100701	7/10/2025 25100701	7/10/2025 25100701	7/10/2025 25100701	3/10/2025 25100302
Apple SUR	24/09/2025	Estuarine	2	1.0	<1	<0.1	0.2	
Apple ARB	24/09/2025	Estuarine	3	1.4	<1	<0.1	<0.1	
CanBridge SUR	24/09/2025	Estuarine	3	1.0	<1	<0.1	0.2	
CanBridge ARB	24/09/2025	Estuarine	2	2.1	<1	<0.1	<0.1	
Heath SUR	24/09/2025	Estuarine	1	0.8	<1	<0.1	0.1	
Mat Central SUR	24/09/2025	Estuarine	1	0.8	<1	<0.1	0.1	
Mat Bay 1 SUR	24/09/2025	Estuarine	<1	0.9	<1	<0.1	0.1	
Mat Bay 1 ARB	24/09/2025	Estuarine	2	1.5	<1	<0.1	<0.1	
Mat Bay 2 SUR	24/09/2025	Estuarine	1	0.9	<1	<0.1	0.1	
Mat Bay 2 ARB	24/09/2025	Estuarine	2	1.6	<1	<0.1	<0.1	
Nar SUR	24/09/2025	Estuarine	2	0.7	<1	<0.1	0.2	
Ellam SUR	24/09/2025	Estuarine	2	0.6	<1	<0.1	0.1	
Ellam ARB	24/09/2025	Estuarine	2	0.6	<1	<0.1	0.1	
Barrack SUR	24/09/2025	Estuarine	1	0.8	<1	<0.1	0.1	
Barrack ARB	24/09/2025	Estuarine	2	2.0	<1	<0.1	<0.1	
Eliz SUR	24/09/2025	Estuarine	2	0.9	<1	<0.1	0.1	
Eliz ARB	24/09/2025	Estuarine	2	1.2	<1	<0.1	<0.1	
QC01 Dup	24/09/2025	Estuarine	2	1.5	<1	<0.1	<0.1	
QC02 Field Blank	24/09/2025	Freshwater	<1	<0.5	<1	<0.1	<0.1	
QC03 Rinsate Blank	24/09/2025	Freshwater	<1	<0.5	<1	<0.1	<0.1	
QC06	24/09/2025	Estuarine						<0.0001

Signatory: Lirong Han
Date: 16/10/2025

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Marine and Freshwater Research Laboratory

Tel: 08 93602907 Address: 90 South St, Murdoch, WA, 6150



Accreditation Number: 10603
Accredited for compliance with ISO/IEC 17025 - Testing.



WATER QUALITY DATA

Contact: Louise Cockerrton
Customer: GHD
Address: Level 10, 999 Hay St, Perth WA 6000

Date of Issue: 16/10/2025
Date Received: 24/09/2025
Our Reference: GHD25-8
Your Reference: 12658388

METHOD SAMPLE CODE	Sampling Date	Sample Type	MS001 Unfiltered Al µg/L	MS001 Unfiltered Cr µg/L	MS001 Unfiltered Mn µg/L	MS001 Unfiltered Fe µg/L	MS001 Unfiltered Co µg/L	MS001 Unfiltered Ni µg/L	MS001 Unfiltered Cu µg/L
Reporting Limit			<5	<0.2	<0.5	<1	<0.05	<0.3	<0.2
Analysis Date File			7/10/2025 25100701-0901	7/10/2025 25100701-0901	7/10/2025 25100701-0901	7/10/2025 25100701-0901	7/10/2025 25100701-0901	7/10/2025 25100701-0901	7/10/2025 25100701-0901
Apple SUR	24/09/2025	Estuarine	220	0.7	22	270	0.2	1.0	2.9
Apple ARB	24/09/2025	Estuarine	47	0.2	220	170	0.26	0.7	13
CanBridge SUR	24/09/2025	Estuarine	300	0.7	31	350	0.2	0.9	2.4
CanBridge ARB	24/09/2025	Estuarine	39	0.2	360	370	0.32	0.6	1.2
Heath SUR	24/09/2025	Estuarine	320	0.8	42	470	0.3	1.1	2.1
Mat Central SUR	24/09/2025	Estuarine	140	0.5	34	360	0.27	1.2	2.4
Mat Bay 1 SUR	24/09/2025	Estuarine	210	0.7	27	360	0.3	1.1	2.5
Mat Bay 1 ARB	24/09/2025	Estuarine	43	0.2	170	70	0.24	0.5	1.2
Mat Bay 2 SUR	24/09/2025	Estuarine	210	0.6	28	350	0.3	1.1	2.3
Mat Bay 2 ARB	24/09/2025	Estuarine	53	0.2	200	83	0.27	0.6	1.3
Nar SUR	24/09/2025	Estuarine	560	1.0	59	760	0.4	1.4	2.4
Ellam SUR	24/09/2025	Estuarine	530	1.0	69	790	0.4	1.4	2.3
Ellam ARB	24/09/2025	Estuarine	550	1.1	68	800	0.4	1.5	2.0
Barrack SUR	24/09/2025	Estuarine	370	0.8	56	590	0.4	1.2	2.4
Barrack ARB	24/09/2025	Estuarine	91	0.3	530	660	0.44	0.6	1.1
Eliz SUR	24/09/2025	Estuarine	380	1.0	120	620	0.4	1.2	2.0
Eliz ARB	24/09/2025	Estuarine	260	0.8	280	520	0.4	0.9	1.7
QC01 Dup	24/09/2025	Estuarine	63	0.2	200	95	0.29	0.6	1.2
QC02 Field Blank	24/09/2025	Freshwater	<5	<0.2	<0.5	<1	<0.05	<0.3	<0.2
QC03 Rinsate Blank	24/09/2025	Freshwater	<5	<0.2	<0.5	<1	<0.05	<0.3	<0.2
QC06	24/09/2025	Estuarine							

Signatory: Lirong Han
Date: 16/10/2025

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WATER QUALITY DATA

Contact: Louise Cockerrton
Customer: GHD
Address: Level 10, 999 Hay St, Perth WA 6000

Date of Issue: 16/10/2025
Date Received: 24/09/2025
Our Reference: GHD25-8
Your Reference: 12658388

METHOD SAMPLE CODE	Sampling Date	Sample Type	MS001 Unfiltered Zn µg/L	MS001 Unfiltered As µg/L	MS001 Unfiltered Se µg/L	MS001 Unfiltered Cd µg/L	MS001 Unfiltered Pb µg/L	ICP006 Total Ext Hg mg/L
Reporting Limit			<1	<0.5	<1	<0.1	<0.1	<0.0001
Analysis Date File			7/10/2025 25100701-0901	7/10/2025 25100701-0901	7/10/2025 25100701-0901	7/10/2025 25100701-0901	7/10/2025 25100701-0901	3/10/2025 25100302
Apple SUR	24/09/2025	Estuarine	6	1	<2	<0.2	0.4	
Apple ARB	24/09/2025	Estuarine	4	1.8	<1	<0.1	0.2	
CanBridge SUR	24/09/2025	Estuarine	6	1	<2	<0.2	0.5	
CanBridge ARB	24/09/2025	Estuarine	3	2.5	<1	<0.1	0.2	
Heath SUR	24/09/2025	Estuarine	3	<1	<2	<0.2	0.4	
Mat Central SUR	24/09/2025	Estuarine	3	0.8	<1	<0.1	0.3	
Mat Bay 1 SUR	24/09/2025	Estuarine	3	<1	<2	<0.2	0.3	
Mat Bay 1 ARB	24/09/2025	Estuarine	3	1.5	<1	<0.1	0.2	
Mat Bay 2 SUR	24/09/2025	Estuarine	7	1	<2	<0.2	0.3	
Mat Bay 2 ARB	24/09/2025	Estuarine	3	1.6	<1	<0.1	0.2	
Nar SUR	24/09/2025	Estuarine	4	<1	<2	<0.2	0.6	
Ellam SUR	24/09/2025	Estuarine	5	<1	<2	<0.2	0.6	
Ellam ARB	24/09/2025	Estuarine	5	<1	<2	<0.2	0.6	
Barrack SUR	24/09/2025	Estuarine	4	<1	<2	<0.2	0.5	
Barrack ARB	24/09/2025	Estuarine	3	2.2	<1	<0.1	0.4	
Eliz SUR	24/09/2025	Estuarine	4	<1	<2	<0.2	0.4	
Eliz ARB	24/09/2025	Estuarine	4	1	<2	<0.2	0.4	
QC01 Dup	24/09/2025	Estuarine	3	1.8	<1	<0.1	0.2	
QC02 Field Blank	24/09/2025	Freshwater	<1	<0.5	<1	<0.1	<0.1	
QC03 Rinsate Blank	24/09/2025	Freshwater	<1	<0.5	<1	<0.1	<0.1	
QC06	24/09/2025	Estuarine						<0.0001

Signatory: Lirong Han
Date: 16/10/2025

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Appendix C

Chemistry tables (April to September)

Location Code	SW06				Date	SW07				Field ID	SW07				Matrix Type	Lab Report Number
	24 Sep 2025		24 Sep 2025			24 Sep 2025		24 Sep 2025			24 Sep 2025		24 Sep 2025			
	GHD-MATBAY1-202509-GR-SUR		GHD-QC04			GHD-MATBAY2-202509-GR-ARB		GHD-QC01			GHD-MatBay2-202509-GR-ARB		GHD-QC06			
	Normal		Field_D			Normal		Field_D			Normal		Field_D			
	Water		Water			Water		Water			Water		Water			

[illegible]

Location Code Date Field ID Sample Type Matrix Type Lab Report Number							SW06			SW07			SW07			SW07				
							24 Sep 2025		24 Sep 2025		24 Sep 2025		24 Sep 2025		24 Sep 2025		24 Sep 2025		24 Sep 2025	
							GHD-MATBAY1-202509-GR-SUR		GHD-QC04		GHD-MATBAY2-202509-GR-ARB		GHD-QC01		GHD-MatBay2-202509-GR-ARB		GHD-QC06			
							Normal		Field_D		Normal		Field_D		Normal		Field_D			
							Water		Water		Water		Water		Water		Water			
							1272659		1272659		RPD		1272659		1272659		RPD		EP2515984	
												</								

Environmental Standards

Department of Agriculture and Water Resources, 2018 updated July 2021, ANZG (2018) - FW - 95% (updated 26 July 2021)
Department of Agriculture and Water Resources, August 2018, ANZG (2018) - MW - 95% species protection (updated 1/10/2021)
HEPA, March 2025, PFAS NEMP 3.0 2025 Freshwater 99%
HEPA, March 2025, PFAS NEMP 3.0 2025 Interim marine 99%

*RPDs have only been considered where a concentration is greater than 1 times the EQL.

**Elevated RPDs are highlighted as per QA/QC Profile settings (Acceptable RPDs for each EQL multiplier range are: 30 (1 - 10 x EQL); 30 (10 - 30 x EQL); 30 (> 30 x EQL))

***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory



Month	Field ID	Date	Sample Type	Lab Report Number	Sep-25					
					GHD-QC02	GHD-QC02	GHD-QC02	GHD-QC03	GHD-QC03	GHD-QC05
					24 Sep 2025	24 Sep 2025	24 Sep 2025	24 Sep 2025	24 Sep 2025	24 Sep 2025
					Rinsate	Rinsate	Rinsate	Field_B	Field_B	Trip_B
				1272659	EP2515984	MAFRL/EP25-8	1272659	EP2515984	1272659	
	Unit	LOR								
Inorganics										
Electrical conductivity (lab)	µS/cm	10	<10	-	-	<10	-	-		
Total Dissolved Solids	mg/L	5	<5	-	-	<5	-	-		
Acidity & Alkalinity										
Alkalinity (Carbonate as CaCO3)	mg/L	5	<5	-	-	<5	-	-		
Alkalinity (Bicarbonate as CaCO3)	mg/L	5	<5	-	-	<5	-	-		
Alkalinity (Hydroxide as CaCO3)	mg/L	5	<5	-	-	<5	-	-		
Alkalinity (total as CaCO3)	mg/L	5	<5	-	-	<5	-	-		
Major Ions										
Calcium	mg/L	0.5	<0.5	-	-	<0.5	-	-		
Magnesium	mg/L	0.5	<0.5	-	-	<0.5	-	-		
Potassium	mg/L	0.5	<0.5	-	-	<0.5	-	-		
Sodium	mg/L	0.5	<0.5	-	-	<0.5	-	-		
Chloride (filtered)	mg/L	5	<5	-	-	<5	-	-		
Sulfate (filtered)	mg/L	1	<1	-	-	<1	-	-		
Minor Ions										
Sulfide	mg/L	0.1	<0.1	-	-	<0.1	-	-		
Nutrients										
Ammonia as N	µg/L		-	-	<3	-	-	-		
Nitrogen (Total Oxidised) (as N)	µg/L		-	-	<2	-	-	-		
Nitrogen (Total)	µg/L		-	-	<50	-	-	-		
Kjeldahl Nitrogen Total	µg/L		-	-	<50	-	-	-		
Nitrogen (Organic)	ug/L		-	-	<50	-	-	-		
Phosphorus (Total)	µg/L		-	-	<5	-	-	-		
Phosphorus	mg/L		-	-	<0.002	-	-	-		
Metals										
Mercury	mg/L	0.00004	-	<0.00004	-	-	<0.00004	-		
Mercury (filtered)	mg/L	0.00004	-	<0.00004	-	-	<0.00004	-		
Organo Metals										
Dibutyltin	µg/L	0.005	<0.005	-	-	<0.005	-	-		
Monobutyltin	ug/L	0.005	<0.005	-	-	<0.005	-	-		
Tributyltin as Sn	NG/L	2	<2	-	-	<2	-	-		
BTEXN										
Napthalene (value used in F2 calc)	µg/L	1	<1	-	-	<1	-	<1		
Benzene	µg/L	1	<1	-	-	<1	-	<1		
Toluene	µg/L	1	<1	-	-	<1	-	<1		
Ethylbenzene	µg/L	1	<1	-	-	<1	-	<1		
Xylene (o)	µg/L	1	<1	-	-	<1	-	<1		
Xylene (m & p)	µg/L	2	<2	-	-	<2	-	<2		
Xylene Total	µg/L	3	<3	-	-	<3	-	<3		
TRH - NEPM 2013										
F1 (C6-C10 minus BTEX)	µg/L	20	<20	-	-	<20	-	<20		
C6-C10 Fraction	µg/L	20	<20	-	-	<20	-	<20		
F2 (>C10-C16 minus Napthalene)	µg/L	20	<20	-	-	<20	-	-		
>C10-C16 Fraction	µg/L	20	<20	-	-	<20	-	-		
F3 (>C16-C34 Fraction)	µg/L	50	<50	-	-	<50	-	-		
F4 (>C34-C40 Fraction)	µg/L	50	<50	-	-	<50	-	-		
>C10-C40 (Sum of Total)	µg/L	50	<50	-	-	<50	-	-		
TRH - NEPM 1999										
C6-C9 Fraction	µg/L	20	<20	-	-	<20	-	<20		
C10-C14 Fraction	µg/L	20	<20	-	-	<20	-	-		
C15-C28 Fraction	µg/L	40	<40	-	-	<40	-	-		
C29-C36 Fraction	µg/L	40	<40	-	-	<40	-	-		
C10-C36 (Sum of Total)	µg/L	40	<40	-	-	<40	-	-		
PAHs - standard 16										
Acenaphthene	µg/L	0.002	-	<0.002	-	-	<0.002	-		
Acenaphthylene	µg/L	0.002	-	<0.002	-	-	<0.002	-		
Anthracene	µg/L	0.001	-	<0.001	-	-	<0.001	-		
Benz(a)anthracene	µg/L	0.002	-	<0.002	-	-	<0.002	-		
Benzo(a)pyrene	µg/L	0.001	-	<0.001	-	-	<0.001	-		
Benzo(b+j)fluoranthene	µg/L	0.004	-	<0.004	-	-	<0.004	-		
Benzo(k)fluoranthene	µg/L	0.004	-	<0.004	-	-	<0.004	-		
Benzo(g,h,i)perylene	µg/L	0.002	-	<0.002	-	-	<0.002	-		
Chrysene	µg/L	0.001	-	<0.001	-	-	<0.001	-		
Dibenz(a,h)anthracene	µg/L	0.001	-	<0.001	-	-	<0.001	-		
Fluoranthene	µg/L	0.001	-	<0.001	-	-	<0.001	-		
Fluorene	µg/L	0.002	-	<0.002	-	-	<0.002	-		
Indeno(1,2,3-c,d)pyrene	µg/L	0.002	-	<0.002	-	-	<0.002	-		
Napthalene	µg/L	0.004	-	<0.004	-	-	<0.004	-		
Phenanthrene	µg/L	0.002	-	<0.002	-	-	<0.002	-		
Pyrene	µg/L	0.001	-	<0.001	-	-	<0.001	-		
PAHs (Sum of total) - Lab calc	µg/L	0.001	-	<0.001	-	-	<0.001	-		
PAHs - extended										
2-methylnapthalene	µg/L	0.002	-	<0.002	-	-	<0.002	-		
3-methylcholanthrene	µg/L	0.004	-	<0.004	-	-	<0.004	-		
7,12-dimethylbenz(a)anthracene	µg/L	0.001	-	<0.001	-	-	<0.001	-		
Benzo(e)pyrene	µg/L	0.001	-	<0.001	-	-	<0.001	-		
Perylene	µg/L	0.002	-	<0.002	-	-	<0.002	-		
Benzo(b+j+k)fluoranthene	µg/L	0.004	-	<0.004	-	-	<0.004	-		
OC Pesticides										
4,4'-DDE	µg/L	0.002	-	<0.002	-	-	<0.002	-		
a-BHC	µg/L	0.002	-	<0.002	-	-	<0.002	-		
Aldrin	µg/L	0.001	-	<0.001	-	-	<0.001	-		
Aldrin + Dieldrin	µg/L	0.002	-	<0.002	-	-	<0.002	-		
b-BHC	µg/L	0.002	-	<0.002	-	-	<0.002	-		

Month	Field ID	Date	Sample Type	Lab Report Number	Sep-25					
					GHD-QC02	GHD-QC02	GHD-QC02	GHD-QC03	GHD-QC03	GHD-QC05
					24 Sep 2025	24 Sep 2025	24 Sep 2025	24 Sep 2025	24 Sep 2025	24 Sep 2025
					Rinsate	Rinsate	Rinsate	Field_B	Field_B	Trip_B
					1272659	EP2515984	MAFRL/EP25-8	1272659	EP2515984	1272659
		Unit	LOR							
Chlordane		µg/L	0.001		-	<0.001	-	-	<0.001	-
Chlordane (cis)		µg/L	0.001		-	<0.001	-	-	<0.001	-
Chlordane (trans)		µg/L	0.001		-	<0.001	-	-	<0.001	-
d-BHC		µg/L	0.002		-	<0.002	-	-	<0.002	-
4,4'-DDD		µg/L	0.002		-	<0.002	-	-	<0.002	-
4,4'-DDT		µg/L	0.002		-	<0.002	-	-	<0.002	-
DDT+DDE+DDD - Lab Calc		µg/L	0.002		-	<0.002	-	-	<0.002	-
Dieldrin		µg/L	0.002		-	<0.002	-	-	<0.002	-
Endosulfan		µg/L	0.002		-	<0.002	-	-	<0.002	-
Endosulfan I (alpha)		µg/L	0.002		-	<0.002	-	-	<0.002	-
Endosulfan II (beta)		µg/L	0.002		-	<0.002	-	-	<0.002	-
Endosulfan Sulfate		µg/L	0.002		-	<0.002	-	-	<0.002	-
Endrin		µg/L	0.002		-	<0.002	-	-	<0.002	-
Endrin aldehyde		µg/L	0.002		-	<0.002	-	-	<0.002	-
Endrin ketone		µg/L	0.002		-	<0.002	-	-	<0.002	-
g-BHC (Lindane)		µg/L	0.002		-	<0.002	-	-	<0.002	-
Heptachlor		µg/L	0.002		-	<0.002	-	-	<0.002	-
Heptachlor epoxide		µg/L	0.002		-	<0.002	-	-	<0.002	-
Hexachlorobenzene		µg/L	0.002		-	<0.002	-	-	<0.002	-
Methoxychlor		µg/L	0.002		-	<0.002	-	-	<0.002	-
Oxychlordane		µg/L	0.002		-	<0.002	-	-	<0.002	-
OP Pesticides										
Chlorpyrifos		µg/L	0.001		-	<0.001	-	-	<0.001	-
PCBs										
Arochlor 1016		mg/L	0.000005		-	<0.000005	-	-	<0.000005	-
Arochlor 1221		mg/L	0.000005		-	<0.000005	-	-	<0.000005	-
Arochlor 1232		mg/L	0.000005		-	<0.000005	-	-	<0.000005	-
Arochlor 1242		mg/L	0.000005		-	<0.000005	-	-	<0.000005	-
Arochlor 1248		mg/L	0.000005		-	<0.000005	-	-	<0.000005	-
Arochlor 1254		mg/L	0.000005		-	<0.000005	-	-	<0.000005	-
Arochlor 1260		mg/L	0.000005		-	<0.000005	-	-	<0.000005	-
PCBs (Total)		mg/L	0.000005		-	<0.000005	-	-	<0.000005	-
SVOCs										
Coronene		µg/L	0.002		-	<0.002	-	-	<0.002	-
PFAS - Perfluoroalkyl Sulfonic Acids										
Perfluorobutane sulfonic acid (PFBS)		µg/L	0.001		<0.001	-	-	<0.001	-	-
Perfluorodecanesulfonic acid (PFDS)		µg/L	0.001		<0.001	-	-	<0.001	-	-
Perfluorononane sulfonate (PFNS)		µg/L	0.001		<0.001	-	-	<0.001	-	-
Perfluorooctane sulfonic acid (PFHpS)		µg/L	0.001		<0.001	-	-	<0.001	-	-
Perfluorooctane sulfonic acid (PFOS)		µg/L	0.0001		<0.0001	-	-	<0.0001	-	-
Perfluoropropanesulfonic acid (PFPrS)		µg/L	0.001		<0.001	-	-	<0.001	-	-
Perfluoropentane sulfonic acid (PFPeS)		µg/L	0.001		<0.001	-	-	<0.001	-	-
Perfluorohexane sulfonic acid (PFHxS)		µg/L	0.001		<0.001	-	-	<0.001	-	-
PFAS - Perfluoroalkyl Carboxylic Acids										
Perfluorobutanoic acid (PFBA)		µg/L	0.005		<0.005	-	-	<0.005	-	-
Perfluorodecanoic acid (PFDA)		µg/L	0.001		<0.001	-	-	<0.001	-	-
Perfluorododecanoic acid (PFDoDA)		µg/L	0.001		<0.001	-	-	<0.001	-	-
Perfluoroheptanoic acid (PFHpA)		µg/L	0.005		<0.005	-	-	<0.005	-	-
Perfluorohexanoic acid (PFHxA)		µg/L	0.001		<0.001	-	-	<0.001	-	-
Perfluorononanoic acid (PFNA)		µg/L	0.001		<0.001	-	-	<0.001	-	-
Perfluorooctanoic acid (PFOA)		µg/L	0.001		<0.001	-	-	<0.001	-	-
Perfluoropentanoic acid (PFPeA)		µg/L	0.001		<0.001	-	-	<0.001	-	-
Perfluorotetradecanoic acid (PFTeDA)		µg/L	0.001		<0.001	-	-	<0.001	-	-
Perfluorotridecanoic acid (PFTriDA)		µg/L	0.001		<0.001	-	-	<0.001	-	-
Perfluoroundecanoic acid (PFUnDA)		µg/L	0.001		<0.001	-	-	<0.001	-	-
PFAS - Perfluoroalkyl Sulfonamide										
N-Ethyl perfluorooctane sulfonamide (EtFOSA)		µg/L	0.005		<0.005	-	-	<0.005	-	-
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)		µg/L	0.005		<0.005	-	-	<0.005	-	-
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)		µg/L	0.005		<0.005	-	-	<0.005	-	-
N-Methyl perfluorooctane sulfonamide (MeFOSA)		µg/L	0.005		<0.005	-	-	<0.005	-	-
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)		µg/L	0.005		<0.005	-	-	<0.005	-	-
N-Methyl perfluorooctane sulfonamidoethanol (MEFOSE)		µg/L	0.005		<0.005	-	-	<0.005	-	-
Perfluorooctane sulfonamide (FOSA)		µg/L	0.005		<0.005	-	-	<0.005	-	-
PFAS - Fluorotelomer Sulfonic Acids										
4:2 Fluorotelomer sulfonic acid (4:2 FTS)		µg/L	0.001		<0.001	-	-	<0.001	-	-
6:2 Fluorotelomer Sulfonate (6:2 FTS)		µg/L	0.005		<0.005	-	-	<0.005	-	-
8:2 Fluorotelomer sulfonic acid (8:2 FTS)		µg/L	0.001		<0.001	-	-	<0.001	-	-
10:2 Fluorotelomer sulfonic acid (10:2 FTS)		µg/L	0.001		<0.001	-	-	<0.001	-	-
PFAS - Sums										
PFAS (Sum of Total)(WA DER List)		µg/L	0.005		<0.005	-	-	<0.005	-	-
Sum of US EPA PFAS (PFOS + PFOA)*		µg/L	0.001		<0.001	-	-	<0.001	-	-
Sum of PFHxS and PFOS		µg/L	0.001		<0.001	-	-	<0.001	-	-
Sum of enHealth PFAS (PFHxS + PFOS + PFOA)*		µg/L	0.001		<0.001	-	-	<0.001	-	-



Appendix C
Table C.3
Field Parameters
September 2025

Perth Transport Authority
PTA Swan River Ferry Expansion

EQL	Field Parameters										
	Sample depth (m below surface)	Fluorescence_SCUFA	pH (Field)	Electrical conductivity (field)	Dissolved Oxygen (Field) (filtered)	DO (%S) (Field)	Redox (Field)	Temperature (Field)	Turbidity (Field)	Salinity (Field)	Specific Conductivity (Field)
	m	µg/L	pH units	µS/cm	mg/L	%S	mV	°C	NTU	PSU	µS/cm
EQL											

Location Code	Field ID	Date	Lab Report Number										
Development Envelopes													
Applecross (SW01)	GHD-Applecross-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659	0.702	>9.16	8.662	9,387.5	13.0105	147.827	119.1	19.8931	2.3313	5.9001
	GHD-Applecross-202509-GR-MID	24 Sep 2025	MAFRL/EP25-8/1272659	1.607	>9.16	8.451	16,005.1	6.9313	79.883	140.8	19.1784	1.7344	10.6792
	GHD-Applecross-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659	3.439	2.8596	7.464	36,740.1	0.1169	1.422	133	16.5372	1.943	28.3141
Barrack Street (SW02)	GHD-Barrack-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659	0.655	>9.16	8.956	9,229.8	15.7209	182.272	160.8	21.0088	3.536	5.6451
	GHD-Barrack-202509-GR-MID	24 Sep 2025	MAFRL/EP25-8/1272659	1.751	5.0286	7.429	26,072.6	1.2172	14.36	191.5	17.9207	1.7103	18.7451
	GHD-Barrack-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659	2.951	3.3318	7.472	35,574.80	0.0664	0.804	16.1	16.6552	3.9593	27.2396
Elizabeth Quay (SW03)	GHD-ElizQuay-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659	0.688	>9.16	6.434	11,857.6	12.1196	141.878	145.9	20.9761	3.7062	7.3999
	GHD-ElizQuay-202509-GR-MID	24 Sep 2025	MAFRL/EP25-8/1272659	1.132	8.9533	6.319	17,005.3	9.7626	115.168	155.1	20.2417	3.3757	11.1231
	GHD-ElizQuay-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659	1.745	8.4832	6.184	22,447.0	5.7684	68.293	147.7	19.1018	3.2932	15.4639
Ellam Street (SW04)	GHD-Ellam-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659	0.664	>9.16	8.225	7,596.41	9.9477	113.329	154.5	20.4066	4.1954	4.6442
	GHD-Ellam-202509-GR-MID	24 Sep 2025	MAFRL/EP25-8/1272659	0.966	>9.16	8.188	7,538.67	10.1397	115.159	166.3	20.2545	4.129	4.6227
	GHD-Ellam-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659	1.502	8.7352	8.397	9,433.8	10.5497	120.379	165.6	20.1106	4.4483	5.9012
Matilda Bay 1 (SW06)	GHD-MatBay1-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659	0.694	>9.16	9.076	10,505.9	15.0524	173.037	113.9	20.2798	1.8556	6.6001
	GHD-MatBay1-202509-GR-MID	24 Sep 2025	MAFRL/EP25-8/1272659	2.201	7.1578	7.443	32,191.9	1.1639	13.895	158.4	16.8291	0.6169	24.2835
	GHD-MatBay1-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659	4.002	2.2371	7.601	36,895.9	1.1579	14.084	160.3	16.4861	0.9243	28.4836
Matilda Bay (SW07)	GHD-MatBay2-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659	0.679	>9.16	9.111	10,607.6	15.5355	179.286	133.7	20.4671	2.2229	6.6399
	GHD-MatBay2-202509-GR-MID	24 Sep 2025	MAFRL/EP25-8/1272659	2.509	4.9978	7.444	31,820.5	1.0834	12.907	179	16.8142	0.5375	23.9832
	GHD-MatBay2-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659	4.345	2.2987	7.586	37,497.9	0.8829	10.773	177.1	16.485	1.6071	29.0009
Reference sites													
Matilda Bay Central (SW08)	GHD-6164602-MatCentral-SUR	24 Sep 2025	MAFRL/EP25-8/1272659	0.694	>9.16	8.996	10,394.3	14.2026	162.22	115.8	19.9577	2.1077	6.574
	GHD-6164602-MatCentral-MID	24 Sep 2025	MAFRL/EP25-8/1272659	2.383	6.1786	7.506	31,804.3	1.4887	17.741	157.9	16.8418	0.6084	23.9533
	GHD-6164602-MatCentral-ARB	24 Sep 2025	MAFRL/EP25-8/1272659	4.166	2.2743	7.601	37,494.6	1.0076	12.293	160	16.4785	1.3383	29.0028
Narrows (SW09)	GHD-6160262-Nar-SUR	24 Sep 2025	MAFRL/EP25-8/1272659	0.651	>9.16	8.419	8,605.1	10.7298	123.429	156.6	20.7154	3.7645	5.2711
	GHD-6160262-Nar-MID	24 Sep 2025	MAFRL/EP25-8/1272659	1.929	4.2246	7.455	32,555.2	0.7074	8.472	182.6	16.9131	0.9383	24.5354
	GHD-61610262-Nar-ARB	24 Sep 2025	MAFRL/EP25-8/1272659	3.214	2.7642	7.517	36,907.1	0.2416	2.94	151.6	16.513	2.8252	28.4743
Heathcote (SW05)	GHD-6161869-Heathcote-SUR	24 Sep 2025	MAFRL/EP25-8/1272659	0.698	>9.16	8.743	10,575.2	12.4952	143.051	103.6	20.0439	2.57	6.6838
	GHD-6161869-Heathcote-MID	24 Sep 2025	MAFRL/EP25-8/1272659	3.343	2.9458	7.566	35,254.0	1.4628	17.655	146.5	16.5324	0.5191	27.05
	GHD-6161869-Heathcote-ARB	24 Sep 2025	MAFRL/EP25-8/1272659	5.986	1.9812	7.658	38,827.0	1.3384	16.446	152.3	16.4876	0.8724	30.1436



Appendix C
Table C.4
Inorganic, organics and major ion anions results
September 2025

					Inorganics			Acidity & Alkalinity				Major Ions						Minor Ions			
					Electrical conductivity (lab)	Total Dissolved Solids	Total Suspended Solids	Alkalinity (Carbonate as CaCO3)	Alkalinity (Bicarbonate as CaCO3)	Alkalinity (Hydroxide as CaCO3)	Alkalinity (total as CaCO3)	Calcium	Magnesium	Potassium	Sodium	Chloride (filtered)	Sulfate (filtered)	Sulfide	Chlorophyll b	Chlorophyll c	Phaeophytin a
					µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	ug/L
EQL					10	5	5	5	5	5	5	0.5	0.5	0.5	0.5	5	1	0.1			
ANZG (2018) - FW - 95% (updated 26 July 2021)																					
ANZG (2018) - MW - 95% species protection (updated 1/10/2021)																					
Location	Code	Depth	Field ID	Date	Lab Report Number																
Development Envelopes																					
Applecross (SW01)	0.877	GHD-Applecross-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	50,000	36,000	<5	<5	120	<5	120	430	1,300	410	12,000	21,000	2,900	<0.1	0.2	1.5	0.8
	0.751	GHD-Applecross-202505-GR-SUR	20 May 2025	MARFL/EP25-4/1222511	50,000	35,000	<5	<5	150	<5	150	440	1,200	390	9,800	17,000	2,300	<0.1	0.2	0.6	0.8
	0.672	GHD-Applecross-202506-GR-SUR	24 Jun 2025	MARFL/EP25-5/1236654	46,000	23,000	<5	<5	100	<5	100	370	1,100	330	9,200	14,000	2,000	<0.1	0.5	1.1	0.8
	0.703	GHD-Applecross-202507-GR-SUR	22 Jul 2025	MARFL/EP25-6/1247871	39,000	18,000	<5	<5	120	<5	120	330	910	290	7,800	14,000	1,900	<0.1	0.2	1.2	1.2
	0.68	GHD-Applecross-202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	13,000	7,500	7.0	<5	84	<5	84	120	310	79	2,400	4,800	610	<0.1	0.1	0.7	1.4
	0.702	GHD-Applecross-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	11,000	6,700	-	<5	96	<5	96	97	260	83	2,600	3,500	480	<0.1	<0.1	35	1.7
	3.47	GHD-Applecross-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	50,000	35,000	<5	<5	120	<5	120	450	1,400	420	12,000	21,000	2,900	<0.1	0.2	1.4	0.8
	3.885	GHD-Applecross-202505-GR-ARB	20 May 2025	MARFL/EP25-4/1222511	46,000	37,000	11	<5	100	<5	100	470	1,300	450	11,000	19,000	2,500	<0.1	0.2	0.5	0.8
	4.392	GHD-Applecross-202506-GR-ARB	24 Jun 2025	MARFL/EP25-5/1236654	49,000	30,000	<5	<5	110	<5	110	390	1,100	340	9,500	15,000	2,200	<0.1	0.2	0.2	1.1
	2.691	GHD-Applecross-202506-GR-ARB	22 Jul 2025	MARFL/EP25-6/1247871	43,000	21,000	5.0	<5	120	<5	120	360	1,000	330	8,800	64	2,100	<0.1	<0.1	1.3	1
Barrack Street (SW02)	2.45	GHD-Applecross-202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	24,000	14,000	<5	<5	93	<5	93	190	540	160	4,400	9,200	1,300	<0.1	<0.1	1	2.3
	3.44	GHD-Applecross-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	41,000	24,000	-	<5	130	<5	130	350	1,100	310	9,000	14,000	2,000	<0.1	<0.1	2	3.6
	0.794	GHD-Barrack-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	51,000	35,000	<5	<5	120	<5	120	420	1,300	410	13,000	22,000	2,900	<0.1	0.2	0.5	0.7
	0.836	GHD-Barrack-202505-GR-SUR	20 May 2025	MARFL/EP25-4/1222511	47,000	34,000	8.0	<5	110	<5	110	430	1,400	440	11,000	20,000	2,500	<0.1	0.4	0.4	2.1
	0.65	GHD-Barrack-202506-GR-SUR	24 Jun 2025	MARFL/EP25-5/1236654	44,000	23,000	<5	<5	100	<5	100	360	1,000	310	8,300	13,000	2,000	<0.1	0.5	1	0.6
	0.671	GHD-Barrack-202506-GR-SUR	22 Jul 2025	MARFL/EP25-6/1247871	40,000	18,000	7.0	<5	110	<5	110	360	1,000	310	8,400	14,000	1,900	<0.1	0.3	0.8	0.8
	0.7	GHD-Barrack-202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	4,800	2,500	<5	<5	61	<5	61	41	100	9.4	680	1,500	170	<0.1	0.1	0.5	1.8
	0.66	GHD-Barrack-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	11,000	6,400	-	<5	97	<5	97	99	280	59	2,200	3,300	410	<0.1	<0.1	16	2.3
	3.112	GHD-Barracks-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	51,000	35,000	6.0	<5	120	<5	120	420	1,300	400	12,000	21,000	2,800	4.0	0.3	1.9	1
	3.133	GHD-Barrack-202505-GR-ARB	20 May 2025	MARFL/EP25-4/1222511	46,000	35,000	19	<5	95	<5	95	430	1,400	430	11,000	19,000	2,500	<0.1	0.5	0.4	0.8
Elizabeth Quay (SW03)	3.021	GHD-Barrack-202506-GR-ARB	24 Jun 2025	MARFL/EP25-5/1236654	47,000	26,000	<5	<5	100	<5	100	390	1,100	340	8,900	14,000	2,100	<0.1	0.2	0.2	1.1
	3.086	GHD-Barrack-202506-GR-ARB	22 Jul 2025	MARFL/EP25-6/1247871	44,000	22,000	10	<5	120	<5	120	380	1,100	330	9,000	15,000	2,100	<0.1	0.1	0.4	1
	2.81	GHD-Barrack-202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	5,400	2,400	11	<5	61	<5	61	46	120	13	800	1,800	200	<0.1	0.1	0.5	1.7
	2.95	GHD-Barrack-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	42,000	25,000	-	<5	120	<5	120	360	1,100	330	9,500	14,000	1,900	<0.1	<0.1	1.2	2.8
	0.548	GHD-ElizQuay-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	51,000	35,000	9.0	<5	110	<5	110	390	1,200	370	11,000	21,000	2,900	<0.1	0.4	1.9	0.9
	0.862	GHD-ElizQuay-202505-GR-SUR	20 May 2025	MARFL/EP25-4/1222511	47,000	35,000	12	<5	110	<5	110	470	1,500	460	12,000	18,000	2,500	<0.1	0.8	0.8	1.4
	0.791	GHD-ElizQuay-202506-GR-SUR	24 Jun 2025	MARFL/EP25-5/1236654	42,000	20,000	<5	<5	100	<5	100	350	1,000	310	8,200	13,000	1,900	<0.1	0.6	2.2	1.1
	0.695	GHD-ElizQuay-202506-GR-SUR	22 Jul 2025	MARFL/EP25-6/1247871	37,000	18,000	<5	<5	110	<5	110	310	860	270	7,300	12,000	1,800	<0.1	0.8	1.2	1.2
	0.65	GHD-ElizQuay-202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	4,700	2,400	11	<5	65	<5	65	40	95	12	660	1,500	180	<0.1	<0.1	0.9	1.6
	0.69	GHD-ElizQuay-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	13,000	7,800	-	<5	100	<5	100	100	280	63	2,200	4,200	500	<0.1	<0.1	5	2
Ellam Street (SW04)	2.053	GHD-ElizQuay-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	51,000	35,000	<5	<5	110	<5	110	420	1,300	410	11,000	21,000	2,800	<0.1	0.3	1.3	1.1
	2.138	GHD-ElizQuay-202505-GR-ARB	20 May 2025	MARFL/EP25-4/1222511	47,000	33,000	19	<5	110	<5	110	470	1,600	490	13,000	18,000	2,500	<0.1	0.6	0.5	1.4
	1.934	GHD-ElizQuay-202506-GR-ARB	24 Jun 2025	MARFL/EP25-5/1236654	44,000	20,000	<5	<5	100	<5	100	360	1,000	310	8,200	13,000	2,000	<0.1	0.4	1	1.2
	1.954	GHD-ElizQuay-202506-GR-ARB	22 Jul 2025	MARFL/EP25-6/1247871	42,000	19,000	<5	<5	120	<5	120	350	1,000	320	8,800	14,000	2,000	<0.1	0.2	0.5	0.9
	1.74	GHD-ElizQuay-202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	4,800	2,400	8.0	<5	65	<5	65	51	120	15	810	1,500	180	<0.1	<0.1	0.7	2.2
	1.75	GHD-ElizQuay-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	16,000	9,400	-	<5	94	<5	94	140	390	94	3,100	5,200	730	<0.1	<0.1	2.3	3.3
	0.546	GHD-Ellam-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	50,000	35,000	6.0	<5	110	<5	110	430	1,300	410	11,000	23,000	2,800	<0.1	0.3	2.2	0.8
	0.875	GHD-Ellam-202505-GR-SUR	20 May 2025	MARFL/EP25-4/1222511	46,000	32,000	14	<5	110	<5	110	440	1,300	430	11,000	18,000	2,400	<0.1	0.5	0.8	0.7
	0.712	GHD-Ellam-202506-GR-SUR	24 Jun 2025	MARFL/EP25-5/1236654	41,000	19,000	<5	<5	100	<5	100	350	980	300	8,000	13,000	1,800	<0.1	0.2	1.5	1.1
	0.666	GHD-Ellam-202506-GR-SUR	22 Jul 2025	MARFL/EP25-6/1247871	37,000	17,000	<5	<5	110	<5	110	310	890	270	7,500	13,000	1,800	<0.1	0.2	0.5	0.8
Ellam Street (SW04)	0.67	GHD-Ellam-202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	5,200	2,400	13	<5	65	<5	65	49	120	10	810	1,700	180	<0.1	0.2	0.6	2.3
	0.66	GHD-Ellam-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	8,100	4,900	-	<5	93	<5	93	80	210	29	1,500	2,600	260	<0.1	<0.1	18	1.4
	1.905	GHD-Ellam-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	50,000	34,000	8.0	<5	110	<5	110	410	1,200	390	12,000	20,000	2,800	<0.1	0.3	1.5	1.3
	2.076	GHD-Ellam-202505-GR-ARB	20 May 2025	MARFL/EP25-4/1222511	45,000	30,000	13	<5	98	<5	98	470	1,500	480	12,000	18,000	2,400	<0.1	0.5	0.4	0.5
	2.055	GHD-Ellam-202506-GR-ARB	24 Jun 2025	MARFL/EP25-5/1236654	45,000	25,000	<5	<5	100	<5	100	370	1,000	320	8,500	13,000	2,000	<0.1	0.4	1	0.9
	1.831	GHD-Ellam-202506-GR-ARB	22 Jul 2025	MARFL/EP25-6/1247871	40,000	19,000	8.0	<5	110	<5	110	340	970	300	8,300	13,000	1,900	<0.1	<0.1	0.2	0.6
	1.69	GHD-Ellam-202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	5,200	2,400	5.0	<5	66	<5	66	51	120	10	810	1,800	190	<0.1			



Appendix C
Table C.4
Inorganic, organics and major ion anions results
September 2025

				Inorganics			Acidity & Alkalinity					Major Ions						Minor Ions					
				Electrical conductivity (lab)	Total Dissolved Solids	Total Suspended Solids	Alkalinity (Carbonate as CaCO3)	Alkalinity (Bicarbonate as CaCO3)	Alkalinity (Hydroxide as CaCO3)	Alkalinity (total as CaCO3)	Calcium	Magnesium	Potassium	Sodium	Chloride (filtered)	Sulfate (filtered)	Sulfide	Chlorophyll b	Chlorophyll c	Phaeophytin a			
				µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	ug/L			
EQL				10	5	5	5	5	5	5	0.5	0.5	0.5	0.5	5	1	0.1						
ANZG (2018) - FW - 95% (updated 26 July 2021)																							
ANZG (2018) - MW - 95% species protection (updated 1/10/2021)																							
Location Code	Depth	Field ID	Date	Lab Report Number																			
Matilda Bay 1 (SW06)	0.517	GHD-MatBay1-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857			51,000	35,000	<5	<5	110	<5	110	440	1,300	420	11,000	21,000	2,900	<0.1	0.3	1.5	0.7
	0.867	GHD-MatBay1-202505-GR-SUR	20 May 2025	MARFL/EP25-4/1222511			46,000	31,000	11	<5	100	<5	100	480	1,400	460	12,000	18,000	2,500	<0.1	0.3	0.6	2.6
	0.687	GHD-MatBay1-202506-GR-SUR	24 Jun 2025	MARFL/EP25-5/1236654			44,000	23,000	<5	<5	100	<5	100	370	1,000	320	8,300	13,000	1,900	<0.1	0.7	0.8	0.8
	0.676	GHD-MatBay1-202506-GR-SUR	22 Jul 2025	MARFL/EP25-6/1247871			40,000	20,000	8.0	<5	110	<5	110	350	970	310	8,300	13,000	1,900	<0.1	0.3	0.9	0.8
	0.73	GHD-MatBay1-202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952			8,400	4,200	<5	<5	68	<5	68	72	190	33	1,400	3,000	310	<0.1	0.4	2.8	1.5
	0.69	GHD-MatBay1-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984			12,000	6,900	-	6.4	84	<5	90	100	280	64	2,200	3,800	460	<0.1	<0.1	11	3
	4.502	GHD-MatBay1-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857			51,000	36,000	7.0	<5	120	<5	120	430	1,300	410	11,000	22,000	2,900	<0.1	0.2	1	0.7
	4.368	GHD-MatBay1-202505-GR-ARB	20 May 2025	MARFL/EP25-4/1222511			46,000	33,000	18	<5	100	<5	100	470	1,400	440	11,000	18,000	2,500	<0.1	0.4	0.9	1.1
	4.447	GHD-MatBay1-202506-GR-ARB	24 Jun 2025	MARFL/EP25-5/1236654			50,000	28,000	<5	<5	110	<5	110	430	1,200	370	9,900	15,000	2,200	<0.1	0.3	0.2	1.7
	4.514	GHD-MatBay1-202506-GR-ARB	22 Jul 2025	MARFL/EP25-6/1247871			45,000	24,000	5.0	<5	110	<5	110	390	1,100	360	9,600	16,000	2,200	<0.1	0.1	0.2	0.7
Matilda Bay (SW07)	4.13	GHD-MatBay1-202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952			-	20,000	<5	<5	100	<5	100	270	790	230	6,400	13,000	1,700	<0.1	<0.1	0.1	1.6
	4	GHD-MatBay1-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984			-	26,000	-	<5	110	<5	110	350	1,100	310	9,000	16,000	2,100	<0.1	<0.1	1.4	2.8
	0.734	GHD-MatBay2-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857			50,000	36,000	<5	<5	110	<5	110	440	1,300	410	11,000	20,000	2,900	<0.1	0.3	1.6	1.1
	0.85	GHD-MatBay2-202505-GR-SUR	20 May 2025	MARFL/EP25-4/1222511			46,000	32,000	7.0	<5	110	<5	110	450	1,200	400	9,900	18,000	2,500	<0.1	0.5	0.9	1.1
	0.732	GHD-MatBay2-202506-GR-SUR	24 Jun 2025	MARFL/EP25-5/1236654			44,000	22,000	<5	<5	100	<5	100	390	1,100	340	8,800	13,000	2,000	<0.1	0.9	1	0.9
	0.699	GHD-MatBay2-202506-GR-SUR	22 Jul 2025	MARFL/EP25-6/1247871			39,000	18,000	<5	<5	110	<5	110	330	920	290	8,000	13,000	1,900	<0.1	0.3	0.7	0.9
	0.66	GHD-MatBay2-202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952			8,000	4,000	6.0	<5	70	<5	70	68	180	29	1,300	2,700	300	<0.1	0.3	3.1	2.7
	0.68	GHD-MatBay2-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984			12,000	7,100	-	<5	88	<5	88	100	270	64	2,100	3,700	440	<0.1	<0.1	40	3
	4.675	GHD-MatBay2-202404-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857			51,000	36,000	6.0	<5	98	<5	98	420	1,300	410	11,000	22,000	2,900	<0.1	0.2	1	0.9
	4.63	GHD-MatBay2-202505-GR-ARB	20 May 2025	MARFL/EP25-4/1222511			48,000	32,000	9.0	<5	110	<5	110	560	1,700	510	14,000	20,000	2,500	<0.1	0.4	0.9	1
Reference sites	4.79	GHD-MatBay2-202506-GR-ARB	24 Jun 2025	MARFL/EP25-5/1236654			51,000	28,000	<5	<5	110	<5	110	420	1,200	360	9,400	15,000	2,300	<0.1	0.2	0.2	0.9
	4.599	GHD-MatBay2-202506-GR-ARB	22 Jul 2025	MARFL/EP25-6/1247871			46,000	25,000	12	<5	120	<5	120	410	1,100	360	9,600	16,000	2,200	<0.1	0.1	0.2	0.6
	4.21	GHD-MatBay2-202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952			31,000	19,000	<5	<5	96	<5	96	260	760	220	6,200	12,000	1,600	<0.1	<0.1	<0.1	1.7
	4.35	GHD-MatBay2-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984			42,000	25,000	-	<5	110	<5	110	360	1,100	320	9,300	15,000	2,100	<0.1	<0.1	2.7	4.4
	0.749	GHD-6164602-MatCentral-SUR	29 Apr 2025	MAFRL/EP25-3/1213857			51,000	35,000	5.0	<5	110	<5	110	410	1,200	390	10,000	21,000	2,900	<0.1	0.2	1.1	0.8
	0.821	GHD-6164602-MatCentral-SUR	20 May 2025	MARFL/EP25-4/1222511			46,000	32,000	11	<5	100	<5	100	460	1,300	430	11,000	20,000	2,500	<0.1	0.4	0.5	2.2
	0.664	GHD-6164602-MatCentral-SUR	24 Jun 2025	MARFL/EP25-5/1236654			44,000	23,000	<5	<5	100	<5	100	360	1,000	320	8,400	13,000	2,000	<0.1	0.9	0.8	1
	0.724	GHD-6164602-MatCentral-SUR	22 Jul 2025	MARFL/EP25-6/1247871			41,000	20,000	5.0	<5	110	<5	110	360	1,000	320	8,600	14,000	2,000	<0.1	0.3	0.9	1
	0.71	GHD-6164602-MatCentral-SUR	28 Aug 2025	MAFRL/EP25-7/1261952			8,300	4,200	<5	<5	71	<5	71	77	200	32	1,400	2,800	320	<0.1	0.2	1.8	1.7
	0.69	GHD-6164602-MatCentral-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984			12,000	7,000	-	<5	91	<5	91	100	280	62	2,200	3,700	440	<0.1	<0.1	14	1.3
Narrows (SW09)	0.505	GHD-6160262-Nar-SUR	29 Apr 2025	MAFRL/EP25-3/1213857			51,000	34,000	<5	<5	110	<5	110	410	1,200	390	10,000	22,000	2,900	<0.1	0.4	1.3	0.9
	0.883	GHD-6160262-Nar-SUR	20 May 2025	MARFL/EP25-4/1222511			48,000	36,000	8.0	<5	110	<5	110	470	1,300	420	11,000	18,000	2,500	<0.1	0.5	0.7	0.7
	0.701	GHD-6160262-Nar-SUR	24 Jun 2025	MARFL/EP25-5/1236654			44,000	22,000	<5	<5	98	<5	98	340	940	290	7,700	13,000	2,000	<0.1	0.6	1.1	1.1
	0.63	GHD-6160262-Nar-SUR	22 Jul 2025	MARFL/EP25-6/1247871			37,000	17,000	<5	<5	110	<5	110	310	870	280	7,400	13,000	1,800	<0.1	0.2	0.5	0.6
	0.69	GHD-6160262-Nar-SUR	28 Aug 2025	MAFRL/EP25-7/1261952			4,300	2,200	9.0	<5	56	<5	56	41	99	9.4	670	1,300	160	<0.1	0.3	0.5	1.7
	0.65	GHD-6160262-Nar-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984			8,700	5,200	-	<5	91	<5	91	79	210	40	1,600	2,800	310	<0.1	<0.1	10	2.6
	0.765	GHD-6161869-Heathcote-SUR	29 Apr 2025	MAFRL/EP25-3/1213857			51,000	34,000	7.0	<5	110	<5	110	390	1,200	390	10,000	21,000	2,900	<0.1	<0.1	0.9	0.8
Heathcote (SW05)	0.841	GHD-6161869-Heathcote-SUR	20 May 2025	MARFL/EP25-4/1222511			48,000	33,000	15	<5	110	<5	110	470	1,400	420	11,000	18,000	2,500	<0.1	0.2	0.5	0.7
	0.658	GHD-6161869-Heathcote-SUR	24 Jun 2025	MARFL/EP25-5/1236654			46,000	23,000	<5	<5	110	<5	110	390	1,100	340	8,900	14,000	2,000	<0.1	0.6	0.8	0.9
	0.682	GHD-6161869-Heathcote-SUR	22 Jul 2025	MARFL/EP25-6/1247871			42,000	21,000	<5	<5	120	<5	120	350	990	310	8,500	14,000	2,100	<0.1	0.5	1	1.2
	0.66	GHD-6161869-Heathcote-SUR	28 Aug 2025	MAFRL/EP25-7/1261952			7,300	3,600	9.0	<5	64	<5	64	68	170	32	1,300	2,400	290	<0.1	0.2	0.7	1.6
	0.7	GHD-6161869-Heathcote-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984			12,000	6,900	-	<5	91	<5	91	100	290	63	2,200	3,700	440	<0.1	<0.1	14	0.3



Appendix C
Table C.4
Inorganic, organics and major ion anions results
September 2025

					Nutrients							
					Ammonia as N	Nitrogen (Total Oxidised) (as N)	Nitrogen (Total)	Kjeldahl Nitrogen Total	Nitrogen (Organic)	Chlorophyll a	Phosphorus (Total)	Phosphorus
					µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L
EQL												
ANZG (2018) - FW - 95% (updated 26 July 2021)					900							
ANZG (2018) - MW - 95% species protection (updated 1/10/2021)					910							
Location	Code	Depth	Field ID	Date	Lab Report Number							
Development Envelopes												
Applecross (SW01)	0.877	GHD-Applecross-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	4	<2	370	370	250	6	42	0.011
	0.751	GHD-Applecross-202505-GR-SUR	20 May 2025	MAFRL/EP25-4/1222511	26	4	310	310	210	2.8	35	0.014
	0.672	GHD-Applecross-202506-GR-SUR	24 Jun 2025	MAFRL/EP25-5/1236654	26	24	430	410	230	6.2	51	0.009
	0.703	GHD-Applecross-202507-GR-SUR	22 Jul 2025	MAFRL/EP25-6/1247871	20	14	350	330	220	5.3	24	0.003
	0.68	GHD-Applecross-202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	65	400	1,300	900	130	4	62	0.011
	0.702	GHD-Applecross-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	4	11	1,500	1,500	690	96	120	0.024
	3.47	GHD-Applecross-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	3	<2	340	340	230	6.1	42	0.01
	3.885	GHD-Applecross-202505-GR-ARB	20 May 2025	MAFRL/EP25-4/1222511	29	8	320	310	220	2.5	36	0.013
	4.392	GHD-Applecross-202506-GR-ARB	24 Jun 2025	MAFRL/EP25-5/1236654	31	13	350	330	160	1.2	38	0.01
	2.691	GHD-Applecross-202506-GR-ARB	22 Jul 2025	MAFRL/EP25-6/1247871	<3	3	260	250	170	6.2	26	0.006
Barrack Street (SW02)	2.45	GHD-Applecross-202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	110	380	1,100	720	360	6.2	46	0.014
	3.44	GHD-Applecross-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	110	37	870	840	470	3.5	57	0.031
	0.794	GHD-Barrack-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	6	2	350	350	250	2.4	45	0.015
	0.836	GHD-Barrack-202505-GR-SUR	20 May 2025	MAFRL/EP25-4/1222511	10	5	340	330	230	1.7	42	0.015
	0.65	GHD-Barrack-202506-GR-SUR	24 Jun 2025	MAFRL/EP25-5/1236654	4	14	350	330	230	6.7	32	0.007
	0.671	GHD-Barrack-202506-GR-SUR	22 Jul 2025	MAFRL/EP25-6/1247871	11	30	370	340	240	4.6	28	0.006
	0.7	GHD-Barrack-202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	62	450	1,700	1,200	900	3.7	120	0.057
	0.66	GHD-Barrack-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	4	19	1,000	990	470	46	52	0.02
	3.112	GHD-Barracks-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	<3	3	380	370	250	8.4	51	0.016
	3.133	GHD-Barrack-202505-GR-ARB	20 May 2025	MAFRL/EP25-4/1222511	11	6	380	370	220	2.5	42	0.014
Elizabeth Quay (SW03)	3.021	GHD-Barrack-202506-GR-ARB	24 Jun 2025	MAFRL/EP25-5/1236654	32	17	340	320	170	1	33	0.01
	3.086	GHD-Barrack-202506-GR-ARB	22 Jul 2025	MAFRL/EP25-6/1247871	8	4	260	260	180	2.3	27	0.006
	2.81	GHD-Barrack-202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	63	440	1,700	1,200	810	3.6	120	0.056
	2.95	GHD-Barrack-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	520	17	1,000	980	320	1.9	110	0.062
	0.548	GHD-ElizQuay-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	6	6	370	370	210	9.4	53	0.017
	0.862	GHD-ElizQuay-202505-GR-SUR	20 May 2025	MAFRL/EP25-4/1222511	15	8	350	350	240	4.3	45	0.016
	0.791	GHD-ElizQuay-202506-GR-SUR	24 Jun 2025	MAFRL/EP25-5/1236654	12	19	440	420	240	15	43	0.007
	0.695	GHD-ElizQuay-202506-GR-SUR	22 Jul 2025	MAFRL/EP25-6/1247871	15	43	470	430	240	8.1	38	0.006
	0.65	GHD-ElizQuay-202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	71	410	1,800	1,300	730	15	100	0.012
	0.69	GHD-ElizQuay-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	47	61	1,000	970	730	20	52	0.021
Ellam Street (SW04)	2.053	GHD-ElizQuay-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	6	6	360	360	260	6.6	52	0.017
	2.138	GHD-ElizQuay-202505-GR-ARB	20 May 2025	MAFRL/EP25-4/1222511	14	8	350	340	200	2.7	44	0.016
	1.934	GHD-ElizQuay-202506-GR-ARB	24 Jun 2025	MAFRL/EP25-5/1236654	18	20	420	400	220	5.9	46	0.008
	1.954	GHD-ElizQuay-202506-GR-ARB	22 Jul 2025	MAFRL/EP25-6/1247871	11	16	360	340	180	3.1	30	0.007
	1.74	GHD-ElizQuay-202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	74	430	1,700	1,300	670	8.7	100	0.013
	1.75	GHD-ElizQuay-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	190	45	1,000	970	640	8	65	0.035
	0.546	GHD-Ellam-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<3	<2	440	440	270	9.5	59	0.019
	0.875	GHD-Ellam-202505-GR-SUR	20 May 2025	MAFRL/EP25-4/1222511	5	3	380	370	240	4.6	49	0.018
	0.712	GHD-Ellam-202506-GR-SUR	24 Jun 2025	MAFRL/EP25-5/1236654	10	12	440	430	240	8.6	48	0.007
	0.666	GHD-Ellam-202506-GR-SUR	22 Jul 2025	MAFRL/EP25-6/1247871	34	70	540	470	240	2.7	34	0.008
Ellam Street (SW04)	0.67	GHD-Ellam-202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	56	430	1,700	1,300	1,000	4.7	130	0.061
	0.66	GHD-Ellam-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	4	120	1,300	1,200	800	50	92	0.021
	1.905	GHD-Ellam-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	<3	<2	420	420	280	6.9	59	0.02
	2.076	GHD-Ellam-202505-GR-ARB	20 May 2025	MAFRL/EP25-4/1222511	4	2	380	380	270	2.5	50	0.018
	2.055	GHD-Ellam-202506-GR-ARB	24 Jun 2025	MAFRL/EP25-5/1236654	43	22	320	300	170	5.8	30	0.009
	1.831	GHD-Ellam-202506-GR-ARB	22 Jul 2025	MAFRL/EP25-6/1247871	28	26	370	340	200	1	31	0.009
	1.69	GHD-Ellam-202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	57	440	1,800	1,300	1,100	4.5	130	0.06
	1.5	GHD-Ellam-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	4	110	1,300	1,200	820	12	97	0.022



Appendix C
Table C.4
Inorganic, organics and major ion anions results
September 2025

					Nutrients							
					Ammonia as N	Nitrogen (Total Oxidised) (as N)	Nitrogen (Total)	Kjeldahl Nitrogen Total	Nitrogen (Organic)	Chlorophyll a	Phosphorus (Total)	Phosphorus
					µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L
EQL												
ANZG (2018) - FW - 95% (updated 26 July 2021)					900							
ANZG (2018) - MW - 95% species protection (updated 1/10/2021)					910							
Location Code	Depth	Field ID	Date	Lab Report Number								
Matilda Bay 1 (SW06)	0.517	GHD-MatBay1-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<3	<2	320	320	280	6.2	45	0.014
	0.867	GHD-MatBay1-202505-GR-SUR	20 May 2025	MARFL/EP25-4/1222511	<3	<2	280	280	190	1.9	38	0.012
	0.687	GHD-MatBay1-202506-GR-SUR	24 Jun 2025	MARFL/EP25-5/1236654	25	24	340	310	250	4.8	29	0.009
	0.676	GHD-MatBay1-202506-GR-SUR	22 Jul 2025	MARFL/EP25-6/1247871	<3	5	290	290	190	4.8	22	0.004
	0.73	GHD-MatBay1-202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	47	400	1,500	1,100	740	16	80	0.024
	0.69	GHD-MatBay1-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	3	<2	1,000	1,000	770	31	52	0.017
	4.502	GHD-MatBay1-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	<3	<2	320	310	230	4.3	42	0.013
	4.368	GHD-MatBay1-202505-GR-ARB	20 May 2025	MARFL/EP25-4/1222511	<3	<2	300	290	180	4.1	38	0.012
	4.447	GHD-MatBay1-202506-GR-ARB	24 Jun 2025	MARFL/EP25-5/1236654	30	13	280	260	180	1	30	0.012
	4.514	GHD-MatBay1-202506-GR-ARB	22 Jul 2025	MARFL/EP25-6/1247871	9	8	230	230	160	1.6	25	0.006
Matilda Bay (SW07)	4.13	GHD-MatBay1-202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	170	190	790	600	190	0.4	38	0.019
	4	GHD-MatBay1-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	140	98	590	490	270	2.6	31	0.023
	0.734	GHD-MatBay2-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<3	<2	340	340	310	6.5	45	0.013
	0.85	GHD-MatBay2-202505-GR-SUR	20 May 2025	MARFL/EP25-4/1222511	<3	3	290	290	210	4.4	38	0.013
	0.732	GHD-MatBay2-202506-GR-SUR	24 Jun 2025	MARFL/EP25-5/1236654	22	25	350	320	220	7	31	0.008
	0.699	GHD-MatBay2-202506-GR-SUR	22 Jul 2025	MARFL/EP25-6/1247871	5	17	320	300	190	3.7	23	0.004
	0.66	GHD-MatBay2-202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	50	400	1,600	1,200	850	16	91	0.026
	0.68	GHD-MatBay2-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	3	<2	1,400	1,400	740	120	100	0.012
	4.675	GHD-MatBay2-202404-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	<3	<2	320	320	240	4.1	44	0.013
	4.63	GHD-MatBay2-202505-GR-ARB	20 May 2025	MARFL/EP25-4/1222511	<3	<2	310	310	190	4.1	40	0.014
Reference sites	4.79	GHD-MatBay2-202506-GR-ARB	24 Jun 2025	MARFL/EP25-5/1236654	26	15	320	300	140	1.1	31	0.01
	4.599	GHD-MatBay2-202506-GR-ARB	22 Jul 2025	MARFL/EP25-6/1247871	15	9	230	220	190	1.2	25	0.008
	4.21	GHD-MatBay2-202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	79	260	1,100	850	360	0.4	39	0.009
	4.35	GHD-MatBay2-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	160	99	600	500	280	5.2	35	0.028
	0.749	GHD-6164602-MatCentral-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<3	<2	320	310	240	4.5	42	0.013
	0.821	GHD-6164602-MatCentral-SUR	20 May 2025	MARFL/EP25-4/1222511	4	4	290	290	220	2	37	0.014
	0.664	GHD-6164602-MatCentral-SUR	24 Jun 2025	MARFL/EP25-5/1236654	30	28	360	330	260	5.2	30	0.009
	0.724	GHD-6164602-MatCentral-SUR	22 Jul 2025	MARFL/EP25-6/1247871	<3	4	330	320	220	4.7	29	0.004
	0.71	GHD-6164602-MatCentral-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	54	400	1,500	1,100	660	11	73	0.025
	0.69	GHD-6164602-MatCentral-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	4	<2	1,000	1,000	840	39	48	0.017
Narrows (SW09)	0.505	GHD-6160262-Nar-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<3	<2	380	370	230	5.9	50	0.016
	0.883	GHD-6160262-Nar-SUR	20 May 2025	MARFL/EP25-4/1222511	10	6	360	350	210	3.5	41	0.014
	0.701	GHD-6160262-Nar-SUR	24 Jun 2025	MARFL/EP25-5/1236654	20	15	410	400	220	6.1	36	0.007
	0.63	GHD-6160262-Nar-SUR	22 Jul 2025	MARFL/EP25-6/1247871	24	69	460	390	260	3	28	0.006
	0.69	GHD-6160262-Nar-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	61	460	1,600	1,200	780	4.1	100	0.049
	0.65	GHD-6160262-Nar-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	10	120	1,100	1,000	750	33	61	0.019
	0.765	GHD-6161869-Heathcote-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<3	<2	280	280	210	3.6	35	0.01
	0.841	GHD-6161869-Heathcote-SUR	20 May 2025	MARFL/EP25-4/1222511	8	3	260	260	180	2.3	31	0.011
	0.658	GHD-6161869-Heathcote-SUR	24 Jun 2025	MARFL/EP25-5/1236654	11	18	340	320	220	5.2	28	0.006
	0.682	GHD-6161869-Heathcote-SUR	22 Jul 2025	MARFL/EP25-6/1247871	<3	5	310	300	190	5.4	27	0.005
Heathcote (SW05)	0.66	GHD-6161869-Heathcote-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	66	410	1,600	1,200	690	4.8	85	0.034
	0.7	GHD-6161869-Heathcote-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	10	14	1,100	1,100	730	41	65	0.019



EQL	Metals												
	Aluminium	Aluminium (filtered)	Arsenic	Arsenic (filtered)	Cadmium	Cadmium (filtered)	Chromium (II+VI)	Chromium (II+VI) (filtered)	Cobalt	Cobalt (filtered)	Copper	Copper (filtered)	Iron
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
ANZG (2018) - FW - 95% (updated 26 July 2021)	0.05	0.05	0.001	0.001	0.0001	0.0001	0.001	0.001	0.001	0.001	0.001	0.001	0.01
ANZG (2018) - MW - 95% species protection (updated 1/10/2021)	0.055	0.055	0.013	0.013	0.0002	0.0002	0.001	0.001	0.001	0.001	0.0013	0.0013	
					0.0055	0.0055	0.0044	0.0044	0.001	0.001	0.0013	0.0013	

Location	Code	Depth	Field ID	Date	Lab Report Number														
Development Envelopes																			
Applecross (SW01)	0.877		GHD-Applecross-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	0.26	<0.05	<0.05	<0.001	<0.001	<0.0001	<0.0001	0.002	<0.001	<0.001	<0.001	0.06		
	0.751		GHD-Applecross-202505-GR-SUR	20 May 2025	MAFRL/EP25-4/1222511		<0.05	<0.05	<0.001	<0.001	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.15		
	0.672		GHD-Applecross-202506-GR-SUR	24 Jun 2025	MARFL/EP25-5/1236654		<0.05	<0.05	0.003	0.001	<0.0001	<0.0001	0.003	<0.001	<0.001	<0.001	0.09		
	0.703		GHD-Applecross-202507-GR-SUR	22 Jul 2025	MARFL/EP25-6/1247871		<0.05	<0.05	0.002	0.001	0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.02		
	0.68		GHD-Applecross - 202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	0.18	<0.05	0.012	0.004	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	0.32	
	0.7		GHD-Applecross-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	0.22	0.022	0.001	0.001	<0.0002	<0.0001	0.0007	0.0003	0.0002	0.0002	0.0029	0.0025	0.27	
	3.47		GHD-Applecross-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	0.26	<0.05	<0.001	<0.001	<0.0001	<0.0001	0.001	<0.001	<0.001	<0.001	0.003	<0.001	0.07	
	3.885		GHD-Applecross-202505-GR-ARB	20 May 2025	MAFRL/EP25-4/1222511		<0.05	<0.05	<0.001	<0.001	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	0.02	
	4.392		GHD-Applecross-202506-GR-ARB	24 Jun 2025	MARFL/EP25-5/1236654		<0.05	<0.05	0.004	0.002	0.0002	<0.0001	0.002	<0.001	<0.001	<0.001	0.001	<0.001	0.10
	2.691		GHD-Applecross-202507-GR-ARB	22 Jul 2025	MARFL/EP25-6/1247871		<0.05	<0.05	0.002	0.001	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	0.02
Barrack Street (SW02)	2.45		GHD-Applecross - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	0.09	<0.05	0.013	0.004	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.17	
	3.44		GHD-Applecross-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	0.047	0.005	0.0018	0.0014	<0.0001	<0.0001	0.0002	<0.0002	0.00026	0.00026	0.013	0.0012	0.17	
	0.794		GHD-Barracks-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	0.29	<0.05	<0.001	<0.001	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	0.15	
	0.836		GHD-Barrack-202505-GR-SUR	20 May 2025	MARFL/EP25-4/1222511		<0.05	<0.05	<0.001	<0.001	0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.15
	0.65		GHD-Barrack-202506-GR-SUR	24 Jun 2025	MARFL/EP25-5/1236654	<0.05 ⁸¹	<0.05	0.002	0.002	<0.0001	<0.0001	0.002	0.001	<0.001	<0.001	0.001	<0.001	0.09	
	0.671		GHD-Barrack-202507-GR-SUR	22 Jul 2025	MARFL/EP25-6/1247871		<0.05	<0.05	0.002	0.001	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	0.04
	0.7		GHD-Barrack - 202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	0.84	<0.05	0.009	0.003	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	1.2	
	0.66		GHD-Barrack-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	0.37	0.012	<0.001	0.0008	<0.0002	<0.0001	0.0008	0.0003	0.0004	0.0003	0.0024	0.0019	0.59	
	3.112		GHD-Barracks-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	0.30	<0.05	0.001	<0.001	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	0.16	
	3.133		GHD-Barrack-202505-GR-ARB	20 May 2025	MARFL/EP25-4/1222511	0.07	<0.05	<0.001	<0.001	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.19	
Elizabeth Quay (SW03)	3.021		GHD-Barrack-202506-GR-ARB	24 Jun 2025	MARFL/EP25-5/1236654	0.07 ⁸¹	<0.05	0.003	0.002	<0.0001	<0.0001	0.002	<0.001	<0.001	<0.001	0.001	<0.001	0.16	
	3.086		GHD-Barrack-202507-GR-ARB	22 Jul 2025	MARFL/EP25-6/1247871	0.07	<0.05	0.002	0.002	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	0.21	
	2.81		GHD-Barrack - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	0.68	<0.05	0.008	0.003	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	1.0	
	2.95		GHD-Barrack-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	0.091	<0.005	0.0022	0.002	<0.0001	<0.0001	0.0003	<0.0002	0.00044	0.00044	0.0011	0.0006	0.66	
	0.548		GHD-ElizQuay-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	0.29	<0.05	<0.001	<0.001	<0.0001	<0.0001	0.002	<0.001	<0.001	<0.001	0.002	<0.001	0.18	
	0.862		GHD-ElizQuay-202505-GR-SUR	20 May 2025	MARFL/EP25-4/1222511	0.08	<0.05	0.001	<0.001	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.16	
	0.791		GHD-ElizQuay-202506-GR-SUR	24 Jun 2025	MARFL/EP25-5/1236654	<0.05 ⁸¹	<0.05	0.003	0.003	<0.0001	<0.0001	0.002	0.001	<0.001	<0.001	0.001	<0.001	0.09	
	0.695		GHD-ElizQuay-202507-GR-SUR	22 Jul 2025	MARFL/EP25-6/1247871		<0.05	<0.05	0.002	0.001	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	0.07
	0.65		GHD-ElizQuay - 202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	0.48	<0.05	0.003	0.003	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	0.92	
	0.69		GHD-ElizQuay-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	0.38	0.012	<0.001	0.0009	<0.0002	<0.0001	0.001	0.0002	0.0004	0.00032	0.002	0.0018	0.62	
Ellam Street (SW04)	2.053		GHD-ElizQuay-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	0.38	<0.05	<0.001	<0.001	<0.0001	<0.0001	0.002	<0.001	<0.001	<0.001	0.002	<0.001	0.23	
	2.138		GHD-ElizQuay-202505-GR-ARB	20 May 2025	MARFL/EP25-4/1222511	0.08	<0.05	0.001	<0.001	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.19	
	1.934		GHD-ElizQuay-202506-GR-ARB	24 Jun 2025	MARFL/EP25-5/1236654	<0.05 ⁸¹	<0.05	0.003	0.002	<0.0001	<0.0001	0.002	0.003	<0.001	<0.001	0.001	0.001	0.10	
	1.954		GHD-ElizQuay-202507-GR-ARB	22 Jul 2025	MARFL/EP25-6/1247871		<0.05	<0.05	0.002	0.002	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	0.10
	1.74		GHD-ElizQuay - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	0.69	<0.05	0.009	0.003	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	1.1	
	1.75		GHD-ElizQuay-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	0.26	0.008	0.001	0.0012	<0.0002	<0.0001	0.0008	0.0002	0.0004	0.00038	0.0017	0.0014	0.52	
	0.546		GHD-Ellam-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	0.36	<0.05	<0.001	<0.001	<0.0001	<0.0001	0.001	<0.001	<0.001	<0.001	0.002	<0.001	0.22	
	0.875		GHD-Ellam-202505-GR-SUR	20 May 2025	MARFL/EP25-4/1222511		<0.05	<0.05	<0.001	<0.001	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.15
	0.712		GHD-Ellam-202506-GR-SUR	24 Jun 2025	MARFL/EP25-5/1236654	<0.05 ⁸¹	<0.05	0.003	0.002	<0.0001	0.0001	0.004	0.002	<0.001	<0.001	0.001	<0.001	0.13	
	0.666		GHD-Ellam-202507-GR-SUR	22 Jul 2025	MARFL/EP25-6/1247871		<0.05	<0.05	0.002	0.001	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	0.07
Ellam Street (SW04)	0.67		GHD-Ellam - 202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	0.57	<0.05	0.010	0.003	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.88	
	0.66		GHD-Ellam-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	0.53	0.012	<0.001	0.0006	<0.0002	<0.0001	0.001	0.0003	0.0004	0.00032	0.0023	0.0018	0.79	
	1.905		GHD-Ellam-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	0.30	<0.05	<0.001	<0.001	<0.0001	<0.0001	0.001	<0.001	<0.001	<0.001	0.003	<0.001	0.19	
	2.076		GHD-Ellam-202505-GR-ARB	20 May 2025	MARFL/EP25-4/1222511		<0.05	<0.05	<0.001	<0.001	0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.15
	2.055		GHD-Ellam-202506-GR-ARB	24 Jun 2025	MARFL/EP25-5/1236654	0.08 ⁸¹	<0.05	0.004	0.002	<0.0001	<0.0001	0.003	<0.001	<0.001	<0.001	0.007	<0.001	0.28	



				Metals														
				Aluminium	Aluminium (filtered)	Arsenic	Arsenic (filtered)	Cadmium	Cadmium (filtered)	Chromium (II+VI)	Chromium (II+VI) (filtered)	Cobalt	Cobalt (filtered)	Copper	Copper (filtered)	Iron		
				mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L		
EQL				0.05	0.05	0.001	0.001	0.0001	0.0001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.01	
ANZG (2018) - FW - 95% (updated 26 July 2021)				0.055	0.055	0.013	0.013	0.0002	0.0002	0.001	0.001			0.0014	0.0014			
ANZG (2018) - MW - 95% species protection (updated 1/10/2021)								0.0055	0.0055	0.0044	0.0044	0.001	0.001	0.0013	0.0013			
Location Code	Depth	Field ID	Date	Lab Report Number														
Matilda Bay 1 (SW06)	1.831	GHD-Ellam-202507-GR-ARB	22 Jul 2025	MAFRL/EP25-6/1247871	<0.05	<0.05	0.002	0.001	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	0.10	
	1.69	GHD-Ellam - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	0.66	<0.05	0.009	0.003	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	1.1	
	1.5	GHD-Ellam-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	0.55	0.012	<0.001	0.0006	<0.0002	<0.0001	0.0011	0.0003	0.0004	0.00035	0.002	0.0018	0.8	
	0.517	GHD-MatBay1-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	0.28	<0.05	<0.001	<0.001	<0.0001	<0.0001	0.001	<0.001	<0.001	<0.001	0.003	<0.001	0.10	
	0.867	GHD-MatBay1-202505-GR-SUR	20 May 2025	MAFRL/EP25-4/1222511	0.06	<0.05	<0.001	<0.001	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.14	
	0.687	GHD-MatBay1-202506-GR-SUR	24 Jun 2025	MAFRL/EP25-5/1236654	<0.05 ^{FI}	<0.05	0.002	0.001	<0.0001	<0.0001	0.002	0.002	<0.001	<0.001	0.002	<0.001	0.10	
	0.676	GHD-MatBay1-202507-GR-SUR	22 Jul 2025	MAFRL/EP25-6/1247871	<0.05	<0.05	0.002	0.002	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	0.03	
	0.73	GHD MatBay1 - 202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	0.66	<0.05	0.010	0.003	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	0.83	
	0.69	GHD-MatBay1-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	0.21	0.012	<0.001	0.0009	<0.0002	<0.0001	0.0007	0.0002	0.0003	0.00023	0.0025	0.0022	0.36	
	4.502	GHD-MatBay1-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	0.24	<0.05	<0.001	<0.001	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	0.09	
	4.368	GHD-MatBay1-202505-GR-ARB	20 May 2025	MARFL/EP25-4/1222511	<0.05	<0.05 ^{FI}	0.001	<0.001	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.13	
	4.447	GHD-MatBay1-202506-GR-ARB	24 Jun 2025	MAFRL/EP25-5/1236654	0.14 ^{FI}	0.06	0.002 ^{FI}	0.004	<0.0001	0.0001	0.003 ^{FI}	<0.001	<0.001 ^{FI}	<0.001	0.002 ^{FI}	<0.001	0.31 ^{FI}	
Matilda Bay (SW07)	4.514	GHD-MatBay1-202507-GR-ARB	22 Jul 2025	MAFRL/EP25-6/1247871	<0.05	<0.05	0.002	0.001	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	0.04	
	4.13	GHD MatBay1 - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	0.06	<0.05	0.016	0.004	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	0.08	
	4	GHD-MatBay1-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	0.043	<0.005	0.0015	0.0015	<0.0001	<0.0001	0.0002	<0.0002	0.00024	0.00023	0.0012	0.0011	0.07	
	0.734	GHD-MatBay2-202404-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	0.24	<0.05	0.002	0.002	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	0.08	
	0.85	GHD-MatBay2-202505-GR-SUR	20 May 2025	MAFRL/EP25-4/1222511	<0.05	<0.05 ^{FI}	<0.001	<0.001	<0.0001	<0.0001	0.002	0.002	<0.001	<0.001	<0.001	<0.001	0.13	
	0.732	GHD-MatBay2-202506-GR-SUR	24 Jun 2025	MAFRL/EP25-5/1236654	0.06 ^{FI}	<0.05	0.003	0.003	<0.0001	<0.0001	0.002	<0.001	<0.001	<0.001	0.002	<0.001	0.09	
	0.699	GHD-Maybay2-202507-GR-SUR	22 Jul 2025	MAFRL/EP25-6/1247871	<0.05	<0.05	0.002	0.002	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	0.04	
	0.66	GHD Maybay2 - 202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	0.38	<0.05	0.010	0.003	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	0.77	
	0.68	GHD-MatBay2-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	0.21	0.013	0.001	0.0009	<0.0002	<0.0001	0.0006	0.0003	0.0003	0.00026	0.0023	0.0022	0.35	
	4.675	GHD-MatBay2-202404-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	0.25	<0.05	<0.001	<0.001	<0.0001	<0.0001	0.001	<0.001	<0.001	<0.001	0.002	<0.001	0.09	
	4.63	GHD-MatBay2-202505-GR-ARB	20 May 2025	MAFRL/EP25-4/1222511	0.07	<0.05	0.009	0.004	<0.0001	<0.0001	0.001	<0.001	<0.001	<0.001	0.001	<0.001	0.13	
	4.79	GHD-MatBay2-202506-GR-ARB	24 Jun 2025	MAFRL/EP25-5/1236654	<0.05 ^{FI}	<0.05	0.003	0.003	<0.0001	<0.0001	0.004	<0.001	<0.001	<0.001	0.002	<0.001	0.13	
Reference sites	4.599	GHD-Matbay2-202507-GR-ARB	22 Jul 2025	MAFRL/EP25-6/1247871	<0.05	<0.05	0.002	0.002	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	0.07	
	4.21	GHD Maybay2 - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	0.05	<0.05	0.014	0.005	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.09	
	4.35	GHD-MatBay2-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	0.053	<0.005	0.0016	0.0016	<0.0001	<0.0001	0.0002	<0.0002	0.00027	0.00026	0.0013	0.001	0.083	
	Matilda Bay Central (SW08)	0.749	GHD-6164602-MatCentral-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	0.24	<0.05	0.001	<0.001	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	0.05
		0.821	GHD-6164602-MatCentral-SUR	20 May 2025	MAFRL/EP25-4/1222511	0.05	<0.05	<0.001	<0.001	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.008	0.002	0.15
		0.664	GHD-6164602-MatCentral-SUR	24 Jun 2025	MAFRL/EP25-5/1236654	<0.05 ^{FI}	<0.05	0.003	0.002	<0.0001	0.0001	0.006	<0.001	<0.001	<0.001	0.006	<0.001	0.48
		0.724	GHD-6164602-MatCentral-SUR	22 Jul 2025	MAFRL/EP25-6/1247871	<0.05	<0.05	0.003	0.002	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	0.02
		0.71	GHD-6164602 - MatCentral SUR	28 Aug 2025	MAFRL/EP25-7/1261952	0.45	<0.05	0.011	0.004	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	0.80
	Narrows (SW09)	0.69	GHD-6164602-MatCentral-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	0.14	0.013	0.0008	0.0008	<0.0001	<0.0001	0.0005	0.0002	0.00027	0.00024	0.0024	0.002	0.36
		0.505	GHD-6160262-Nar-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	0.38	0.05	<0.001	<0.001	<0.0001	<0.0001	0.001	<0.001	<0.001	<0.001	0.003	<0.001	0.30
		0.883	GHD-6160262-Nar-SUR	20 May 2025	MAFRL/EP25-4/1222511	<0.05	<0.05	<0.001	<0.001	<0.0001	<0.0001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	0.09
		0.701	GHD-61610262-Nar-SUR	24 Jun 2025	MAFRL/EP25-5/1236654	<0.05 ^{FI}	<0.05	0.002	0.002	<0.0001	<0.0001	0.003	0.004	<0.001	<0.001	0.002	0.006	0.09
0.63		GHD-6160262-Nar-SUR	22 Jul 2025	MAFRL/EP25-6/1247871	<0.05	<0.05	0.002	0.002	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	0.05	
Heathcote (SW05)	0.69	GHD - 6160262 - Nar - SUR	28 Aug 2025	MAFRL/EP25-7/1261952	1.2	<0.05	0.010	0.003	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	1.4	
	0.65	GHD-6160262-Nar-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	0.56	0.013	<0.001	0.0007	<0.0002	<0.0001	0.001	0.0003	0.0004	0.00031	0.0024	0.002	0.76	
	0.765	GHD-6161869-Heathcote-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	0.21	<0.05	<0.001	<0.001	<0.0001	<0.0001	0.001	<0.001	<0.001	<0.001	0.002	<0.001	0.03	
	0.841	GHD-6161869-Heathcote-SUR	20 May 2025	MAFRL/EP25-4/1222511	0.07	<0.05	0.009	0.002	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.002	0.002	0.20	
	0.658	GHD-6161869-Heathcote-SUR	24 Jun 2025	MAFRL/EP25-5/1236654	<0.05 ^{FI}	<0.05	0.003	0.002	<0.0001	<0.0001	0.003	0.003	<0.001	<0.001	0.001	<0.001	0.07	
0.682	GHD-6161869-Heathcote-SUR	22 Jul 2025	MAFRL/EP25-6/1247871	<0.05	<0.05	0.002	0.002	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	0.02		
0.66	GHD-6161869 - Heathcote-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	0.62	<0.05	0.008	0.003	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.77	
0.7	GHD-6161869-Heathcote-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	0.32	0.014	<0.001	0.0008	<0.0002	<0.0001	0.0008	0.0003	0.0003	0.00025	0.0021	0.0021	0.47		

				Metals													
				Iron (filtered)	Lead	Lead (filtered)	Manganese	Manganese (filtered)	Mercury	Mercury (filtered)	Molybdenum	Molybdenum (filtered)	Nickel	Nickel (filtered)	Selenium	Selenium (filtered)	
				mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	
EQL				0.01	0.001	0.001	0.005	0.005	0.00004	0.00004	0.001	0.001	0.001	0.001	0.001	0.001	
ANZG (2018) - FW - 95% (updated 26 July 2021)					0.0034	0.0034	1.9	1.9	0.0006	0.0006			0.011	0.011	0.011	0.011	
ANZG (2018) - MW - 95% species protection (updated 1/10/2021)					0.0044	0.0044			0.0004	0.0004			0.07	0.07			
Location Code	Depth	Field ID	Date	Lab Report Number													
Development Envelopes																	
Applecross (SW01)	0.877	GHD-Applecross-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<0.01	0.001	<0.001	0.025	0.009	0.0004	<0.0001	0.016	0.015	0.001	<0.001	0.008	<0.001
	0.751	GHD-Applecross-202505-GR-SUR	20 May 2025	MAFRL/EP25-4/1222511	0.09	<0.001	<0.001	0.015	0.015	<0.0001	<0.0001	0.013	0.017	<0.001	<0.001	0.006	0.003
	0.672	GHD-Applecross-202506-GR-SUR	24 Jun 2025	MARFL/EP25-5/1236654	0.06	<0.001	<0.001	0.025	0.023	0.0003	0.0001	0.011	0.011	<0.001	<0.001	<0.001	<0.001
	0.703	GHD-Applecross-202507-GR-SUR	22 Jul 2025	MARFL/EP25-6/1247871	<0.01	<0.001	<0.001	0.016	0.013	0.0002	0.0001	0.010	0.009	<0.001	<0.001	<0.001	<0.001
	0.68	GHD-Applecross - 202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	0.08	<0.001	<0.001	0.021	0.021	<0.0001	<0.0001	0.003	0.003	<0.001	<0.001	0.002	0.002
	0.7	GHD-Applecross-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	0.11	0.0004	0.0002	0.022	0.016	<0.00004	<0.00004	-	-	0.001	0.0008	<0.002	<0.001
	3.47	GHD-Applecross-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	<0.01	0.002	<0.001	0.023	0.009	0.0002	<0.0001	0.015	0.015	<0.001	<0.001	0.006	<0.001
	3.885	GHD-Applecross-202505-GR-ARB	20 May 2025	MAFRL/EP25-4/1222511	0.02	<0.001	<0.001	<0.005	<0.005	<0.0001	<0.0001	0.014	0.014	0.001	<0.001	0.007	<0.001
	4.392	GHD-Applecross-202506-GR-ARB	24 Jun 2025	MARFL/EP25-5/1236654	0.01	0.003	<0.001	0.017	<0.005	0.0003	0.0003	0.011	0.013	0.001	<0.001	<0.001	0.001
	2.691	GHD-Applecross-202507-GR-ARB	22 Jul 2025	MARFL/EP25-6/1247871	<0.01	<0.001	<0.001	0.012	0.008	0.0002	<0.0001	0.009	0.009	<0.001	<0.001	<0.001	<0.001
Barrack Street (SW02)	2.45	GHD-Applecross - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	0.04	<0.001	<0.001	0.053	0.051	<0.0001	<0.0001	0.004	0.004	<0.001	<0.001	0.001	0.001
	3.44	GHD-Applecross-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	0.035	0.0002	<0.0001	0.22	0.2	<0.00004	<0.00004	-	-	0.0007	0.0006	<0.001	<0.001
	0.794	GHD-Barracks-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<0.01	0.002	<0.001	0.025	0.010	0.0003	<0.0001	0.015	0.015	<0.001	<0.001	0.006	0.001
	0.836	GHD-Barrack-202505-GR-SUR	20 May 2025	MARFL/EP25-4/1222511	0.13	<0.001	<0.001	0.021	0.021	0.0007	<0.0001	0.014	0.014	<0.001	<0.001	0.012	0.001
	0.65	GHD-Barrack-202506-GR-SUR	24 Jun 2025	MARFL/EP25-5/1236654	0.06	<0.001	<0.001	0.029	0.030	<0.0001	0.0002	0.010	0.010	<0.001	<0.001	<0.001	<0.001
	0.671	GHD-Barrack-202507-GR-SUR	22 Jul 2025	MARFL/EP25-6/1247871	<0.01	<0.001	<0.001	0.020	0.014	0.0002	0.0001	0.009	0.008	<0.001	<0.001	<0.001	<0.001
	0.7	GHD-Barrack - 202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	0.20	<0.001	<0.001	0.036	0.034	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	0.66	GHD-Barrack-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	0.17	0.0005	0.0001	0.056	0.059	<0.00004	<0.00004	-	-	0.0012	0.0011	<0.002	<0.001
	3.112	GHD-Barracks-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	<0.01	0.001	<0.001	0.025	0.010	0.0003	<0.0001	0.015	0.015	0.001	<0.001	0.012	0.001
	3.133	GHD-Barrack-202505-GR-ARB	20 May 2025	MARFL/EP25-4/1222511	0.17	<0.001	<0.001	0.022	0.022	0.0003	<0.0001	0.014	0.014	0.001	<0.001	0.004	<0.001
Elizabeth Quay (SW03)	3.021	GHD-Barrack-202506-GR-ARB	24 Jun 2025	MARFL/EP25-5/1236654	<0.01	<0.001	<0.001	0.028	0.010	<0.0001	0.0002	0.011	0.012	0.001	<0.001	<0.001	<0.001
	3.086	GHD-Barrack-202507-GR-ARB	22 Jul 2025	MARFL/EP25-6/1247871	<0.01	<0.001	<0.001	0.019	0.006	0.0001	<0.0001	0.010	0.011	<0.001	<0.001	<0.001	<0.001
	2.81	GHD-Barrack - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	0.19	<0.001	<0.001	0.035	0.035	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	2.95	GHD-Barrack-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	0.19	0.0004	<0.0001	0.53	0.53	<0.00004	<0.00004	-	-	0.0006	0.0005	<0.001	<0.001
	0.548	GHD-ElizQuay-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<0.01	0.001	<0.001	0.024	0.011	0.0004	0.0002	0.014	0.014	0.001	<0.001	0.007	0.002
	0.862	GHD-ElizQuay-202505-GR-SUR	20 May 2025	MARFL/EP25-4/1222511	0.13	<0.001	<0.001	0.022	0.022	0.0004	<0.0001	0.015	0.015	<0.001	<0.001	0.010	<0.001
	0.791	GHD-ElizQuay-202506-GR-SUR	24 Jun 2025	MARFL/EP25-5/1236654	0.07	<0.001	<0.001	0.038	0.040	<0.0001	0.0002	0.010	0.011	0.001	<0.001	<0.001	<0.001
	0.695	GHD-ElizQuay-202507-GR-SUR	22 Jul 2025	MARFL/EP25-6/1247871	<0.01	<0.001	<0.001	0.024	0.016	<0.0001	<0.0001	0.008	0.008	<0.001	<0.001	<0.001	<0.001
	0.65	GHD-ElizQuay - 202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	0.16	0.004	<0.001	0.033	0.030	<0.0001	<0.0001	<0.001	<0.001	0.001	0.001	<0.001	<0.001
	0.69	GHD-ElizQuay-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	0.18	0.0004	0.0001	0.12	0.12	<0.00004	<0.00004	-	-	0.0012	0.0009	<0.002	<0.001
Ellam Street (SW04)	2.053	GHD-ElizQuay-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	<0.01	0.002	<0.001	0.027	0.009	0.0002	0.0001	0.015	0.015	0.001	<0.001	0.012	<0.001
	2.138	GHD-ElizQuay-202505-GR-ARB	20 May 2025	MARFL/EP25-4/1222511	0.14	<0.001	<0.001	0.024	0.021	0.0002	<0.0001	0.015	0.014	<0.001	<0.001	0.006	0.001
	1.934	GHD-ElizQuay-202506-GR-ARB	24 Jun 2025	MARFL/EP25-5/1236654	0.10	<0.001	<0.001	0.034	0.040	<0.0001	0.0001	0.009	0.011	<0.001	<0.001	<0.001	<0.001
	1.954	GHD-ElizQuay-202507-GR-ARB	22 Jul 2025	MARFL/EP25-6/1247871	<0.01	<0.001	<0.001	0.018	0.010	0.0002	<0.0001	0.009	0.009	<0.001	<0.001	<0.001	<0.001
	1.74	GHD-ElizQuay - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	0.19	<0.001	<0.001	0.032	0.032	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	1.75	GHD-ElizQuay-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	0.13	0.0004	<0.0001	0.28	0.27	<0.00004	<0.00004	-	-	0.0009	0.0009	<0.002	<0.001
	0.546	GHD-Ellam-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<0.01	0.002	<0.001	0.032	0.017	0.0001	<0.0001	0.016	0.015	0.001	<0.001	0.008	0.001
	0.875	GHD-Ellam-202505-GR-SUR	20 May 2025	MARFL/EP25-4/1222511	0.10	<0.001	<0.001	0.025	0.025	0.0002	<0.0001	0.014	0.014	<0.001	<0.001	0.008	<0.001
	0.712	GHD-Ellam-202506-GR-SUR	24 Jun 2025	MARFL/EP25-5/1236654	0.09	<0.001	<0.001	0.058	0.054	<0.0001	<0.0001	0.009	0.009	<0.001	0.010	<0.001	<0.001
	0.666	GHD-Ellam-202507-GR-SUR	22 Jul 2025	MARFL/EP25-6/1247871	<0.01	<0.001	<0.001	0.030	0.024	<0.0001	<0.0001	0.008	0.008	<0.001	<0.001	<0.001	<0.001

					Metals												
					Iron (filtered)	Lead	Lead (filtered)	Manganese	Manganese (filtered)	Mercury	Mercury (filtered)	Molybdenum	Molybdenum (filtered)	Nickel	Nickel (filtered)	Selenium	Selenium (filtered)
					mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL					0.01	0.001	0.001	0.005	0.005	0.00004	0.00004	0.001	0.001	0.001	0.001	0.001	0.001
ANZG (2018) - FW - 95% (updated 26 July 2021)						0.0034	0.0034	1.9	1.9	0.0006	0.0006			0.011	0.011	0.011	0.011
ANZG (2018) - MW - 95% species protection (updated 1/10/2021)						0.0044	0.0044			0.0004	0.0004			0.07	0.07		
Location Code	Depth	Field ID	Date	Lab Report Number													
Matilda Bay 1 (SW06)	1.831	GHD-Ellam-202507-GR-ARB	22 Jul 2025	MAFRL/EP25-6/1247871	<0.01	<0.001	<0.001	0.025	0.017	<0.0001	<0.0001	0.009	0.008	<0.001	<0.001	<0.001	<0.001
	1.69	GHD-Ellam - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	0.22	0.001	<0.001	0.034	0.034	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	1.5	GHD-Ellam-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	0.22	0.0006	0.0001	0.068	0.068	<0.00004	<0.00004	0.0015	0.0011	<0.002	<0.001		
	0.517	GHD-MatBay1-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<0.01	0.001	<0.001	0.022	0.007	0.0002	<0.0001	0.015	0.015	0.002	<0.001	0.010	<0.001
	0.867	GHD-MatBay1-202505-GR-SUR	20 May 2025	MAFRL/EP25-4/1222511	0.09	<0.001	<0.001	0.014	0.014	<0.0001	<0.0001	0.014	0.014	0.001	<0.001	0.012	<0.001
	0.687	GHD-MatBay1-202506-GR-SUR	24 Jun 2025	MARFL/EP25-5/1236654	0.17	<0.001	<0.001	0.026	0.029	<0.0001	0.0004	0.012	0.011	<0.001	<0.001	0.002	0.002
	0.676	GHD-MatBay1-202507-GR-SUR	22 Jul 2025	MARFL/EP25-6/1247871	<0.01	<0.001	<0.001	0.016	0.011	<0.0001	<0.0001	0.009	0.008	<0.001	<0.001	<0.001	<0.001
	0.73	GHD MatBay1 - 202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	0.14	<0.001	<0.001	0.032	0.032	<0.0001	<0.0001	0.001	0.001	<0.001	<0.001	0.001	0.001
	0.69	GHD-MatBay1-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	0.11	0.0003	0.0001	0.027	0.018	<0.00004	<0.00004	-	-	0.0011	0.001	<0.002	<0.001
	4.502	GHD-MatBay1-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	<0.01	<0.001	<0.001	0.023	0.006	0.0002	<0.0001	0.015	0.015	<0.001	<0.001	0.011	<0.001
	4.368	GHD-MatBay1-202505-GR-ARB	20 May 2025	MARFL/EP25-4/1222511	0.08	<0.001	<0.001	0.014	0.014	0.0002	<0.0001	0.014	0.014	<0.001	<0.001	0.009	0.001
	4.447	GHD-MatBay1-202506-GR-ARB	24 Jun 2025	MARFL/EP25-5/1236654	0.16	<0.001	0.001	0.025 ^{W2}	0.022	<0.0001	0.0005	0.016	0.015	0.001 ^{W2}	<0.001	0.003 ^{W2}	0.002
	4.514	GHD-MatBay1-202507-GR-ARB	22 Jul 2025	MARFL/EP25-6/1247871	<0.01	<0.001	<0.001	0.015	0.006	<0.0001	<0.0001	0.010	0.009	<0.001	<0.001	<0.001	<0.001
	4.13	GHD MatBay1 - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	0.02	<0.001	<0.001	0.045	0.040	<0.0001	<0.0001	0.007	0.007	0.066	0.003	0.002	<0.001
4	GHD-MatBay1-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	0.009	0.0002	<0.0001	0.17	0.16	<0.00004	<0.00004	-	-	0.0005	0.0005	<0.001	<0.001	
Matilda Bay (SW07)	0.734	GHD-MatBay2-202404-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	0.05	0.001	<0.001	0.021	0.019	0.0001	0.0001	0.016	0.016	0.001	<0.001	0.006	0.003
	0.85	GHD-MatBay2-202505-GR-SUR	20 May 2025	MARFL/EP25-4/1222511	0.11	<0.001	<0.001	0.013	0.013	<0.0001	<0.0001	0.012	0.012	0.002	0.001	0.005	0.002
	0.732	GHD-MatBay2-202506-GR-SUR	24 Jun 2025	MARFL/EP25-5/1236654	0.05	<0.001	<0.001	0.030	0.024	<0.0001	0.0001	0.011	0.010	<0.001	<0.001	<0.001	<0.001
	0.699	GHD-Maybay2-202507-GR-SUR	22 Jul 2025	MARFL/EP25-6/1247871	<0.01	<0.001	<0.001	0.019	0.013	<0.0001	<0.0001	0.008	0.008	<0.001	<0.001	<0.001	<0.001
	0.66	GHD Maybay2 - 202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	0.12	<0.001	<0.001	0.031	0.028	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001
	0.68	GHD-MatBay2-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	0.11	0.0003	0.0001	0.028	0.02	<0.00004	<0.00004	-	-	0.0011	0.001	<0.002	<0.001
	4.675	GHD-MatBay2-202404-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	0.07	0.001	<0.001	0.022	0.020	0.0002	<0.0001	0.015	0.015	0.001	<0.001	0.007	<0.001
	4.63	GHD-MatBay2-202505-GR-ARB	20 May 2025	MARFL/EP25-4/1222511	0.10	<0.001	<0.001	0.018	0.015	0.0002	<0.0001	0.017	0.017	<0.001	<0.001	0.001	0.001
	4.79	GHD-MatBay2-202506-GR-ARB	24 Jun 2025	MARFL/EP25-5/1236654	0.12	<0.001	<0.001	0.020	0.018	<0.0001	<0.0001	0.012	0.013	<0.001	<0.001	<0.001	<0.001
	4.599	GHD-Matbay2-202507-GR-ARB	22 Jul 2025	MARFL/EP25-6/1247871	<0.01	<0.001	<0.001	0.016	0.006	<0.0001	<0.0001	0.010	0.009	<0.001	<0.001	<0.001	<0.001
	4.21	GHD Maybay2 - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	0.02	<0.001	<0.001	0.040	0.029	<0.0001	<0.0001	0.006	0.006	<0.001	<0.001	0.001	<0.001
	4.35	GHD-MatBay2-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	0.007	0.0002	<0.0001	0.2	0.19	<0.00004	<0.00004	-	-	0.0006	0.0005	<0.001	<0.001
	Reference sites																
Matilda Bay Central (SW08)	0.749	GHD-6164602-MatCentral-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	0.04	<0.001	<0.001	0.018	0.018	0.0003	<0.0001	0.015	0.015	<0.001	<0.001	0.009	<0.001
	0.821	GHD-6164602-MatCentral-SUR	20 May 2025	MARFL/EP25-4/1222511	0.09	<0.001	<0.001	0.016	0.016	0.0002	<0.0001	0.014	0.014	<0.001	<0.001	0.010	<0.001
	0.664	GHD-6164602-MatCentral-SUR	24 Jun 2025	MARFL/EP25-5/1236654	0.07	<0.001	<0.001	0.033	0.027	<0.0001	0.0003	0.010	0.010	<0.001	<0.001	0.001	<0.001
	0.724	GHD-6164602-MatCentral-SUR	22 Jul 2025	MARFL/EP25-6/1247871	<0.01	<0.001	<0.001	0.015	0.010	<0.0001	<0.0001	0.009	0.008	<0.001	<0.001	<0.001	<0.001
	0.71	GHD-6164602 - MatCentral SUR	28 Aug 2025	MAFRL/EP25-7/1261952	0.16	<0.001	<0.001	0.030	0.030	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	0.69	GHD-6164602-MatCentral-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	0.12	0.0003	0.0001	0.034	0.023	<0.00004	<0.00004	-	-	0.0012	0.001	<0.001	<0.001
Narrows (SW09)	0.505	GHD-6160262-Nar-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	0.13	0.001	<0.001	0.029	0.027	0.0001	<0.0001	0.015	0.015	<0.001	<0.001	0.012	<0.001
	0.883	GHD-6160262-Nar-SUR	20 May 2025	MARFL/EP25-4/1222511	0.08	<0.001	<0.001	0.017	0.017	0.0001	<0.0001	0.014	0.014	0.002	<0.001	0.005	0.001
	0.701	GHD-61610262-Nar-SUR	24 Jun 2025	MARFL/EP25-5/1236654	0.09	<0.001	<0.001	0.040	0.042	<0.0001	0.0002	0.009	0.010	<0.001	0.010	0.001	<0.001
	0.63	GHD-6160262-Nar-SUR	22 Jul 2025	MARFL/EP25-6/1247871	<0.01	<0.001	<0.001	0.025	0.021	<0.0001	<0.0001	0.008	0.007	<0.001	<0.001	<0.001	<0.001
	0.69	GHD - 6160262 - Nar - SUR	28 Aug 2025	MAFRL/EP25-7/1261952	0.20	0.001	<0.001	0.038	0.036	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Heathcote (SW05)	0.65	GHD-6160262-Nar-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	0.2	0.0006	0.0002	0.059	0.056	<0.00004	<0.00004	-	-	0.0014	0.0011	<0.002	<0.001
	0.765	GHD-6161869-Heathcote-SUR	29 Apr 2025	MARFL/EP25-3/1213857	0.02	<0.001	<0.001	0.013	0.013	0.0002	<0.0001	0.013	0.013	0.001	<0.001	0.014	<0.001
	0.841	GHD-6161869-Heathcote-SUR	20 May 2025	MARFL/EP25-4/1222511	0.05	<0.001	<0.001	0.013	0.013	0.0002	<0.0001	0.014	0.014	<0.001	<0.001	0.001	<0.001
	0.658	GHD-6161869-Heathcote-SUR	24 Jun 2025	MARFL/EP25-5/1236654	0.06	<0.001	<0.001	0.019	0.019	<0.0001	0.0003	0.010	0.011	<0.001	0.004	<0.001	0.001
	0.682	GHD-6161869-Heathcote-SUR	22 Jul 2025	MARFL/EP25-6/1247871	<0.01	<0.001	<0.001	0.014	0.009	<0.0001	<0.0001	0.009	0.009	<0.001	<0.001	<0.001	<0.001
	0.66	GHD-6161869 -Heathcote-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	0.14	<0.001	<0.001	0.029	0.029	<0.0001	<0.0001	0.001	0.001	<0.001	<0.001	0.001	<0.001
	0.7	GHD-6161869-Heathcote-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	0.15	0.0004	0.0001	0.042	0.038	<0.00004	<0.00004	-	-	0.0011	0.001	<0.002	<0.001



Appendix C
Table C.5
Metals and Organometals

Perth Transport Authority
PTA Swan River Ferry Expansion

					Metals		Organo Metals			Organic Indicators
					Zinc	Zinc (filtered)	Dibutyltin	Monobutyltin	Tributyltin as Sn	Dissolved Organic Carbon (filtered)
					mg/L	mg/L	µg/L	ug/L	NG/L	mg/L
EQL					0.005	0.005	0.005	0.005	2	5
ANZG (2018) - FW - 95% (updated 26 July 2021)					0.008	0.008				
ANZG (2018) - MW - 95% species protection (updated 1/10/2021)					0.008	0.008				
Location Code	Depth	Field ID	Date	Lab Report Number						
Development Envelopes										
Applecross (SW01)	0.877	GHD-Applecross-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	0.016	0.012	<0.005	<0.005	<2	<5
	0.751	GHD-Applecross-202505-GR-SUR	20 May 2025	MAFRL/EP25-4/1222511	<0.005	<0.005	<0.005	<0.005	<2	<5
	0.672	GHD-Applecross-202506-GR-SUR	24 Jun 2025	MAFRL/EP25-5/1236654	<0.005	0.036	<0.005	<0.005	<2	<5
	0.703	GHD-Applecross-202507-GR-SUR	22 Jul 2025	MAFRL/EP25-6/1247871	<0.005	<0.005	<0.005	<0.005	<2	<5
	0.68	GHD Applecross - 202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	0.013	0.013	<0.005	<0.005	<2	14
	0.7	GHD-Applecross-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	0.006	0.002	<0.005	<0.005	<2	-
	3.47	GHD-Applecross-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	0.014	0.014	<0.005	<0.005	<2	<5
	3.885	GHD-Applecross-202505-GR-ARB	20 May 2025	MAFRL/EP25-4/1222511	<0.005	<0.005	<0.005	<0.005	<2	<5
	4.392	GHD-Applecross-202506-GR-ARB	24 Jun 2025	MAFRL/EP25-5/1236654	33	0.017	<0.005	<0.005	<2	<5
	2.691	GHD-Applecross-202507-GR-ARB	22 Jul 2025	MAFRL/EP25-6/1247871	<0.005	<0.005	<0.005	<0.005	<2	<5
Barrack Street (SW02)	2.45	GHD Applecross - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	0.011	0.011	<0.005	<0.005	<2	11
	3.44	GHD-Applecross-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	0.004	0.003	<0.005	<0.005	<2	-
	0.794	GHD-Barracks-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	0.015	0.011	<0.005	<0.005	<2	<5
	0.836	GHD-Barrack-202505-GR-SUR	20 May 2025	MAFRL/EP25-4/1222511	<0.005	<0.005	<0.005	<0.005	<2	<5
	0.65	GHD-Barrack-202506-GR-SUR	24 Jun 2025	MAFRL/EP25-5/1236654	<0.005	0.035	<0.005	<0.005	<2	<5
	0.671	GHD-Barrack-202507-GR-SUR	22 Jul 2025	MAFRL/EP25-6/1247871	0.005	0.005	<0.005	<0.005	<2	<5
	0.7	GHD Barrack - 202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	0.018	0.018	<0.005	<0.005	<2	22
	0.66	GHD-Barrack-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	0.004	0.001	<0.005	<0.005	-	-
	3.112	GHD-Barracks-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	0.015	0.015	<0.005	<0.005	<2	<5
	3.133	GHD-Barrack-202505-GR-ARB	20 May 2025	MAFRL/EP25-4/1222511	<0.005	<0.005	<0.005	<0.005	<2	<5
Elizabeth Quay (SW03)	3.021	GHD-Barrack-202506-GR-ARB	24 Jun 2025	MAFRL/EP25-5/1236654	<0.005	0.017	<0.005	<0.005	<2	16
	3.086	GHD-Barrack-202507-GR-ARB	22 Jul 2025	MAFRL/EP25-6/1247871	<0.005	<0.005	<0.005	<0.005	<2	<5
	2.81	GHD Barrack - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	0.017	0.017	<0.005	<0.005	<2	22
	2.95	GHD-Barrack-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	0.003	0.002	<0.005	<0.005	<2	-
	0.548	GHD-ElizQuay-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	0.015	0.008	<0.005	<0.005	<2	<5
	0.862	GHD-ElizQuay-202505-GR-SUR	20 May 2025	MAFRL/EP25-4/1222511	<0.005	<0.005	<0.005	<0.005	<2	<5
	0.791	GHD-ElizQuay-202506-GR-SUR	24 Jun 2025	MAFRL/EP25-5/1236654	<0.005	0.040	<0.005	<0.005	<2	<5
	0.695	GHD-ElizQuay-202507-GR-SUR	22 Jul 2025	MAFRL/EP25-6/1247871	<0.005	<0.005	<0.005	<0.005	<2	<5
	0.65	GHD ElizQuay - 202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	0.026	0.020	<0.005	<0.005	<2	20
	0.69	GHD-ElizQuay-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	0.004	0.002	<0.005	<0.005	<2	-
Ellam Street (SW04)	2.053	GHD-ElizQuay-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	0.020	0.006	<0.005	<0.005	<2	<5
	2.138	GHD-ElizQuay-202505-GR-ARB	20 May 2025	MAFRL/EP25-4/1222511	<0.005	<0.005	<0.005	<0.005	<2	<5
	1.934	GHD-ElizQuay-202506-GR-ARB	24 Jun 2025	MAFRL/EP25-5/1236654	<0.005	0.038	<0.005	<0.005	<2	5.3
	1.954	GHD-ElizQuay-202507-GR-ARB	22 Jul 2025	MAFRL/EP25-6/1247871	<0.005	<0.005	<0.005	<0.005	<2	<5
	1.74	GHD ElizQuay - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	0.017	0.017	<0.005	<0.005	<2	29
	1.75	GHD-ElizQuay-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	0.004	0.002	<0.005	<0.005	<2	-
	0.546	GHD-Ellam-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	0.013	0.013	<0.005	<0.005	<2	<5
	0.875	GHD-Ellam-202505-GR-SUR	20 May 2025	MAFRL/EP25-4/1222511	<0.005	<0.005	<0.005	<0.005	<2	<5
	0.712	GHD-Ellam-202506-GR-SUR	24 Jun 2025	MAFRL/EP25-5/1236654	0.018	0.038	<0.005	<0.005	<2	35
	0.666	GHD-Ellam-202507-GR-SUR	22 Jul 2025	MAFRL/EP25-6/1247871	<0.005	<0.005	<0.005	<0.005	<2	<5
0.67	GHD Ellam - 202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	0.016	0.016	<0.005	<0.005	<2	24	
0.66	GHD-Ellam-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	0.005	0.002	<0.005	<0.005	<2	-	
1.905	GHD-Ellam-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	0.015	0.015	<0.005	<0.005	<2	<5	
2.076	GHD-Ellam-202505-GR-ARB	20 May 2025	MAFRL/EP25-4/1222511	<0.005	<0.005	<0.005	<0.005	<2	<5	
2.055	GHD-Ellam-202506-GR-ARB	24 Jun 2025	MAFRL/EP25-5/1236654	0.037	0.10	<0.005	<0.005	<2	<5	



Appendix C
Table C.5
Metals and Organometals

Perth Transport Authority
PTA Swan River Ferry Expansion

				Metals		Organo Metals			Organic Indicators
				Zinc	Zinc (filtered)	Dibutyltin	Monobutyltin	Tributyltin as Sn	Dissolved Organic Carbon (filtered)
				mg/L	mg/L	µg/L	ug/L	NG/L	mg/L
EQL				0.005	0.005	0.005	0.005	2	5
ANZG (2018) - FW - 95% (updated 26 July 2021)				0.008	0.008				
ANZG (2018) - MW - 95% species protection (updated 1/10/2021)				0.008	0.008				

Location Code	Depth	Field ID	Date	Lab Report Number						
Matilda Bay 1 (SW06)	1.831	GHD-Ellam-202507-GR-ARB	22 Jul 2025	MARFL/EP25-6/1247871						
	1.69	GHD-Ellam - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952						
	1.5	GHD-Ellam-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984						
	0.517	GHD-MatBay1-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857						
	0.867	GHD-MatBay1-202505-GR-SUR	20 May 2025	MARFL/EP25-4/1222511						
	0.687	GHD-MatBay1-202506-GR-SUR	24 Jun 2025	MARFL/EP25-5/1236654						
	0.676	GHD-MatBay1-202507-GR-SUR	22 Jul 2025	MARFL/EP25-6/1247871						
	0.73	GHD MatBay1 - 202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952						
	0.69	GHD-MatBay1-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984						
	4.502	GHD-MatBay1-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857						
	4.368	GHD-MatBay1-202505-GR-ARB	20 May 2025	MARFL/EP25-4/1222511						
Matilda Bay (SW07)	4.447	GHD-MatBay1-202506-GR-ARB	24 Jun 2025	MARFL/EP25-5/1236654						
	4.514	GHD-MatBay1-202507-GR-ARB	22 Jul 2025	MARFL/EP25-6/1247871						
	4.13	GHD MatBay1 - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952						
	4	GHD-MatBay1-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984						
	0.734	GHD-MatBay2-202404-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857						
	0.85	GHD-MatBay2-202505-GR-SUR	20 May 2025	MARFL/EP25-4/1222511						
	0.732	GHD-MatBay2-202506-GR-SUR	24 Jun 2025	MARFL/EP25-5/1236654						
	0.699	GHD-Maybay2-202507-GR-SUR	22 Jul 2025	MARFL/EP25-6/1247871						
	0.66	GHD Maybay2 - 202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952						
	0.68	GHD-MatBay2-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984						
	4.675	GHD-MatBay2-202404-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857						
Narrows (SW09)	4.63	GHD-MatBay2-202505-GR-ARB	20 May 2025	MARFL/EP25-4/1222511						
	4.79	GHD-MatBay2-202506-GR-ARB	24 Jun 2025	MARFL/EP25-5/1236654						
	4.599	GHD-Matbay2-202507-GR-ARB	22 Jul 2025	MARFL/EP25-6/1247871						
	4.21	GHD Maybay2 - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952						
	4.35	GHD-MatBay2-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984						
	Reference sites									
	Matilda Bay Central (SW08)	0.749	GHD-6164602-MatCentral-SUR	29 Apr 2025	MAFRL/EP25-3/1213857					
		0.821	GHD-6164602-MatCentral-SUR	20 May 2025	MARFL/EP25-4/1222511					
0.664		GHD-6164602-MatCentral-SUR	24 Jun 2025	MARFL/EP25-5/1236654						
0.724		GHD-6164602-MatCentral-SUR	22 Jul 2025	MARFL/EP25-6/1247871						
0.71		GHD-6164602 - MatCentral SUR	28 Aug 2025	MAFRL/EP25-7/1261952						
0.69		GHD-6164602-MatCentral-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984						
Heathcote (SW05)	0.505	GHD-6160262-Nar-SUR	29 Apr 2025	MAFRL/EP25-3/1213857						
	0.883	GHD-6160262-Nar-SUR	20 May 2025	MARFL/EP25-4/1222511						
	0.701	GHD-61610262-Nar-SUR	24 Jun 2025	MARFL/EP25-5/1236654						
	0.63	GHD-6160262-Nar-SUR	22 Jul 2025	MARFL/EP25-6/1247871						
	0.69	GHD - 6160262 - Nar - SUR	28 Aug 2025	MAFRL/EP25-7/1261952						
	0.65	GHD-6160262-Nar-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984						



Appendix C
Table C.6
TRH, BTEXN, PAHs and Phenols

Perth Transport Authority
PTA Swan River Ferry Expansion

						TRH - NEPM 2013							TRH - NEPM 1999							BTEXN			
						F1 (C6-C10 minus BTEX)	C6-C10 Fraction	F2 (>C10-C16 minus Naphthalene)	>C10-C16 Fraction	F3 (>C16-C34 Fraction)	F4 (>C34-C40 Fraction)	>C10-C40 (Sum of Total)	C6-C9 Fraction	C10-C14 Fraction	C15-C28 Fraction	C29-C36 Fraction	C10-C36 (Sum of Total)	Naphthalene (value used in F2 calc)	Benzene	Toluene	Ethylbenzene	Xylene (o)	
						µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	
EQL						20	20	20	20	50	50	50	20	20	40	40	40	1	0.5	0.5	0.5	1	
ANZG (2018) - FW - 95% (updated 26 July 2021)																		950	180	80	350		
ANZG (2018) - MW - 95% species protection (updated 1/10/2021)																		700	180	80			
Location	Code	Depth	Field ID	Date	Lab Report Number																		
Development Envelopes																							
Applecross (SW01)	0.877	GHD-Applecross-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<0.5	<0.5	<0.5	<1	
	0.751	GHD-Applecross-202505-GR-SUR	20 May 2025	MAFRL/EP25-4/1222511	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<0.5	<0.5	<0.5	<1	
	0.672	GHD-Applecross-202506-GR-SUR	24 Jun 2025	MARFL/EP25-5/1236654	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<0.5	<0.5	<0.5	<1	
	0.703	GHD-Applecross-202507-GR-SUR	22 Jul 2025	MARFL/EP25-6/1247871	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<0.5	<0.5	<0.5	<1	
	0.68	GHD-Applecross-202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<0.5	<0.5	<0.5	<1	
	0.7	GHD-Applecross-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<1	<1	<1	<1	
	3.47	GHD-Applecross-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<0.5	<0.5	<0.5	<1	
	3.885	GHD-Applecross-202505-GR-ARB	20 May 2025	MARFL/EP25-4/1222511	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<0.5	<0.5	<0.5	<1	
	4.392	GHD-Applecross-202506-GR-ARB	24 Jun 2025	MARFL/EP25-5/1236654	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<0.5	<0.5	<0.5	<1	
	2.691	GHD-Applecross-202507-GR-ARB	22 Jul 2025	MARFL/EP25-6/1247871	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<0.5	<0.5	<0.5	<1	
Barrack Street (SW02)	2.45	GHD Applecross-202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<0.5	<0.5	<0.5	<1	
	3.44	GHD-Applecross-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<1	<1	<1	<1	
	0.794	GHD-Barracks-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<0.5	<0.5	<0.5	<1	
	0.836	GHD-Barrack-202505-GR-SUR	20 May 2025	MARFL/EP25-4/1222511	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<0.5	<0.5	<0.5	<1	
	0.671	GHD-Barrack-202507-GR-SUR	22 Jul 2025	MARFL/EP25-5/1236654	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<0.5	<0.5	<0.5	<1	
	0.65	GHD-Barrack-202506-GR-SUR	24 Jun 2025	MARFL/EP25-6/1247871	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<0.5	<0.5	<0.5	<1	
	0.7	GHD Barrack 202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<0.5	<0.5	<0.5	<1	
	0.66	GHD-Barrack-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	-	<1	<1	<1	<1	
	3.112	GHD-Barracks-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<0.5	<0.5	<0.5	<1	
	3.133	GHD-Barrack-202505-GR-ARB	20 May 2025	MARFL/EP25-4/1222511	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<0.5	<0.5	<0.5	<1	
Elizabeth Quay (SW03)	3.021	GHD-Barrack-202506-GR-ARB	24 Jun 2025	MARFL/EP25-5/1236654	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<0.5	<0.5	<0.5	<1	
	3.086	GHD-Barrack-202507-GR-ARB	22 Jul 2025	MARFL/EP25-6/1247871	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<0.5	<0.5	<0.5	<1	
	2.81	GHD Barrack - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<0.5	<0.5	<0.5	<1	
	2.95	GHD-Barrack-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<1	<1	<1	<1	
	0.862	GHD-ElizQuay-202505-GR-SUR	20 May 2025	MAFRL/EP25-3/1213857	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<0.5	<0.5	<0.5	<1	
	0.791	GHD-ElizQuay-202506-GR-SUR	24 Jun 2025	MARFL/EP25-4/1222511	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<0.5	<0.5	<0.5	<1	
	0.548	GHD-ElizQuay-202504-GR-SUR	29 Apr 2025	MARFL/EP25-5/1236654	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<0.5	<0.5	<0.5	<1	
	0.695	GHD-ElizQuay-202507-GR-SUR	22 Jul 2025	MARFL/EP25-6/1247871	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<0.5	<0.5	<0.5	<1	
	0.65	GHD ElizQuay - 202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<0.5	<0.5	<0.5	<1	
	0.69	GHD-ElizQuay-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	-	-	-	<1	<1	
Ellam Street (SW04)	2.053	GHD-ElizQuay-202504-GR-ARB	29 Apr 2025	MARFL/EP25-3/1213857	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<0.5	<0.5	<0.5	<1	
	2.138	GHD-ElizQuay-202505-GR-ARB	20 May 2025	MARFL/EP25-4/1222511	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<0.5	<0.5	<0.5	<1	
	1.934	GHD-ElizQuay-202506-GR-ARB	24 Jun 2025	MARFL/EP25-5/1236654	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<0.5	<0.5	<0.5	<1	
	1.954	GHD-ElizQuay-202507-GR-ARB	22 Jul 2025	MARFL/EP25-6/1247871	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<0.5	<0.5	<0.5	<1	
	1.74	GHD ElizQuay - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<0.5	<0.5	<0.5	<1	
	1.75	GHD-ElizQuay-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<0.5	<0.5	<0.5	<1	
	0.546	GHD-Ellam-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<0.5	<0.5	<0.5	<1	
	0.875	GHD-Ellam-202505-GR-SUR	20 May 2025	MARFL/EP25-4/1222511	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<0.5	<0.5	<0.5	<1	
	0.712	GHD-Ellam-202506-GR-SUR	24 Jun 2025	MARFL/EP25-5/1236654	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<0.5	<0.5	<0.5	<1	
	0.666	GHD-Ellam-202507-GR-SUR	22 Jul 2025	MARFL/EP25-6/1247871	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<0.5	<0.5	<0.5	<1	
Ellam Street (SW04)	0.67	GHD ELLAM - 202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<0.5	<0.5	<0.5	<1	
	0.66	GHD-Ellam-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<1	<1	<1	<1	
	1.905	GHD-Ellam-202504-GR-ARB	29 Apr 2025	MARFL/EP25-3/1213857	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<0.5	<0.5	<0.5	<1	
	2.076	GHD-Ellam-202505-GR-ARB	20 May 2025	MARFL/EP25-4/1222511	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<0.5	<0.5	<0.5	<1	
	2.055	GHD-Ellam-202506-GR-ARB	24 Jun 2025	MARFL/EP25-5/1236654	<20	<20	<20	<20	<50	<50	<50	<20	<20	<40	<40	<40	<40	<1	<0.5	<0.5	<0.5	<1	



Appendix C
Table C.6
TRH, BTEXN, PAHs and Phenols

Perth Transport Authority
PTA Swan River Ferry Expansion

					TRH - NEPM 2013							TRH - NEPM 1999					BTEXN				
					F1 (C6-C10 minus BTEX)	C6-C10 Fraction	F2 (>C10-C16 minus Naphthalene)	>C10-C16 Fraction	F3 (>C16-C34 Fraction)	F4 (>C34-C40 Fraction)	>C10-C40 (Sum of Total)	C6-C9 Fraction	C10-C14 Fraction	C15-C28 Fraction	C29-C36 Fraction	C10-C36 (Sum of Total)	Naphthalene (value used in F2 calc)	Benzene	Toluene	Ethylbenzene	Xylene (o)
					µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL					20	20	20	20	50	50	50	20	20	40	40	40	1	0.5	0.5	0.5	1
ANZG (2018) - FW - 95% (updated 26 July 2021)																		950	180	80	350
ANZG (2018) - MW - 95% species protection (updated 1/10/2021)																		700	180	80	
Location	Code	Depth	Field ID	Date	Lab Report Number																
Matilda Bay 1 (SW06)	1.831		GHD-Ellam-202507-GR-ARB	22 Jul 2025	MARFL/EP25-6/1247871				<20	<20	<20	<20	<20	<20	<20	<20	<1	<0.5	<0.5	<0.5	<1
	1.69		GHD ELLAM - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952				<20	<20	<20	<20	<20	<20	<20	<20	<1	<0.5	<0.5	<0.5	<1
	1.5		GHD-Ellam-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984				<20	<20	<20	<20	<20	<20	<20	<20	<1	<1	<1	<1	<1
	0.517		GHD-MatBay1-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857				<20	<20	<20	<20	<20	<20	<20	<20	<1	<0.5	<0.5	<0.5	<1
	0.867		GHD-MatBay1-202505-GR-SUR	20 May 2025	MARFL/EP25-4/1222511				<20	<20	<20	<20	<20	<20	<20	<20	<1	<0.5	<0.5	<0.5	<1
	0.676		GHD-MatBay1-202507-GR-SUR	22 Jul 2025	MARFL/EP25-5/1236654				<20	<20	<20	<20	<20	<20	<20	<20	<1	<0.5	<0.5	<0.5	<1
	0.687		GHD-MatBay1-202506-GR-SUR	24 Jun 2025	MARFL/EP25-6/1247871				<20	<20	<20	<20	<20	<20	<20	<20	<1	<0.5	<0.5	<0.5	<1
	0.73		GHD MATBAY1 - 202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952				<20	<20	<20	<20	<20	<20	<20	<20	<1	<0.5	<0.5	<0.5	<1
	0.69		GHD-MatBay1-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984				<20	<20	<20	<20	<20	<20	<20	<20	<1	<1	<1	<1	<1
	4.502		GHD-MatBay1-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857				<20	<20	<20	<20	<20	<20	<20	<20	<1	<0.5	<0.5	<0.5	<1
	4.368		GHD-MatBay1-202505-GR-SUR	20 May 2025	MARFL/EP25-4/1222511				<20	<20	<20	<20	<20	<20	<20	<20	<1	<0.5	<0.5	<0.5	<1
	4.447		GHD-MatBay1-202506-GR-ARB	24 Jun 2025	MARFL/EP25-5/1236654				<20	<20	<20	<20	<20	<20	<20	<20	<1	<0.5	<0.5	<0.5	<1
Matilda Bay (SW07)	4.514		GHD-MatBay1-202507-GR-ARB	22 Jul 2025	MARFL/EP25-6/1247871				<20	<20	<20	<20	<20	<20	<20	<20	<1	<0.5	<0.5	<0.5	<1
	4.13		GHD-MatBay1 - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952				<20	<20	<20	<20	<20	<20	<20	<20	<1	<0.5	<0.5	<0.5	<1
	4		GHD-MatBay1-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984				<20	<20	<20	<20	<20	<20	<20	<20	<1	<1	<1	<1	<1
	0.734		GHD-MatBay2-202404-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857				<20	<20	<20	<20	<20	<20	<20	<20	<1	<0.5	<0.5	<0.5	<1
	0.85		GHD-MatBay2-202505-GR-SUR	20 May 2025	MARFL/EP25-4/1222511				<20	<20	<20	<20	<20	<20	<20	<20	<1	<0.5	<0.5	<0.5	<1
	0.732		GHD-MatBay2-202506-GR-SUR	24 Jun 2025	MARFL/EP25-5/1236654				<20	<20	<20	<20	<20	<20	<20	<20	<1	<0.5	<0.5	<0.5	<1
	0.699		GHD-Maybay2-202507-GR-SUR	22 Jul 2025	MARFL/EP25-6/1247871				<20	<20	<20	<20	<20	<20	<20	<20	<1	<0.5	<0.5	<0.5	<1
	0.66		GHD Maybay2 - 202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952				<20	<20	<20	<20	<20	<20	<20	<20	<1	<0.5	<0.5	<0.5	<1
	0.68		GHD-MatBay2-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984				<20	<20	<20	<20	<20	<20	<20	<20	<1	<1	<1	<1	<1
	4.675		GHD-MatBay2-202404-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857				<20	<20	<20	<20	<20	<20	<20	<20	<1	<0.5	<0.5	<0.5	<1
	4.63		GHD-MatBay2-202505-GR-ARB	20 May 2025	MARFL/EP25-4/1222511				<20	<20	<20	<20	<20	<20	<20	<20	<1	<0.5	<0.5	<0.5	<1
	4.79		GHD-MatBay2-202506-GR-ARB	24 Jun 2025	MARFL/EP25-5/1236654				<20	<20	<20	<20	<20	<20	<20	<20	<1	<0.5	<0.5	<0.5	<1
Reference sites	4.599		GHD-Matbay2-202507-GR-ARB	22 Jul 2025	MARFL/EP25-6/1247871				<20	<20	<20	<20	<20	<20	<20	<20	<1	<0.5	<0.5	<0.5	<1
	4.21		GHD-Matbay2-202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952				<20	<20	<20	<20	<20	<20	<20	<20	<1	<0.5	<0.5	<0.5	<1
	4.35		GHD-MatBay2-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984				<20	<20	<20	<20	<20	<20	<20	<20	<1	<1	<1	<1	<1
Matilda Bay Central (SW08)	0.749		GHD-6164602-MatCentral-SUR	29 Apr 2025	MAFRL/EP25-3/1213857				<20	<20	<20	<20	<20	<20	<20	<20	<1	<0.5	<0.5	<0.5	<1
	0.821		GHD-6164602-MatCentral-SUR	20 May 2025	MARFL/EP25-4/1222511				<20	<20	<20	<20	<20	<20	<20	<20	<1	<0.5	<0.5	<0.5	<1
	0.664		GHD-6164602-MatCentral-SUR	24 Jun 2025	MARFL/EP25-5/1236654				<20	<20	<20	<20	<20	<20	<20	<20	<1	<0.5	<0.5	<0.5	<1
	0.724		GHD-6164602-MatCentral-SUR	22 Jul 2025	MARFL/EP25-6/1247871				<20	<20	<20	<20	<20	<20	<20	<20	<1	<0.5	<0.5	<0.5	<1
	0.71		GHD-6164602 - MatCentral SUR	28 Aug 2025	MAFRL/EP25-7/1261952				<20	<20	<20	<20	<20	<20	<20	<20	<1	<0.5	<0.5	<0.5	<1
	0.69		GHD-6164602-MatCentral-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984				<20	<20	<20	<20	<20	<20	<20	<20	<1	<1	<1	<1	<1
Narrows (SW09)	0.505		GHD-6160262-Nar-SUR	29 Apr 2025	MAFRL/EP25-3/1213857				<20	<20	<20	<20	<20	<20	<20	<20	<1	<0.5	<0.5	<0.5	<1
	0.883		GHD-6160262-Nar-SUR	20 May 2025	MARFL/EP25-4/1222511				<20	<20	<20	<20	<20	<20	<20	<20	<1	<0.5	<0.5	<0.5	<1
	0.701		GHD-61610262-Nar-SUR	24 Jun 2025	MARFL/EP25-5/1236654				<20	<20	<20	<20	<20	<20	<20	<20	<1	<0.5	<0.5	<0.5	<1
	0.63		GHD-6160262-NAR-SUR	22 Jul 2025	MARFL/EP25-6/1247871				<20	<20	<20	<20	<20	<20	<20	<20	<1	<0.5	<0.5	<0.5	<1
	0.69		GHD - 6160262 - NAR - SUR	28 Aug 2025	MAFRL/EP25-7/1261952				<20	<20	<20	<20	<20	<20	<20	<20	<1	<0.5	<0.5	<0.5	<1
	0.65		GHD-6160262-Nar-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984				<20	<20	<20	<20	<20	<20	<20	<20	<1	<1	<1	<1	<1
Heathcote (SW05)	0.765		GHD-6161869-Heathcote-SUR	29 Apr 2025	MAFRL/EP25-3/1213857				<20	<20	<20	<20	<20	<20	<20	<20	<1	<0.5	<0.5	<0.5	<1
	0.841		GHD-6161869-Heathcote-SUR	20 May 2025	MARFL/EP25-4/1222511				<20	<20	<20	<20	<20	<20	<20	<20	<1	<0.5	<0.5	<0.5	<1
	0.658		GHD-6161869-Heathcote-SUR	24 Jun 2025	MARFL/EP25-5/1236654				<20	<20	<20	<20	<20	<20	<20	<20	<1	<0.5	<0.5	<0.5	<1
	0.682		GHD-6161869-Heathcote-SUR	22 Jul 2025	MARFL/EP25-6/1247871				<20	<20	<20	<20	<20	<20	<20	<20	<1	<0.5	<0.5	<0.5	<1
	0.66		GHD-6161869 - HEATHCOTE SUR	28 Aug 2025	MAFRL/EP25-7/1261952				<20	<20	<20	<20	<20	<20	<20	<20	<1	<0.5	<0.5	<0.5	<1
	0.7		GHD-6161869-Heathcote-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984				<20	<20	<20	<20	<20	<20	<20	<20	<1	<1	<1	<1	<1

					PAHs - standard 16																	
					Xylene (m & p)	Xylene Total	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(g,h,i)perylene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Naphthalene-PAH	
					µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	
EQL					2	3	0.002	0.002	0.001	0.002	0.001	0.004	0.004	0.002	0.001	0.001	0.001	0.001	0.002	0.002	0.004	0.01
ANZG (2018) - FW - 95% (updated 26 July 2021)									0.4		0.2						1.4			16	16	
ANZG (2018) - MW - 95% species protection (updated 1/10/2021)											0.2						1.4			70	70	
Location	Code	Depth	Field ID	Date	Lab Report Number																	
Development Envelopes																						
Applecross (SW01)	0.877	GHD-Applecross-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<2	<3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	
	0.751	GHD-Applecross-202505-GR-SUR	20 May 2025	MAFRL/EP25-4/1222511	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	0.672	GHD-Applecross-202506-GR-SUR	24 Jun 2025	MAFRL/EP25-5/1236654	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	0.703	GHD-Applecross-202507-GR-SUR	22 Jul 2025	MAFRL/EP25-6/1247871	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	0.68	GHD-Applecross-202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	0.7	GHD-Applecross-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<2	<3	<0.002	<0.002	<0.001	<0.002	<0.001	<0.004	<0.004	<0.002	<0.001	<0.001	<0.001	<0.002	<0.002	<0.004	-	
	3.47	GHD-Applecross-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	<2	<3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	
	3.885	GHD-Applecross-202505-GR-ARB	20 May 2025	MAFRL/EP25-4/1222511	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	4.392	GHD-Applecross-202506-GR-ARB	24 Jun 2025	MAFRL/EP25-5/1236654	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	2.691	GHD-Applecross-202507-GR-ARB	22 Jul 2025	MAFRL/EP25-6/1247871	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
Barrack Street (SW02)	2.45	GHD-Applecross-202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	3.44	GHD-Applecross-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<2	<3	<0.002	<0.002	<0.001	<0.002	<0.001	<0.004	<0.004	<0.002	<0.001	<0.001	<0.001	<0.002	<0.002	<0.004	-	
	0.794	GHD-Barracks-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<2	<3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	
	0.836	GHD-Barrack-202505-GR-SUR	20 May 2025	MAFRL/EP25-4/1222511	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	0.671	GHD-Barrack-202507-GR-SUR	22 Jul 2025	MAFRL/EP25-5/1236654	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	0.65	GHD-Barrack-202506-GR-SUR	24 Jun 2025	MAFRL/EP25-6/1247871	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	0.7	GHD-Barrack-202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	0.66	GHD-Barrack-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<2	<3	<0.002	<0.002	<0.001	<0.002	<0.001	<0.004	<0.004	<0.002	<0.001	<0.001	<0.001	<0.002	<0.002	<0.004	-	
	3.112	GHD-Barracks-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	<2	<3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	
	3.133	GHD-Barrack-202505-GR-ARB	20 May 2025	MAFRL/EP25-4/1222511	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
Elizabeth Quay (SW03)	3.021	GHD-Barrack-202506-GR-ARB	24 Jun 2025	MAFRL/EP25-5/1236654	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	3.086	GHD-Barrack-202507-GR-ARB	22 Jul 2025	MAFRL/EP25-6/1247871	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	2.81	GHD-Barrack-202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	2.95	GHD-Barrack-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<2	<3	<0.002	<0.002	<0.001	<0.002	<0.001	<0.004	<0.004	<0.002	<0.001	<0.001	<0.001	<0.002	<0.002	<0.004	-	
	0.862	GHD-ElizQuay-202505-GR-SUR	20 May 2025	MAFRL/EP25-3/1213857	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	0.791	GHD-ElizQuay-202506-GR-SUR	24 Jun 2025	MAFRL/EP25-4/1222511	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	0.548	GHD-ElizQuay-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-5/1236654	<2	<3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	
	0.695	GHD-ElizQuay-202507-GR-SUR	22 Jul 2025	MAFRL/EP25-6/1247871	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	0.65	GHD-ElizQuay-202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	0.69	GHD-ElizQuay-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<2	<3	<0.002	<0.002	<0.001	<0.002	<0.001	<0.004	<0.004	<0.002	<0.001	<0.001	<0.001	<0.002	<0.002	<0.004	-	
Ellam Street (SW04)	2.053	GHD-ElizQuay-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	<2	<3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	
	2.138	GHD-ElizQuay-202505-GR-ARB	20 May 2025	MAFRL/EP25-4/1222511	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	1.934	GHD-ElizQuay-202506-GR-ARB	24 Jun 2025	MAFRL/EP25-5/1236654	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	1.954	GHD-ElizQuay-202507-GR-ARB	22 Jul 2025	MAFRL/EP25-6/1247871	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	1.74	GHD-ElizQuay-202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	1.75	GHD-ElizQuay-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<2	<3	<0.002	<0.002	<0.001	<0.002	<0.001	<0.004	<0.004	<0.002	<0.001	<0.001	<0.001	<0.002	<0.002	<0.004	-	
	0.546	GHD-Ellam-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<2	<3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	
	0.875	GHD-Ellam-202505-GR-SUR	20 May 2025	MAFRL/EP25-4/1222511	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	0.712	GHD-Ellam-202506-GR-SUR	24 Jun 2025	MAFRL/EP25-5/1236654	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	0.666	GHD-Ellam-202507-GR-SUR	22 Jul 2025	MAFRL/EP25-6/1247871	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
Ellam Street (SW04)	0.67	GHD-ELLAM-202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	0.66	GHD-Ellam-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<2	<3	<0.002	<0.002	<0.001	<0.002	<0.001	<0.004	<0.004	<0.002	<0.001	<0.001	<0.001	<0.002	<0.002	<0.004	-	
	1.905	GHD-Ellam-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	<2	<3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	
	2.076																					

						PAHs - standard 16																	
						Xylene (m & p)	Xylene Total	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b,j)fluoranthene	Benzo(k)fluoranthene	Benzo(g,h,i)perylene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Naphthalene-PAH	
						µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	
EQL						2	3	0.002	0.002	0.001	0.002	0.001	0.004	0.004	0.002	0.001	0.001	0.001	0.002	0.002	0.004	0.01	
ANZG (2018) - FW - 95% (updated 26 July 2021)										0.4		0.2						1.4			16	16	
ANZG (2018) - MW - 95% species protection (updated 1/10/2021)												0.2						1.4			70	70	
Location	Code	Depth	Field ID	Date	Lab Report Number																		
Matilda Bay 1 (SW06)	1.831	GHD-Ellam-202507-GR-ARB	22 Jul 2025	MAFRL/EP25-6/1247871	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	1.69	GHD ELLAM - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	1.5	GHD-Ellam-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<2	<3	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.004	<0.004	<0.002	<0.001	<0.001	<0.002	<0.002	<0.004	-		
	0.517	GHD-MatBay1-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<2	<3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-		
	0.867	GHD-MatBay1-202505-GR-SUR	20 May 2025	MAFRL/EP25-4/1222511	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	0.676	GHD-MatBay1-202507-GR-SUR	22 Jul 2025	MAFRL/EP25-5/1236654	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	0.687	GHD-MatBay1-202506-GR-SUR	24 Jun 2025	MAFRL/EP25-6/1247871	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	0.73	GHD MATBAY1 - 202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	0.69	GHD-MatBay1-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<2	<3	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.004	<0.004	<0.002	<0.001	<0.001	<0.002	<0.002	<0.004	-		
	4.502	GHD-MatBay1-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	<2	<3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-		
	4.368	GHD-MatBay1-202505-GR-ARB	20 May 2025	MAFRL/EP25-4/1222511	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	4.447	GHD-MatBay1-202506-GR-ARB	24 Jun 2025	MAFRL/EP25-5/1236654	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	4.514	GHD-MatBay1-202507-GR-ARB	22 Jul 2025	MAFRL/EP25-6/1247871	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	4.13	GHD-MatBay1 - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
4	GHD-MatBay1-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<2	<3	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.004	<0.004	<0.002	<0.001	<0.001	<0.002	<0.002	<0.004	-			
Matilda Bay (SW07)	0.734	GHD-MatBay2-202404-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<2	<3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-		
	0.85	GHD-MatBay2-202505-GR-SUR	20 May 2025	MAFRL/EP25-4/1222511	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	0.732	GHD-MatBay2-202506-GR-SUR	24 Jun 2025	MAFRL/EP25-5/1236654	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	0.699	GHD-Maybay2-202507-GR-SUR	22 Jul 2025	MAFRL/EP25-6/1247871	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	0.66	GHD Maybay2 - 202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	0.68	GHD-MatBay2-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<2	<3	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.004	<0.004	<0.002	<0.001	<0.001	<0.002	<0.002	<0.004	-		
	4.675	GHD-MatBay2-202404-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	<2	<3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-		
	4.63	GHD-MatBay2-202505-GR-ARB	20 May 2025	MAFRL/EP25-4/1222511	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	4.79	GHD-MatBay2-202506-GR-ARB	24 Jun 2025	MAFRL/EP25-5/1236654	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	4.599	GHD-Matbay2-202507-GR-ARB	22 Jul 2025	MAFRL/EP25-6/1247871	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
4.21	GHD-Matbay2-202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1213857	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01		
4.35	GHD-MatBay2-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<2	<3	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.004	<0.004	<0.002	<0.001	<0.001	<0.002	<0.002	<0.004	-			
Reference sites																							
Matilda Bay Central (SW08)	0.749	GHD-6164602-MatCentral-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<2	<3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-		
	0.821	GHD-6164602-MatCentral-SUR	20 May 2025	MAFRL/EP25-4/1222511	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	0.664	GHD-6164602-MatCentral-SUR	24 Jun 2025	MAFRL/EP25-5/1236654	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	0.724	GHD-6164602-MatCentral-SUR	22 Jul 2025	MAFRL/EP25-6/1247871	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	0.71	GHD-6164602 -MatCentral-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	0.69	GHD-6164602-MatCentral-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<2	<3	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.004	<0.004	<0.002	<0.001	<0.001	<0.002	<0.002	<0.004	-		
Narrows (SW09)	0.505	GHD-6160262-Nar-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<2	<3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-		
	0.883	GHD-6160262-Nar-SUR	20 May 2025	MAFRL/EP25-4/1222511	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	0.701	GHD-61610262-Nar-SUR	24 Jun 2025	MAFRL/EP25-5/1236654	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	0.63	GHD-6160262-NAR-SUR	22 Jul 2025	MAFRL/EP25-6/1247871	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	0.69	GHD - 6160262 - NAR - SUR	28 Aug 2025	MAFRL/EP25-7/1261952	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	0.65	GHD-6160262-Nar-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<2	<3	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.004	<0.004	<0.002	<0.001	<0.001	<0.002	<0.002	<0.004	-		
Heathcote (SW05)	0.765	GHD-6161869-Heathcote-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<2	<3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-		
	0.841	GHD-6161869-Heathcote-SUR	20 May 2025	MAFRL/EP25-4/1222511	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	-	<0.01	
	0.658																						



Appendix C
Table C.6
TRH, BTEXN, PAHs and Phenols

Perth Transport Authority
PTA Swan River Ferry Expansion

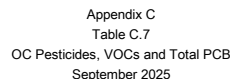
					PAHs - extended													
					Phenanthrene	Pyrene	PAHs (Sum of total) - Lab calc	Total 8 PAHs (as BaP TEQ) (zero LOR) - Lab Calc	Total 8 PAHs (as BaP TEQ) (half LOR) - Lab Calc	Total 8 PAHs (as BaP TEQ) (full LOR) - Lab Calc	2-methylnaphthalene	3-methylcholanthrene	7,12-dimethylbenz(a)anthracene	Benzo(e)pyrene	Perylene	Benzo(b+g+h)fluoranthene	Benzo(b)fluoranthene	
					µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	
EQL					0.002	0.001	0.001	0.001	0.001	0.001	0.002	0.004	0.001	0.001	0.002		0.004	0.01
ANZG (2018) - FW - 95% (updated 26 July 2021)					2													
ANZG (2018) - MW - 95% species protection (updated 1/10/2021)					2													
Location	Code	Depth	Field ID	Date	Lab Report Number													
Development Envelopes																		
Applecross (SW01)	0.877	GHD-Applecross-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<1	<1	<1	<1	-	-	-	-	-	-	-	-	-	
	0.751	GHD-Applecross-202505-GR-SUR	20 May 2025	MAFRL/EP25-4/1222511	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	0.672	GHD-Applecross-202506-GR-SUR	24 Jun 2025	MAFRL/EP25-5/1236654	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	0.703	GHD-Applecross-202507-GR-SUR	22 Jul 2025	MAFRL/EP25-6/1247871	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	0.68	GHD-Applecross-202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	0.7	GHD-Applecross-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	0.007	<0.004	<0.001	<0.001	<0.002	<0.004	-	
	3.47	GHD-Applecross-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	<1	<1	<1	<1	-	-	-	-	-	-	-	-	-	
	3.885	GHD-Applecross-202505-GR-ARB	20 May 2025	MAFRL/EP25-4/1222511	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	4.392	GHD-Applecross-202506-GR-ARB	24 Jun 2025	MAFRL/EP25-5/1236654	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	2.691	GHD-Applecross-202507-GR-ARB	22 Jul 2025	MAFRL/EP25-6/1247871	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	2.45	GHD Applecross 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	3.44	GHD-Applecross-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.004	<0.001	<0.001	<0.002	<0.004	-	
	Barrack Street (SW02)	0.794	GHD-Barracks-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<1	<1	<1	<1	-	-	-	-	-	-	-	-	-
0.836		GHD-Barrack-202505-GR-SUR	20 May 2025	MAFRL/EP25-4/1222511	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
0.671		GHD-Barrack-202507-GR-SUR	22 Jul 2025	MAFRL/EP25-5/1236654	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
0.65		GHD-Barrack-202506-GR-SUR	24 Jun 2025	MAFRL/EP25-6/1247871	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
0.7		GHD Barrack 202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
0.66		GHD-Barrack-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.004	<0.001	<0.001	<0.002	<0.004	-	
3.112		GHD-Barracks-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	<1	<1	<1	<1	-	-	-	-	-	-	-	-	-	
3.133		GHD-Barrack-202505-GR-ARB	20 May 2025	MAFRL/EP25-4/1222511	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
3.021		GHD-Barrack-202506-GR-ARB	24 Jun 2025	MAFRL/EP25-5/1236654	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
3.086		GHD-Barrack-202507-GR-ARB	22 Jul 2025	MAFRL/EP25-6/1247871	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
2.81		GHD Barrack - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
2.95		GHD-Barrack-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.004	<0.001	<0.001	<0.002	<0.004	-	
Elizabeth Quay (SW03)		0.862	GHD-ElizQuay-202505-GR-SUR	20 May 2025	MAFRL/EP25-3/1213857	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01
	0.791	GHD-ElizQuay-202506-GR-SUR	24 Jun 2025	MAFRL/EP25-4/1222511	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	0.548	GHD-ElizQuay-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-5/1236654	<1	<1	<1	<1	-	-	-	-	-	-	-	-	-	
	0.695	GHD-ElizQuay-202507-GR-SUR	22 Jul 2025	MAFRL/EP25-6/1247871	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	0.65	GHD ElizQuay - 202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	0.69	GHD-ElizQuay-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.004	<0.001	<0.001	<0.002	<0.004	-	
	2.053	GHD-ElizQuay-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	<1	<1	<1	<1	-	-	-	-	-	-	-	-	-	
	2.138	GHD-ElizQuay-202505-GR-ARB	20 May 2025	MAFRL/EP25-4/1222511	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	1.934	GHD-ElizQuay-202506-GR-ARB	24 Jun 2025	MAFRL/EP25-5/1236654	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	1.954	GHD-ElizQuay-202507-GR-ARB	22 Jul 2025	MAFRL/EP25-6/1247871	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	1.74	GHD ElizQuay - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	1.75	GHD-ElizQuay-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.004	<0.001	<0.001	<0.002	<0.004	-	
	Ellam Street (SW04)	0.546	GHD-Ellam-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<1	<1	<1	<1	-	-	-	-	-	-	-	-	-
0.875		GHD-Ellam-202505-GR-SUR	20 May 2025	MAFRL/EP25-4/1222511	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
0.712		GHD-Ellam-202506-GR-SUR	24 Jun 2025	MAFRL/EP25-5/1236654	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
0.666		GHD-Ellam-202507-GR-SUR	22 Jul 2025	MAFRL/EP25-6/1247871	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
0.67		GHD ELLAM - 202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
0.66		GHD-Ellam-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.004	<0.001	<0.001	<0.002	<0.004	-	
1.905	GHD-Ellam-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	<1	<1	<1	<1	-	-	-	-	-	-	-	-	-		
2.076	GHD-Ellam-202505-GR-ARB	20 May 2025	MAFRL/EP25-4/1222511	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01		
2.055	GHD-Ellam-202506-GR-ARB	24 Jun 2025	MAFRL/EP25-5/1236654	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01		

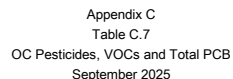


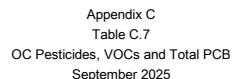
Appendix C
Table C.6
TRH, BTEXN, PAHs and Phenols

Perth Transport Authority
PTA Swan River Ferry Expansion

					PAHs - extended													
					Phenanthrene	Pyrene	PAHs (Sum of total) - Lab calc	Total 8 PAHs (as BaP TEQ) (zero LOR) - Lab Calc	Total 8 PAHs (as BaP TEQ) (half LOR) - Lab Calc	Total 8 PAHs (as BaP TEQ) (full LOR) - Lab Calc	2-methylnaphthalene	3-methylcholanthrene	7,12-dimethylbenz(a)anthracene	Benzo(e)pyrene	Perylene	Benzo(b+j+k)fluoranthene	Benzo(b)fluoranthene	
					µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	
EQL					0.002	0.001	0.001	0.001	0.001	0.001	0.002	0.004	0.001	0.001	0.002		0.004	0.01
ANZG (2018) - FW - 95% (updated 26 July 2021)					2													
ANZG (2018) - MW - 95% species protection (updated 1/10/2021)					2													
Location Code	Depth	Field ID	Date	Lab Report Number														
Matilda Bay 1 (SW06)	1.831	GHD-Ellam-202507-GR-ARB	22 Jul 2025	MAFRL/EP25-6/1247871	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	1.69	GHD ELLAM - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	1.5	GHD-Ellam-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.004	<0.001	<0.001	<0.002	<0.004	-	
	0.517	GHD-MatBay1-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<1	<1	<1	<1	-	-	-	-	-	-	-	-	-	
	0.867	GHD-MatBay1-202505-GR-SUR	20 May 2025	MAFRL/EP25-4/1222511	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	0.676	GHD-MatBay1-202507-GR-SUR	22 Jul 2025	MAFRL/EP25-5/1236654	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	0.687	GHD-MatBay1-202506-GR-SUR	24 Jun 2025	MAFRL/EP25-6/1247871	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	0.73	GHD MATBAY1 - 202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	0.69	GHD-MatBay1-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.004	<0.001	<0.001	<0.002	<0.004	-	
	4.502	GHD-MatBay1-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	<1	<1	<1	<1	-	-	-	-	-	-	-	-	-	
	4.368	GHD-MatBay1-202505-GR-ARB	20 May 2025	MAFRL/EP25-4/1222511	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	4.447	GHD-MatBay1-202506-GR-ARB	24 Jun 2025	MAFRL/EP25-5/1236654	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	4.514	GHD-MatBay1-202507-GR-ARB	22 Jul 2025	MAFRL/EP25-6/1247871	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	4.13	GHD-MatBay1 - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	4	GHD-MatBay1-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.004	<0.001	<0.001	<0.002	<0.004	-	
Matilda Bay (SW07)	0.734	GHD-MatBay2-202404-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<1	<1	<1	<1	-	-	-	-	-	-	-	-	-	
	0.85	GHD-MatBay2-202505-GR-SUR	20 May 2025	MAFRL/EP25-4/1222511	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	0.732	GHD-MatBay2-202506-GR-SUR	24 Jun 2025	MAFRL/EP25-5/1236654	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	0.699	GHD-Maybay2-202507-GR-SUR	22 Jul 2025	MAFRL/EP25-6/1247871	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	0.66	GHD Maybay2 - 202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	0.68	GHD-MatBay2-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	0.005	<0.004	<0.001	<0.001	<0.002	<0.004	-	
	4.675	GHD-MatBay2-202404-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	<1	<1	<1	<1	-	-	-	-	-	-	-	-	-	
	4.63	GHD-MatBay2-202505-GR-ARB	20 May 2025	MAFRL/EP25-4/1222511	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	4.79	GHD-MatBay2-202506-GR-ARB	24 Jun 2025	MAFRL/EP25-5/1236654	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	4.599	GHD-Matbay2-202507-GR-ARB	22 Jul 2025	MAFRL/EP25-6/1247871	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	4.21	GHD-Matbay2-202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	4.35	GHD-MatBay2-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.004	<0.001	<0.001	<0.002	<0.004	-	
Reference sites																		
Matilda Bay Central (SW08)	0.749	GHD-6164602-MatCentral-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<1	<1	<1	<1	-	-	-	-	-	-	-	-	-	
	0.821	GHD-6164602-MatCentral-SUR	20 May 2025	MAFRL/EP25-4/1222511	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	0.664	GHD-6164602-MatCentral-SUR	24 Jun 2025	MAFRL/EP25-5/1236654	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	0.724	GHD-6164602-MatCentral-SUR	22 Jul 2025	MAFRL/EP25-6/1247871	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	0.71	GHD-6164602 -MatCentral SUR	28 Aug 2025	MAFRL/EP25-7/1261952	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	0.69	GHD-6164602-MatCentral-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.004	<0.001	<0.001	<0.002	<0.004	-	
Narrows (SW09)	0.505	GHD-6160262-Nar-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<1	<1	<1	<1	-	-	-	-	-	-	-	-	-	
	0.883	GHD-6160262-Nar-SUR	20 May 2025	MAFRL/EP25-4/1222511	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	0.701	GHD-61610262-Nar-SUR	24 Jun 2025	MAFRL/EP25-5/1236654	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	0.63	GHD-6160262-NAR-SUR	22 Jul 2025	MAFRL/EP25-6/1247871	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	0.69	GHD - 6160262 - NAR - SUR	28 Aug 2025	MAFRL/EP25-7/1261952	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	0.65	GHD-6160262-Nar-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.004	<0.001	<0.001	<0.002	<0.004	-	
Heathcote (SW05)	0.765	GHD-6161869-Heathcote-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<1	<1	<1	<1	-	-	-	-	-	-	-	-	-	
	0.841	GHD-6161869-Heathcote-SUR	20 May 2025	MAFRL/EP25-4/1222511	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	0.658	GHD-6161869-Heathcote-SUR	24 Jun 2025	MAFRL/EP25-5/1236654	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	0.682	GHD-6161869-Heathcote-SUR	22 Jul 2025	MAFRL/EP25-6/1247871	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	0.66	GHD-6161869 - HEATHCOTE SUR	28 Aug 2025	MAFRL/EP25-7/1261952	<0.01	<0.01	-	-	-	-	<0.01	-	-	-	-	-	<0.01	
	0.7	GHD-6161869-Heathcote-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	<0.004	<0.001	<0.001	<0.002	<0.004	-	



[illegible]

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							OP		Chlorinated Hydrocarbons															
							Pesticide	Pesticides																
					Methoxychlor	Oxychlorane	Chlorpyrifos	Chlorothalonil	1,1,1,2-tetrachloroethane	1,1,1-trichloroethane	1,1,2,2-tetrachloroethane	1,1-dichloroethane	1,2,4-trichlorobenzene	1,2-dichlorobenzene	1,2-dichloroethane	1,4-dichlorobenzene	Carbon tetrachloride	Chlorobenzene	cis-1,2-dichloroethane	Methylene chloride	Hexachlorobutadiene	Vinyl chloride		
					µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L		
EQL					0.002	0.001	0.001	0.01	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	5	0.5	0.2	
ANZG (2018) - FW - 95% (updated 26 July 2021)							0.01		270	400	700	170	160	1,900	60	240	55		4,000		100			
ANZG (2018) - MW - 95% species protection (updated 1/10/2021)							0.009		270	400	700	80		1,900		240	55		4,000			100		
Location	Cod	Depth	Field ID	Date	Lab Report Number																			
Matilda Bay 1 (SW06)	1.831		GHD-Ellam-202507-GR-ARB	22 Jul 2025	MAFRU/EP25-6/1247871		<0.02	<0.001	<0.005	<0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2		
	1.69		GHD Ellam - 202508-GR-ARB	28 Aug 2025	MAFRU/EP25-7/1261952		<0.02	<0.001	<0.005	<0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2		
	1.5		GHD-Ellam-202509-GR-ARB	24 Sep 2025	MAFRU/EP25-8/1272659/EP2515984		<0.002	<0.002	<0.001	-	-	-	-	-	-	-	-	-	-	-	-	-		
	0.517		GHD-MatBay1-202504-GR-SUR	29 Apr 2025	MAFRU/EP25-3/1213857		<0.02	<0.001	<0.005	<0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2		
	0.867		GHD-MatBay1-202505-GR-SUR	20 May 2025	MAFRU/EP25-4/1222511		<0.02	<0.001	<0.005	<0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2		
	0.687		GHD-MatBay1-202506-GR-SUR	24 Jun 2025	MAFRU/EP25-5/1236654		<0.02	<0.001	<0.005	<0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2		
	0.676		GHD-MatBay1-202507-GR-SUR	22 Jul 2025	MAFRU/EP25-6/1247871		<0.02	<0.001	<0.005	<0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2		
	0.73		GHD MatBay1 - 202508-GR-SUR	28 Aug 2025	MAFRU/EP25-7/1261952		<0.02	<0.001	<0.005	<0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2		
	0.69		GHD-MatBay1-202509-GR-SUR	24 Sep 2025	MAFRU/EP25-8/1272659/EP2515984		<0.002	<0.002	<0.001	-	-	-	-	-	-	-	-	-	-	-	-	-		
	4.502		GHD-MatBay1-202504-GR-ARB	29 Apr 2025	MAFRU/EP25-3/1213857		<0.02	<0.001	<0.005	<0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2		
Matilda Bay (SW07)	4.368		GHD-MatBay1-202505-GR-ARB	20 May 2025	MAFRU/EP25-4/1222511		<0.02	<0.001	<0.005	<0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2		
	4.447		GHD-MatBay1-202506-GR-ARB	24 Jun 2025	MAFRU/EP25-5/1236654		<0.02	<0.001	<0.005	<0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2		
	4.514		GHD-MatBay1-202507-GR-ARB	22 Jul 2025	MAFRU/EP25-6/1247871		<0.02	<0.001	<0.005	<0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2		
	4.13		GHD MatBay1 - 202508-GR-ARB	28 Aug 2025	MAFRU/EP25-7/1261952		<0.02	<0.001	<0.005	<0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2		
	4		GHD-MatBay1-202509-GR-ARB	24 Sep 2025	MAFRU/EP25-8/1272659/EP2515984		<0.002	<0.002	<0.001	-	-	-	-	-	-	-	-	-	-	-	-	-		
	0.734		GHD-MatBay2-202404-GR-SUR	29 Apr 2025	MAFRU/EP25-3/1213857		<0.02	<0.001	<0.005	<0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2		
	0.85		GHD-MatBay2-202505-GR-SUR	20 May 2025	MAFRU/EP25-4/1222511		<0.02	<0.001	<0.005	<0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2		
	0.732		GHD-MatBay2-202506-GR-SUR	24 Jun 2025	MAFRU/EP25-5/1236654		<0.02	<0.001	<0.005	<0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2		
	0.699		GHD-Maybay2-202507-GR-SUR	22 Jul 2025	MAFRU/EP25-6/1247871		<0.02	<0.001	<0.005	<0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2		
	0.66		GHD Maybay2 - 202508-GR-SUR	28 Aug 2025	MAFRU/EP25-7/1261952		<0.02	<0.001	<0.005	<0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2		
Reference sites	0.68		GHD-MatBay2-202509-GR-SUR	24 Sep 2025	MAFRU/EP25-8/1272659/EP2515984		<0.002	<0.002	<0.001	-	-	-	-	-	-	-	-	-	-	-	-	-		
	4.675		GHD-MatBay2-202404-GR-ARB	29 Apr 2025	MAFRU/EP25-3/1213857		<0.02	<0.001	<0.005	<0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2		
	4.63		GHD-MatBay2-202505-GR-ARB	20 May 2025	MAFRU/EP25-4/1222511		<0.02	<0.001	<0.005	<0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2		
	4.79		GHD-MatBay2-202506-GR-ARB	24 Jun 2025	MAFRU/EP25-5/1236654		<0.02	<0.001	<0.005	<0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2		
	4.599		GHD-Matbay2-202507-GR-ARB	22 Jul 2025	MAFRU/EP25-6/1247871		<0.02	<0.001	<0.005	<0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2		
	4.21		GHD Maybay2 - 202508-GR-ARB	28 Aug 2025	MAFRU/EP25-7/1261952		<0.02	<0.001	<0.005	<0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2		
	4.35		GHD-MatBay2-202509-GR-ARB	24 Sep 2025	MAFRU/EP25-8/1272659/EP2515984		<0.002	<0.002	<0.001	-	-	-	-	-	-	-	-	-	-	-	-	-		
	0.749		GHD-6164602-MatCentral-SUR	29 Apr 2025	MAFRU/EP25-3/1213857		<0.02	<0.001	<0.005	<0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2		
	0.821		GHD-6164602-MatCentral-SUR	20 May 2025	MAFRU/EP25-4/1222511		<0.02	<0.001	<0.005	<0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2		
	0.664		GHD-6164602-MatCentral-SUR	24 Jun 2025	MAFRU/EP25-5/1236654		<0.02	<0.001	<0.005	<0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2		
Matilda Bay Central (SW08)	0.724		GHD-6164602-MatCentral-SUR	22 Jul 2025	MAFRU/EP25-6/1247871		<0.02	<0.001	<0.005	<0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2		
	0.71		GHD-6164602 - MatCentral-SUR	28 Aug 2025	MAFRU/EP25-7/1261952		<0.02	<0.001	<0.005	<0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2		
	0.69		GHD-6164602-MatCentral-SUR	24 Sep 2025	MAFRU/EP25-8/1272659/EP2515984		<0.002	<0.002	<0.001	-	-	-	-	-	-	-	-	-	-	-	-	-		
	0.505		GHD-6160262-Nar-SUR	29 Apr 2025	MAFRU/EP25-3/1213857		<0.02	<0.001	<0.005	<0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2		
	0.883		GHD-6160262-Nar-SUR	20 May 2025	MAFRU/EP25-4/1222511		<0.02	<0.001	<0.005	<0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2		
	0.701		GHD-61610262-Nar-SUR	24 Jun 2025	MAFRU/EP25-5/1236654		<0.02	<0.001	<0.005	<0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2		
	0.63		GHD-6160262-NAR-SUR	22 Jul 2025	MAFRU/EP25-6/1247871		<0.02	<0.001	<0.005	<0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2		
	0.69		GHD - 6160262 - NAR - SUR	28 Aug 2025	MAFRU/EP25-7/1261952		<0.02	<0.001	<0.005	<0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2		
	0.65		GHD-6160262-Nar-SUR	24 Sep 2025	MAFRU/EP25-8/1272659/EP2515984		<0.002	<0.002	<0.001	-	-	-	-	-	-	-	-	-	-	-	-	-		
	0.765		GHD-6161869-Heathcote-SUR	29 Apr 2025	MAFRU/EP25-3/1213857		<0.02	<0.001	<0.005	<0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	
Heathcote (SW05)	0.841		GHD-6161869-Heathcote-SUR	20 May 2025	MAFRU/EP25-4/1222511		<0.02	<0.001	<0.005	<0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2		
	0.658		GHD-6161869-Heathcote-SUR	24 Jun 2025	MAFRU/EP25-5/1236654		<0.02	<0.001	<0.005	<0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2		
	0.682		GHD-6161869-Heathcote-SUR	22 Jul 2025	MAFRU/EP25-6/1247871		<0.02	<0.001	<0.005	<0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5					



Appendix C
Table C.7
OC Pesticides, VOCs and Total PCB
September 2025

Perth Transport Authority
PTA Swan River Ferry Expansion

EQL	PCBs	MAH	SVOCs	VOCs						
	PCBs (Total)	Styrene	1,3,5-Trichlorobenzene	1,1-dichloroethane	1,2,3-Trichlorobenzene	1,3-dichlorobenzene	MTBE	Trichloroethene	Tetrachloroethene	trans-1,2-dichloroethene
	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
ANZG (2018) - FW - 95% (updated 26 July 2021)	0.000005	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	2
ANZG (2018) - MW - 95% species protection (updated 1/10/2021)			13		10	260		330	70	

Location	Cod	Depth	Field ID	Date	Lab Report Number	PCBs	MAH	SVOCs	1,1-dichloroethane	1,2,3-Trichlorobenzene	1,3-dichlorobenzene	MTBE	Trichloroethene	Tetrachloroethene	trans-1,2-dichloroethene
Development Envelopes															
Applecross (SW01)	0.877		GHD-Applecross-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.751		GHD-Applecross-202505-GR-SUR	20 May 2025	MAFRL/EP25-4/1222511	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.672		GHD-Applecross-202506-GR-SUR	24 Jun 2025	MAFRL/EP25-5/1236654	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.703		GHD-Applecross-202507-GR-SUR	22 Jul 2025	MAFRL/EP25-6/1247871	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.68		GHD-Applecross - 202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.7		GHD-Applecross-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.000005	-	-	-	-	-	-	-	-	-
	3.47		GHD-Applecross-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	3.885		GHD-Applecross-202505-GR-ARB	20 May 2025	MAFRL/EP25-4/1222511	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	4.392		GHD-Applecross-202506-GR-ARB	24 Jun 2025	MAFRL/EP25-5/1236654	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	2.691		GHD-Applecross-202507-GR-ARB	22 Jul 2025	MAFRL/EP25-6/1247871	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
Barrack Street (SW02)	2.45		GHD-Applecross - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	3.44		GHD-Applecross-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.000005	-	-	-	-	-	-	-	-	-
	0.794		GHD-Barracks-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.836		GHD-Barracks-202505-GR-SUR	20 May 2025	MAFRL/EP25-4/1222511	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.65		GHD-Barrack-202506-GR-SUR	24 Jun 2025	MAFRL/EP25-5/1236654	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.671		GHD-Barrack-202507-GR-SUR	22 Jul 2025	MAFRL/EP25-6/1247871	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.7		GHD-Barrack - 202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.66		GHD-Barrack-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.000005	-	-	-	-	-	-	-	-	-
	3.112		GHD-Barracks-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	3.133		GHD-Barrack-202505-GR-ARB	20 May 2025	MAFRL/EP25-4/1222511	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
Elizabeth Quay (SW03)	3.021		GHD-Barrack-202506-GR-ARB	24 Jun 2025	MAFRL/EP25-5/1236654	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	3.086		GHD-Barrack-202507-GR-ARB	22 Jul 2025	MAFRL/EP25-6/1247871	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	2.81		GHD-BARRACK - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	2.95		GHD-Barrack-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.000005	-	-	-	-	-	-	-	-	-
	0.548		GHD-ElizQuay-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.862		GHD-ElizQuay-202505-GR-SUR	20 May 2025	MAFRL/EP25-4/1222511	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.791		GHD-ElizQuay-202506-GR-SUR	24 Jun 2025	MAFRL/EP25-5/1236654	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.695		GHD-ElizQuay-202507-GR-SUR	22 Jul 2025	MAFRL/EP25-6/1247871	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.65		GHD-ElizQuay- 202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.69		GHD-ElizQuay-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.000005	-	-	-	-	-	-	-	-	-
Ellam Street (SW04)	2.053		GHD-ElizQuay-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	2.138		GHD-ElizQuay-202505-GR-ARB	20 May 2025	MAFRL/EP25-4/1222511	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	1.934		GHD-ElizQuay-202506-GR-ARB	24 Jun 2025	MAFRL/EP25-5/1236654	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	1.954		GHD-ElizQuay-202507-GR-ARB	22 Jul 2025	MAFRL/EP25-6/1247871	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	1.74		GHD-ElizQuay - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	1.75		GHD-ElizQuay-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.000005	-	-	-	-	-	-	-	-	-
	0.546		GHD-Ellam-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.875		GHD-Ellam-202505-GR-SUR	20 May 2025	MAFRL/EP25-4/1222511	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.712		GHD-Ellam-202506-GR-SUR	24 Jun 2025	MAFRL/EP25-5/1236654	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.666		GHD-Ellam-202507-GR-SUR	22 Jul 2025	MAFRL/EP25-6/1247871	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2



Appendix C
Table C.7
OC Pesticides, VOCs and Total PCB
September 2025

Perth Transport Authority
PTA Swan River Ferry Expansion

EQL	ANZG (2018) - FW - 95% (updated 26 July 2021)	ANZG (2018) - MW - 95% species protection (updated 1/10/2021)	PCBs	MAH	SVOCs	VOCs						
			PCBs (Total)	Styrene	1,3,5-Trichlorobenzene	1,1-dichloroethane	1,2,3-Trichlorobenzene	1,3-dichlorobenzene	MTBE	Trichloroethene	Tetrachloroethene	trans-1,2-dichloroethene
			mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
			0.000005	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	2
					13		10	260		330	70	
					13					330	70	

Location	Cod	Depth	Field ID	Date	Lab Report Number	PCBs	MAH	SVOCs	1,1-dichloroethane	1,2,3-Trichlorobenzene	1,3-dichlorobenzene	MTBE	Trichloroethene	Tetrachloroethene	trans-1,2-dichloroethene
Matilda Bay 1 (SW06)	1.831		GHD-Ellam-202507-GR-ARB	22 Jul 2025	MARFL/EP25-6/1247871	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	1.69		GHD Ellam - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	1.5		GHD-Ellam-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.000005	-	-	-	-	-	-	-	-	-
	0.517		GHD-MatBay1-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.867		GHD-MatBay1-202505-GR-SUR	20 May 2025	MARFL/EP25-4/1222511	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.687		GHD-MatBay1-202506-GR-SUR	24 Jun 2025	MARFL/EP25-5/1236654	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.676		GHD-MatBay1-202507-GR-SUR	22 Jul 2025	MARFL/EP25-6/1247871	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.73		GHD MatBay1 - 202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.69		GHD-MatBay1-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.000005	-	-	-	-	-	-	-	-	-
	4.502		GHD-MatBay1-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	4.368		GHD-MatBay1-202505-GR-ARB	20 May 2025	MARFL/EP25-4/1222511	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	4.447		GHD-MatBay1-202506-GR-ARB	24 Jun 2025	MARFL/EP25-5/1236654	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	4.514		GHD-MatBay1-202507-GR-ARB	22 Jul 2025	MARFL/EP25-6/1247871	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	4.13		GHD MatBay1 - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	4		GHD-MatBay1-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.000005	-	-	-	-	-	-	-	-	-
Matilda Bay (SW07)	0.734		GHD-MatBay2-202404-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.85		GHD-MatBay2-202505-GR-SUR	20 May 2025	MARFL/EP25-4/1222511	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.732		GHD-MatBay2-202506-GR-SUR	24 Jun 2025	MARFL/EP25-5/1236654	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.699		GHD-Maybay2-202507-GR-SUR	22 Jul 2025	MARFL/EP25-6/1247871	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.66		GHD Maybay2 - 202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.68		GHD-MatBay2-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.000005	-	-	-	-	-	-	-	-	-
	4.675		GHD-MatBay2-202404-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	4.63		GHD-MatBay2-202505-GR-ARB	20 May 2025	MARFL/EP25-4/1222511	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	4.79		GHD-MatBay2-202506-GR-ARB	24 Jun 2025	MARFL/EP25-5/1236654	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	4.599		GHD-Matbay2-202507-GR-ARB	22 Jul 2025	MARFL/EP25-6/1247871	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	4.21		GHD Maybay2 - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	4.35		GHD-MatBay2-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.000005	-	-	-	-	-	-	-	-	-
Reference sites															
Matilda Bay Central (SW08)	0.749		GHD-6164602-MatCentral-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.821		GHD-6164602-MatCentral-SUR	20 May 2025	MARFL/EP25-4/1222511	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.664		GHD-6164602-MatCentral-SUR	24 Jun 2025	MARFL/EP25-5/1236654	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.724		GHD-6164602-MatCentral-SUR	22 Jul 2025	MARFL/EP25-6/1247871	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.71		GHD-6164602 - MatCentral-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.69		GHD-6164602-MatCentral-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.000005	-	-	-	-	-	-	-	-	-
Narrows (SW09)	0.505		GHD-6160262-Nar-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.883		GHD-6160262-Nar-SUR	20 May 2025	MARFL/EP25-4/1222511	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.701		GHD-61610262-Nar-SUR	24 Jun 2025	MARFL/EP25-5/1236654	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.63		GHD-6160262-NAR-SUR	22 Jul 2025	MARFL/EP25-6/1247871	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.69		GHD - 6160262 - NAR - SUR	28 Aug 2025	MAFRL/EP25-7/1261952	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.65		GHD-6160262-Nar-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.000005	-	-	-	-	-	-	-	-	-
Heathcote (SW05)	0.765		GHD-6161869-Heathcote-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.841		GHD-6161869-Heathcote-SUR	20 May 2025	MARFL/EP25-4/1222511	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.658		GHD-6161869-Heathcote-SUR	24 Jun 2025	MARFL/EP25-5/1236654	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.682		GHD-6161869-Heathcote-SUR	22 Jul 2025	MARFL/EP25-6/1247871	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.66		GHD-6161869 - Heathcote SUR	28 Aug 2025	MAFRL/EP25-7/1261952	<0.00002	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
	0.7		GHD-6161869-Heathcote-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.000005	-	-	-	-	-	-	-	-	-

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EQL	PFAS - Perfluoroalkyl Sulfonic Acids								PFAS - Perfluoroalkyl Carboxylic Acids										
	Perfluorobutane sulfonic acid (PFBS)	Perfluorodecanesulfonic acid (PFDS)	Perfluorononane sulfonate (PFNS)	Perfluoroheptane sulfonic acid (PFHpS)	Perfluorooctane sulfonic acid (PFOS)	Perfluoropropanesulfonic acid (PFPrS)	Perfluoropentane sulfonic acid (PFPeS)	Perfluorohexane sulfonic acid (PFHxS)	Perfluorobutanoic acid (PFBA)	Perfluorodecanoic acid (PFDA)	Perfluorododecanoic acid (PFDDA)	Perfluorotetradecanoic acid (PFThA)	Perfluorohexanoic acid (PFHxA)	Perfluorononanoic acid (PFNA)	Perfluorooctanoic acid (PFOA)	Perfluoropentanoic acid (PFPeA)	Perfluorotetradecanoic acid (PFThA)	Perfluorotridecanoic acid (PFTTDA)	Perfluoroundecanoic acid (PFUnDA)
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
0.001	0.001	0.001	0.001	0.001	0.0001	0.001	0.001	0.001	0.005	0.001	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001	0.001
PFAS NEMP 3.0 2025 Freshwater 99%					0.00023										19				
PFAS NEMP 3.0 2025 Interim marine 99%					0.00023										19				

Location	Cod	Depth	Field ID	Date	Lab Report Number																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
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	PFAS - Perfluoroalkyl Sulfonic Acids								PFAS - Perfluoroalkyl Carboxylic Acids											
	Perfluorobutane sulfonic acid (PFBS)	Perfluorodecanesulfonic acid (PFDS)	Perfluorononane sulfonate (PFNS)	Perfluorooheptane sulfonic acid (PFHpS)	Perfluorooctane sulfonic acid (PFOS)	Perfluoropropanesulfonic acid (PFPrS)	Perfluoropentane sulfonic acid (PFPeS)	Perfluorohexane sulfonic acid (PFHxS)	Perfluorobutanoic acid (PFBA)	Perfluorodecanoic acid (PFDA)	Perfluorododecanoic acid (PFDDA)	Perfluorooheptanoic acid (PFHpA)	Perfluorohexanoic acid (PFHxA)	Perfluorononanoic acid (PFNA)	Perfluorooctanoic acid (PFOA)	Perfluoropentanoic acid (PFPeA)	Perfluorotetradecanoic acid (PFTeDA)	Perfluorotridecanoic acid (PFTrDA)	Perfluoroundecanoic acid (PFUnDA)	
EQL	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	
PFAS NEMP 3.0 2025 Freshwater 99%	0.001	0.001	0.001	0.001	0.0001	0.001	0.001	0.001	0.005	0.001	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001	0.001	
PFAS NEMP 3.0 2025 Interim marine 99%					0.00023										19					
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Location	Cod	Depth	Field ID	Date	Lab Report Number																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												</
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Comments

#1 Quantification of linear and branched isomers has been conducted as a single total response using the relative response factor for the corresponding linear/branched standard.



Appendix C
Table C.9
PFAS Results

Perth Transport Authority
PTA Swan River Ferry Expansion

	PFAS - Perfluoroalkyl Sulfonamide							PFAS - Fluorotelomer Sulfonic Acids				PFAS - Sums			
	N-Ethyl perfluorooctane sulfonamide (EFOA)	N-Ethyl perfluorooctane sulfonamidoacetic acid (EFOSA4)	N-Ethyl perfluorooctane sulfonamidoethanol (EFOSE)	N-Methyl perfluorooctane sulfonamide (MeFOA)	N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSA4)	N-Methyl perfluorooctane sulfonamidoethanol (MEFOSE)	Perfluorooctane sulfonamide (FOA)	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	PFAS (Sum of Total)(WA DER List)	Sum of US EPA PFAS (PFOS + PFOA)*	Sum of PFHxS and PFOS	Sum of enHealth PFAS (PFHxS + PFOS + PFOA)*
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.001	0.005	0.001	0.001	0.005	0.001	0.001	0.001
PFAS NEMP 3.0 2025 Freshwater 99%															
PFAS NEMP 3.0 2025 Interim marine 99%															

Location	Cod	Depth	Field ID	Date	Lab Report Number												
Development Envelopes																	
Applecross (SW01)	0.877	GHD-Applecross-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0198	0.0078
	0.751	GHD-Applecross-202505-GR-SUR	20 May 2025	MAFRL/EP25-4/1222511	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0126	0.0056
	0.672	GHD-Applecross-202506-GR-SUR	24 Jun 2025	MAFRL/EP25-5/1236654	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.022	0.01
	0.703	GHD-Applecross-202507-GR-SUR	22 Jul 2025	MAFRL/EP25-6/1247871	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.029	0.012
	0.68	GHD-Applecross - 202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.038	0.017
	0.7	GHD-Applecross-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.047	0.021
	3.47	GHD-Applecross-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0167	0.0067
	3.885	GHD-Applecross-202505-GR-ARB	20 May 2025	MAFRL/EP25-4/1222511	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0133	0.0063
	4.392	GHD-Applecross-202506-GR-ARB	24 Jun 2025	MAFRL/EP25-5/1236654	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0174	0.0074
	2.691	GHD-Applecross-202507-GR-ARB	22 Jul 2025	MAFRL/EP25-6/1247871	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0226	0.010
Barrack Street (SW02)	2.45	GHD-Applecross - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.036	0.015
	3.44	GHD-Applecross-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.012	0.007
	0.794	GHD-Barracks-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0179	0.0079
	0.836	GHD-Barrack-202505-GR-SUR	20 May 2025	MAFRL/EP25-4/1222511	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0184	0.0084
	0.65	GHD-Barrack-202506-GR-SUR	24 Jun 2025	MAFRL/EP25-5/1236654	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.033	0.015
	0.671	GHD-Barrack-202507-GR-SUR	22 Jul 2025	MAFRL/EP25-6/1247871	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.034	0.014
	0.7	GHD Barrack - 202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.029	0.014
	0.66	GHD-Barrack-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.052	0.023
	3.112	GHD-Barracks-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0167	0.0077
	3.133	GHD-Barrack-202505-GR-ARB	20 May 2025	MAFRL/EP25-4/1222511	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0176	0.0076
Elizabeth Quay (SW03)	3.021	GHD-Barrack-202506-GR-ARB	24 Jun 2025	MAFRL/EP25-5/1236654	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0253	0.0113
	3.086	GHD-Barrack-202507-GR-ARB	22 Jul 2025	MAFRL/EP25-6/1247871	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0233	0.010
	2.81	GHD Barrack - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.031	0.013
	2.95	GHD-Barrack-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0122	0.007
	0.548	GHD-ElizQuay-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0146	0.0076
	0.862	GHD-ElizQuay-202505-GR-SUR	20 May 2025	MAFRL/EP25-4/1222511	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0163	0.0073
	0.695	GHD-ElizQuay-202507-GR-SUR	22 Jul 2025	MAFRL/EP25-5/1236654	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.039	0.018
	0.791	GHD-ElizQuay-202506-GR-SUR	24 Jun 2025	MAFRL/EP25-6/1247871	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.039	0.018
	0.65	GHD ElizQuay - 202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.031	0.016
	0.69	GHD-ElizQuay-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.048	0.021
Ellam Street (SW04)	2.053	GHD-ElizQuay-202504-GR-ARB	29 Apr 2025	MAFRL/EP25-3/1213857	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.025	0.015
	2.138	GHD-ElizQuay-202505-GR-ARB	20 May 2025	MAFRL/EP25-4/1222511	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.026	0.012
	1.934	GHD-ElizQuay-202506-GR-ARB	24 Jun 2025	MAFRL/EP25-5/1236654	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.036	0.016
	1.954	GHD-ElizQuay-202507-GR-ARB	22 Jul 2025	MAFRL/EP25-6/1247871	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0246	0.011
	1.74	GHD ElizQuay - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.037	0.014
	1.75	GHD-ElizQuay-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.043	0.019
	0.546	GHD-Ellam-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.034	0.013
	0.875	GHD-Ellam-202505-GR-SUR	20 May 2025	MAFRL/EP25-4/1222511	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0248	0.0108
	0.712	GHD-Ellam-202506-GR-SUR	24 Jun 2025	MAFRL/EP25-5/1236654	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.042	0.018
	0.666	GHD-Ellam-202507-GR-SUR	22 Jul 2025	MAFRL/EP25-6/1247871	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.047	0.022

	PFAS - Perfluoroalkyl Sulfonamide							PFAS - Fluorotelomer Sulfonic Acids				PFAS - Sums			
	N-Ethyl perfluorooctane sulfonamide (EFOA)	N-Ethyl perfluorooctane sulfonamidacetic acid (EFOA4)	N-Ethyl perfluorooctane sulfonamidoethanol (EFOSE)	N-Methyl perfluorooctane sulfonamide (MeFOA)	N-Methyl perfluorooctane sulfonamidacetic acid (MeFOA4)	N-Methyl perfluorooctane sulfonamidoethanol (MEFOSE)	Perfluorooctane sulfonamide (FOA)	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	PFAS (Sum of Total)(WA DER List)	Sum of US EPA PFAS (PFOS + PFOA)*	Sum of PFHxS and PFOS	Sum of enHealth PFAS (PFHxS + PFOS + PFOA)*
EQL	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
PFAS NEMP 3.0 2025 Freshwater 99%	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.001	0.005	0.001	0.001	0.005	0.001	0.001	0.001
PFAS NEMP 3.0 2025 Interim marine 99%															

Location	Cod	Depth	Field ID	Date	Lab Report Number												
	2.055	GHD-Ellam-202506-GR-ARB	24 Jun 2025	MARFL/EP25-5/1236654	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.032	0.013
	1.831	GHD-Ellam-202507-GR-ARB	22 Jul 2025	MARFL/EP25-6/1247871	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.029	0.012
	1.69	GHD Ellam - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.028	0.012
	1.5	GHD-Ellam-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.055	0.024
Matilda Bay 1 (SW06)	0.517	GHD-MatBay1-202504-GR-SUR	29 Apr 2025	MAFRL/EP25-3/1213857	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0176	0.0106
	0.867	GHD-MatBay1-202505-GR-SUR	20 May 2025	MARFL/EP25-4/1222511	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.014	0.007
	0.687	GHD-MatBay1-202506-GR-SUR	24 Jun 2025	MARFL/EP25-5/1236654	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0256	0.0116
	0.676	GHD-MatBay1-202507-GR-SUR	22 Jul 2025	MARFL/EP25-6/1247871	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.033	0.014
	0.73	GHD MatBay1 - 202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.034	0.015
	0.69	GHD-MatBay1-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.041	0.019
	4.502	GHD-MatBay1-202504-GR-ARB	29 Apr 2025	MARFL/EP25-3/1213857	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.012	0.007
	4.368	GHD-MatBay1-202505-GR-ARB	20 May 2025	MARFL/EP25-4/1222511	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0163	0.0083
	4.447	GHD-MatBay1-202506-GR-ARB	24 Jun 2025	MARFL/EP25-5/1236654	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0155	0.0065
	4.514	GHD-MatBay1-202507-GR-ARB	22 Jul 2025	MARFL/EP25-6/1247871	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.016	0.007
Matilda Bay (SW07)	4.13	GHD MatBay1 - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.023	0.012
	4	GHD-MatBay1-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.01	0.005
	0.734	GHD-MatBay2-202404-GR-SUR	29 Apr 2025	MARFL/EP25-3/1213857	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0125	0.0075
	0.85	GHD-MatBay2-202505-GR-SUR	20 May 2025	MARFL/EP25-4/1222511	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0141	0.0071
	0.732	GHD-MatBay2-202506-GR-SUR	24 Jun 2025	MARFL/EP25-5/1236654	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.027	0.013
	0.699	GHD-Maybay2-202507-GR-SUR	22 Jul 2025	MARFL/EP25-6/1247871	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.033	0.014
	0.66	GHD MATBAY2 - 202508-GR-SUR	28 Aug 2025	MAFRL/EP25-7/1261952	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.025	0.013
	0.68	GHD-MATBAY2-202509-GR-SUR	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.041	0.019
	4.675	GHD-MatBay2-202404-GR-ARB	29 Apr 2025	MARFL/EP25-3/1213857	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0137	0.0067
	4.63	GHD-MatBay2-202505-GR-ARB	20 May 2025	MARFL/EP25-4/1222511	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0136	0.0066
	4.79	GHD-MatBay2-202506-GR-ARB	24 Jun 2025	MARFL/EP25-5/1236654	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.017	0.007
	4.599	GHD-Matbay2-202507-GR-ARB	22 Jul 2025	MARFL/EP25-6/1247871	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0146	0.007
	4.21	GHD Matbay2 - 202508-GR-ARB	28 Aug 2025	MAFRL/EP25-7/1261952	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.029	0.013
	4.35	GHD-Matbay2-202509-GR-ARB	24 Sep 2025	MAFRL/EP25-8/1272659/EP2515984	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0111	0.006

	PFAS - Perfluoroalkyl Sulfonamide							PFAS - Fluorotelomer Sulfonic Acids				PFAS - Sums			
	N-Ethyl perfluorooctane sulfonamide (EFOA)	N-Ethyl perfluorooctane sulfonamidodiacetic acid (EFOSAA)	N-Ethyl perfluorooctane sulfonamidoethanol (EFOSE)	N-Methyl perfluorooctane sulfonamide (MeFOA)	N-Methyl perfluorooctane sulfonamidodiacetic acid (MeFOSAA)	N-Methyl perfluorooctane sulfonamidoethanol (MEFOSE)	Perfluorooctane sulfonamide (FOA)	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	PFAS (Sum of Total)(WA DER List)	Sum of US EPA PFAS (PFOS + PFOA)*	Sum of PFHxS and PFOS	Sum of enHealth PFAS (PFHxS + PFOS + PFOA)*
EQL	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
PFAS NEMP 3.0 2025 Freshwater 99%	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.001	0.005	0.001	0.001	0.005	0.001	0.001	0.001
PFAS NEMP 3.0 2025 Interim marine 99%															

Location	Cod Depth	Field ID	Date	Lab Report Number															
Reference sites																			
Matilda Bay Central (SW08)	0.749	GHD-6164602-MatCentral-SUR	29 Apr 2025	MAFRL/EP25-3/1213857		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0115	0.0065	0.0085	0.0095
	0.821	GHD-6164602-MatCentral-SUR	20 May 2025	MARFL/EP25-4/1222511		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0151	0.0071	0.0091	0.0101
	0.664	GHD-6164602-MatCentral-SUR	24 Jun 2025	MARFL/EP25-5/1236654		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.026	0.012	0.015	0.017
	0.724	GHD-6164602-MatCentral-SUR	22 Jul 2025	MARFL/EP25-6/1247871		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0258	0.011	0.0148	0.0168
	0.71	GHD-6164602 - MatCentral SUR	28 Aug 2025	MAFRL/EP25-7/1261952		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.032	0.014	0.019	0.021
	0.69	GHD-6164602-MatCentral-SUR	24 Sep 2025	MARFL/EP25-8/1272659/EP2515984		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.041	0.019	0.026	0.029
Narrows (SW09)	0.505	GHD-6160262-Nar-SUR	29 Apr 2025	MAFRL/EP25-3/1213857		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0205	0.0095	0.0115	0.0135
	0.883	GHD-6160262-Nar-SUR	20 May 2025	MARFL/EP25-4/1222511		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0172	0.0072	0.0102	0.0112
	0.701	GHD-61610262-Nar-SUR	24 Jun 2025	MARFL/EP25-5/1236654		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.031	0.014	0.019	0.021
	0.63	GHD-6160262-Nar-SUR	22 Jul 2025	MARFL/EP25-6/1247871		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.054	0.026	0.036	0.039
	0.69	GHD - 6160262 - Nar - SUR	28 Aug 2025	MAFRL/EP25-7/1261952		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.027	0.014	0.02	0.022
	0.65	GHD-6160262-NarSUR	24 Sep 2025	MARFL/EP25-8/1272659/EP2515984		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.046	0.022	0.03	0.033
Heathcote (SW05)	0.765	GHD-6161869-Heathcote-SUR	29 Apr 2025	MAFRL/EP25-3/1213857		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0114	0.0044	0.0074	0.0074
	0.841	GHD-6161869-Heathcote-SUR	20 May 2025	MARFL/EP25-4/1222511		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0092	0.0042	0.0062	0.0062
	0.658	GHD-6161869-Heathcote-SUR	24 Jun 2025	MARFL/EP25-5/1236654		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0214	0.0094	0.0114	0.0134
	0.682	GHD-6161869-Heathcote-SUR	22 Jul 2025	MARFL/EP25-6/1247871		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0251	0.011	0.0151	0.0171
	0.66	GHD-6161869 - Heathcote SUR	28 Aug 2025	MAFRL/EP25-7/1261952		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.031	0.016	0.023	0.025
	0.7	GHD-6161869-Heathcote-SUR	24 Sep 2025	MARFL/EP25-8/1272659/EP2515984		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.036	0.020	0.026	0.029

Comments

#1 Quantification of linear and branched isomers has been conducted as a single total response using the relative res



Development Envelopes													Reference Sites		
Applecross (SW01)		Barrack Street (SW02)		Elizabeth Quay (SW03)		Ellam Street (SW04)		Matilda Bay 1 (SW06)		Matilda Bay 2 (SW07)			Heathcote (SW05)	Matilda Bay Central (SW08)	Narrows (SW09)
24 Sep 2025	24 Sep 2025	24 Sep 2025	24 Sep 2025	24 Sep 2025	24 Sep 2025	24 Sep 2025	24 Sep 2025	24 Sep 2025	24 Sep 2025	24 Sep 2025	24 Sep 2025	24 Sep 2025	24 Sep 2025	24 Sep 2025	24 Sep 2025
GHD-Applecross-202509-GR-SUR	GHD-Applecross-202509-GR-ARB	GHD-Barracks-202509-GR-SUR	GHD-Barracks-202509-GR-ARB	GHD-ElizQuay-202509-GR-SUR	GHD-ElizQuay-202509-GR-ARB	GHD-Ellam-202509-GR-SUR	GHD-Ellam-202509-GR-ARB	GHD-Matilda Bay 1-202509-GR-SUR	GHD-Matilda Bay 1-202509-GR-ARB	GHD-Matilda Bay 2-202509-GR-SUR	GHD-Matilda Bay 2-202509-GR-ARB	GHD-QC01	GHD-6161869-Heathcote-SUR	GHD-6164602-MatCentral-SUR	GHD-6160262-Nar-SUR
Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Duplicate	Normal	Normal	Normal
0.7	3.44	0.66	2.95	0.69	1.75	0.66	1.5	0.89	4	0.68	4.35	4.35	0.7	0.69	0.65
1272659	1272659	1272659	1272659	1272659	1272659	1272659	1272659	1272659	1272659	1272659	1272659	1272659	1272659	1272659	1272659

	Unit	LOR														
Bacillariophyceae																
Amphora spp	cells ml ⁻¹	10	20	10												
Chaetoceros danicus	cells ml ⁻¹	10	500	2400												
Chaetoceros spp	cells ml ⁻¹	10				1700	1000	2600	1600	3400		350	20	600	1000	1600
Cylindrotheca closterium	cells ml ⁻¹	10			90	20	350	100	6200	4500				20	10	2200
Entomoneis spp	cells ml ⁻¹	10					10	10	10							
Melosira spp	cells ml ⁻¹	10					50									
Navicula spp	cells ml ⁻¹	10						10								
Nitzschia obtusa	cells ml ⁻¹	10						20								
Skeletonema spp	cells ml ⁻¹	10	210				30	70					110	360		240
Thalassionema spp	cells ml ⁻¹	10					500	110								
Thalassiosira pseudonana	cells ml ⁻¹	10	550	100		10				20	10					
Thalassiosira spp	cells ml ⁻¹	10	50		130	10			200	130	130	50	100	20	300	100
Thalassiothrix spp	cells ml ⁻¹	10													100	
Chlorodendrophyceae																
Tetraselmis spp	cells ml ⁻¹	10			20		140	150								300
Chlorophyceae																
Chlamydomonas spp (O)	cells ml ⁻¹	10							10	40		10			20	60
Monoraphidium spp	cells ml ⁻¹	10					20	10		10						
Chrysophyceae																
Chrysophytes (unknown)	cells ml ⁻¹	10	230			20	10	10	10							10
Coccolithophyceae																
Chrysoschromulina spp	cells ml ⁻¹	10		60										40		
Haptophytes (unknown)	cells ml ⁻¹	10			200	100	400					500	200	10	500	60
Cryptophyceae																
Hillea spp	cells ml ⁻¹	10	20	30			60	110	20		200	20	30	400	10	40
Rhodomonas spp	cells ml ⁻¹	10			40											300
Cyanophyceae																
Planktolyngbya contorta (t)	cells ml ⁻¹	10				10			10							
Pseudanabaena acicularis (t)	cells ml ⁻¹	10			20											
Pseudanabaena spp	cells ml ⁻¹	10					10									
Raphidopsis raciborskii (PT)	cells ml ⁻¹	10			8000		15500	140							420	
Dinophyceae																
Diplopsalis spp	cells ml ⁻¹	10				10										
Gymnodinium spp	cells ml ⁻¹	10								20						
Gyrodinium spp	cells ml ⁻¹	10	360	10	50	10	50	80	50	30	90	40	20	60	60	40
Heterocapsa spp	cells ml ⁻¹	10							10	10						
Kryptoperidinium triquetrum	cells ml ⁻¹	10	460	10	10		30	40	10	30			200		20	10
Oxyrrhis marina	cells ml ⁻¹	10			10											
cf. Peridiniella danica	cells ml ⁻¹	10	10													
Prorocentrum cordatum (PT)	cells ml ⁻¹	10	90		10					260			70		20	
Prorocentrum spp	cells ml ⁻¹	10				10										
Scorpiosella spp	cells ml ⁻¹	10	870	20	60		20		170	160	60	10	2650		220	110
Euglenophyceae																
Eutreptiella marina	cells ml ⁻¹	10							10	10						
Haptophyceae																
Nephroselmidophyceae																
cf Nephroselmis spp	cells ml ⁻¹	10					30	30						10		
Prasinophyceae																
Prasinophytes (unknown)	cells ml ⁻¹	10	200	400		10	600	700	300			450	10	100	150	10
Pyramimonadophyceae																
Telenoma																
Telonema spp	cells ml ⁻¹	10		450		20	30	10				20	10		200	

Pyramimonadophyceae

#1 Quantification of linear and branched isomers has been conducted as a single total response using the relative response factor for the corresponding linear/branched standard.
#2 Reported Analyte LOR is higher than Requested Analyte LOR

Statistics

* A Non Detect Multiplier of 0.5 has been applied.

			Development Envelopes												Reference Sites					
			Applecross (SW01)		Barrack Street (SW02)		Elizabeth Quay (SW03)		Ellam Street (SW04)		Matilda Bay 1 (SW06)		Matilda Bay 2 (SW07)		Heathcote (SW05)		Matilda Bay Central (SW08)	Narrows (SW09)		
			28 Aug 2025	28 Aug 2025	28 Aug 2025	28 Aug 2025	28 Aug 2025	28 Aug 2025	28 Aug 2025	28 Aug 2025	28 Aug 2025	28 Aug 2025	28 Aug 2025	28 Aug 2025	28 Aug 2025	28 Aug 2025	28 Aug 2025	28 Aug 2025		
			GHD-Applecross-202508-GR-SUR	GHD-Applecross-202508-GR-ARB	GHD-Barracks-202508-GR-SUR	GHD-Barracks-202508-GR-ARB	GHD-ElizabethQuay-202508-GR-SUR	GHD-ElizabethQuay-202508-GR-ARB	GHD-Ellam-202508-GR-SUR	GHD-Ellam-202508-GR-ARB	GHD-MatBay1-202508-GR-SUR	GHD-MatBay1-202508-GR-ARB	GHD-MatBay2-202508-GR-SUR	GHD-MatBay2-202708-GR-ARB	GHD-6161869-Heathcote-SUR	GHD-QC01	GHD-6161862-MatCentral-SUR	GHD-6160262-Nar-SUR		
			Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Duplicate	Normal	Normal		
			0.68	2.45	0.7	2.81	0.65	1.74	0.67	1.69	0.73	4.13	0.66	4.21	0.66	0.66	0.71	0.69		
			1261952	1261952	1261952	1261952	1261952	1261952	1261952	1261952	1261952	1261952	1261952	1261952	1261952	1261952	1261952	1261952		
	Unit	LOR																		
Bacillariophyceae																				
Amphora spp.	cells ml ⁻¹	10			10		10	40		20					30			20		
Chaetoceros danicus	cells ml ⁻¹	10	180	40																
Chaetoceros minimus	cells ml ⁻¹	10										10		20	70		10			
Chaetoceros spp.	cells ml ⁻¹	10																		
Chaetoceros subtilis	cells ml ⁻¹	10																		
Chaetoceros tenuissimus	cells ml ⁻¹	10																		
Conticribra weissflogii	cells ml ⁻¹	10					10	30	10			10								
Cocconeis spp.	cells ml ⁻¹	10																		
Coccinodiscus spp.	cells ml ⁻¹	10																		
Cylindrotheca closterium	cells ml ⁻¹	10							10	20	10	10			10	10	20			
Entomoneis spp.	cells ml ⁻¹	10			10	30	10	20	10	10	10	10			10	10		40		
Leptocylindrus minimus	cells ml ⁻¹	10																		
Lessardia spp.	cells ml ⁻¹	10																		
Nauticula spp.	cells ml ⁻¹	10			10	20	60	50	30				10		10	20		20		
Nitzschia obtusa	cells ml ⁻¹	10				10		20	10											
Plagiotropis spp.	cells ml ⁻¹	10																		
Pleurosigma spp.	cells ml ⁻¹	10																		
Rhizosolenia setigera	cells ml ⁻¹	10																		
Skeletonema menziesii	cells ml ⁻¹	10																		
Skeletonema spp.	cells ml ⁻¹	10	10600	4420		30					7850	1380	3420	510	2280	1850	2940			
Synechella spp. (O)	cells ml ⁻¹	10				10			10	10						10				
Thalassionema spp.	cells ml ⁻¹	10							130	210	340					500				
Thalassiosira pseudonana	cells ml ⁻¹	10		20	200	280	900	1200	500	1200	1900	300	2100	40	400	600	1600	400		
Thalassiosira spp.	cells ml ⁻¹	10		800	120	90	70	110					190		460		300	100		
Thalassiothrix spp.	cells ml ⁻¹	10																		
Chlorodendrophyceae																				
Tetraselmis spp.	cells ml ⁻¹	10			30	90	40	100	20	3100	30	2800	10	600	800	900	10			
Chlorophyceae																				
Acutodesmus spp.	cells ml ⁻¹	10				1000	800			20										
Chlamydomonas spp. (O)	cells ml ⁻¹	10								30								10		
Desmodesmus spp.	cells ml ⁻¹	10				80														
Golenkinia spp.	cells ml ⁻¹	10				30	20													
Monoraphidium contortum	cells ml ⁻¹	10					30						10							
Monoraphidium spp.	cells ml ⁻¹	10			10	10	20		20					10	10					
Spermatocopsis spp.	cells ml ⁻¹	10					10													
Chrysophyceae																				
Chrysophytes (unknown)	cells ml ⁻¹	10	10																	
Dinobryon spp.	cells ml ⁻¹	10																		
Coccolithophyceae																				
Chrysosphaerulina spp.	cells ml ⁻¹	10																		
Haptophyte (unknown)	cells ml ⁻¹	10	400	400	10								50		50	10				
Cryptophyceae																				
Cryptomonas spp.	cells ml ⁻¹	10			10															
Hemiselmis spp.	cells ml ⁻¹	10																		
Hillea spp.	cells ml ⁻¹	10	550	100	10	10	10	10	10	150	200	500	200		1100					
Leucocryptos spp.	cells ml ⁻¹	10																		
Plagioselmis spp.	cells ml ⁻¹	10																		
Rhodomonas spp.	cells ml ⁻²	10				30										10	20			
Teleaulax spp.	cells ml ⁻¹	10																		
Cyanophyceae																				
Microcystis spp. (PT)	cells ml ⁻¹	10			660	250	80													
Planktolyngbya contorta (I)	cells ml ⁻¹	10				140	300													
Planktolyngbya limnetica (I)	cells ml ⁻¹	10				100	50													
Pseudanabaena acicularis (I)	cells ml ⁻¹	10				2600	4200	20								20				
Pseudanabaena spp.	cells ml ⁻¹	10							40											
Raphidiopsis raciborskii (PT)	cells ml ⁻¹	10	1490			69300	68700			2290		3850		360	860	2980	60			
Dictyocophyceae																				
Apedinella radians	cells ml ⁻¹	10		20						10		20		20						
Dictyocha spp.	cells ml ⁻¹	10																		
Ocellularia octonaria	cells ml ⁻¹	10																		
Dinophyceae																				
Akashiwo sanguinea	cells ml ⁻¹	10																		
Dinophysis acuminata (PT)	cells ml ⁻¹	10																		
Gymnodinium impudicum	cells ml ⁻¹	10																		
Gymnodinium spp.	cells ml ⁻¹	10																		
Gyrodinium spp.	cells ml ⁻¹	10	10	70	20															
Heterosigma minima	cells ml ⁻¹	10	50								3900	100	3800	60	80	300	800			
Heterosigma spp.	cells ml ⁻¹	10																		

			Development Envelopes										Reference Sites					
			Applecross (SW01)		Barrack Street (SW02)		Elizabeth Quay (SW03)		Ellam Street (SW04)		Matilda Bay 1 (SW06)		Matilda Bay 2 (SW07)		Heathcote (SW05)		Matilda Bay Central (SW08)	Narrows (SW09)
			28 Aug 2025	28 Aug 2025	28 Aug 2025	28 Aug 2025	28 Aug 2025	28 Aug 2025	28 Aug 2025	28 Aug 2025	28 Aug 2025	28 Aug 2025	28 Aug 2025	28 Aug 2025	28 Aug 2025	28 Aug 2025	28 Aug 2025	28 Aug 2025
			GHD-Applecross-202508-GR-SUR	GHD-Applecross-202508-GR-ARB	GHD-Barracks-202508-GR-SUR	GHD-Barracks-202508-GR-ARB	GHD-ElizabethQuay-202508-GR-SUR	GHD-ElizabethQuay-202508-GR-ARB	GHD-Ellam-202508-GR-SUR	GHD-Ellam-202508-GR-ARB	GHD-MatBay1-202508-GR-SUR	GHD-MatBay1-202508-GR-ARB	GHD-MatBay2-202508-GR-SUR	GHD-MatBay2-202708-GR-ARB	GHD-6161869-Heathcote-SUR	GHD-QC01	GHD-6164602-MatCentral-SUR	GHD-6160262-Nar-SUR
			Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Duplicate	Normal	Normal
			0.68	2.45	0.7	2.81	0.65	1.74	0.67	1.69	0.73	4.13	0.66	4.21	0.66	0.66	0.71	0.69
			1261952	1261952	1261952	1261952	1261952	1261952	1261952	1261952	1261952	1261952	1261952	1261952	1261952	1261952	1261952	1261952
Katodinium spp Katodinium armiger Katodinium spp Katodinium veneficum Kryptoperidinium triquetrum cf. Peridiniella danica Peridinioid Dinoflagellate (unknown) Prorocentrum cordatum (PT) Prorocentrum dentatum Prorocentrum triestinum Protoperidinium bipes Protoperidinium spp Scrippsiella spp Tripos furca Euglenophyceae Eutropiella marina Haptophyceae Haptophyte (unknown) Nephroselmidophyceae cf Nephroselmis spp Prasinophyceae Prasinophyte (unknown) Pyramimonadophyceae Pachysphaera spp Pyramimonas spp Taxon Pyramimonas longicauda Pyramimonas spp Raphidophyceae Fibrocapsa japonica Heterosigma akashiwo Telenoma Telenoma spp	Unit	LOR																
	cells ml ⁻¹	10																
	cells ml ⁻²	10																
	cells ml ⁻¹	10																
	cells ml ⁻¹	10																
	cells ml ⁻¹	10																
	cells ml ⁻¹	10																
	cells ml ⁻¹	10				10					50			140			10	
	cells ml ⁻¹	10												90				
	cells ml ⁻¹	10		100	10						60						10	
	cells ml ⁻¹	10		10														
	cells ml ⁻¹	10																
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cells ml ⁻¹	10																	

Pyramimonadophyceae

#1 Quantification of linear and branched isomers has been conducted as a single total response using the relative response factor for the corresponding linear/branched standard.

#2 Reported Analyte LOR is higher than Requested Analyte LOR

Statistics

* A Non Detect Multiplier of 0.5 has been applied.

			Development Envelopes														Reference Sites		
			Applecross (SW01)		Barrack Street (SW02)		Elizabeth Quay (SW03)		Ellam Street (SW04)		Matilda Bay 1 (SW06)			Matilda Bay 2 (SW07)		Heathcote (SW05)	Matilda Bay Central (SW08)	Narrows (SW09)	
			22 Jul 2025	22 Jul 2025	22 Jul 2025	22 Jul 2025	22 Jul 2025	22 Jul 2025	22 Jul 2025	22 Jul 2025	22 Jul 2025	22 Jul 2025	22 Jul 2025	22 Jul 2025	22 Jul 2025	22 Jul 2025	22 Jul 2025	22 Jul 2025	
			GHD-Applecross-202507-GR-SUR	GHD-Applecross-202507-GR-ARB	GHD-Barracks-202507-GR-SUR	GHD-Barracks-202507-GR-ARB	GHD-Elizabeth-202507-GR-SUR	GHD-Elizabeth-202507-GR-ARB	GHD-Ellam-202507-GR-SUR	GHD-Ellam-202507-GR-ARB	GHD-MatBay1-202507-GR-SUR	GHD-MatBay1-202507-GR-ARB	GHD-QC01	GHD-MatBay2-202507-GR-SUR	GHD-MatBay2-202708-GR-ARB	GHD-6161869-Heathcote-SUR	GHD-6164602-MatCentral-SUR	GHD-6160262-Narrows-SUR	
			Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Field_D	Normal	Normal	Normal	Normal	Normal	
			0.703	2.691	0.671	3.086	0.695	1.954	0.666	1.831	0.676	4.514	0.676	0.699	4.599	0.682	0.724	0.63	
			1247871	1247871	1247871	1247871	1247871	1247871	1247871	1247871	1247871	1247871	1247871	1247871	1247871	1247871	1247871	1247871	
Bacillariophyceae	Unit	LOR																	
	Amphora spp	cells ml ⁻¹	10							10									
	Chaetoceros danicus	cells ml ⁻¹	10																
	Chaetoceros minimus	cells ml ⁻¹	10																
	Chaetoceros spp	cells ml ⁻¹	10	80	210	80	10		10		40	30	50	240	100	70	360	80	
	Chaetoceros subtilis	cells ml ⁻¹	10																
	Chaetoceros tenuissimus	cells ml ⁻¹	10	80		100		200		10			20					320	
	Conticribra weissflogii	cells ml ⁻¹	10																
	Cocconeis spp	cells ml ⁻¹	10														10		
	Coscinodiscus spp	cells ml ⁻¹	10												10				
	Cylindrotheca closterium	cells ml ⁻¹	10		20			10			10	30					10		
	Leptocylindrus minimus	cells ml ⁻¹	10																
	Leisardia spp	cells ml ⁻¹	10																
	Navicula spp	cells ml ⁻¹	10							10									
	Plagiotropis spp	cells ml ⁻¹	10																
	Pleurosigma spp	cells ml ⁻¹	10					10											
	Rhizosolenia setigera	cells ml ⁻¹	10							140		7460							
	Skeletonema menziesii	cells ml ⁻¹	10																
	Skeletonema spp	cells ml ⁻¹	10	5320	2140	1130	1030	700	810			1080	1880	7370	570	1630	6100	390	
Thalassionema spp	cells ml ⁻¹	10							10							40			
Thalassiosira pseudonana	cells ml ⁻¹	10	400	280	120						310	50	250	180		580	330		
Thalassiosira spp	cells ml ⁻¹	10	30		10	10	10	20			20		40	20			20		
Thalassiothrix spp	cells ml ⁻¹	10																	
Chlorodendrophyceae																			
Tetraselmis spp	cells ml ⁻¹	10	230	390	210	90	480	120	70	20	230		160	70		190	290	170	
Chlorophyceae																			
Monoraphidium contortum	cells ml ⁻¹	10																20	
Chrysophyceae																			
Chrysophytes (unknown)	cells ml ⁻¹	10																	
Dinobryon spp	cells ml ⁻¹	10	10	10	20			10			10		20	10		10			
Coccolithophyceae																			
Chrysochromulina spp	cells ml ⁻¹	10																	
Cryptophyceae																			
Hemiselmis spp	cells ml ⁻¹	10																	
Hillea spp	cells ml ⁻¹	10	890	2200	680	650	1300	1680	1270	1090	770	1280	1050	420	800	1100	630	820	
Leucocryptos spp	cells ml ⁻¹	10																	
Plagioselmis spp	cells ml ⁻¹	10	240	170	370	10	870	110	410	30	150	40	280	70		260	150	100	
Rhodomonas spp	cells ml ⁻²	10	10	10	30		20	20	50		20		10	10			40		
Taleaulax spp	cells ml ⁻¹	10		10	210	140	160	200			10	10					50		
Dictyochophyceae																			
Apedinella radians	cells ml ⁻¹	10				50	30										10	80	
Dictyocha spp	cells ml ⁻¹	10																	
Octatis octonaria	cells ml ⁻¹	10																	
Dinophyceae																			
Akashiwo sanguinea	cells ml ⁻¹	10																	
Dinophysis acuminata (PT)	cells ml ⁻¹	10							20										
Gymnodinium impudicum	cells ml ⁻¹	10						20								30			
Gymnodinium spp	cells ml ⁻¹	10																	
Gyrodinium spp	cells ml ⁻¹	10	40	50	100	30	30	40	70	50	20		10		20	80	60	10	
Heterocapsa minima	cells ml ⁻¹	10	250	810	330	130	210	40	400	60	460	40	290	390	50	1220	600	890	
Heterocapsa spp	cells ml ⁻¹	10																	
Karlodinium spp	cells ml ⁻¹	10												10					
Karlodinium armiger	cells ml ⁻²	10																	
Karlodinium spp	cells ml ⁻¹	10																	
Karlodinium veneficum	cells ml ⁻²	10																	
cf. Peridiniella danica	cells ml ⁻²	10																	
Peridinioid Dinoflagellate (unknown)	cells ml ⁻¹	10																	
Prorocentrum cordatum (PT)	cells ml ⁻¹	10							10					10		10			
Prorocentrum dentatum	cells ml ⁻¹	10					10				10		10			10			



			Development Envelopes												Reference Sites			
			Applecross (SW01)		Barrack Street (SW02)		Elizabeth Quay (SW03)		Ellam Street (SW04)		Matilda Bay 1 (SW06)			Matilda Bay 2 (SW07)		Heathcote (SW05)	Matilda Bay Central (SW08)	Narrows (SW09)
			22 Jul 2025	22 Jul 2025	22 Jul 2025	22 Jul 2025	22 Jul 2025	22 Jul 2025	22 Jul 2025	22 Jul 2025	22 Jul 2025	22 Jul 2025	22 Jul 2025	22 Jul 2025	22 Jul 2025	22 Jul 2025	22 Jul 2025	22 Jul 2025
			GHD-Applecross-202507-GR-SUR	GHD-Applecross-202507-GR-ARB	GHD-Barracks-202507-GR-SUR	GHD-Barracks-202507-GR-ARB	GHD-ElizQuay-202507-GR-SUR	GHD-ElizQuay-202507-GR-ARB	GHD-Ellam-202507-GR-SUR	GHD-Ellam-202507-GR-ARB	GHD-MatBay1-202507-GR-SUR	GHD-MatBay1-202507-GR-ARB	GHD-QC01	GHD-MatBay2-202507-GR-SUR	GHD-MatBay2-202706-GR-ARB	GHD-6161869-Heathcote-SUR	GHD-6164602-MatCentral-SUR	GHD-6160262-Nar-SUR
			Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Field D	Normal	Normal	Normal	Normal	Normal
			0.703	2.691	0.671	3.086	0.695	1.954	0.666	1.831	0.676	4.514	0.678	0.699	4.599	0.682	0.724	0.63
			1247871	1247871	1247871	1247871	1247871	1247871	1247871	1247871	1247871	1247871	1247871	1247871	1247871	1247871	1247871	
Proorocentrum triestinum	Unit	LOR																
	cells ml ⁻¹	10			10		10								10			
	Protopteridinium bipes	cells ml ⁻¹	10															
	Protopteridinium spp	cells ml ⁻¹	10													20		
	Scrippsiella spp	cells ml ⁻¹	10	10														
Tripos furca	cells ml ⁻¹	10																
Euglenophyceae																		
Eutreptiella marina	cells ml ⁻¹	10	10					10		10						10		
Haptophyceae																		
Haptophyte (unknown)	cells ml ⁻¹	10	520	410	160	140	330	130	170		150	20	410	130	120	130	130	
Nephroselmidophyceae																		
cf Nephroselmis spp	cells ml ⁻¹	10	160	270	150	30	40	110	30	20	80	110	150	60		160	40	
Prasinophyceae																		
Prasinophyte (unknown)	cells ml ⁻¹	10	210	190	270	40	550	310	200	30	210	220	80	90	270	200	720	
Pyramimonadophyceae																		
Pachysphaera spp	cells ml ⁻¹	10																
Pyramimonas spp	cells ml ⁻¹	10	10		10	10	70							80		40	60	
Taxon																		
Pyramimonas longicauda	cells ml ⁻¹	10																
Pyramimonas spp	cells ml ⁻²	10									40							
Raphidophyceae																		
Fibrocapsa japonica	cells ml ⁻¹	10																
Heterosigma akashiwo	cells ml ⁻¹	10	10	700	40	30	20	20	60	110	10		20	90		40	50	
Telenoma																		
Telenoma spp	cells ml ⁻¹	10							20				10				180	

Pyramimonadophyceae

#1 Quantification of linear and branched isomers has been conducted as a single total response using the relative response factor for the corresponding linear/branched standard.

#2 Reported Analyte LOR is higher than Requested Analyte LOR

Statistics

* A Non Detect Multiplier of 0.5 has been applied.

			Development Envelopes														Reference Sites													
			Applecross (SW01)		Barrack Street (SW02)		Elizabeth Quay (SW03)		Ellam Street (SW04)		Matilda Bay 1 (SW06)		Matilda Bay 2 (SW07)		Heathcote (SW05)	Matilda Bay Central (SW08)	Narrows (SW09)													
			25 Jun 2025	GHD-Applecross-202506-GR-SUR	25 Jun 2025	GHD-Applecross-202506-GR-ARB	25 Jun 2025	GHD-Barracks-202506-GR-SUR	25 Jun 2025	GHD-Barracks-202506-GR-ARB	25 Jun 2025	GHD-EllzQuay-202506-GR-SUR	25 Jun 2025	GHD-Ellam-202506-GR-SUR	25 Jun 2025	GHD-OC01	25 Jun 2025	GHD-Ellam-202506-GR-ARB	25 Jun 2025	GHD-MatBay1-202506-GR-ARB	25 Jun 2025	GHD-MatBay2-202406-GR-SUR	25 Jun 2025	MatBay2-202406-GR-ARB	25 Jun 2025	GHD-6161869-Heathcote-SUR	25 Jun 2025	GHD-6164602-MatCentral-SUR	25 Jun 2025	GHD-6160262-Narrows-SUR
			Normal	Normal	0.672	4.392	0.65	3.021	0.791	1.934	0.712	0.712	2.055	0.687	4.447	0.732	4.79	0.658	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	0.664	0.701	
			1236654	1236654	1236654	1236654	1236654	1236654	1236654	1236654	1236654	1236654	1236654	1236654	1236654	1236654	1236654	1236654	1236654	1236654	1236654	1236654	1236654	1236654	1236654	1236654	1236654	1236654		
	Unit	LOR																												
Bacillariophyceae																														
	cells ml ⁻¹	10						20			10																			
	cells ml ⁻¹	10					20																							
	cells ml ⁻¹	10														20						10								
	cells ml ⁻¹	10																												
	cells ml ⁻¹	10	20	10	30	40					360	60	10	20	10							100	20		80					
	cells ml ⁻¹	10									100											490	150		270	50				
	cells ml ⁻¹	10		40	30	220	1270			30	470				60	40	50				730			60		320				
	cells ml ⁻¹	10														10														
	cells ml ⁻¹	10																												
Chlorodendrophyceae																														
	cells ml ⁻¹	10	320	50	340	2330	360	60	250	160	310	290			130	120					450			80		480				
Coccolithophyceae																														
	cells ml ⁻¹	10														10														
Cryptophyceae																														
	cells ml ⁻¹	10											10				10											10		
	cells ml ⁻¹	10		1120	420	530	380	900	380	720	570	1600	310	250		620						640			260		410			
	cells ml ⁻¹	10																												
	cells ml ⁻¹	10	1360	170	440	10	90	90	60	70	60	600	70		400	110						270			290		20			
	cells ml ⁻²	10						20	10			10																		
	cells ml ⁻¹	10							10							10														
Dicynophyceae																														
	cells ml ⁻¹	10		30	40			180						20		110					10			10						
Diophyceae																														
	cells ml ⁻¹	10																												
	cells ml ⁻¹	10			50	10	30	30	200		20	10				50					40			10						
	cells ml ⁻¹	10	120	40	90			20			30																			
	cells ml ⁻¹	10				10	100	160	100	80	70	50			140	30														
	cells ml ⁻¹	10	490	10	220	20	540	440	200	480	230																			
	cells ml ⁻¹	10																												
	cells ml ⁻²	10																												
	cells ml ⁻¹	10														10					90			30		40				
	cells ml ⁻¹	10															10													
	cells ml ⁻¹	10		10																										
	cells ml ⁻²	10			10																									
	cells ml ⁻¹	10		10																										
	cells ml ⁻¹	10																												
	cells ml ⁻¹	10																												
	cells ml ⁻¹	10		10																										
	cells ml ⁻¹	10		10																										
	cells ml ⁻¹	10		10																										
	cells ml ⁻¹	10		10																										
	cells ml ⁻¹	10		10																										
	cells ml ⁻¹	10		10																										
	cells ml ⁻¹	10		10																										
	cells ml ⁻¹	10		10																										
	cells ml ⁻¹	10		10																										
	cells ml ⁻¹	10		10																										
	cells ml ⁻¹	10		10																										
	cells ml ⁻¹	10		10																										
	cells ml ⁻¹	10		10																										
	cells ml ⁻¹	10		10																										
	cells ml ⁻¹	10		10																										
	cells ml ⁻¹	10		10																										
	cells ml ⁻¹	10		10																										
	cells ml ⁻¹	10		10																										
	cells ml ⁻¹	10		10																										
	cells ml ⁻¹	10		10																										
	cells ml ⁻¹	10		10																										
	cells ml ⁻¹	10		10																										

Pyramimonadophyceae#1 Quantification of linear and branched isomers has been conducted as a single total response using the relative response factor for the corresponding linear/branched standard.
#2 Reported Analyte LOR is higher than Requested Analyte LOR**Statisticals**

* A Non Detect Multiplier of 0.5 has been applied.



Development Envelopes													
Applecross (SW01)			Barrack Street (SW02)		Elizabeth Quay (SW03)		Eilam Street (SW04)		Matilda Bay 1 (SW06)		Matilda Bay 2 (SW07)		Maltilda Bay Central (SW08)
29 Apr 2025 GHD- Applecross- 202504-GR- SUR	29 Apr 2025 GHD- Applecross- 202504-GR- ARB	29 Apr 2025 GHD-QC01	29 Apr 2025 GHD-Barracks- 202504-GR- SUR	29 Apr 2025 GHD-Barracks- 202504-GR-ARB	29 Apr 2025 GHD-ElizQuay- 202504-GR- SUR	29 Apr 2025 GHD-ElizQuay- 202504-GR-ARB	29 Apr 2025 GHD-Eilam- 202504-GR-SUR	29 Apr 2025 GHD-Eilam- 202504-GR-ARB	29 Apr 2025 GHD- MatBay1- 202504-GR- SUR	29 Apr 2025 GHD-MatBay1- 202504-GR- ARB	29 Apr 2025 GHD- MatBay2- 202404-GR- SUR	29 Apr 2025 GHD- MatBay2- 202404-GR- ARB	29 Apr 2025 GHD-6164602- MatCentral- SUR
Normal	Normal	Field_D	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
0.877	3.47	0.877	0.794	3.112	0.548	2.053	0.546	1.905	0.517	4.502	0.734	4.675	0.749
1213857	1213857	1213857	1213857	1213857	1213857	1213857	1213857	1213857	1213857	1213857	1213857	1213857	1213857

	Unit	LOR												
Bacillariophyceae														
Amphora spp	cells ml ⁻¹	10	30	10	10		10		10				10	
Chaetoceros danicus	cells ml ⁻¹	10	10	10					10		20		20	
Chaetoceros minimus	cells ml ⁻¹	10							10					
Chaetoceros spp	cells ml ⁻¹	10	140	20	20				10					
Chaetoceros subtilis	cells ml ⁻¹	10	20		10									
Chaetoceros tenuissimus	cells ml ⁻¹	10	50	20	10				80	70	10			
Conticribra weissflogii	cells ml ⁻¹	10	10	10	130				10			10		
Cylindrotheca closterium	cells ml ⁻¹	10	120	120										
Leptocylindrus minimus	cells ml ⁻¹	10	20	20	10	40	30	20	50		10	60	40	70
Lessardia spp	cells ml ⁻¹	10	10	10	20								10	
Navicula spp	cells ml ⁻¹	10	30	10	10								10	
Rhizosolenia setigera	cells ml ⁻¹	10		10				10	10		10		10	10
Skeletonema menziesii	cells ml ⁻¹	10	200	700	150								10	
Skeletonema spp	cells ml ⁻¹	10	130	60			10			60	80		140	
Thalassiosira psuedonana	cells ml ⁻¹	10	500	1100	480	60			180			310		10
Thalassiosira spp	cells ml ⁻¹	10	40	40	70	10	60	30	500	200			200	50
Thalassiothrix spp	cells ml ⁻¹	10				10	20	20			20	400		20
Chlorodendrophyceae														
Tetraselmis spp	cells ml ⁻¹	10	40	30		20		30	10	280	120	500	600	400
Chrysophyceae														
Chrysophytes (unknown)	cells ml ⁻¹	10						30						
Coccolithophyceae														
Chrysochromulina spp	cells ml ⁻¹	10	20	10	900		10	10						
Cryptophyceae														
Hillea spp	cells ml ⁻¹	10	900	500		200	240	350	600	1000	2000	1400	800	1000
Leucocryptos spp	cells ml ⁻¹	10											20	10
Plagioselmis spp	cells ml ⁻¹	10									10			
Teleaulax spp	cells ml ⁻¹	10			30						20			
Dictyochophyceae														
Apedinella radians	cells ml ⁻¹	10	10											
Dictyocha spp	cells ml ⁻¹	10			30		10		10					
Octatis octonaria	cells ml ⁻¹	10		10	420	10	20				10	40	10	30
Dinophyceae														



Development Envelopes													
Applecross (SW01)			Barrack Street (SW02)		Elizabeth Quay (SW03)		Ellam Street (SW04)		Matilda Bay 1 (SW06)		Matilda Bay 2 (SW07)		Matilda Bay Central (SW08)
29 Apr 2025 GHD- Applecross- 202504-GR- SUR	29 Apr 2025 GHD- Applecross- 202504-GR- ARB	29 Apr 2025 GHD-QC01	29 Apr 2025 GHD-Barracks- 202504-GR- SUR	29 Apr 2025 GHD-Barracks- 202504-GR-ARB	29 Apr 2025 GHD-ElizQuay- 202504-GR- SUR	29 Apr 2025 GHD-ElizQuay- 202504-GR-ARB	29 Apr 2025 GHD-Ellam- 202504-GR-SUR	29 Apr 2025 GHD-Ellam- 202504-GR-ARB	29 Apr 2025 GHD-MatBay1- 202504-GR- SUR	29 Apr 2025 GHD-MatBay1- 202504-GR- ARB	29 Apr 2025 GHD-MatBay2- 202404-GR- SUR	29 Apr 2025 GHD-MatBay2- 202404-GR- ARB	29 Apr 2025 GHD-6164602- MatCentral- SUR
Normal	Normal	Field_D	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
0.877	3.47	0.877	0.794	3.112	0.548	2.053	0.546	1.905	0.517	4.502	0.734	4.675	0.749
1213857	1213857	1213857	1213857	1213857	1213857	1213857	1213857	1213857	1213857	1213857	1213857	1213857	1213857

			12-1000†	12-1000†	12-1000†	12-1000†	12-1000†	12-1000†	12-1000†	12-1000†	12-1000†	12-1000†	12-1000†	12-1000†	12-1000†	12-1000†
	Unit	LOR														
Akashiwo sanguinea	cells ml ⁻¹	10		10				30	60		10					10
Gymnodinium impudicum	cells ml ⁻¹	10	10	10				20	20					10		
Gymnodinium spp	cells ml ⁻¹	10			40	10	10	20								
Gyrodinium spp	cells ml ⁻¹	10	20	20	180	20			10	10	60	10				
Heterocapsa spp	cells ml ⁻¹	10	20	40		100	30	10	60	20	10	50	40	30	120	170
Karlodinium spp	cells ml ⁻¹	10													10	
Peridinioid Dinoflagellate (unknown)	cells ml ⁻¹	10			70							10				
Prorocentrum cordatum (PT)	cells ml ⁻¹	10		30	60	70	30	20	60	80	40	10	80	60	200	150
Prorocentrum dentatum	cells ml ⁻¹	10	30	20	10	150	70	40	50	50	60	100	300	230	330	170
Prorocentrum triestinum	cells ml ⁻¹	10	20	10					10	20	30	10	30		30	
Protoperidinium bipes	cells ml ⁻¹	10	10	10	20									10		10
Protoperidinium spp	cells ml ⁻¹	10			40					10				10		10
Scrippsiella spp	cells ml ⁻¹	10	180	210		90		20	20	20		220	50	50	60	40
Tripos furca	cells ml ⁻¹	10			10											
Euglenophyceae																
Eutreptiella marina	cells ml ⁻¹	10			500	10		10							10	
Haptophyceae																
Haptophyte (unknown)	cells ml ⁻¹	10	1200	1500	30	400	170	280	600	300		300	200	500	400	1500
Nephroselmidophyceae																
cf Nephroselmis spp	cells ml ⁻¹	10	10								10	10				10
Raphidophyceae																
Heterosigma akashiwo	cells ml ⁻¹	10			40			20	100	30	10	30	20	40	50	20
Prasinophyceae																
Prasinophyte (unknown)	cells ml ⁻¹	10	2300	3500	1680	700	1280	700	110	1600	1500	1600	1400	2700	1600	1700
Telonmea																
Telonema spp	cells ml ⁻¹	10										10	10			

Comments

- #1 Quantification of linear and branched isomers has been conducted as a single total response using the relative response factor for the corresponding linear/branched standard
#2 Reported Analyte LOR is higher than Requested Analyte LOR

Statistics

* A Non Detect Multiplier of 0.5 has been applied.



Reference Sites				
Narrows (SW09)		Heathcote (SW05)		
29 Apr 2025		29 Apr 2025		
GHD-6160262-Nar-SUR		GHD-6161869-Heathcote-SUR		
Normal		Normal		
0.505		0.765		
1213857		1213857		

	Unit	LOR		
Bacillariophyceae				
Amphora spp	cells ml ⁻¹	10		10
Chaetoceros danicus	cells ml ⁻¹	10	10	20
Chaetoceros minimus	cells ml ⁻¹	10		
Chaetoceros spp	cells ml ⁻¹	10		20
Chaetoceros subtilis	cells ml ⁻¹	10		
Chaetoceros tenuissimus	cells ml ⁻¹	10		
Conticribra weissflogii	cells ml ⁻¹	10	10	10
Cylindrotheca closterium	cells ml ⁻¹	10		
Leptocylindrus minimus	cells ml ⁻¹	10	30	60
Lessardia spp	cells ml ⁻¹	10		
Navicula spp	cells ml ⁻¹	10	30	10
Rhizosolenia setigera	cells ml ⁻¹	10	10	
Skeletonema menzeldii	cells ml ⁻¹	10		
Skeletonema spp	cells ml ⁻¹	10		400
Thalassiosira psuedonana	cells ml ⁻¹	10	20	10
Thalassiosira spp	cells ml ⁻¹	10	160	20
Thalassiothrix spp	cells ml ⁻¹	10		60
Chlorodendrophyceae				
Tetraselmis spp	cells ml ⁻¹	10	300	100
Chrysophyceae				
Chrysophytes (unknown)	cells ml ⁻¹	10		
Coccolithophyceae				
Chrysochromulina spp	cells ml ⁻¹	10	10	10
Cryptophyceae				
Hillea spp	cells ml ⁻¹	10	1000	900
Leucocryptos spp	cells ml ⁻¹	10		30
Plagioselmis spp	cells ml ⁻¹	10		
Teleaulax spp	cells ml ⁻¹	10		
Dictyochophyceae				
Apedinella radians	cells ml ⁻¹	10	20	
Dictyocha spp	cells ml ⁻¹	10		10
Octatis octonaria	cells ml ⁻¹	10	10	10
Dinophyceae				



Reference Sites				
Narrows (SW09)		Heathcote (SW05)		
29 Apr 2025		29 Apr 2025		
GHD-6160262-Nar-SUR		GHD-6161869-Heathcote-SUR		
Normal		Normal		
0.505		0.765		
1213857		1213857		
	Unit	LOR		
Akashiwo sanguinea	cells ml ⁻¹	10	10	
Gymnodinium impudicum	cells ml ⁻¹	10	10	
Gymnodinium spp	cells ml ⁻¹	10	20	
Gyrodinium spp	cells ml ⁻¹	10	40	
Heterocapsa spp	cells ml ⁻¹	10	90	90
Karlodinium spp	cells ml ⁻¹	10	40	10
Peridinioid Dinoflagellate (unknown)	cells ml ⁻¹	10		
Prorocentrum cordatum (PT)	cells ml ⁻¹	10	70	160
Prorocentrum dentatum	cells ml ⁻¹	10	200	110
Prorocentrum triestinum	cells ml ⁻¹	10	40	10
Protoperidinium bipes	cells ml ⁻¹	10		
Protoperidinium spp	cells ml ⁻¹	10		
Scrippsiella spp	cells ml ⁻¹	10	50	30
Tripos furca	cells ml ⁻¹	10		20
Euglenophyceae				
Eutreptiella marina	cells ml ⁻¹	10		
Haptophyceae				
Haptophyte (unknown)	cells ml ⁻¹	10	700	600
Nephroselmidophyceae				
of Nephroselmis spp	cells ml ⁻¹	10		
Raphidophyceae				
Heterosigma akashiwo	cells ml ⁻¹	10	70	60
Prasinophyceae				
Prasinophyte (unknown)	cells ml ⁻¹	10	1000	1000
Telonmea				
Telonema spp	cells ml ⁻¹	10		

Comments

#1 Quantification of linear and branched isomers has been co

#2 Reported Analyte LOR is higher than Requested Analyte L

Statistics

* A Non Detect Multiplier of 0.5 has been applied.

Appendix D

Photo log (September)



Plate 1 SeaBird (SBE) 19plus V2 SeaCAT Profiler CTD



Plate 2 Field filtration equipment for algae sampling



Plate 3 Niskin equivalent sampler which features a non-metallic construction with a manually activated spring closure.



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➔ **The Power of Commitment**

Appendix B

Biological Survey (GHD,
2025)

Swan River Ferry Expansion

Biological Survey

Public Transport Authority

30 April 2025

→ The Power of Commitment



Project name		Swan River Ferry Expansion					
Document title		Swan River Ferry Expansion Biological Survey					
Project number		12658767					
File name		12658767-RPT-B_Swan River Ferry Expansion Biological Survey.docx					
Status Code	Revision	Author	Reviewer		Approved for issue		
			Name	Signature	Name	Signature	Date
S3	A	P Patterson R Jarrold	T Sleigh	On file	M Brook	On file	04/04/25
S4	B	P Patterson	T Sleigh	On file	M Brook	On file	30/04/25
[Status code]							
[Status code]							
[Status code]							

GHD Pty Ltd | ABN 39 008 488 373
999 Hay Street , Level 10
Perth, Western Australia 6000, Australia
T +61 8 6222 8222 | **F** +61 8 6222 8555 | **E** permail@ghd.com | **ghd.com**

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Executive summary

The Public Transport Authority (PTA) is planning to expand the ferry public transport system within the Swan River. Stage 1 of the project is expected to include the following elements:

- Expansion of the ferry fleet with new ferries, potentially using water jet propulsion and electric power.
- Ferry terminals, including:
 - extension of the existing Elizabeth Quay jetty.
 - new jetty at Matilda Bay with onshore electric charging infrastructure and public amenities.
 - new jetty at Applecross with associated pedestrian access.
 - new jetty at Canning Bridge, with pedestrian access provided through the Canning Bridge Bus Interchange project.
- A berthing facility at Ellam Street (next to the current DWER Ellam Street office), including car parking and staff amenities such as an office.
- Maintenance dredging of a navigational channel along Langley Park between Elizabeth Quay and Heirisson Island.
- Capital dredging of a new navigational channel west and south of Heirisson Island to the Ellam Street berthing facility.
- Operation of new ferry services between Elizabeth Quay, Matilda Bay, Applecross, Canning Bridge, and Ellam Street.

GHD Pty Ltd was engaged by Public Transport Authority (PTA) to undertake the assessment of flora, vegetation and fauna values and diversity and abundance within the Survey Area that encompasses the project.

The biological survey involved a desktop assessment, basic reconnaissance flora and vegetation survey and basic reconnaissance-level fauna survey assessment. The flora and vegetation surveys and fauna surveys were conducted concurrently on the March 7th, 2025 and 27th March 2025. The purpose of the surveys was to identify the flora, vegetation, fauna and values present within the area to inform the design, environmental assessment and approvals process.

Vegetation and flora

The background desktop assessment identified three main vegetation unit types with no wetlands or major conservation reserves or ecological communities directly intersecting or occurring within the four survey sites themselves, and a total of 167 significant listed threatened and priority flora species located within a 10 km radius Study Area of all four Survey Sites. However, no such species were found or recorded within the survey sites themselves and were confined to neighbouring ecological communities and established nature reserves and parks.

A small number of basic vegetation types were recorded within the four various Survey Areas, varying from one to three vegetation types across the four sites, with the larger range of vegetation types and vegetation cover being observed at Ellam Street and Matilda Bay. Across the Survey Area, the dominant vegetation types consisted of cleared parkland, scattered native Eucalypt, Melaleuca, and Peppermint, Shoreline and Estuarine Riparian, rehabilitation and re-plantings. The remaining areas consisted of sections completely devoid of vegetation. As a result, all four sites across the Survey Area were considered to be Cleared.

A total of 23 vascular flora species, were recorded across all four sites within the Survey Area. This total included 16 native and seven introduced species. As the Survey Area has previously been significantly cleared and altered, the flora of the area consisted of both planted exotic and native species, with scattered, significant individual trees from various *Agonis* (Peppermint), *Melaleuca*, Eucalypt and Marri species present in small numbers at both the Matilda Bay and Ellam Street sites. No observed flora species are listed as declared pest plants in WA under the BAM Act, or Weeds of National Significance (WoNS) (Australian Weeds 2012).

No EPBC or state listed TECs, or DBCA listed PECs were recorded within any of the four sites within the Survey Area, reinforcing the highly degraded, low ecological value of the Survey Area in the current state compared to

historically occurring ecological diversity, value, and in comparison to the established higher value systems present in communities within the 10km radius of the desktop Study Area such as Banksia Woodlands of the Swan Coastal Plain, and in neighbouring nature reserves and conservation-listed parks.

Fauna

Database desktop searches across various state and federal records have identified a significant number (94 taxa of species and sub-species) of Threatened and Priority fauna species that had either been previously recorded or determined to be likely to occur within the Study Area, which includes a 10 km radius from all four sites across the Survey Area. However, such previous records were not located within the Survey Area in great frequency, and were concentrated within neighbouring areas of higher habitat value or established conservation reserves and parks.

A small number of basic fauna habitat types were recorded across the Survey Area, consisting of four basic habitat types to varying sizes and coverage across the four sites of the Survey Area. These fauna types were classified as Scattered Trees (Native and Exotic), Parkland over revegetation and re-planted flora, Riparian Rivers and shoreline wetlands and Completely Cleared. These fauna habitats are likely to support a comparatively small range of regionally common terrestrial fauna species, primarily birds, within the habitats available. Field surveys across all four Survey Areas recorded small numbers of predominantly locally common bird species, ranging from as few as four species at Elizabeth Quay to 13 species at Ellam Street. Furthermore, no conservation significant fauna species, listed under either *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) level or the *WA Biodiversity Conservation Act 2016* (BC Act), were recorded. A total of 17 potential black cockatoo breeding trees (with a diameter at breast height (DBH) of 500 mm) were identified at both Ellam Street and Matilda Bay sites, respectively, though these were typically in highly isolated patches within the sites themselves. It is, however, unlikely that the current Survey Area and specific Survey Sites contain enough habitat of sufficient quality to allow for persistent use in breeding, foraging or roosting activity when compared to the neighbouring recorded areas of higher quality and value for black cockatoos.

From an assessment of potentially significant trees that were deemed to be of notable importance in terms of size, significance to native fauna use and overall importance to the Survey Site, there were no significant trees observed at either the Applecross Survey Site or the Elizabeth Quay Survey Site. When including the suitable DBH trees in the assessment, a total of 26 potentially significant tree groupings were identified and recorded across the remaining two Survey Sites, with seven at Ellam Street and 19 at Matilda Bay respectively. The majority of these trees were isolated individuals with a small number of small groupings of three to four. Most of these trees were also native species of older ages and size and condition compared to other surrounding flora species observed, with each of them offering potential foraging, temporary resting and nesting habitat for locally common bird species as well as the identified black cockatoo trees offering the potential for lower value foraging and feeding and temporary resting habitat. The details of each group of potentially significant trees are provided in table format in Appendix D. It is noted that while other trees of smaller size and condition were observed at the Ellam Street and Matilda Bay Survey Sites, these were not deemed to have a significant size or condition to be assessed as of significance to each Survey Site as a source of fauna utilisation when compared to those identified and highlighted trees. While the majority of the previously identified significant species from desktop assessment were not assessed as likely to occur or known to occur, a small number of similar species across the Survey Area were deemed likely to occur or possibly occurring, ranging from eight species at the Elizabeth Quay and Applecross sites, to nine species at the Matilda Bay and Ellam Street sites. There was a higher number of such species at both Matilda Bay and Ellam Street assessed as being likely to occur as opposed to potentially occurring. This is due to the higher presence of re-planted and rehabilitated vegetation cover and the presence of a small number of clusters of scattered existing trees, of which a smaller number were assessed as being of lower value but potential feeding and foraging trees for the three local threatened Black Cockatoo species. These sites also contained greater potential for temporary resting or temporary foraging for species such as Osprey and Quenda.

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1. Introduction

1.1 Project background

The Public Transport Authority (PTA) is planning to expand the ferry public transport system within the Swan River. Stage 1 of the project is expected to include the following elements:

- Expansion of the ferry fleet with new ferries, potentially using water jet propulsion and electric power
- Ferry terminals, including:
 - extension of the existing Elizabeth Quay jetty
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- Capital dredging of a new navigational channel west and south of Heirisson Island to the Ellam Street berthing facility
- Operation of new ferry services between Elizabeth Quay, Matilda Bay, Applecross, Canning Bridge, and Ellam Street.

1.2 Purpose of this report

PTA commissioned GHD to conduct a biological assessment to support the project approvals process. Specifically, the scope was to undertake terrestrial flora, vegetation, and fauna desktop assessment field surveys for the four proposed sites associated with the project.

1.3 Location

1.3.1 Study Area

The total Study Area for the desktop assessment and related database searches comprised of a 10 km buffer radius from all four proposed survey sites, which was compiled into a single Study Area for assessment. Figure 1, Appendix A maps the Study Area.

1.3.2 Survey Area

The Survey Area consisted of four separate sites across the Swan River Region. These locations were based at:

- Elizabeth Quay
- Applecross
- Ellam St
- Matilda Bay.

A figure outlining specifics of each survey location are provided in Appendix A, Figure 1.

1.4 Scope of works

The scope of works addressed the survey area and includes:

- A desktop review of publicly available information to determine the environmental values of the Survey Area
- A reconnaissance flora and vegetation field survey to verify/ground truth the desktop assessment findings through techniques in accordance with Environmental Protection Authority (EPA) flora and vegetation survey guidelines (EPA, 2016)
- A basic fauna survey including fauna habitat mapping based on vegetation units in accordance with EPA (2020)
- Preparation of a biological assessment report (this document) on the findings of the desktop assessment and field survey.

1.5 Relevant legislation, conservation codes and background information

In Western Australia (WA) significant communities, and flora and fauna are protected under both Federal and State Government legislation, including the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), *Environmental Protection Act 1986* (EP Act), *Biodiversity Conservation Act 2016* (BC Act) and the *Biosecurity and Agriculture Management Act 2007* (BAM Act).

In addition, regulatory bodies also provide a range of guidance and information on expected standards and protocols for environmental surveys. An overview of key legislation and guidelines, conservation codes and background information relevant to this Project are provided in Appendix B.

1.6 Report limitations and assumptions

This report has been prepared by GHD for and may only be used and relied on by PTA for the purpose agreed between GHD and PTA as set out in section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

GHD has prepared this report on the basis of information provided by PTA and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

This report has assessed desktop environmental aspects and biological factors in the field for the survey sites. Should these areas change or be refined, further assessment may be required.

2. Methodology

2.1 Desktop Assessment

Prior to the commencement of the field survey, a desktop assessment was undertaken to identify relevant environmental information pertaining to the study area and to assist in survey design, with a 10km radius buffer search around all four identified sites. Given the close proximity of the four sites together across the Perth Metropolitan area, one whole desktop analysis encompassing all five sites was undertaken. The desktop assessment involved a review of the following:

- The Department of Climate Change, Energy, Environment and Water (DCCEEW) Protected Matters Search Tool (PMST) to identify communities and species listed under the EPBC Act potentially occurring within the study area (Department of Climate Change, Energy, the Environment and Water 2022a) (Appendix C)
- The Department of Biodiversity, Conservation and Attractions (DBCA) *NatureMap* database for flora and fauna species previously recorded within the study area. (Note that the minimum buffer distance of the *NatureMap/Dandjoo* Search is 10 km, so this encompasses species beyond the 5 km study area) (DBCA 2025a), Appendix C)
- The BirdLife Australia's Atlas, Birddata datasets and Great Cocky Count dataset to identify Black Cockatoo roosts (Birdlife Australia 2016).
- The DBCA Threatened Ecological Community (TEC) and Priority Ecological Community (PEC) database to determine the potential for TECs or PECs to be present within the study area (Department of Biodiversity, Conservation and Attractions 2022b).
- The DBCA Threatened and Priority Flora database (TPFL) and the WA Herbarium database (WAHERB) for Threatened flora species listed under the EPBC Act and/or the BC Act and listed as Priority by DBCA, previously recorded within the study area (2025c).
- Broad vegetation mapping of the Survey Area (Beard 1979 and Heddle *et al* 1980), aerial photography, geology/soils and hydrology information to provide background information on the variability of the environment, likely vegetation units and fauna habitats and to identify areas with potential to contain TECs, PECs, and Threatened and Priority listed flora and fauna species.
- Atlas of Living Australia (ALA) Spatial Portal (Atlas of Living Australia 2025), due to the limitations of the *NatureMap* Search, the flora diversity section of the desktop assessment is informed by the ALA spatial portal database search.
- Data WA main database website (www.data.wa.gov.au) with access to specific state-based information relating to Hydrology, Wetlands, Landforms and Soils, Environmentally Sensitive Areas (ESA) and conservation reserves.

2.2 Field Survey

2.2.1 Vegetation and flora

The field surveys were undertaken to verify the results of the desktop assessment, identify and describe the dominant vegetation types, assess vegetation condition, and identify and record vascular flora taxa present at the time of survey. Searches for significant ecological communities and flora taxa were also undertaken during the field survey. A map depicting GPS track logs to attest to time and effort expended is included in Figure 2, Appendix A. GHD Zoologist Phil Patterson and Graduate Ecologist Rebecca Jarrold conducted the flora and vegetation survey over one and half days on 7th March 2025 and 27th March 2025.

The survey methodology employed by GHD was undertaken with reference to the EPA *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (Environmental Protection Authority 2016).

2.2.1.1 Data collection

Given the highly disturbed nature of the site and lack of native vegetation, quadrat sampling was not deemed necessary, and effort was placed in traversing the Survey Area to identify native species, overall dominant

vegetation types and flora species, and potentially significant weeds (as shown in Table 1. This survey effort is considered suitable to meet the requirement of a reconnaissance survey.

Table 1 *Data collected during the field survey*

Aspect	Measurement
Physical features	Landform, slope, aspect, soil attributes, ground surface cover, leaf and wood litter.
Location	Coordinates recorded in GDA94 datum using a hand-held GPS tool.
Vegetation condition	Vegetation condition was assessed using the condition rating scale adapted by EPA (2016) for the South West Botanical Province.
Disturbance	Level and nature of disturbances (e.g. weed presence, fire and time since last fire, impacts from grazing, anthropogenic activities).
Flora	Broad flora species overview and description of dominant species present with positively identified significant flora species recorded and mapped where or if evident.

2.2.1.2 Vegetation types and mapping

Vegetation types were identified, and boundaries delineated using a combination of aerial photography, topographical features, and field data and observations.

Vegetation types were described based on structure, dominant taxa and cover characteristics as defined by relevant data and field observations. Vegetation type descriptions followed Native Vegetation Information System (NVIS) and consistent with NVIS level V (Association). At Level V up to three taxa per stratum are used to describe the association (NVIS Technical Working Group 2017).

2.2.1.3 Vegetation condition

Vegetation condition was assessed and mapped in accordance with the vegetation condition rating scale for the South West and Interzone Botanical Provinces (devised by Keighery (1994) and adapted by EPA (2016). The scale recognises the intactness of vegetation and consists of six rating levels. The vegetation condition rating scale is outlined in Appendix B.

2.2.1.4 Targeted surveys for significant flora

The results of the desktop assessment were reviewed, and a target list of significant flora taxa compiled. Ecological information (habitat, associated flora taxa and phenology) was sourced from *FloraBase* (Western Australian Herbarium 2022) and other relevant publications where available.

Habitat for significant flora taxa in the Survey Area was traversed on foot. The survey methods were undertaken with reference to EPA (2016). Figure 2 (Appendix A) presents survey effort through GPS track logs.

Where significant flora taxa were identified the locations and number of plants present were recorded using a GPS unit.

2.2.1.5 Taxonomy and Nomenclature

A flora inventory was compiled from taxa listed from opportunistic floristic records throughout the Survey Areas. Species that were well known to the survey ecologists were identified in the field. Species were identified by the use of taxonomic literature, electronic keys and online electronic databases.

The conservation status of all recorded flora was compared against the current lists available on *FloraBase* (Western Australian Herbarium 2022) and the EPBC Act Threatened species database provided by DCCEEW (2022b).

Nomenclature used in this report follows that used by the WA Herbarium as reported on *FloraBase* (Western Australian Herbarium 2022).

2.2.2 Vertebrate fauna survey

GHD Zoologist Phil Patterson and Graduate Ecologist Rebecca Jarrold conducted the fauna survey over one and half days on 7th March 2025 and 27th March 2025.

The following guidance were referenced to conduct the survey:

- Technical Guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA 2020)
- Referral guideline for 3 WA threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black Cockatoo (Department of Agriculture, Water and Environment (DAWE) 2022).

In the context of a Basic fauna survey, the guidance statement advises field observers to describe the fauna habitats of the Survey Area, which give a comprehensive list of fauna that can reasonably be expected to occur. Therefore, the aim of the fauna component of the survey included descriptions of fauna habitats in the Survey Area and a compilation of fauna species recorded opportunistically as the Survey Area was traversed. Significant fauna considered likely to occur were targeted during the traverses undertaken, through targeting and recording any secondary signs of fauna (mounds, tracks, feeding evidence) or visible/audible encounters of the target species in suitable habitat. Black Cockatoos known to occur locally, and their habitat were specifically targeted during the survey as detailed below.

2.2.2.1 Fauna habitat assessment

A fauna habitat assessment was undertaken to document the types, value, and extent of habitats within the Survey Area. Habitat delineation was aligned closely with the vegetation community types identified during the flora and vegetation survey. Specifically, the assessment included:

- Habitat structure (vegetation community type, structural layers such as ground cover and mid storey)
- Presence/absence of refuge including density of vegetation strata and ground debris, hollow-bearing trees and stags, and the type and extent of each refuge
- Presence/absence of waterways (natural or artificial)
- Location of the habitat within the Survey Area and local context with surrounding landscape
- Habitat connectivity and identification of wildlife corridors within and immediately adjacent to the Survey Area
- Current land use and disturbance history
- Evaluation of key habitat features, and types identified during the desktop assessment relevant to fauna of conservation significance
- Evaluation of the likelihood of occurrence of significant fauna, based on presence of suitable habitat
- Mapping of the broad habitat types identified
- A representative photograph of each broad habitat type.

2.2.2.2 Opportunistic fauna searches

Opportunistic fauna searches were undertaken across the Survey Area, involving:

- Species inventory based on observed fauna and recorded tracks, scats, and other evidence.
- Searching through microhabitats including turning over logs or rocks, turning over leaf litter and examining tree hollows and logs
- Visual and aural surveys, which accounted for many bird species potentially utilising the Survey Area
- Recording GPS locations of any significant fauna species observed.

2.2.2.3 Taxonomy and Nomenclature

Identification of fauna species was made in the field using available field guides and electronic guides. In accordance with the EPA technical guidance, nomenclature for herpetofauna and mammals follows that of the Western Australian Museum Checklist of the Vertebrates of Western Australia (Western Australia Museum 2021) and birds follows the Australian Faunal Directory (Department of Environment and Energy 2022).

2.3 Survey limitations

Following completion of the desktop assessment and field surveys, a review of any limitations that may have affected a complete assessment of the data collected was conducted.

The EPBC Act PMST is based on bioclimatic modelling for the potential presence of species. As such, this does not represent actual records of the species within the area. The records from the Department of Biodiversity, Conservation and attractions (DBCA) searches of Threatened flora and fauna provide more accurate information for the general area based on prior records. However, some records of collections, sightings or trappings cannot be dated and often misrepresent the current range of Threatened species. Notwithstanding, database records pertaining to significant taxa and plant communities are interrogated where possible anomalies or outlying records are found to ensure thoroughness and accuracy.

The limitations listed in Table 2 are based on those suggested as considerations in Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (Environmental Protection Authority 2016) and Technical Guidance – Terrestrial Fauna Surveys for Environmental Impact Assessment (Environmental Protection Authority 2020).

Table 2 Field survey limitations

Aspect	Constraint	Comment
Sources of information and availability of contextual information.	Nil	The vegetation types of the Swan Coastal Plain (SCP) were mapped by Beard at a scale of 1:250,000 in the 1960s and 1970s (later digitised) with the entire area later mapped at a scale of 1:1,000,000 (Beard 1979). Vegetation complexes of the SCP (south of Lancelin) have been mapped at a scale of 1:250,000 and compiled into a dataset (Department of Biodiversity, Conservation and Attractions 2018a). The majority of the SCP was described by Heddle, Loneragan and Havel (1980) with the far southern section completed by Webb et al (2016). Information at a local scale is available for Bush Forever Sites (Government of Western Australia 2000). All fauna databases such as DBCA, Dandjoo and Atlas of Living Australia have extensive current and historical recordings of both common and significant fauna and outlining of core and suitable habitat and were assessed in combination with the current field survey assessments.
Scope (what life forms were sampled etc.)	Minor	Vascular terrestrial flora and terrestrial vertebrate fauna were assessed during the survey. Non-vascular flora, aquatic flora, invertebrate and aquatic fauna were not surveyed. Furthermore, aquatic vertebrate fauna species were only observed on an opportunistic basis due to the small proportion of various survey sites that featured marine habitat.
Proportion of flora collected and identified (based on sampling, timing and intensity) Proportion of fauna identified, recorded and/or collected	Minor	The single season reconnaissance level flora and vegetation survey was undertaken in Autumn (March 2025), which is outside of the typically optimal timing for flora surveys in the Southwest Botanical Province (EPA 2016). However, due to the highly degraded and historically cleared nature of all four survey sites, this was not considered to significantly impact the diversity and abundance of species or their capacity to be identified. Given the small survey site sizes, low remnant vegetation and low remaining species diversity due to extensive clearing and land conversion, the reconnaissance level assessment required for the current project and brief overview of vegetation and flora species type was considered sufficient. The Basic fauna survey and habitat assessment was undertaken in March 2025. The fauna assessment was aimed at identifying broad habitat types and significant terrestrial vertebrate fauna utilising the Survey Area. The fauna assessment sampled those species that can be easily seen, heard or have distinctive signs, such as tracks, scats, diggings, etc. Many cryptic species would not have been identified during a Basic survey and seasonal variation within species often requires Targeted surveys at a particular time of the year. Of the fauna species recorded during the survey, all were identified to species level. The survey timing was considered appropriate for the purpose of the assessment.
Flora determination	Minor	Flora determination was undertaken by GHD ecologists and zoologists in the field and through further consultation with senior botanists and ecologists once back in the main GHD office from photos and GPS recordings. None of the species observed were potential significant flora. The taxonomy and conservation status of the WA flora is dynamic. This report was prepared with reliance on taxonomy and conservation status current at the time report development, but it should be noted

Aspect	Constraint	Comment
		this may change in response to ongoing research and review of International Union for Conservation Nature criteria.
Completeness and further work which might be needed (e.g. was the relevant area fully surveyed)	Nil	The Survey Area was considered adequately surveyed to compile a representative list of species, as well as to describe and map vegetation at a level appropriate for impact assessment and approval determination.
Mapping reliability	Minor	The survey was conducted using high-resolution aerial imagery obtained from Landgate, topographical features, previous vegetation mapping (Heddle <i>et al.</i> 1980 and Webb <i>et al.</i> 2016) and field data. Data was recorded in the field using hand-held GPS tools (e.g. Samsung tablet, Garmin GPS and Trimble). Certain atmospheric factors and other sources of error can affect the accuracy of GPS receivers, including tree canopies. The Garmin GPS units used for this survey are accurate to within ± 5 metres on average, whereas the Trimble unit is capable of a < 2 m accuracy. Therefore, the data points consisting of coordinates recorded from the GPS may contain minor inaccuracies.
Timing/weather/season/cycle	Minor	The field survey was conducted during the early Autumn period (March, 2025 (Bureau of Meteorology 2025). In the three months prior to the survey (November 2024- January 2025) 19.6 mm of rainfall was recorded. This total is below the long-term average for the same period (November 2024 -January 2025; 50mm) (Bureau of Meteorology 2025), and represents the drier and hotter season for numerous species of flora and fauna. This may slightly reduce recordings of certain terrestrial vertebrate fauna species. However, due to the highly degraded and altered aspects of all four survey sites, it is unlikely that this would significantly impact the accuracy of findings in terms of representing flora and fauna presence at the survey sites.
Disturbances (e.g. fire, flood, accidental human intervention)	Minor	The survey sites have previously been completely cleared due to historic land use, and conversion to recreational parkland and infrastructure.
Intensity (in retrospect, was the intensity adequate)	Nil	The vascular flora of the Survey Area was sampled in accordance with EPA (2016) and terrestrial fauna sampled in accordance with EPA (2020). The survey intensity was of suitable intensity for the size, location and level of existing disturbances and development across the survey sites. A minimum of three flora sample sites were located within each identified vegetation type, where possible. In some instances, less than three sites were described per vegetation type, this was due to the limited area and geographic range of the vegetation type and/or the degraded condition of the vegetation. As the area has been completely cleared and replanted with a mixture of local and non-local native species, relevés were used to sample vegetation, and quadrats were subsequently not required as The Survey Area was sufficiently covered by the GHD ecologist and zoologist during the survey.
Resources	Nil	Adequate resources were employed during the field survey. Two days were spent undertaking the survey using a combination of one graduate ecologists and one zoologist. The relatively small sizes of each survey site and in proximity to one-another allowed for each site to be accessed and surveyed within a single day of fieldwork.
Access restrictions	Nil	No access restrictions were encountered for the survey sites in the field.
Experience levels	Minor	The zoologist and graduate ecologist who executed the survey are experienced practitioners with over 4 years of environmental consultancy experience, including assessment and research surrounding the Swan Coastal Plain.

3. Desktop assessment

3.1 Climate

The Study Area experiences a temperate climate with distinctly dry, hot summers and cool, wet winters.

The Bureau of Meteorology Perth Metro station (site number 009225) is the nearest weather station to the Study Area with continuous long-term data. Climatic data from this site indicates the mean maximum temperature of the area ranges from 19.0°C in July to 29.7 °C in December and the mean minimum temperature ranges from 8.7 °C in July to 19.4 °C in February (Bureau of Meteorology 2025). The mean annual rainfall is 726.9 mm (Bureau of Meteorology 2025). In the three months prior to the survey (November 2024- January 2025) 19.6 mm of rainfall was recorded. This total is below the long-term average for the same period (November 2024 -January 2025; 50mm) (Bureau of Meteorology 2025).

3.2 Landforms and soil

The Survey Area occurs on the Swan Coastal Plain and within two soil landscape systems:

- Spearwood System (211Sp): Comprises predominantly of sand dunes and plains with yellow deep sands, pale deep sands and yellow/brown shallow sands.
- Vasse System (211Va): Poorly drained estuarine flats, of the Swan Coastal Plain. Tidal flat soil, saline wet soil and pale deep sand. Samphire, sedges and paperbark woodland.

The DPIRD soil mapping indicates that there are two soil landscapes that intersect the Survey Area (Table 3) (Department of Primary Industries and Regional Development 2021).

Table 3 Landforms within the Survey Area

Unit	Name	Description	Area (ha)
211Sp S14	EnvGeol S14 phase	SAND - pale grey to white, medium-grained sub-angular, quartz and feldspar, well sorted, abundant whole and broken bivalves and gastropod shells, of alluvial origin	3.32
211Va C1	EnvGeol C1 phase	CLAY - mid to dark grey, soft, saturated, prominent 0.2 m thick oyster shell bed near surface of alluvial origin. Variable organic content	9.53

3.3 Hydrology

The DWER geographic data layers (Department of Water and Environmental Regulation 2023) identified the following hydrology and hydrogeology aspects proclaimed under the *Rights in Water and Irrigation Act 1914* (RIWI Act) within the Survey Area (Table 4).

Table 4 Department of Water and Environmental Regulation geographic data atlas queries for the Survey Area

Aspect	Details	Result
Groundwater area	Groundwater areas proclaimed under the RIWI Act.	The Survey Area is located within the Perth Groundwater Area.
Surface water areas	Surface water areas proclaimed under the RIWI Act.	None Present
Irrigation district	Irrigation Districts proclaimed under the RIWI Act.	None Present
Rivers	Rivers proclaimed under the RIWI Act.	The Survey Area intersects with the Swan River.
Public Drinking Water Source Areas (PDWSA)	PDWSAs is a collective term used for the description of Water Reserves, Catchment Areas and Underground Pollution Control Areas declared (gazetted) under the provisions of the <i>Metropolitan Water Supply, Sewage and Drainage Act 1909</i> .	None Present. The closest PDWSA is the Perth Coastal and Gwelup Underground Water Pollution Control Area located 12km to the North of the Survey Area.

Aspect	Details	Result
Waterway Management Areas	Areas proclaimed under the <i>Waterway Conservation Act 1976</i> .	None Present

3.3.1 Wetlands

The desktop search across the PMST MNES database and DBCA listed RAMSAR and Nationally Important Wetlands recorded one RAMSAR listed Wetland, this being the Forrestdale and Thompsons Lakes, and four (4) Nationally Important Wetlands, with these being Palmer Barracks, Herdsman Lake, Booragoon Swamp, and the Swan-Canning Estuary. Only one of the identified wetlands was located within the 10 km radius of the current Survey Area, that being the Swan-Canning Estuary, with all others more than 10 km away.

Based on the Geomorphic Wetlands of the Swan Coastal Plain mapping (Department of Biodiversity, Conservation and Attractions 2021a), two geomorphic wetlands intersect the Survey Area while an additional two are within 250 m. Geomorphic wetlands are detailed in Table 5 and mapped on Figure 3, Appendix A.

Table 5 Geomorphic wetlands within 250 m of the Survey Area

UFI	Wetland name	Wetland management	Wetland Type	Distance to Survey Area
8147	Heirisson Island Artificial Lake	Multiple Use	Artificial Lake	51 m north of Ellam Street site
8148	Heirisson Island Artificial Lake	Multiple Use	Artificial Lake	97 m north of Ellam Street site
8152	South Perth Foreshore	Conservation	Estuary-Peripheral	Intersects the south west open water portion of the Ellam Street site
13316	Swan River Estuary	Conservation	Estuary-Waterbody	Intersects the open water portion of all sites excluding Elizabeth Quay

3.4 Land use

3.4.1 Region Schemes

The Survey Area intersected multiple Local Government Authorities (LGAs) including the City of Perth, the Town of Victoria Park, City of South Perth and the City of Melville. The Metropolitan Region Scheme (MRS) indicated that the land parcels within the Survey Area are predominately zoned as “Waterways” and “Parks and Recreation” (Department of Planning, Lands and Heritage 2025). The general land uses surrounding the Study Area are mapped on Figure 4, Appendix A and land uses within the Survey Area sites are summarised in Table 6.

Table 6 Surrounding land use and zoning

Survey Area	LGA	Details
Applecross Site	City of Melville	The site intersects the Canning River, attributing to the “Waterways” MRS zoning. The southern end of the site is attributed to “Primary regional roads” due to intersecting the Canning Highway while the remainder of the site is “Parks and Recreation”. The area south of the site comprises urban land use.
Elizabeth Quay Site	City of Perth	Elizabeth Quay is located in the Perth CBD and zoned as “Central city area”. It is adjacent to the Swan River, attributing to the “Waterways” land use.
Ellam Street Site	Town of Victoria Park City of South Perth	The site lies adjacent to the Swan River, attributing to the “Waterways” MRS zoning. The remainder of the site is zoned as “Parks and Recreation” due to being located in Taylor Reserve and McCallum Park.
Matilda Bay Site	City of Perth	The Matilda Bay site intersects the Swan River, attributing to the “Waterways” MRS zoning. A large portion of the site is located in the Matilda Bay Reserve, which is zoned as “Parks and Recreation”. The University of

Survey Area	LGA	Details
		Western Australia is located to the west of the site which is zoned as “Public purposes – university”.

3.4.2 Conservation Reserves

The Survey Area is partially located in DBCA managed areas, the Swan River and Canning River (R 48325 and R 48327) vested with the Swan River Trust for the purpose of Landscape Protection. As outlined below in Section 3.4.2.1, the Swan and Canning River Development Control Area extends along all survey sites excluding Elizabeth Quay. The Survey Area also intersects the Matilda Bay Reserve (R 17375), a Class A Conservation Park and DBCA managed reserve vested with the Conservation Commission Of WA. DBCA legislated lands are listed in Table 7 and mapped on Figure 5, Appendix A (Department of Biodiversity Conservation and Attractions 2022c).

Table 7 DBCA legislated lands or water within the Survey Area

Reserve name	Identifier	Class	Category	Act
-	R 48325	-	Crown Land	<i>Swan and Canning Rivers Management Act 2006</i>
-	R 48327	-	Crown Land	<i>Swan and Canning Rivers Management Act 2006</i>
Matilda Bay Reserve	R 17375	A	Crown Land	<i>Conservation and Land Management Act 1984 - Section 5(1)(g)</i>

3.4.2.1 Development Control Area

The Swan and Canning Rivers, and adjoining parks and recreation reserves are contained within the Swan and Canning River Development Control Area (DCA). The Swan and Canning River DCA extends along all survey sites excluding Elizabeth Quay (Department of Biodiversity Conservation and Attractions 2019a).

The responsibility for the management of development within the Swan and Canning DCA sits with the Rivers and Estuaries Branch of the DBCA. Policies have been developed to ensure land use planning and development in the DCA protects and enhances the ecological health, community benefit, amenity and heritage value of the Swan and Canning River system. The process for development approvals in and around the rivers depends on the location of the proposed development with respect to the DCA.

Land use planning and development in the DCA is subject to the approval processes of Part 5 of the *Swan and Canning Rivers Management Act 2006* (SCRM Act) and the Swan and Canning Rivers Management Regulations 2007 (SCRM Regulations).

Section 3 of the SCRM Act defines development as:

- the erection, construction, demolition, alteration or carrying out of any building, excavation, or other works in, on, over or under land or waters
- a material change in use of land or waters
- any other act or activity in relation to land or waters declared by the regulations.

Certain classes of works, acts and activities are excluded from the definition of development under the SCRM Regulations. For example, this may include investigative activities and temporary works.

Part 5 of the SCRM Act applies to development wholly within the DCA. DBCA prepare a report, the Swan River Trust endorse and make a recommendation, and the Minister for Environment is the decision maker. Where the development is partly in the DCA or abuts the DCA or may affect the DCA, it is dealt with under the planning approval process via clause 30A of the MRS. In this case Swan River Trust provides advice, often from the DBCA Rivers and Estuaries Branch to the planning authority (Western Australian Planning Commission (WAPC) or LGA).

3.4.3 Bush Forever Sites

No bush forever sites intersect the Survey Area. The nearest bush forever site is site number 402, located approximately 100m south of the Matilda Bay site. Bush forever is mapped on Figure 6, Appendix A.

3.4.4 Environmentally Sensitive Areas

The Survey Area intersects 10 Environmentally Sensitive Areas (ESAs) (Department of Water and Environmental Regulation 2021). These ESAs are associated with Important Wetlands in Australia (Swan-Canning Estuary), Swan Coastal Plain wetlands and Register of the National Estate and are mapped on Figure 6, Appendix A.

3.5 Regional biogeography

The Survey Area is situated in the Southwest Botanical Province of WA (Beard 1979) within the Swan Coastal Plain (SCP) bioregion and the Perth subregion as described by the Interim Biogeographic Regionalisation of Australia (IBRA) (Commonwealth of Australia 2012).

The SCP bioregion is a low lying coastal plain, mainly covered with woodlands. The Perth subregion is composed of colluvial and aeolian sands, alluvial river flats and costal limestone. Heath and/or Tuart woodlands occur on limestone, Banksia and Jarrah-Banksia woodlands on Quaternary marine dunes of various ages and Marri on colluvial and alluvial soils. The subregion also includes a complex series of seasonal wetlands (Mitchell et al. 2002).

3.5.1 Vegetation associations

Broad scale (1:250,000) pre-European vegetation mapping of the area has been completed by Beard (1979) at an association level. The mapping indicates that two vegetation associations intersect the Survey Area:

- Medium woodland; tuart & jarrah (association 6)
- Medium very sparse woodland; jarrah, with low woodland; banksia & casuarina (association 1001).

The pre-European mapping has been adapted and digitised by Shepherd et al. (2002). The extent of vegetation associations have been determined by the state-wide vegetation remaining extent calculations maintained by DBCA, most recently updated in 2019 (Department of Biodiversity Conservation and Attractions 2019b). The 2019 extent remaining of vegetation association 6 is 23.72% of pre-European extent at state, regional and subregional level, and less than 5% at Local Government Authority (LGA) levels in the City of Melville, City of South Perth and Town of Victoria Park while above 20% in the city of Perth. (Table 8). The extent remaining of vegetation association 1001 is 22.05% at state, regional and subregional level, and 0.66% at LGA level in the Town of Victoria Park (Table 8).

Regional vegetation complexes have been mapped by Heddle et al. (1980) with updates from Webb et al. (2016) based on major geomorphic units on the SCP. The mapping indicates that the Survey Area occurs within two vegetation complexes:

- **Bassendean Complex-Central and South:** Vegetation ranges from woodland of *Eucalyptus marginata* (Jarrah) - *Allocasuarina fraseriana* (Sheoak) - *Banksia* species to low woodland of *Melaleuca* species, and sedgelands on the moister sites. This area includes the transition of *Eucalyptus marginata* (Jarrah) to *Eucalyptus todtiana* (Prickly bark) in the vicinity of Perth.
- **Vasse Complex:** Mixture of the closed scrub of *Melaleuca* species fringing woodland of *Eucalyptus rudis* (Flooded Gum) - *Melaleuca* species and open forest of *Eucalyptus gomphocephala* (Tuart) - *Eucalyptus marginata* (Jarrah) - *Corymbia calophylla* (Marri). Will include areas dominated by *Tecticornia* and *Salicornia* species (Samphire) near Mandurah and south of the Capel River.

The DBCA and DWER have assessed the vegetation complexes against presumed pre-European extents within the SCP IBRA bioregion and the LGA level respectively (Table 9). At the bioregion and LGA level in the City of South Perth, the Bassendean Complex – Central and South has less than 30% and 3% pre-European extent remaining, respectively (Department of Biodiversity Conservation and Attractions 2019c). At the bioregion and LGA level in the City of Perth, City of South Perth and the Town of Victoria Park, the Vasse Complex has greater than 30% and less than 2% pre-European extent remaining, respectively (Department of Biodiversity Conservation and Attractions 2019c).

Table 8 *Extent of pre-European vegetation associations mapped within the Survey Area*

Vegetation association	Scale	Pre-European extent (ha)	Current extent (ha)	Remaining (%)	% Current extent in all DBCA managed land (proportion of Current Extent)
6	State: Western Australia	56,343.01	13,362.25	23.72	39.83
	IBRA bioregion: SCP	56,343.01	13,362.25	23.72	39.83
	IBRA Subregion: Perth	56,343.01	13,362.25	23.72	39.83
	LGA: City of Melville	3,687.84	155.72	4.22	4.62
	LGA: City of Perth	1,377.03	332.35	24.14	96.34
	LGA: City of South Perth	1,397.18	28.72	2.06	2.98
	LGA: Town of Victoria Park	12.64	0	0	0
1001	State: Western Australia	57,410.23	12,660.76	22.05	14.19
	IBRA bioregion: SCP	57,410.23	12,660.76	22.05	14.19
	IBRA Subregion: Perth	57,410.23	12,660.76	22.05	14.19
	LGA: Town of Victoria Park	1,583.57	10.46	0.66	0

Table 9 *Extent of vegetation complex on the SCP and LGA level mapped within the Survey Area*

Vegetation Complex	Scale	Pre-European Extent (ha)	Current Extent (ha)	% Remaining	Current percentage remaining within all DBCA managed land (%)
Bassendean Complex-Central and South	IBRA bioregion: SCP	87,476.26	23,508.66	26.87	5.00
	LGA: City of South Perth	1,666.43	40.79	2.45	0
Vasse Complex	IBRA bioregion: SCP	15,691.63	4,926.97	31.40	14.62
	LGA: City of Perth	512.40	9.19	1.79	0
	LGA: City of South Perth	67.88	0.06	0.09	0
	LGA: Town of Victoria Park	55.33	0	0	0

3.6 Vegetation and flora

3.6.1 Significant ecological communities

A review of the DBCA TEC and PEC database (Department of Biodiversity, Conservation and Attractions 2025) and the EPBC Act PMST (Department of Climate Change, Energy, the Environment and Water 2022a) identified the presence of listed communities previously recorded within the Study Area. Table 10 details TECs identified by the PMST report in the Study Area and the TECs/PECs identified by the DBCA TEC and PEC database within 250 m of the Survey Area.

The locations of the TECs and PECs in the vicinity of the Study Area are mapped in Figure 7, Appendix A.

Table 10 Threatened and Priority Ecological Communities surrounding the Survey Area

Community name	Status		Description	Distance from Survey Area
	EPBC Act	BC Act/ DBCA		
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Priority 3	Canopy is most commonly dominated or co-dominated by <i>Banksia attenuata</i> and/or <i>B. menziesii</i> . Other Banksia species that can dominate in the community are <i>B. prionotes</i> or <i>B. ilicifolia</i> . It typically occurs on well drained, low nutrient soils on sandplain landforms, particularly deep Bassendean and Spearwood sands and occasionally on Quindalup sands; it is also common on sandy colluvium and aeolian sands of the Ridge Hill Shelf, Whicher Scarp and Dandaragan Plateau and can occur in other less common scenarios.	PMST: In feature area DBCA: 60 m south from Applecross site
Tuart (<i>Eucalyptus gomphocephala</i>) Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Priority 3	Mostly confined to Quindalup Dunes and Spearwood Dunes but can also occur on the Bassendean dunes and Pinjarra Plain. It can occur on the banks of rivers and wetlands. Tuart is the key upper canopy species although it may co-occur with trees of other species. Trees commonly co-occurring with Tuart include <i>Agonis flexuosa</i> (peppermint), <i>Banksia grandis</i> , <i>Banksia attenuata</i> , <i>Eucalyptus marginata</i> ; and less commonly, <i>Corymbia calophylla</i> , <i>Banksia menziesii</i> and <i>Banksia prionotes</i> . An understorey of native plants is typically present, which may include grasses, herbs and shrubs.	PMST: In feature area DBCA: 630 m north Matilda Bay site
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Priority 3	Consists of the assemblage of plants, animals and micro-organisms associated with saltmarsh in coastal regions of sub-tropical and temperate Australia (south of 23°S latitude). It occurs on the coastal margin, along estuaries and coastal embayments and on low wave energy coast in places with at least some tidal connection, including rarely-inundated supratidal areas, intermittently opened or closed lagoons, and groundwater tidal influences. The community occurs on sandy or muddy substrate and may include coastal clay pans and similar habitats. It consists of dense to patchy areas of characteristic coastal saltmarsh plant species that include salt- tolerant herbs, succulent shrubs or grasses, and may also include bare sediment as part of the mosaic. It can occur where the proportional cover by tree canopy such as mangroves, <i>Melaleucas</i> or <i>Casuarinas</i> or seagrass is not greater than 50%.	PMST: In buffer area only (10 km) DBCA: 50 m north of Ellam Street site
Honeymyrtle shrubland on limestone ridges of the Swan Coastal Plain Bioregion	Critically Endangered	N/A	The Honeymyrtle shrubland is the assemblage of plants, animals and other organisms associated with a type of warm temperate shrubland or heath, dominated by <i>Melaleuca huegelii</i> (chenille honeymyrtle), <i>M. systema</i> (coastal honeymyrtle), and/or <i>Banksia sessilis</i> (parrot bush). It occurs only in southwest Western Australia (WA). It is known from a small number of locations in the Swan Coastal Plain IBRA1 Bioregion (SWA). It is a shrub-dominated ecological community, with sclerophyll shrubs forming thickets or heaths, above a typically diverse ground layer of herbs, including sedges, Restionaceae and occasional grasses. Honeymyrtle shrubland only occurs on the slopes and tops of limestone ridges on the Swan Coastal Plain. Its plants provide food for a variety of nectar-, seed- and fruit-eating birds, and browsing for mammals. The associated rocky and sandy substrates provide ample reptile basking sites, and the shrub layer gives them cover.	PMST: In buffer area only (10 km) DBCA: N/A

Community name	Status		Description	Distance from Survey Area
	EPBC Act	BC Act/ DBCA		
<i>Empodisma</i> peatlands of southwestern Australia	Endangered	N/A	<i>Empodisma</i> peatlands is the assemblage of plants, animals and other organisms associated with a type of freshwater, peat-based wetland that is found in the High Rainfall Province of the south-west of Western Australia. It is typically a sedgeland to shrubland vegetation complex on peaty substrates that almost always includes the perennial grass-like twig rush <i>Empodisma gracillimum</i> (tanglefoot). <i>Empodisma</i> peatlands provide habitat for a diverse range of hydrophilic species, including threatened, regionally endemic, and relictual flora and fauna species.	PMST: In buffer area only (10 km) DBCA: N/A

¹: (Department of Biodiversity, Conservation and Attractions 2021b); (Department of Biodiversity, Conservation and Attractions 2018b)

3.6.2 Flora diversity

The *NatureMap* and *Dandjoo* database search, featuring a 10 km buffer radius of the Survey Area, identified 2,095 flora taxa (both species and sub-species) previously recorded. These consisted of 674 species of Monocot, 1,392 species of Dicot, 13 species of Ferns, 10 species of Gymnosperms and six species of Liverworts. Due to the potential for duplications and minor inaccuracies with both *NatureMap* and *Dandjoo* searches, some exclusions and omissions were made from the original results. The species exclusions are based on lack or suitable habitat within the Survey Area. Other records have been omitted due to taxonomic errors within the DBCA database resulting in multiple listings of taxa under superseded names. The *NatureMap* and *Dandjoo* database search is provided in Appendix C.

3.6.3 Significant flora

The EPBC Act PMST, *NatureMap* database and DBCA TPFL and WAHERB databases identified the presence or potential presence of 167 significant flora taxa within the Study Area (10 km radius of the Survey Area). There were no significant flora records from the DBCA TPFL or WAHERB within the Survey Area. The desktop searches recorded the potential for the following listed species:

- Five species listed as Critically Endangered (CR) under the Federal EPBC Act and WA State DBCA BC Act.
- 30 species listed as Endangered (EN) under the Federal EPBC Act and WA State DBCA BC Act.
- Eight species listed as Vulnerable (VU) under the Federal EPBC Act and WA State DBCA BC Act.
- 17 species listed as Priority 1 (P1) under the WA State DBCA BC Act.
- 26 species listed as Priority 2 (P2) under the WA State DBCA BC Act.
- 51 species listed as Priority 3 (P3) under the WA State DBCA BC Act.
- 30 species listed as Priority 4 (P4) under the WA State DBCA BC Act.

The significant flora species identified in the desktop assessment are provided in the likelihood of occurrence table (Appendix D).

3.7 Fauna

3.7.1 Fauna diversity

The *NatureMap* database identified 479 terrestrial vertebrate fauna taxa (species and sub-species) within the Study Area comprising 13 amphibians, 48 mammals, 339 birds, and 79 reptiles. A number of these taxa namely marine species of mammals, reptiles and fish have been omitted from this likelihood of occurrence assessment in Appendix E. Species exclusions are based on lack or suitable habitat within the Survey Area. Other records have been omitted due to taxonomic errors within the DBCA database resulting in multiple listings of taxa under superseded names. The *NatureMap* database search is provided in Appendix C.

3.7.2 Significant fauna

Desktop searches of the EPBC Act PMST, *NatureMap*, DBCA Threatened Fauna databases identified the presence/potential presence of 94 significant fauna species. This number excludes non-relevant species including pelagic or marine mammals and reptiles that have had no recent records within the marine habitat aspects of the Study Area, historical records of regionally extinct taxa and erroneous database records. Specifically, the significant fauna species identified consisted of:

- Five species listed as Critically Endangered (CR) under the Federal EPBC Act and WA State DBCA BC Act.
- 13 species listed as Endangered (EN) under the EPBC Act and WA State DBCA BC Act.
- 23 species listed as Vulnerable (VU) under the EPBC Act and WA State DBCA BC Act.
- 35 species listed as Migratory (MI) under the EPBC Act and WA State DBCA BC Act.
- One species listed as Conservation Dependent (CD) under the WA State DBCA BC Act.
- One species listed as Other Special Protection Status (OS) under the under the WA State DBCA BC Act.
- Eight species listed as Priority 4 (P4) under the WA State DBCA BC Act.
- Eight species listed as Priority 3 (P3) under the WA State DBCA BC Act.

All significant fauna identified in the searches are presented in the likelihood of occurrence assessment (Appendix E).

3.7.3 Black Cockatoos

A search of the DBCA database and Great Cockie Count Database (GCC) from Birdlife Australia (2023) identified numerous local records of Black Cockatoo roosting sites, (Department of Biodiversity, Conservation and Attractions 2019e). The Matilda Bay and Ellam Street sites intersect with buffers of confirmed sites – identified through both the GCC dataset the DBCA Black Cockatoo Roosting Sites (DBCA-064) dataset. These correspond with confirmed roosting sites approximately 800 m west of the Matilda Bay survey sites and 300 m south of the Ellam Street survey site. The nearest roosting site to Elizabeth Quay is 1250 m west while the nearest to the Applecross site is 700 m south west. Figure 8, Appendix A displays breeding and roosting sites in the study area.

No breeding sites from the Black Cockatoo Breeding Sites - Buffered (DBCA-063) dataset intersect with the Study Area, with the nearest being approximately 22 km north from Elizabeth Quay in Joondalup (Department of Biodiversity, Conservation and Attractions 2019d).

3.7.4 Significant benthic habitat

DBCA Draft seagrass mapping for Perth indicates that there is seagrass present along the shoreline of the Ellam Street site and in the surrounding area of Elizabeth Quay (Department of Biodiversity, Conservation and Attractions 2020). Seagrass mapping intersects with the open water portion of the Ellam Street site in the Swan River, with a dense patch intersecting the north east portion of the site, north of Heirisson Island. Perth seagrass mapping is mapped on Figure 8.

As part of overall benthic habitat assessment context for the current survey, the Causeway Pedestrian and Cyclist Bridge (CPCB) Project is located approximately 160 m north east of the Ellam Street site and was completed via a crossing of the Swan River approximately 80-90 metres downstream of the existing Causeway bridge from Point Fraser to Heirisson Island and to McCallum Park. . This project included a marine geophysics and hydrographic survey conducted by Golder (2021). The survey did not identify any significant benthic habitat classes (i.e. seagrass or macroalgae) in the riverbed. Findings from the survey indicated that the Swan River is generally characterised by bare substrate with fine/silty sands or rock rubble with no or very sparse filter feeders/macroalgae (Main Roads 2022).

4. Survey results – Applecross Site

4.1 Vegetation and flora

4.1.1 Vegetation types

Based on the structural and floristic characteristics observed in the field, three vegetation types, none of which are considered to be remnant vegetation were recorded in the Survey Site.

These vegetation types included:

- Replanting (VT01)
- Wetland/Shoreline (VT02)
- Parkland with Planted Trees (VT03)

The remaining areas have been mapped as Cleared. The vegetation types are described in Table 11 and mapped in Figure 10A (Appendix A).

Table 11 Recorded vegetation types for Applecross Survey Site

Vegetation type	Vegetation Type Description	Landform and Substrate	Extent (ha) and proportion of Survey Areas (%)	Photograph
VT01	Landsaped replanted areas consisting of mixed locally native and non-native species, typically patchy mixed native sedges and non-native palms, exotic flowering plants and shrubs.	Landsaped areas	0.15 ha (6.89%)	 Coordinates: -32.0109 115.8523 Photograph: Facing North-West
VT02	Wetland/Shore-bank vegetation consisting of highly modified previous shoreline wetland and estuarine vegetation communities with varying levels of reeds and <i>Melaleuca</i> species, and introduced River Oak (<i>Casuarina cunninghamiana</i>), as well as small sections of bulrush (<i>juncus kraussii</i>). Includes some native and exotic emergent aquatic plants.	Landsaped areas	0.07 ha (3.25%)	

Vegetation type	Vegetation Type Description	Landform and Substrate	Extent (ha) and proportion of Survey Areas (%)	Photograph
				Coordinates: -32.0099 115.8506 Photograph: Facing North
VT03	Parkland areas consisting of planted trees over mown grass	Landscaped Areas	0.05 ha (2.75%)	 Coordinates: -32.0100 115.8512 Photograph: Facing North-West
Open Water	Open Water and Estuarine	-	1.66 ha (76.00%)	 Coordinates: -32.0102 115.8519

Vegetation type	Vegetation Type Description	Landform and Substrate	Extent (ha) and proportion of Survey Areas (%)	Photograph
				Photograph: Facing North-East
Cleared	Completely devoid of vegetation	-	0.24 ha (11.00%)	 Coordinates: -32.0101 115.8519 Photograph: Facing North-West

4.1.2 Vegetation condition

The entire survey site has been cleared, with modifications carried out over time to the natural edge of the site, with artificial maritime structures bordering what would have historically been estuarine-based riparian shoreline and riverbank species or potentially *Banksia* and *Melaleuca* and *Eucalypt* species. Therefore, the vegetation types were not assigned a vegetation condition as they are not representative of native vegetation.

4.1.3 Significant ecological communities

No EPBC or state listed TECs, or DBCA listed PECs were recorded within the Survey Site.

4.1.4 Flora diversity

A total of six vascular flora species, were recorded in the Survey Site. Two of the flora species recorded were native taxa with the remaining four of not considered to be locally native to the area and classified as introduced. In the context of the current Survey Area and the vegetation types and descriptions, it is also important to note that the native species recorded were part of a re-planting activity. A species list by family type is presented in Appendix D.

4.1.5 Significant flora

No EPBC Act or BC Act listed flora were recorded within the Survey Site.

Likelihood of occurrence

A likelihood of occurrence assessment was conducted and post-field survey for significant flora taxa identified in the desktop assessment (Appendix D). The assessment took into account previous records, habitat requirements, efficacy of the survey, intensity of the survey, flowering times and the cryptic nature of species.

The likelihood of occurrence assessment post-field survey concluded that no taxa identified by the desktop assessment are known to occur or likely to occur. This is due to a combination of known distribution, preferred habitat, visibility of the taxa during the field survey, and most significantly, the high level of disturbance and clearing throughout the Survey Site and conversion to artificial infrastructure and cleared sections of parkland.

4.1.6 Introduced flora

No observed flora species are listed as declared pest plants in WA under the BAM Act, or Weeds of National Significance (WoNS) (Australian Weeds 2012).

4.2 Fauna

4.2.1 Fauna habitat types

Three broad habitat types were identified within the Survey Site, based on the predominant vegetation structure and geography. These habitats generally align with the vegetation community types (VTs) described in 11, and mapped from the concurrent flora and vegetation assessment. The fauna habitats tend to be simple in structure and vegetation diversity as they are derived from relatively recent revegetation of trees, shrubs and wetlands plants comprising native and exotic species including *Melaleuca*, *Casuarina*, date palms, deciduous and evergreen trees. The habitat types include:

- Riparian, River and Shoreline
- Native and exotic plantings
- Parkland with planted trees
- Cleared areas
- Open water.

Fauna habitat are described in more detail in Table 12 and mapped in Figure 11A, Appendix A.

Table 12 Fauna habitat types within the Applecross Survey Site

Habitat Type	Description	Extent (ha) and proportion of Survey Areas (%)	Representative photograph
Native and exotic plantings (VT01)	This habitat type consists of areas of replanted native and exotic trees and some areas of scattered planted native shrubs. Exotic species include <i>Allocasuarina</i>, and exotic palm species. This habitat is very small in size and in representation of the overall Suver Area and lacked vegetation diversity and structure. The habitat provides very limited and small available foraging habitat for some common native perching bird species. Given the low overall quality and size of the habitat, no significant species are likely to use the habitat on a regular basis. However, the close proximity to open water sources and the Swan River may allow for occasional fly-over activity or temporary perching and resting from various migratory shorebirds and sea-birds.	0.13 ha (5.96%)	 Coordinates: -32.0101 115.8519 Photograph: Facing South
Riparian, River and Shoreline (VT02)	This habitat consists of waterbodies and shoreline systems with varying levels of reeds and <i>Melaleuca</i> species, and introduced River Oak (<i>Casuarina cunninghamiana</i>). Includes some native and exotic emergent aquatic plants. This habitat provides potential, temporary habitat for waterfowl and wading bird species such as black swans (<i>Cygnus atratus</i>), Pacific Black Ducks (<i>Anas superciliosus</i>) and locally common moorhens and swamphens. This habitat is not likely to be important for migratory birds due to lack of shallow open shoreline suitable as foraging habitat for waders, however they may occur occasionally as temporary foraging or resting-based visitation due to proximity to estuarine habitat of the Swan River. Furthermore, the highly degraded and altered state of the habitat type is unlikely to support wetland and shoreline mammalian species such as water rat (Rakali) (<i>Hydromys chrysogaster</i>).	0.07 ha (3.2%)	 Coordinates: -32.0099 115.8506 Photograph: Facing South

Habitat Type	Description	Extent (ha) and proportion of Survey Areas (%)	Representative photograph
Parkland	This habitat consists of landscaped areas or open parklands, garden beds, lawns with sections of recent native replanting and re-vegetation, which consists of both native and exotic species. The majority of these areas are regularly maintained and therefore weed presence and significant hollows, logs, leaf litter or rocks and crevices are few in number. The nature of the highly modified habitat with the lack of additional microhabitats and understory suggests that native mammal and reptile suitability is low, with the exception of possible use for brief foraging activity by Quenda (<i>Isoodon fusciventer</i>). Avian fauna species may utilise the area as part of brief, occasional foraging and resting activity. This may include significant-listed fauna species including Osprey (<i>Pandion haliaetus</i>), Peregrine Falcon (<i>Falco peregrinus</i>) and the three endemic Black Cockatoo Species.	0.05 ha (2.3%)	 Coordinates: -32.0100 115.8512 Photograph: Facing North-West
Open Water	Open Water and Estuarine Habitat featuring shallow and mid-level water systems close to shore. These areas are typically disturbed from persistent boating activity and previous infrastructure development but may allow for occasional foraging use by locally common marine mammal species such as bottlenose dolphins (<i>Tursiops aduncus</i>).	1.66 ha (76.00%)	 Coordinates: -32.0102 115.8519 Photograph: Facing North.
Completely Cleared Areas	Unmapped areas that include roads, cleared construction areas and lawn areas. These areas had little or no habitat value for fauna including significant species. May had some value for locally common birds.	0.24 ha (11.00%)	

4.2.2 Fauna diversity

The field survey recorded a total of eight birds, one mammal species, no reptiles and no fish species or frog species. This represents a small proportion of the total number of vertebrates that are likely or known to occur in the study area. One species across all vertebrate species groups recorded was introduced, that being the rainbow lorikeet (*Trichoglossus moluccanus*). The full species list is provided in Appendix E.

With the exception of the recorded significant species, all are common widespread species known to utilise urban habitat in and modified wetlands and coastal and estuarine environments. From a species of cultural significance, black swans were recorded consistently across the Survey Site along shoreline sections and banks with or without the presence of riparian reedbed vegetation. Concentrations of the species were focussed on the outer edges of the Survey Areas where riparian vegetation and resting sections of shorelines were present. However, the majority of the Survey Areas does not contain habitat that would typically support a significant or persistent breeding population, which was reinforced by the absence of nesting activity, old or newly formed nesting mounds.

4.2.3 Significant fauna

During the field survey, no significant species were recorded. A further eight significant species, listed in Table 13 below, were assessed as Likely or Possibly occurring based on local occurrence and habitat availability.

Other significant fauna species include migratory birds that have historically been recorded locally due to the proximity of the Survey Site to neighbouring nature reserves and the Swan River, in most cases as vagrant visitors, or from rescued individual cases after heavy storm activity. These species potentially occur within the Survey Areas as infrequent visitors on at least an occasional basis, although habitat value and quality are considered low for these species. Therefore, these migratory species have not been considered further in this assessment. The inclusion of certain migratory species and the exclusion of consideration of others stems from frequency of local occurrence and utilisation of shoreline and wetland habitats of the Swan Coastal Plain and Perth Metropolitan region. For example, numerous ocean-going seabirds (e.g. Albatross, prions) and shore-birds (plovers, sandpipers) have not typically been recorded or have breeding, nesting and core feeding habitats that are found in great abundance within the Survey Site or the surrounding environments. Furthermore, other migratory species such as Ospreys, Caspian terns and Crested Terns are known from consistent DBCA database records (DBCA 2025) and are known to utilise shoreline and artificial wetland and maritime habitats within the Survey Area and surrounding environments.

Table 13 Significant fauna identified as likely to occur or recorded within the Applecross Survey Site

Common name	Species Name	Status EPBC Act	Status DBCA BC Act	Likelihood of occurrence
Baudin's Black Cockatoo	<i>Zanda baudinii</i>	EN	EN	Possible
Carnaby's Black Cockatoo	<i>Zanda latirostris</i>	EN	EN	Possible
Forest Red-tailed Black Cockatoo	<i>Calyptorhynchus banksii naso</i>	VU	VU	Possible
Peregrine Falcon	<i>Falco peregrinus</i>	-	OS	Possible
Blue-billed duck	<i>Oxyura australis</i>	-	P4	Possible
Osprey	<i>Pandion haliaetus</i>	MI	MI	Likely
Caspian Tern	<i>Hydroprogne caspia</i>	MI	MI	Possible
Crested Tern	<i>Thalasseus bergii</i>	MI	MI	Possible

Peregrine Falcon (*Falco peregrinus*)

The Peregrine Falcon is listed by the DBCA as otherwise in need of special protection under section 18 of the BC Act. It is uncommon but wide ranging across Australia from woodlands to open grasslands and coastal cliffs, and occasionally in desert regions. It feeds almost entirely on other birds, although it occasionally eats rabbits and other moderate sized mammals, bats and reptiles. The Peregrine Falcon is very territorial during the breeding

season, the male courting the female with an impressive display of aerobatics (DEE 2019b, Morcombe 2004). Nest sites include tall trees, cliffs, and elevated artificial structures that provide a secluded and secure platform.

This species was not recorded during the survey and no nest sites were recorded. However, the species has been recorded as utilising urbanised areas along the Swan River and Swan Coastal Plain region, including coastal environments. Therefore, the species may possibly utilise the Survey Areas at least on an occasional basis for perching and resting periods or as part of fly-over activity.

Baudin's Cockatoo (*Zanda baudinii*)

The Baudin's Cockatoo is listed as Endangered under the EPBC Act and BC Act. This species is endemic to the south-west of WA. The range of Baudin's Cockatoo varies considerably between the breeding and non-breeding seasons. During the breeding season (from October to January), the species nests in isolated pockets of the far south-west of WA within Jarrah, Marri and Karri forests which receive an average of 750 mm of rainfall annually. In addition to the south-west, there is an isolated patch of known breeding recorded at Perth Hills, east of Armadale (Johnstone & Storr 1998, Johnstone & Kirkby 2008).

Breeding generally occurs in woodland or forest but may also occur in former woodland or forest now present as isolated trees within partially cleared parkland or farmland. Nesting occurs in hollows of live or dead Karri, Marri, Wandoo and Tuart (*Eucalyptus gomphocephala*) trees (DSEWPac 2012). During the breeding season feeding primarily occurs in native vegetation, particularly Marri (DSEWPac 2012). The range then expands during the non-breeding season (from February) as flocks disperse to forage more widely, congregating on the central and northern parts of the Darling plateau, as far as Mundaring and Giddegannup (DSEWPac 2012; Saunders 1974 & 1979).

No birds were observed or recorded during the survey, no evidence of foraging or feeding evidence was recorded within the Survey Areas. However, the high number of confirmed recordings of the species throughout neighbouring locations to the current Survey Site suggests that the species may temporarily utilise the site for perching, resting or temporary fly-over activity, albeit for brief periods. The utilisation for long-term, significant persistence with regards to feeding, foraging or breeding, however, is highly unlikely.

Carnaby's Cockatoo (*Zanda latirostris*)

The Carnaby's Cockatoo is listed as Endangered under the EPBC Act and BC Act. This species is endemic to the south-west of WA from near Cape Arid on the south coast through the eastern Wheat Belt and north to about Kalbarri. Carnaby's Cockatoo nest in hollows of live or dead eucalyptus, primarily smooth-barked salmon gum (*Eucalyptus salmonophloia*) and Wandoo (*E. wandoo*) (Saunders 1979, 1982) though breeding has been reported in other Wheatbelt tree species and some tree species on the Swan Coastal Plain and Jarrah forest (Saunders 1979, 1982, Storr 1991, Johnstone & Storr 1998).

Success in breeding is dependent on sufficient high quality foraging habitat located in proximity of nesting and is nominally a radius of up to 12km of nesting sites (Saunders 1979, 1982, Saunders and Ingram 1987). High quality foraging habitat includes Kwongan heathlands and Banksia woodlands having abundant Banksia species and other proteaceous plants.

No birds were observed or recorded during the survey, no evidence of foraging or feeding evidence was recorded within the Survey Site. However, the high number of confirmed recordings of the species throughout neighbouring locations to the current Survey Areas suggests that the species may temporarily utilise the site for perching, resting or temporary fly-over activity, albeit for brief periods. The utilisation for long-term, significant persistence with regards to feeding, foraging or breeding, however, is highly unlikely.

Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*)

The Forest Red-tailed Black Cockatoo inhabits the dense jarrah, karri, and marri forests receiving more than 600 mm annual average rainfall but also occurs in a range of other forest and woodland types, including Blackbutt (*E. patens*), Wandoo (*E. wandoo*), Tuart (*E. gomphocephala*), Albany Blackbutt (*E. staeri*), Yate (*E. cornuta*), and Flooded Gum (*E. rudis*) (DEE 2017). Habitats tend to have an understorey or snottygobble (*Persoonia* spp.), holly-leaved mirbelia (*Mirbelia dilatata*), *Taxandria* spp. and sheoak (*Allocasuarina fraseriana*). They are most common in the jarrah forest region of the northern Darling Range from Collie north to Mundaring and are very local throughout the lower south-west. They can be found on the Swan Coastal Plain, mainly in search of food the

exotic white cedar (*Melia azedarach*). There are also several small, isolated populations in the eastern parts of its range (DAWE 2022).

No birds were observed or recorded during the survey, no evidence of foraging or feeding evidence was recorded within the Survey Site. However, the high number of confirmed recordings of the species throughout neighbouring locations to the current Survey Site suggests that the species may temporarily utilise the site for perching, resting or temporary fly-over activity, albeit for brief periods. The utilisation for long-term, significant persistence with regards to feeding, foraging or breeding, however, is highly unlikely.

Caspian Tern (*Hydroprogne caspia*)

The Caspian Tern is a migratory coastal and oceanic specialised species member of the gull family Laridae and is easily distinguished by its significantly larger size (the largest of all tern species globally) and its significant and prominent, elongated red bill. The species is currently listed as Migratory and under the EPBC Act and DBCA BC Act. This species is mostly associated with sheltered coasts such as harbours, bays, estuaries, etc. They can also be found in inland terrestrial wetlands (saline or fresh) or man-made bodies of water (lakes or reservoirs). (DCCEEW).

No recordings of the species were made during the survey of the Applecross Survey Site, and long-term, suitable habitat for the species is not readily present. However, the number of DBCA recordings within close proximity to the current Survey Areas and the additional close proximity of the Survey Areas to open water sources and nearby perching and resting sites suggest that the species may temporarily utilise the site for resting or minor foraging activity, or in a fly-over capacity.

Crested Tern (*Thalasseus bergii*)

The Crested Tern is a migratory coastal and oceanic specialised species member of the gull family Laridae, and is easily distinguished by its yellow- coloured bill and extended, mobile crest arrangement for head feathers. The species is currently listed as Migratory and under the EPBC Act and DBCA BC Act.

This species inhabits tropical and subtropical coastlines, foraging in the shallow waters of lagoons, coral reefs, estuaries, bays, harbours and inlets, along sandy, rocky, coral or muddy shores, on rocky outcrops in open sea, in mangrove swamps and also far out to sea on open water. It shows a preference for nesting on offshore islands, low-lying coral reefs, sandy or rocky coastal islets, coastal spits, lagoon mudflats, and artificial islets in salt pans and sewage works within 3 km of the coast. (BirdLife International, 2023).

No recordings of the species were made during the survey of the Survey Site , and long-term, suitable habitat for the species is not readily present. However, the number of DBCA recordings within close proximity to the current Survey Site and the additional close proximity of the Survey Areas to open water sources and nearby perching and resting sites suggest that the species may temporarily utilise the site for resting or minor foraging activity, or in a fly-over capacity.

Blue-billed Duck (*Oxyura australis*)

The blue-billed duck is a small Australian, almost entirely aquatic duck, with both the male and female growing to a length of 40 cm. The male has a slate-blue bill which changes to bright blue during the breeding season (Morcombe 2004). The species is listed as a Priority 4 (P4) significant species under the DBCA BC Act.

The blue-billed duck is endemic to Australia's temperate regions, ranging from the southwest of Western Australia, extending to southern Queensland, through New South Wales and Victoria, to Tasmania. The species is readily seen on freshwater lakes and billabongs where deep fresh water is present (Morcombe 2004).

No recordings of the species were made during the survey of the Applecross Survey Site, and long-term, suitable habitat for the species is not readily present. However, the number of DBCA recordings within close proximity to the current Survey Site and the additional close proximity of the Survey Areas to readily used lakes and remnant shores and banks of higher habitat value suggest that the species may temporarily utilise the site for resting or minor foraging activity, or in a fly-over capacity.

Osprey (*Pandion haliaetus*)

The Osprey is a medium to large bird of prey within the sea-hawk genus group of the Accipiteriformes order of larger raptor species, with specialised beak and talon properties for marine, coastal and inland freshwater predation and habitats. The species is currently listed as Migratory under the EPBC Act and the DBCA BC Act.

Ospreys occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. They are mostly found in coastal areas but occasionally travel inland along major rivers, particularly in northern Australia. They require extensive areas of open fresh, brackish or saline water for foraging (Marchant & Higgins 1993). They frequent a variety of wetland habitats including inshore waters, reefs, bays, coastal cliffs, beaches, estuaries, mangrove swamps, broad rivers, reservoirs and large lakes and waterholes. They exhibit a preference for coastal cliffs and elevated islands in some parts of their range, but may also occur on low sandy, muddy or rocky shores and over coral cays.

No recordings of the species were made during the survey of the Applecross Survey Site and long-term, suitable habitat for the species is not readily present. However, the number of DBCA recordings within close proximity to the current Survey Site and adjacent readily used lakes and remnant shores and banks of higher habitat value, suggest that the species may temporarily utilise the site for resting or minor foraging activity, or in a fly-over capacity. Furthermore, this species will readily utilise man-made infrastructure for short-term perching and even occasional nesting activity when bordering coastlines or the banks and shores of suitable marine and freshwater feeding areas. Therefore, the species is likely to occasionally utilise the current Survey Site for such purposes.

5. Survey results – Elizabeth Quay Site

5.1 Vegetation and flora

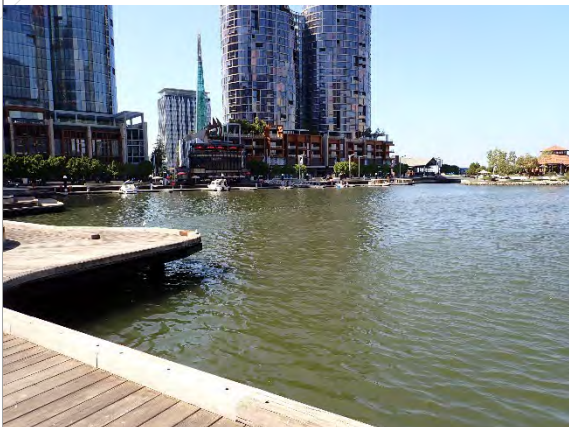
5.1.1 Vegetation types

Based on the structural and floristic characteristics observed in the field, one vegetation type, which is not considered to be remnant vegetation were recorded in the Survey Site:

- Replanting (VT01)

The remaining areas have been mapped as Cleared. The vegetation types are described in Table 13 and mapped in Figure 10B (Appendix A).

Table 14 Recorded vegetation types for Elizabeth Quay Survey Site

Vegetation type	Vegetation Type Description	Landform and Substrate	Extent (ha) and proportion of Survey Areas (%)	Photograph
VT01	Landscaped re-planted areas consisting mixed locally native and non-native species, typically <i>Melaleuca sp.</i> , <i>Ficus sp.</i> , and non-native, exotic flowering plants and shrubs.	Landscaped areas	0.002 ha (2.05%)	 Coordinates: -31.9577 115.8575 Photograph: Facing North
Open Water	Open Water and Estuarine	-	0.046 ha (49.56%)	 Coordinates: -31.9577 115.8575 Photograph: Facing East
Cleared Areas	Completely devoid of vegetation	-	0.045 ha (48.39%)	

5.1.2 Vegetation condition

The entire Survey Site has been cleared, with modifications carried out over time to the natural edge of the site, with artificial maritime structures bordering what would have historically been estuarine-based riparian shoreline and riverbank species or potentially *Banksia* and *Melaleuca* and *Eucalypt* species. Therefore, the vegetation types were not assigned a vegetation condition as they are not representative of native vegetation.

5.1.3 Significant ecological communities

No EPBC or state listed TECs, or DBCA listed PECs were recorded within the Survey Site.

Vegetation recorded within the Survey Site does not meet the structural or compositional criteria to represent any of the TEC or PECs which have been identified within the desktop-based Study Area.

5.1.4 Flora diversity

A total of five vascular flora species, were recorded in the Survey Site. Three of the flora recorded were native taxa, with the remaining two species not considered to be locally native to the area and classified as introduced. In the context of the current Survey Site and the vegetation types and descriptions, it is also important to note that the native species recorded were part of a re-planting activity. A species list by family type is presented in Appendix D.

5.1.5 Significant flora

No EPBC Act or BC Act listed flora were recorded within the Survey Site, and no priority-listed species flora species were recorded within the Survey Site. Furthermore, no significant tree species of conservation significance for species such as black cockatoos or individual groupings of mature, higher ecological value were identified or recorded within the Survey Area.

Likelihood of occurrence

A likelihood of occurrence assessment was conducted post-field survey for significant flora taxa identified in the desktop assessment (Appendix D). The assessment took into account previous records, habitat requirements, efficacy of the survey, intensity of the survey, flowering times and the cryptic nature of species.

The likelihood of occurrence assessment post-field survey concluded that no taxa identified by the desktop assessment are known to occur or likely to occur. This is due to a combination of known distribution, preferred habitat, visibility of the taxa during the field survey, and most significantly, the high level of disturbance and clearing throughout the Survey Site and its conversion to maritime infrastructure.

5.1.6 Introduced flora

No observed flora species are listed as declared pest plants in WA under the BAM Act, or Weeds of National Significance (WoNS) (Australian Weeds 2012).

5.2 Fauna

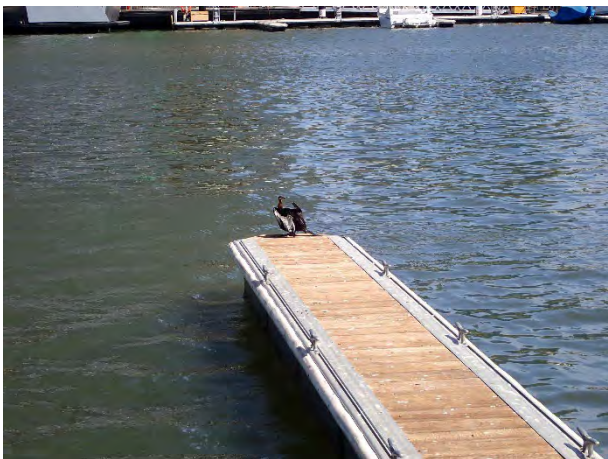
5.2.1 Fauna habitat types

Two broad habitat types were identified within the Survey Site, based on the predominant vegetation structure and geography. These habitats generally align with the vegetation community types (VTs) described Table 14 and mapped from the concurrent flora and vegetation assessment. The fauna habitats tend to be simple in structure and vegetation diversity as they are all derived from relatively recent revegetation of trees and plants comprising native and exotic species including *Eucalyptus*, *Melaleuca*, *Casuarina*, palms, deciduous and evergreen trees. Consequently, much of the habitat types were largely artificial. The habitat types include:

- Native and exotic mixed plantings
- Cleared Areas.

Fauna habitat are described in more detail in Table 15 and mapped in Figure 11B (Appendix A).

Table 15 Recorded Fauna Habitat Types for Elizabeth Quay Survey Site

Habitat Type	Habitat Description	Extent (ha) and proportion of Survey Areas (%)	Photograph
Native and exotic mixed plantings (VT01)	This habitat type consists of areas of replanted native and exotic trees and some areas of scattered planted native shrubs and wetland reed species. This habitat is very small in size and in representation of the overall Suver Area and lacked vegetation diversity and structure. The habitat provides very limited and small available foraging habitat for some common native perching bird species. Given the low overall quality and size of the habitat, no significant species are likely to use the habitat on a regular basis. However, the close proximity to open water sources and the Swan River may allow for occasional fly-over activity or temporary perching and resting from various migratory shorebirds and sea-birds.	0.002 ha (2.05%)	 Coordinates: -31.9577 115.8575 Photograph: Facing North
Open Water	Open Water and Estuarine Habitat featuring shallow and mid-level water systems close to shore. These areas are typically disturbed from persistent boating activity and previous infrastructure development but may allow for occasional foraging use by locally common marine mammal species such as bottlenose dolphins (<i>Tursiops aduncus</i>).	0.046 ha (49.56%)	 Coordinates: -31.9577 115.8575 Photograph: Facing East
Cleared Areas	Unmapped areas that include roads, cleared construction areas and lawn areas along with maritime infrastructure. These areas had little or no habitat value for fauna including significant species. May have some value for locally common birds.	0.045 ha (48.39%)	

5.2.2 Fauna diversity

The field survey recorded a total of four birds, no mammals, no reptile and no fish species. While this total represents a small proportion of the total number of vertebrates that have historically been recorded through previous desktop and database searches, the low total recorded in this instance reflects the level of disturbance

and cleared habitat of the Survey Site which does not provide habitat for a large abundance and diversity of vertebrate species. One of the species, was introduced, the domestic pigeon (*Columba livia*). The full species list is provided in Appendix E.

All recorded species are common, widespread species known to utilise urban habitat in and modified shoreline, coastal environments.

5.2.3 Significant fauna

During the field survey, no significant species were recorded. A further eight significant species, which are listed in Table 16, are considered either likely to occur or may possibly occur based on local occurrence and habitat availability suited to that particular species, with one such species assessed as likely, with the remaining seven assessed as possibly occurring.

Other significant fauna species may include migratory birds that have been recorded locally due to the proximity of the Survey Site to the estuarine habitat of the Swan River. However, these species are likely to be infrequent visitors from a purely fly-over activity basis, based on the small area size, highly cleared and altered state of the Survey Site. The Survey Site represents very low habitat value for these migratory species and they have therefore not been considered further in this assessment.

Table 16 Significant Fauna Species Assessment for Elizabeth Quay Survey Site

Common Name	Species Name	Conservation Status EPBC Act	Conservation Status BC Act/DBCA	Likelihood
Baudin's Black Cockatoo	<i>Zanda baudinii</i>	EN	EN	Possible.
Carnaby's Black Cockatoo	<i>Zanda latirostris</i>	EN	EN	Possible.
Forest Red-tailed Black Cockatoo	<i>Calyptorhynchus banksii naso</i>	VU	VU	Possible.
Peregrine Falcon	<i>Falco peregrinus</i>	-	OS	Possible
Blue-billed duck	<i>Oxyura australis</i>	-	P4	Possible.
Osprey	<i>Pandion haliaetus</i>	MI	MI	Likely.
Caspian Tern	<i>Hydroprogne caspia</i>	MI	MI	Possible.
Crested Tern	<i>Thalasseus bergii</i>	MI	MI	Possible.

Peregrine Falcon (*Falco peregrinus*)

The Peregrine Falcon is listed by the DBCA as otherwise in need of special protection under section 18 of the BC Act. It is uncommon but wide ranging across Australia from woodlands to open grasslands and coastal cliffs, and occasionally in desert regions. It feeds almost entirely on other birds, although it occasionally eats rabbits and other moderate sized mammals, bats and reptiles. The Peregrine Falcon is very territorial during the breeding season, the male courting the female with an impressive display of aerobatics (DEE 2019b, Morcombe 2004). Nest sites include tall trees, cliffs, and elevated artificial structures that provide a secluded and secure platform.

This species was not recorded during the survey and no nest sites were recorded. However, the species has been recorded as utilising urbanised areas along the Swan River and Swan Coastal Plain region, including coastal environments. Therefore, the species may possibly utilise the Survey Site at least on an occasional basis for perching and resting periods or as part of fly-over activity.

Baudin's Cockatoo (*Zanda baudinii*)

The Baudin's Cockatoo is listed as Endangered under the EPBC Act and BC Act. This species is endemic to the south-west of WA. The range of Baudin's Cockatoo varies considerably between the breeding and non-breeding seasons. During the breeding season (from October to January), the species nests in isolated pockets of the far south-west of WA within Jarrah, Marri and Karri forests which receive an average of 750 mm of rainfall annually. In

addition to the south-west, there is an isolated patch of known breeding recorded at Perth Hills, east of Armadale (Johnstone & Storr 1998, Johnstone & Kirkby 2008).

Breeding generally occurs in woodland or forest but may also occur in former woodland or forest now present as isolated trees within partially cleared parkland or farmland. Nesting occurs in hollows of live or dead Karri, Marri, Wandoo and Tuart (*Eucalyptus gomphocephala*) trees (DSEWPaC 2012). During the breeding season feeding primarily occurs in native vegetation, particularly Marri (DSEWPaC 2012). The range then expands during the non-breeding season (from February) as flocks disperse to forage more widely, congregating on the central and northern parts of the Darling plateau, as far as Mundaring and Gidgegannup (DSEWPaC 2012; Saunders 1974 & 1979).

No birds were observed or recorded during the survey, no evidence of foraging or feeding evidence was recorded within the Survey Site. However, the high number of confirmed recordings of the species throughout neighbouring locations to the current Survey Site suggests that the species may temporarily utilise the site for perching, resting or temporary fly-over activity, albeit for brief periods. The utilisation for long-term, significant persistence with regards to feeding, foraging or breeding, however, is highly unlikely.

Carnaby's Cockatoo (*Zanda latirostris*)

The Carnaby's Cockatoo is listed as Endangered under the EPBC Act and BC Act. This species is endemic to the south-west of WA from near Cape Arid on the south coast through the eastern Wheat Belt and north to about Kalbarri. Carnaby's Cockatoo nest in hollows of live or dead eucalyptus, primarily smooth-barked salmon gum (*Eucalyptus salmonophloia*) and Wandoo (*E. wandoo*) (Saunders 1979, 1982) though breeding has been reported in other Wheatbelt tree species and some tree species on the Swan Coastal Plain and Jarrah forest (Saunders 1979, 1982, Storr 1991, Johnstone & Storr 1998).

Success in breeding is dependent on sufficient high quality foraging habitat located in proximity of nesting and is nominally a radius of up to 12km of nesting sites (Saunders 1979, 1982, Saunders and Ingram 1987). High quality foraging habitat includes Kwongan heathlands and Banksia woodlands having abundant Banksia species and other proteaceous plants.

No birds were observed or recorded during the survey, no evidence of foraging or feeding evidence was recorded within the Survey Site. However, the high number of confirmed recordings of the species throughout neighbouring locations to the current Survey Site suggests that the species may temporarily utilise the site for perching, resting or temporary fly-over activity, albeit for brief periods. The utilisation for long-term, significant persistence with regards to feeding, foraging or breeding, however, is highly unlikely.

Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*)

The Forest Red-tailed Black Cockatoo inhabits the dense jarrah, karri, and marri forests receiving more than 600 mm annual average rainfall but also occurs in a range of other forest and woodland types, including Blackbutt (*E. patens*), Wandoo (*E. wandoo*), Tuart (*E. gomphocephala*), Albany Blackbutt (*E. staeri*), Yate (*E. cornuta*), and Flooded Gum (*E. rudis*) (DEE 2017). Habitats tend to have an understorey or snottygobble (*Persoonia* spp.), holly-leaved mirbelia (*Mirbelia dilatata*), and sheoak (*Allocasuarina fraseriana*). They are most common in the jarrah forest region of the northern Darling Range from Collie north to Mundaring and are very local throughout the lower south-west. They can be found on the Swan Coastal Plain, mainly in search of food the exotic white cedar (*Melia azedarach*). There are also several small, isolated populations in the eastern parts of its range (DAWE 2022).

No birds were observed or recorded during the survey, no evidence of foraging or feeding evidence was recorded within the Survey Site. However, the high number of confirmed recordings of the species throughout neighbouring locations to the current Survey Site suggests that the species may temporarily utilise the site for perching, resting or temporary fly-over activity, albeit for brief periods. The utilisation for long-term, significant persistence with regards to feeding, foraging or breeding, however, is highly unlikely.

Caspian Tern (*Hydroprogne caspia*)

The Caspian Tern is a migratory coastal and oceanic specialised species member of the gull family Laridae, and is easily distinguished by its significantly larger size (the largest of all tern species globally) and its significant and prominent, elongated red bill. The species is currently listed as Migratory and under the EPBC Act and DBCA BC Act. This species is mostly associated with sheltered coasts such as harbours, bays, estuaries, etc. They can also

be found in inland terrestrial wetlands (saline or fresh) or man-made bodies of water (lakes or reservoirs). (DCCEEW).

No recordings of the species were made during the survey of the Survey Site, and long-term, suitable habitat for the species is not readily present. However, the number of DBCA recordings within proximity to the current Survey Areas and the additional close proximity of the Survey Areas to open water sources and nearby perching and resting sites suggest that the species may temporarily utilise the site for resting or minor foraging activity, or in a fly-over capacity.

Crested Tern (*Thalasseus bergii*)

The Crested Tern is a migratory coastal and oceanic specialised species member of the gull family Laridae and is easily distinguished by its yellow- coloured bill and extended, mobile crest arrangement for head feathers. The species is currently listed as Migratory and under the EPBC Act and DBCA BC Act.

This species inhabits tropical and subtropical coastlines, foraging in the shallow waters of lagoons, coral reefs, estuaries, bays, harbours and inlets, along sandy, rocky, coral or muddy shores, on rocky outcrops in open sea, in mangrove swamps and also far out to sea on open water. It shows a preference for nesting on offshore islands, low-lying coral reefs, sandy or rocky coastal islets, coastal spits, lagoon mudflats, and artificial islets in salt pans and sewage works within 3 km of the coast. (BirdLife International, 2023).

No recordings of the species were made during the survey of the Survey Site, and long-term, suitable habitat for the species is not readily present. However, the number of DBCA recordings within proximity to the current Survey Site and adjacent to open water sources and nearby perching and resting sites suggest that the species may temporarily utilise the site for resting or minor foraging activity, or in a fly-over capacity.

Blue-billed Duck (*Oxyura australis*)

The blue-billed duck is a small Australian almost entirely aquatic duck, with both the male and female growing to a length of 40 cm. The male has a slate-blue bill which changes to bright blue during the breeding season (Morcombe 2004). The species is listed as a Priority 4 (P4) significant species under the DBCA BC Act.

The blue-billed duck is endemic to Australia's temperate regions, ranging from the southwest of Western Australia, extending to southern Queensland, through New South Wales and Victoria, to Tasmania. The species is readily seen on freshwater lakes and billabongs where deep fresh water is present (Morcombe 2004).

No recordings of the species were made during the survey of the Survey Site, and long-term, suitable habitat for the species is not readily present. However, the number of DBCA recordings within proximity to the current Survey Areas and the additional proximity of the Survey Areas to readily used lakes and remnant shores and banks of higher habitat value suggest that the species may temporarily utilise the site for resting or minor foraging activity, or in a fly-over capacity.

Osprey (*Pandion haliaetus*)

The Osprey is a medium to large bird of prey within the sea-hawk genus group of the Accipitriformes order of larger raptor species, with specialised beak and talon properties for marine, coastal and inland freshwater predation and habitats. The species is currently listed as Migratory under the EPBC Act and the DBCA BC Act.

Ospreys occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. They are mostly found in coastal areas but occasionally travel inland along major rivers, particularly in northern Australia. They require extensive areas of open fresh, brackish or saline water for foraging (Marchant & Higgins 1993). They frequent a variety of wetland habitats including inshore waters, reefs, bays, coastal cliffs, beaches, estuaries, mangrove swamps, broad rivers, reservoirs and large lakes and waterholes. They exhibit a preference for coastal cliffs and elevated islands in some parts of their range, but may also occur on low sandy, muddy or rocky shores and over coral cays.

No recordings of the species were made during the survey of the Survey Site, and long-term, suitable habitat for the species is not readily present. However, the number of DBCA recordings within proximity to the current Survey Site and the additional close proximity of the Survey Site to readily used lakes and remnant shores and banks of higher habitat value suggest that the species may temporarily utilise the site for resting or minor foraging activity, or in a fly-over capacity. Furthermore, this species will readily utilise man-made infrastructure for short-term perching and even occasional nesting activity when bordering coastlines or the banks and shores of suitable

marine and freshwater feeding areas. Therefore, the species is likely to occasionally utilise the current Survey Site for such purposes.

6. Survey results – Ellam Street Site

6.1 Vegetation and flora

6.1.1 Vegetation types

Based on the structural and floristic characteristics observed in the field, three vegetation types, none of which are considered to be remnant vegetation were recorded in the Survey Site.

These vegetation types included:

- Revegetation and Replanting (VT01)
- Parkland with planted trees. (VT02)
- Wetland/Shoreline (VT03).

The remaining areas have been marked as Cleared Areas and Open Water. The vegetation types are described in Table 17 and mapped in Figure 10C (Appendix A).

Table 17 Recorded Vegetation Types for Ellam Street Survey Site

Vegetation type	Vegetation Type Description	Landform and Substrate	Extent (ha) and proportion of Survey Areas (%)	Photograph
VT01	Revegetated and replanted areas consisting mixed locally native and non-native species, typically patchy mixed native sedges and non-native and native Eucalypt species, exotic flowering plants and shrubs.	Landscaped areas	1.68 ha (4.20%)	 Coordinates: -31.9719 115.8796 Photograph: Facing West
VT02	Parkland areas consisting of planted trees over mown grass consisting of <i>Melaleuca</i> sp., <i>Agonis</i> sp., individual Marri and Tuart and She-oak in low density.	Landscaped areas	4.73 ha (11.83%)	 Coordinates: -31.9709 115.8814 Photograph: Facing North-East

Vegetation type	Vegetation Type Description	Landform and Substrate	Extent (ha) and proportion of Survey Areas (%)	Photograph
VT03	Wetland/Shore-bank vegetation consisting of highly modified previous shoreline wetland and estuarine vegetation communities with varying levels of reeds and <i>Melaleuca</i> species, and introduced River Oak (<i>Casuarina cunninghamiana</i>), as well as small sections of bulrush (<i>Juncus kraussii</i>). Includes some native and exotic emergent aquatic plants.	Landscaped Areas	0.32 ha (0.80%)	 Coordinates: -31.9701 115.8821 Photograph: Facing North-West
Open Water	Open Water and Estuarine Habitat	-	29.99 ha (76.92%)	
Cleared Areas	Completely devoid of vegetation	-	2.27 ha (5.68%)	

6.1.2 Vegetation condition

The entire Survey Site has been predominantly cleared, with modifications carried out over time to the natural edge of the site, with artificial maritime structures bordering what would have historically been estuarine-based riparian shoreline and riverbank species or potentially *Banksia* and *Melaleuca* and *Eucalypt* species. Therefore, the vegetation types were not assigned a vegetation condition as they are not representative of native vegetation.

6.1.3 Significant ecological communities

No EPBC or state listed TECs, or DBCA listed PECs were recorded within the Survey Site.

Vegetation recorded within the Survey Site does not meet the structural or compositional criteria to represent any of the TEC or PECs which have been identified within the Study Area as part of the desktop study assessment.

6.1.4 Flora diversity

A total of 19 vascular flora species were recorded in the Survey Site. Of these, 12 of the flora recorded were native taxa, with the remaining seven not considered to be locally native to the area and considered introduced species. In the context of the current Survey Site and the vegetation types and descriptions, it is also important to note that the presence of specific native species recorded were part of a re-planting activity. A species list by family type is presented in Appendix D.

6.1.5 Significant flora

No EPBC Act or BC Act listed flora were recorded within the Survey Site, and no DBCA Priority listed flora species were identified within the Survey Site during the field survey.

Likelihood of occurrence

A likelihood of occurrence assessment was conducted and post-field survey for significant flora taxa identified in the desktop assessment (Appendix D). The assessment took into account previous records, habitat requirements, efficacy of the survey, intensity of the survey, flowering times and the cryptic nature of species.

The likelihood of occurrence assessment post-field survey concluded that no taxa identified by the desktop assessment are known to occur or likely to occur. This is due to a combination of known distribution, preferred habitat, visibility of the taxa during the field survey, and most significantly, the high level of disturbance and clearing throughout the Survey Site and conversion to open recreational parkland or building infrastructure closer to the shorelines of the Survey Site.

6.1.6 Introduced flora

No observed flora species are listed as declared pest plants in WA under the BAM Act, or Weeds of National Significance (WoNS) (Australian Weeds 2012).

6.2 Fauna

6.2.1 Fauna habitat types

Three broad habitat types were identified within the Survey Site (not including cleared areas), based on the predominant vegetation structure and geography. These habitats generally align with the vegetation community types (VTs) described in Table 18, and mapped from the concurrent flora and vegetation assessment. The fauna habitats tend to be simple in structure and vegetation diversity as they are all derived from relatively recent revegetation of trees, shrubs and wetlands plants comprising native and exotic species including *Eucalyptus*, *Melaleuca*, *Casuarina*, *Agonis flexuosa*, deciduous and evergreen trees. Consequently, the habitat types were

largely artificial, with the majority concentrated to the centre of the parkland regions and banks and shoreline sections of the Survey Site. The habitat types include:

- Shoreline Wetlands, Riparian and River
- Scattered trees
- Parkland over revegetation and re-planted vegetation
- Open Water
- Cleared areas.

Fauna habitat are described in more detail in Table 18 and mapped in Figure 11C (Appendix A).

Table 18 Recorded Fauna Habitat Type for Ellam Street Survey Site

Habitat Type	Habitat Description	Extent (ha) and proportion of Survey Areas (%)	Photograph
Shoreline Wetlands, Riparian and River (VT03)	This habitat consists of waterbodies and shoreline systems with varying levels of reeds and <i>Melaleuca</i> species, and introduced River Oak (<i>Casuarina cunninghamiana</i>). Includes some native and exotic emergent aquatic plants. This habitat provides potential, temporary habitat for waterfowl and wading bird species such as black swans (<i>Cygnus atratus</i>), Pacific Black Ducks (<i>Anas superciliosus</i>) and locally common moorhens and swamphens. This habitat is not likely to be important for migratory birds due to lack of shallow open shoreline suitable as foraging habitat for waders, however they may occur occasionally as temporary foraging or resting-based visitation due to proximity to estuarine habitat of the Swan River. Furthermore, the highly degraded and altered state of the habitat type is unlikely to support wetland and shoreline mammalian species such as water rat (Rakali) (<i>Hydromys chrysogaster</i>). The small areas of marine system as a part of the extended open water sections of the Survey Area may be used for brief foraging periods by locally common marine mammal species such as bottlenosed dolphins (<i>Tursiops aduncus</i>).	0.32 ha (0.80%)	 Coordinates: -31.9701 115.8821 Photograph: Facing North-East
Parkland over re-vegetation and re-planted vegetation (VT02)	This habitat consists of landscaped areas or open parklands, garden beds, lawns with sections of recent native replanting and re-vegetation, which consists of both native and exotic species. The majority of these areas are regularly maintained and therefore weed presence and significant hollows, logs, leaf litter or rocks and crevices are few in number. The nature of the highly modified habitat with the lack of additional microhabitats and understory suggests that native mammal and reptile suitability is low, with the exception of possible use for brief foraging activity by Quenda (<i>Isodon fusciventer</i>). Avian fauna species may utilise the area as part of brief, occasional foraging and resting activity. This may include significant-listed fauna species including Osprey (<i>Pandion haliaetus</i>), Peregrine Falcon (<i>Falco peregrinus</i>) and the three endemic Black Cockatoo Species.	1.68 ha (4.20%)	 Coordinates: -31.9709 115.8809 Photograph: Facing North

Habitat Type	Habitat Description	Extent (ha) and proportion of Survey Areas (%)	Photograph
Scattered Trees (VT01)	This is a generally highly modified habitat containing isolated and small stands of native and introduced tree species over a virtually entirely cleared understorey. The trees present are located across mostly maintained lawns. Tree species identified include Flooded Gum (<i>E. rudis</i>), Paperbark species (<i>Melaleuca</i> sp.), Peppermint (<i>Agonis flexuosa</i>) and <i>Casuarina</i> sp. as well as small isolated numbers of Jarrah, Marri and Tuart. Sources of hollows and nesting opportunities are occasionally present but typically rare, with hollow logs, leaf litter and thick grass or bushes to provide additional microhabitat. The nature of the highly modified habitat with the lack of additional microhabitats and understory suggests that native mammal and reptile suitability is low, with the exception of possible use for brief foraging activity by Quendas (<i>Isoodon fusciventer</i>). Avian fauna species may utilise the area as part of brief, occasional foraging and resting activity. This may include significant-listed fauna species including Osprey (<i>Pandion haliaetus</i>) and the three endemic Black Cockatoo Species. Small numbers of isolated potential nesting size trees (DBH>500mm) were identified.	4.73 ha (11.83%)	 Coordinates: -31.9704 115.8833 Photograph: Facing North-West
Open Water	Open Water and Estuarine Habitat featuring shallow and mid-level water systems close to shore. These areas are typically disturbed from persistent boating activity and previous infrastructure development but may allow for occasional foraging use by locally common marine mammal species such as bottlenose dolphins (<i>Tursiops aduncus</i>).	29.99 ha (76.92%)	
Cleared Areas	Unmapped areas that include roads, cleared construction areas and lawn areas. These areas had little or no habitat value for fauna including significant species, but may occasionally be used by various avian fauna species for temporary perching and resting activity given the proximity to open water bodies.	2.27 ha (5.68%)	

6.2.2 Fauna diversity

The field survey recorded a total of 13 bird species, with no mammals, reptiles, fish or frog species. This represents a small proportion of the total number of vertebrates that are likely or known to occur in the study area. Two of the 13 recorded species are introduced, being the Rainbow Lorikeet (*Trichoglossus moluccanus*) and the Laughing Dove (*Streptopelia senegalensis*). The full species list is provided in Appendix E.

All recorded fauna species are common, widespread species known to utilise urban habitat in and modified wetlands and coastal shorelines and highly modified parklands.

6.2.3 Significant fauna

During the field survey, no significant species were recorded. A further nine significant species, which are listed in Table 19, were assessed as being likely to occur or possibly occurring, based local occurrence and habitat availability. Of these nine species, five were assessed as being likely to occur with four assessed as possibly occurring.

Other significant fauna species include migratory birds that have been recorded locally due to the proximity of the Survey Site to the Swan River and neighbouring parks and nature reserves. These species may therefore potentially occur within the Survey Areas as infrequent visitors on at least an occasional basis or in a fly-over activity context, given that habitat value and quality are considered low for these species. Therefore, these migratory species have not been considered further in this assessment. The reasoning behind the inclusion of certain migratory species and the exclusion of consideration of others stems from frequency of local occurrence and utilisation of shoreline and wetland habitats of the Swan Coastal Plain and Perth Metropolitan region. For example, numerous ocean-going seabirds (E.g. Albatross, prions) and shore-birds (plovers, sandpipers) have not typically been recorded or have breeding, nesting and core feeding habitats that are found in great abundance within the Survey Site or the surrounding environments. Furthermore, other migratory species such as Ospreys, Caspian terns and Crested Terns are known from consistent DBCA database records (DBCA, 2024) and are known to utilise shoreline and artificial wetland and maritime habitats within the Survey Site and surrounding environments.

Table 19 Significant Fauna Species within Ellam Street Survey Site

Common Name	Species Name	Status EPBC Act	Status DBCA BC Act	Likelihood
Baudin's Black Cockatoo	<i>Zanda baudinii</i>	EN	EN	Likely
Carnaby's Black Cockatoo	<i>Zanda latirostris</i>	EN	EN	Likely
Forest Red-tailed Black Cockatoo	<i>Calyptrorhynchus banksii naso</i>	VU	VU	Likely
Peregrine Falcon	<i>Falco peregrinus</i>	-	OS	Likely
Blue-billed duck	<i>Oxyura australis</i>	-	P4	Possible
Osprey	<i>Pandion haliaetus</i>	MI	MI	Likely
Caspian Tern	<i>Hydroprogne caspia</i>	MI	MI	Possible
Crested Tern	<i>Thalasseus bergii</i>	MI	MI	Possible
Quenda	<i>Isodon fusciventer</i>	-	P4	Possible

Peregrine Falcon (*Falco peregrinus*)

The Peregrine Falcon is listed by the DBCA as otherwise in need of special protection under section 18 of the BC Act. It is uncommon but wide ranging across Australia from woodlands to open grasslands and coastal cliffs, and occasionally in desert regions. It feeds almost entirely on other birds, although it occasionally eats rabbits and other moderate sized mammals, bats and reptiles. The Peregrine Falcon is very territorial during the breeding season, the male courting the female with an impressive display of aerobatics (DEE 2019b, Morcombe 2004). Nest sites include tall trees, cliffs, and elevated artificial structures that provide a secluded and secure platform.

This species was not recorded during the survey and no nest sites were recorded. However, the species has been recorded as utilising urbanised areas along the Swan River and Swan Coastal Plain region, including coastal environments. Therefore, the species may possibly utilise the Survey Areas at least on an occasional basis for perching and resting periods or as part of fly-over activity.

Baudin's Cockatoo (*Zanda baudinii*)

The Baudin's Cockatoo is listed as Endangered under the EPBC Act and BC Act. This species is endemic to the south-west of WA. The range of Baudin's Cockatoo varies considerably between the breeding and non-breeding seasons. During the breeding season (from October to January), the species nests in isolated pockets of the far south-west of WA within Jarrah, Marri and Karri forests which receive an average of 750 mm of rainfall annually. In addition to the south-west, there is an isolated patch of known breeding recorded at Perth Hills, east of Armadale (Johnstone & Storr 1998, Johnstone & Kirkby 2008).

Breeding generally occurs in woodland or forest but may also occur in former woodland or forest now present as isolated trees within partially cleared parkland or farmland. Nesting occurs in hollows of live or dead Karri, Marri, Wandoo and Tuart (*Eucalyptus gomphocephala*) trees (DSEWPac 2012). During the breeding season feeding primarily occurs in native vegetation, particularly Marri (DSEWPac 2012). The range then expands during the non-breeding season (from February) as flocks disperse to forage more widely, congregating on the central and northern parts of the Darling plateau, as far as Mundaring and Gidgegannup (DSEWPac 2012; Saunders 1974 & 1979).

No birds were observed or recorded during the survey, no evidence of foraging or feeding evidence was recorded within the Survey Site. However, the high number of confirmed recordings of the species throughout neighbouring locations to the current Survey Site suggests that the species may temporarily utilise the site for perching, resting or temporary fly-over activity, albeit for brief periods. Furthermore, several nesting trees of sufficient diameter breast height (DBH) were recorded in scattered areas across the Survey Site, highlighting the potential for brief site utilisation. These specific individual trees are outlined in fauna habitat mapping in Appendix A. The utilisation for long-term, significant persistence with regards to feeding, foraging or breeding, however, is highly unlikely.

Carnaby's Cockatoo (*Zanda latirostris*)

The Carnaby's Cockatoo is listed as Endangered under the EPBC Act and BC Act. This species is endemic to the south-west of WA from near Cape Arid on the south coast through the eastern Wheat Belt and north to about Kalbarri. Carnaby's Cockatoo nest in hollows of live or dead eucalyptus, primarily smooth-barked salmon gum (*Eucalyptus salmonophloia*) and Wandoo (*E. wandoo*) (Saunders 1979, 1982) though breeding has been reported in other Wheatbelt tree species and some tree species on the Swan Coastal Plain and Jarrah forest (Saunders 1979, 1982, Storr 1991, Johnstone & Storr 1998).

Success in breeding is dependent on sufficient high quality foraging habitat located in proximity of nesting and is nominally a radius of up to 12 km of nesting sites (Saunders 1979, 1982, Saunders and Ingram 1987). High quality foraging habitat includes Kwongan heathlands and Banksia woodlands having abundant Banksia species and other proteaceous plants.

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south-west. They can be found on the Swan Coastal Plain, mainly in search of food the exotic white cedar (*Melia azedarach*). There are also several small, isolated populations in the eastern parts of its range (DAWE 2022).

No birds were observed or recorded during the survey, no evidence of foraging or feeding evidence was recorded within the Survey Areas. However, the high number of confirmed recordings of the species throughout neighbouring locations to the current Survey Areas suggests that the species may temporarily utilise the site for perching, resting or temporary fly-over activity, albeit for brief periods. Furthermore, several potential nesting trees of sufficient DBH were recorded in scattered areas across the Survey Site, highlighting the potential for brief site utilisation. These specific individual trees are outlined in fauna habitat mapping in Appendix A. The utilisation for long-term, significant persistence with regards to feeding, foraging or breeding, however, is highly unlikely.

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No recordings of the species were made during the survey of the Ellam Street Survey Site, and long-term, suitable habitat for the species is not readily present. However, the number of DBCA recordings within proximity to the current Survey Areas and the additional close proximity of the Survey Areas to open water sources and nearby perching and resting sites suggest that the species may temporarily utilise the site for resting or minor foraging activity, or in a fly-over capacity.

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This species inhabits tropical and subtropical coastlines, foraging in the shallow waters of lagoons, coral reefs, estuaries, bays, harbours and inlets, along sandy, rocky, coral or muddy shores, on rocky outcrops in open sea, in mangrove swamps and also far out to sea on open water. It shows a preference for nesting on offshore islands, low-lying coral reefs, sandy or rocky coastal islets, coastal spits, lagoon mudflats, and artificial islets in salt pans and sewage works within 3 km of the coast. (BirdLife International, 2023).

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Blue-billed Duck (*Oxyura australis*)

The blue-billed duck is a small Australian, almost entirely aquatic duck, with both the male and female growing to a length of 40 cm. The male has a slate-blue bill which changes to bright blue during the breeding season (Morcombe 2004). The species is listed as a Priority 4 (P4) significant species under the DBCA BC Act.

The blue-billed duck is endemic to Australia's temperate regions, ranging from the southwest of Western Australia, extending to southern Queensland, through New South Wales and Victoria, to Tasmania. The species is readily seen on freshwater lakes and billabongs where deep fresh water is present (Morcombe 2004).

No recordings of the species were made during the survey of the Ellam Street Survey Site, and long-term, suitable habitat for the species is not readily present. However, the number of DBCA recordings within close proximity to the current Survey Site and the additional close proximity of the Survey Site to readily used lakes and remnant shores and banks of higher habitat value suggest that the species may temporarily utilise the site for resting or minor foraging activity, or in a fly-over capacity.

Osprey (*Pandion haliaetus*)

The Osprey is a medium to large bird of prey within the sea-hawk genus group of the Accipitriformes order of larger raptor species, with specialised beak and talon properties for marine, coastal and inland freshwater predation and habitats. The species is currently listed as Migratory under the EPBC Act and the DBCA BC Act.

Ospreys occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. They are mostly found in coastal areas but occasionally travel inland along major rivers, particularly in northern Australia. They require extensive areas of open fresh, brackish or saline water for foraging (Marchant & Higgins 1993). They frequent a variety of wetland habitats including inshore waters, reefs, bays, coastal cliffs, beaches, estuaries, mangrove swamps, broad rivers, reservoirs and large lakes and waterholes. They exhibit a preference for coastal cliffs and elevated islands in some parts of their range, but may also occur on low sandy, muddy or rocky shores and over coral cays.

No recordings of the species were made during the survey of the Ellam Street Survey Site, and long-term, suitable habitat for the species is not readily present. However, the number of DBCA recordings within proximity to the current Survey Site and the additional proximity of the Survey Site to readily used lakes and remnant shores and banks of higher habitat value suggest that the species may temporarily utilise the site for resting or minor foraging activity, or in a fly-over capacity. Furthermore, this species will readily utilise man-made infrastructure for short-term perching and even occasional nesting activity when bordering coastlines or the banks and shores of suitable marine and freshwater feeding areas. Therefore, the species is likely to occasionally utilise the current Survey Site for such purposes.

Quenda (*Isoodon fusciventer*)

The quenda is a medium sized peramelid marsupial species reaching 1.5-2 kg in weight in mature adult males, with buff brown fur coating across the body, and with distinctive conical snout and small, protruding ears.

At present, the Quenda is listed by DBCA as a Priority 4 species. Its preferred habitat is low dense scrubby, often swampy, vegetation with dense cover up to one metre high. It also occurs in woodlands and is also known to utilise weedy low condition habitat adjacent higher quality bushland. The species often feeds in adjacent forest and woodland that is burnt on a regular basis and in areas of pasture and cropland close to dense cover (Van Dyck & Strahan 2008). The species will persist in semi-rural areas such as Swan Valley and occurs in some Perth urban areas where re-planted vegetation or small patches of remaining native vegetation allow linkages between suitable feeding and foraging sites.

No recordings of the species were made during the survey of the Ellam Street Survey Site and no digging evidence within the Survey Site was recorded. However, the known presence of the species in numerous neighbouring reserves and urban areas bordering the Survey Site, and the species' capacity to utilise urban gardens and partially replanted parklands despite the presence of human disturbance, suggests that the species may temporarily utilise the current Survey Site for occasional foraging or as a linkage-related pathway between more suitable feeding and foraging sites.

7. Survey results – Matilda Bay Site

7.1 Vegetation and flora

7.1.1 Vegetation types

Based on the structural and floristic characteristics observed in the field, 3 vegetation types, none of which are considered native vegetation, were recorded in the two separate sections that comprised the overall Matilda Bay Survey Site.

These vegetation types included:

- Revegetation and Re-planting (VT01)
- Parkland areas consisting of planted trees over lawns. (VT02)

- Wetland/Waterline Shore-bank (VT03).

An additional section of the Survey Area has been mapped as Open Water. The remaining areas have been mapped as Cleared Areas. The vegetation types are described in Table 20 and mapped in Figure 10D (Appendix A).

Table 20 Recorded Vegetation Types for Matilda Bay Survey Site

Vegetation type	Vegetation Type Description	Landform and Substrate	Extent (ha) and proportion of Survey Areas (%)	Photograph
VT01	Replanted areas consisting of mixed locally native and non-native species, typically patchy mixed native sedges and non-native and native <i>Eucalypt</i> and <i>Melaleuca</i> species, exotic flowering plants and shrubs.	Landscaped areas	1.13 ha (14.62%)	 Coordinates: -31.978 115.8212 Photograph: Facing North
VT02	Parkland areas consisting of planted trees over mown grass consisting of <i>Melaleuca</i> sp., <i>Agonis</i> sp., individual Marri and Tuart and <i>Casuarina</i> sp. in low density.	Landscaped areas	0.63 ha (8.15%)	 Coordinates: -31.9773 115.8215 Photograph: Facing North

Vegetation type	Vegetation Type Description	Landform and Substrate	Extent (ha) and proportion of Survey Areas (%)	Photograph
VT03	Wetland/Shore-bank vegetation consisting of highly modified previous shoreline wetland and estuarine vegetation communities with varying levels of reeds and <i>Melaleuca</i> species, and introduced River Oak (<i>Casuarina cunninghamiana</i>), as well as small sections of bulrush (<i>Juncus kraussii</i>). Includes some native and exotic emergent aquatic plants.	Landscaped Areas	0.11 ha (1.42%)	 Coordinates: -31.9769 115.8219 Photograph: Facing North-East
Open Water	Open Water and Estuarine	-	4.88 ha (63.13%)	 Coordinates: -31.9806 115.821 Photograph: Facing South-East
Cleared Areas	Completely devoid of vegetation	-	0.99 ha (12.80%)	

7.1.2 Vegetation condition

The entire Survey Site has been cleared, with modifications carried out over time to the natural edge of the site, with artificial maritime structures bordering what would have historically been estuarine-based riparian shoreline and riverbank species or potentially *Banksia* and *Melaleuca* and *Eucalypt* species. Therefore, the vegetation types were not assigned a vegetation condition as they are not representative of native vegetation.

7.1.3 Significant ecological communities

No EPBC or state listed TECs, or DBCA listed PECs were recorded within the Survey Site.

Vegetation recorded within the Survey Area does not meet the structural or compositional criteria to represent any of the TEC or PECs which have been identified within the desktop Study Area.

7.1.4 Flora diversity

A total of 18 vascular flora species were recorded in the Survey Site. A total of 12 of the flora recorded were native taxa, with the remaining six not considered to be locally native to the area and were classified as introduced. A species list and species by family type are presented in Appendix D.

7.1.5 Significant flora

No EPBC Act or DBCA BC Act listed flora were recorded within the Survey Site.

Likelihood of occurrence

A likelihood of occurrence assessment was conducted post-field survey for significant flora taxa identified in the desktop assessment (Appendix D). The assessment took into account previous records, habitat requirements, efficacy of the survey, intensity of the survey, flowering times and the cryptic nature of species.

The likelihood of occurrence assessment post-field survey concluded that no taxa identified by the desktop assessment are either known to occur or are likely to occur. This is due to a combination of known distribution, preferred habitat, visibility of the taxa during the field survey, and most significantly, the high level of disturbance and clearing throughout the Survey Site and its conversion to public infrastructure and recreational parkland.

7.1.6 Introduced flora

No observed flora species are listed as declared pest plants in WA under the BAM Act, or Weeds of National Significance (WoNS) (Australian Weeds 2012).

7.2 Fauna

7.2.1 Fauna habitat types

Five broad habitat types were identified within the two separate sections of the Matilda Bay Survey Site based on the predominant vegetation structure and geography. These habitats generally align with the vegetation community types (VTs) described in Table 21, and mapped from the concurrent flora and vegetation assessment. The fauna habitats tend to be simple in structure and vegetation diversity as they are all derived from relatively recent revegetation of trees, shrubs and wetlands plants comprising native and exotic species including *Eucalyptus* sp., *Melaleuca* sp., *Casuarina* sp., *Agonis flexuosa*, deciduous and evergreen trees. Consequently, the habitat types were largely artificial. The habitat types include:

- Shoreline Wetlands, Riparian and River
- Scattered trees
- Parkland over revegetation and re-planted vegetation
- Cleared areas.

- Open Water.

Fauna habitat are described in more detail in Table 21 and mapped in Figure 11D (Appendix A).

Table 21 Recorded Fauna Habitat for Matilda Bay Survey Site

Habitat Type	Habitat Description	Extent (ha) and proportion of Survey Areas (%)	Photograph
Shoreline Wetlands, Riparian and River (VT03)	This habitat consists of waterbodies and shoreline systems with varying levels of reeds and <i>Melaleuca</i> species, and introduced River Oak (<i>Casuarina cunninghamiana</i>), as well as small sections of bulrush (<i>Juncus kraussii</i>). Includes some native and exotic emergent aquatic plants. This habitat provides potential, temporary habitat for waterfowl and wading bird species such as black swans (<i>Cygnus atratus</i>), Pacific Black Ducks (<i>Anas superciliosus</i>) and locally common moorhens and swamphens. This habitat is not likely to be important for migratory birds due to lack of shallow open shoreline suitable as foraging habitat for waders, however they may occur occasionally as temporary foraging or resting-based visitation due to proximity to estuarine habitat of the Swan River. Furthermore, the highly degraded and altered state of the habitat type is unlikely to support wetland and shoreline mammalian species such as water rat (Rakali) (<i>Hydromys chrysogaster</i>). The small areas of marine system as a part of the extended open water sections of the Survey Areas may be used for brief foraging periods by locally common marine mammal species such as bottlenosed dolphins (<i>Tursiops aduncus</i>).	0.11 ha (1.42%)	 Coordinates: -31.9769 115.8219 Photograph: Facing North-East
Parkland over re-vegetation and re-planted vegetation (VT01)	This habitat consists of landscaped areas or open parklands, garden beds, lawns with sections of recent native replanting and re-vegetation, which consists of both native and exotic species. The majority of these areas are regularly maintained and therefore weed presence and significant hollows, logs, leaf litter or rocks and crevices are few in number. The nature of the highly modified habitat with the lack of additional microhabitats and understory suggests that native mammal and reptile suitability is low, with the exception of possible use for brief foraging activity by Quendas (<i>Isodon fusciventer</i>). Avian fauna species may utilise the area as part of brief, occasional foraging and resting activity. This may include significant-listed fauna species including Osprey (<i>Pandion haliaetus</i>), Peregrine Falcon (<i>Falco peregrinus</i>) and the three endemic Black Cockatoo Species.	1.13 ha (14.62%)	 Coordinates: -31.978 115.8212 Photograph: Facing North

Habitat Type	Habitat Description	Extent (ha) and proportion of Survey Areas (%)	Photograph
Scattered Trees over Parkland (VT02)	This is a generally highly modified habitat containing isolated and small stands of native and introduced tree species over a virtually entirely cleared understorey. The trees present are located across mostly maintained lawns. Tree species identified include Paperbark species (<i>Melaleuca</i> sp.), Peppermint (<i>Agonis flexuosa</i>) and <i>Casuarina</i> sp. as well as isolated individual Jarrah, Marri and Tuart tree species. Sources of hollows and nesting opportunities are occasionally present but typically rare, with hollow logs, leaf litter and thick grass or bushes to provide additional microhabitat. The nature of the highly modified habitat with the lack of additional microhabitats and understory suggests that native mammal and reptile suitability is low, with the exception of possible use for brief foraging activity by Quendas (<i>Isodon fusciventer</i>). Avian fauna species may utilise the area as part of brief, occasional foraging and resting activity. This may include significant-listed fauna species including Osprey (<i>Pandion haliaetus</i>) and the three endemic Black Cockatoo Species. Small numbers of isolated potential nesting size trees (DBH>500mm) were identified.	0.63 ha (8.15%)	 Coordinates: -31.9765 115.8219 Photograph: Facing West
Open Water	Open Water and Estuarine Habitat featuring shallow and mid-level water systems close to shore. These areas are typically disturbed from persistent boating activity and previous infrastructure development but may allow for occasional foraging use by locally common marine mammal species such as bottlenose dolphins (<i>Tursiops aduncus</i>).	4.88 ha (63.13%)	 Coordinates: -31.9806 115.821 Photograph: Facing South-East
Cleared Areas	Unmapped areas that include roads, cleared construction areas and lawn areas. These areas had little or no habitat value for fauna including significant species, but may occasionally be used by various	0.99 ha (12.80%)	

Habitat Type	Habitat Description	Extent (ha) and proportion of Survey Areas (%)	Photograph
	avian fauna species for temporary perching and resting activity given the proximity to open water bodies.		

7.2.2 Fauna diversity

The field survey recorded a total of 11 bird species, with no mammals, reptiles, fish or amphibian species recorded. This represents a small proportion of the total number of vertebrates that are likely or known to occur in the study area, based on desktop databases searches and assessments. Two species were introduced species, these being the Rainbow Lorikeet (*Trichoglossus moluccanus*) and the Long-billed Corella (*Cacatua tenuirostris*). The full species list is provided in Appendix E.

All of the fauna species identified are common, widespread species known to utilise urban habitat, modified wetlands, coastal shorelines and converted recreational parklands.

7.2.3 Significant fauna

During the field survey, no significant species were recorded. A further nine significant species, which are listed in Table 22, are likely to occur based on local occurrence and habitat availability. Of these nine species, five were assessed as being likely to occur, with a further four species assessed as possibly occurring.

Other significant fauna species may include migratory birds that have been recorded locally due to the proximity of the Survey Site to the estuarine habitat of the Swan River. However, these species are likely to be infrequent visitors from a purely fly-over activity basis, based on the small area size, highly cleared and altered state of the Survey Site. The Survey Site represents very low habitat value for these migratory species and they have therefore not been considered further in this assessment.

Table 22 Significant Fauna Species across Matilda Bay Survey Site

Common Name	Species Name	Status Listing EPBC Act	Status Listing DBCA BC Act	Likelihood
Baudin's Black Cockatoo	<i>Zanda baudinii</i>	EN	EN	Likely.
Carnaby's Black Cockatoo	<i>Zanda latirostris</i>	EN	EN	Likely.
Forest Red-tailed Black Cockatoo	<i>Calyptrorhynchus banksii naso</i>	VU	VU	Likely.
Peregrine Falcon	<i>Falco peregrinus</i>	-	OS	Likely.
Blue-billed duck	<i>Oxyura australis</i>	-	P4	Possible.
Osprey	<i>Pandion haliaetus</i>	MI	MI	Likely.
Caspian Tern	<i>Hydroprogne caspia</i>	MI	MI	Possible.
Crested Tern	<i>Thalasseus bergii</i>	MI	MI	Possible.
Quenda	<i>Isodon fusciventer</i>	-	P4	Possible.

Peregrine Falcon (*Falco peregrinus*)

The Peregrine Falcon is listed by the DBCA as otherwise in need of special protection under section 18 of the BC Act. It is uncommon but wide ranging across Australia from woodlands to open grasslands and coastal cliffs, and occasionally in desert regions. It feeds almost entirely on other birds, although it occasionally eats rabbits and other moderate sized mammals, bats and reptiles. The Peregrine Falcon is very territorial during the breeding season, the male courting the female with an impressive display of aerobatics (DEE 2019b, Morcombe 2004). Nest sites include tall trees, cliffs, and elevated artificial structures that provide a secluded and secure platform.

This species was not recorded during the survey and no nest sites were recorded. However, the species has been recorded as utilising urbanised areas along the Swan River and Swan Coastal Plain region, including coastal environments. Therefore, the species may possibly utilise the Survey Site at least on an occasional basis for perching and resting periods or as part of fly-over activity.

Baudin's Cockatoo (*Zanda baudinii*)

The Baudin's Cockatoo is listed as Endangered under the EPBC Act and BC Act. This species is endemic to the south-west of WA. The range of Baudin's Cockatoo varies considerably between the breeding and non-breeding seasons. During the breeding season (from October to January), the species nests in isolated pockets of the far south-west of WA within Jarrah, Marri and Karri forests which receive an average of 750 mm of rainfall annually. In addition to the south-west, there is an isolated patch of known breeding recorded at Perth Hills, east of Armadale (Johnstone & Storr 1998, Johnstone & Kirkby 2008).

Breeding generally occurs in woodland or forest but may also occur in former woodland or forest now present as isolated trees withing partially cleared parkland or farmland. Nesting occurs in hollows of live or dead Karri, Marri, Wandoo and Tuart (*Eucalyptus gomphocephala*) trees (DSEWPac 2012). During the breeding season feeding primarily occurs in native vegetation, particularly Marri (DSEWPac 2012). The range then expands during the non-breeding season (from February) as flocks disperse to forage more widely, congregating on the central and northern parts of the Darling plateau, as far as Mundaring and Gidgegannup (DSEWPac 2012; Saunders 1974 & 1979).

No birds were observed or recorded during the survey, no evidence of foraging or feeding evidence was recorded within the Survey Site. However, the high number of confirmed recordings of the species throughout neighbouring locations to the current Survey Areas suggests that the species may temporarily utilise the site for perching, resting or temporary fly-over activity, albeit for brief periods. Furthermore, several potential nesting trees of sufficient DBH were recorded in scattered areas across the Survey Site, highlighting the potential for brief site utilisation. These specific individual trees are outlined in fauna habitat mapping in Appendix A. The utilisation for long-term, significant persistence with regards to feeding, foraging or breeding, however, is highly unlikely.

Carnaby's Cockatoo (*Zanda latirostris*)

The Carnaby's Cockatoo is listed as Endangered under the EPBC Act and BC Act. This species is endemic to the south-west of WA from near Cape Arid on the south coast through the eastern Wheat Belt and north to about Kalbarri. Carnaby's Cockatoo nest in hollows of live or dead eucalyptus, primarily smooth-barked salmon gum (*Eucalyptus salmonophloia*) and Wandoo (*E. wandoo*) (Saunders 1979, 1982) though breeding has been reported in other Wheatbelt tree species and some tree species on the Swan Coastal Plain and Jarrah forest (Saunders 1979, 1982, Storr 1991, Johnstone & Storr 1998).

Success in breeding is dependent on sufficient high quality foraging habitat located in proximity of nesting and is nominally a radius of up to 12km of nesting sites (Saunders 1979, 1982, Saunders and Ingram 1987). High quality foraging habitat includes Kwongan heathlands and Banksia woodlands having abundant Banksia species and other proteaceous plants.

No birds were observed or recorded during the survey, no evidence of foraging or feeding evidence was recorded within the Survey Site. However, the high number of confirmed recordings of the species throughout neighbouring locations to the current Survey Site suggests that the species may temporarily utilise the site for perching, resting or temporary fly-over activity, albeit for brief periods. Furthermore, several potential nesting trees of sufficient DBH were recorded in scattered areas across the Survey Site, highlighting the potential for brief site utilisation. These specific individual trees are outlined in fauna habitat mapping in Appendix A. The utilisation for long-term, significant persistence with regards to feeding, foraging or breeding, however, is highly unlikely.

Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*)

The Forest Red-tailed Black Cockatoo inhabits the dense jarrah, karri, and marri forests receiving more than 600 mm annual average rainfall but also occurs in a range of other forest and woodland types, including Blackbutt (*E. patens*), Wandoo (*E. wandoo*), Tuart (*E. gomphocephala*), Albany Blackbutt (*E. staeri*), Yate (*E. cornuta*), and Flooded Gum (*E. rudis*) (DEE 2017). Habitats tend to have an understorey or snottygobble (*Persoonia* spp.), holly-leaved mirbelia (*Mirbelia dilatata*), and sheoak (*Allocasuarina fraseriana*). They are most common in the jarrah forest region of the northern Darling Range from Collie north to Mundaring and are very local throughout the lower south-west. They can be found on the Swan Coastal Plain, mainly in search of food the exotic white cedar (*Melia azedarach*). There are also several small, isolated populations in the eastern parts of its range (DAWE 2022).

No birds were observed or recorded during the survey, no evidence of foraging or feeding evidence was recorded within the Survey Site. However, the high number of confirmed recordings of the species throughout neighbouring locations to the current Survey Areas suggests that the species may temporarily utilise the site for perching,

resting or temporary fly-over activity, albeit for brief periods. Furthermore, several potential nesting trees of sufficient diameter breast height (DBH) were recorded in scattered areas across the Survey Site, highlighting the potential for brief site utilisation. These specific individual trees are outlined in fauna habitat mapping in Appendix A. The utilisation for long-term, significant persistence with regards to feeding, foraging or breeding, however, is highly unlikely.

Caspian Tern (*Hydroprogne caspia*)

The Caspian Tern is a migratory coastal and oceanic specialised species member of the gull family Laridae and is easily distinguished by its significantly larger size (the largest of all tern species globally) and its significant and prominent, elongated red bill. The species is currently listed as Migratory and under the EPBC Act and DBCA BC Act. This species is mostly associated with sheltered coasts such as harbours, bays, estuaries, etc. They can also be found in inland terrestrial wetlands (saline or fresh) or man-made bodies of water (lakes or reservoirs). (DCCEEW).

No recordings of the species were made during the survey, and long-term, suitable habitat for the species is not readily present. However, the number of DBCA recordings within proximity to the current Survey Site and the additional close proximity of the Survey Site to open water sources and nearby perching and resting sites suggest that the species may temporarily utilise the site for resting or minor foraging activity, or in a fly-over capacity.

Crested Tern (*Thalasseus bergii*)

The Crested Tern is a migratory coastal and oceanic specialised species member of the gull family Laridae and is easily distinguished by its yellow- coloured bill and extended, mobile crest arrangement for head feathers. The species is currently listed as Migratory and under the EPBC Act and DBCA BC Act.

This species inhabits tropical and subtropical coastlines, foraging in the shallow waters of lagoons, coral reefs, estuaries, bays, harbours and inlets, along sandy, rocky, coral or muddy shores, on rocky outcrops in open sea, in mangrove swamps and also far out to sea on open water. It shows a preference for nesting on offshore islands, low-lying coral reefs, sandy or rocky coastal islets, coastal spits, lagoon mudflats, and artificial islets in salt pans and sewage works within 3 km of the coast. (BirdLife International, 2023).

No recordings of the species were made during the survey, and long-term, suitable habitat for the species is not readily present. However, the number of DBCA recordings within proximity to the current Survey Site and adjacent to open water sources and nearby perching and resting sites suggest that the species may temporarily utilise the site for resting or minor foraging activity, or in a fly-over capacity.

Blue-billed Duck (*Oxyura australis*)

The blue-billed duck is a small Australian, almost entirely aquatic duck, with both the male and female growing to a length of 40 cm. The male has a slate-blue bill which changes to bright blue during the breeding season (Morcombe 2004). The species is listed as a Priority 4 (P4) significant species under the DBCA BC Act.

The blue-billed duck is endemic to Australia's temperate regions, ranging from the southwest of Western Australia, extending to southern Queensland, through New South Wales and Victoria, to Tasmania. The species is readily seen on freshwater lakes and billabongs where deep fresh water is present (Morcombe 2004).

No recordings of the species were made during the survey, and long-term, suitable habitat for the species is not readily present. However, the number of DBCA recordings within proximity to the current Survey Site and the additional close proximity of the Survey Areas to readily used lakes and remnant shores and banks of higher habitat value suggest that the species may temporarily utilise the site for resting or minor foraging activity, or in a fly-over capacity.

Osprey (*Pandion haliaetus*)

The Osprey is a medium to large bird of prey within the sea-hawk genus group of the Accipitriformes order of larger raptor species, with specialised beak and talon properties for marine, coastal and inland freshwater predation and habitats. The species is currently listed as Migratory under the EPBC Act and the DBCA BC Act.

Ospreys occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. They are mostly found in coastal areas but occasionally travel inland along major rivers, particularly in northern Australia. They require extensive areas of open fresh, brackish or saline water for foraging

(Marchant & Higgins 1993). They frequent a variety of wetland habitats including inshore waters, reefs, bays, coastal cliffs, beaches, estuaries, mangrove swamps, broad rivers, reservoirs and large lakes and waterholes. They exhibit a preference for coastal cliffs and elevated islands in some parts of their range, but may also occur on low sandy, muddy or rocky shores and over coral cays.

No recordings of the species were made during the survey of the Matilda Bay Survey Site, and long-term, suitable habitat for the species is not readily present. However, the number of DBCA recordings within close proximity to the current Survey Site and the additional close proximity of the Survey Site to readily used lakes and remnant shores and banks of higher habitat value suggest that the species may temporarily utilise the site for resting or minor foraging activity, or in a fly-over capacity. Furthermore, this species will readily utilise man-made infrastructure for short-term perching and even occasional nesting activity when bordering coastlines or the banks and shores of suitable marine and freshwater feeding areas. Therefore, the species is likely to occasionally utilise the current Survey Site for such purposes.

Quenda (*Isoodon fusciventer*)

The quenda is a medium sized peramelid marsupial species reaching 1.5-2 kg in weight in mature adult males, with buff brown fur coating across the body, and with distinctive conical snout and small, protruding ears.

At present, the Quenda is listed by DBCA as a Priority 4 species. Its preferred habitat is low dense scrubby, often swampy, vegetation with dense cover up to one metre high. It also occurs in woodlands, and also known to utilise weedy low condition habitat adjacent higher quality bushland. The species often feeds in adjacent forest and woodland that is burnt on a regular basis and in areas of pasture and cropland close to dense cover (Van Dyck & Strahan 2008). The species will persist in semi-rural areas such as Swan Valley and occurs in some Perth urban areas where re-planted vegetation or small patches of remaining native vegetation allow linkages between suitable feeding and foraging sites.

No recordings of the species were made during the survey of the site and no digging evidence within the Survey Site was recorded. However, the known presence of the species in numerous neighbouring reserves and urban areas bordering the Survey Site, and the species' capacity to utilise urban gardens and partially replanted parklands despite the presence of human disturbance, suggests that the species may temporarily utilise the current Survey Site for occasional foraging or as a linkage-related pathway between more suitable feeding and foraging sites.

8. Discussion and Conclusions

8.1 Vegetation

A small number of basic vegetation types were recorded within the four Survey Sites across the Survey Area, varying from one to three vegetation types across the four sites, with the larger range of vegetation types and vegetation cover being observed at Ellam Street and Matilda Bay.

Across the four Survey Sites, the dominant vegetation types consisted of cleared parkland, scattered native Eucalypt, Melaleuca, and Peppermint, Shoreline and Estuarine Riparian, native and exotic re-plantings, with remaining sections classified as open water and completely cleared. As a result, all four Survey Sites of the Survey Area are classified as Cleared Areas.

No EPBC or state listed TECs, or DBCA listed PECs were recorded within any of the four Survey Sites of the Survey Area. The absence of significant vegetation reflects the highly degraded, low ecological value of the overall Survey Area in its current state.

8.2 Flora

A total of 23 vascular flora species, were recorded across all four Survey Sites of the Survey Area, a total which included 16 native and 7 introduced species. As the Survey Sites have previously been cleared and significantly altered, the flora of the area consisted both planted exotic and native species, with scattered, individual trees from various *Agonis* (Peppermint), *Melaleuca*, Eucalypt and Marri species present in small numbers at both the Matilda Bay and Ellam Street sites.

No EPBC Act or BC Act listed Threatened flora or DBCA-listed Priority Flora species were recorded within the four Survey Areas. Database desktop searches across various state and federal records identified a number of Threatened and Priority flora species previously recorded or likely to occur within the study area of a 10km radius of all four Survey Sites, specifically 167 taxa of species and sub-species. However, all such identified species are considered either unlikely or highly unlikely to occur within any of the four Survey Sites post survey, due to historical disturbance, lack of suitable habitat, and distance of known records from the Survey Sites.

No recorded flora species were listed as declared pest plants in WA under the BAM Act, or Weeds of National Significance (WoNS) (Australian Weeds 2012).

8.3 Fauna

A small number of basic fauna habitat types were recorded across the four Survey Sites of the Survey Area, consisting of five basic habitat types (excluding Cleared Areas) to varying sizes and coverage across the four Survey Sites. These fauna types were classified as Scattered Trees, Parkland over revegetation and re-planted flora, Riparian Rivers and Shoreline Wetlands, Native and exotic mixed plantings and Open Water. These fauna habitats are likely to support a comparatively small range of regionally common terrestrial fauna species, primarily birds, within the habitats available.

The Open Water habitats are present across all four Survey Sites and are likely to provide brief foraging habitats for a range of locally common fish, crustacean and marine mammal species such as bottlenose dolphins, which were observed engaging in brief foraging behaviour at the Applecross Site. However, specialised, environmentally significant marine and estuarine habitats are not present within these identified Open Water habitats, and their smaller size within the context of larger surrounding marine habitats suggests that these areas are not likely to support the persistence of large numbers of important marine fauna species. The majority of mapped areas of seagrass habitat is located outside of the Survey Site areas, with no evidence of mapped seagrass within the Applecross and Matilda Bay Survey Sites or within proximity to those Survey Sites. Both the Elizabeth Quay and Ellam Street Survey Sites contain small fragments of sparse-rated and medium-rated seagrass cover on the outer regions of these Open Water sections. These fragments represent a small percentage of the total seagrass

recorded in surrounding marine and estuarine habitats and thus are not likely to be used for significant sheltering and foraging activity by various marine species that may occur in the areas on a temporary basis.

A total of 17 suitable DBH (DBH of greater than 500 mm) were identified at across the Ellam Street and Matilda Bay Survey Sites (two trees and 15 trees respectively), though these were typically in highly isolated patches within the Survey Sites themselves as shown in Figure 12C and 12D. (Appendix A). Suitable DBH trees have the potential to support black cockatoo breeding when in proximity to moderate to high quality feeding and foraging habitat. In the context of the present Survey Area, neither the Applecross or Elizabeth Quay Site contain any foraging habitat or roosting habitat of noted quality or for breeding purposes (DCCEEW, 2017). The small number of isolated suitable DBH trees at both the Matilda Bay and Ellam Street Survey Sites may provide small sources of temporary roosting and foraging, albeit of low quality rating. However, given that no hollows were observed and that there are numerous recordings of confirmed roosting and higher quality foraging habitat in surrounding areas of all four Survey Sites, these recorded trees are not likely to provide high quality foraging or roosting habitat for any of the three black cockatoo species to persist in numbers or with consistent visitation.

From an assessment of potentially significant trees that were deemed to be of importance in terms of size, significance to native fauna use and overall importance to the Survey Site, there were no significant trees observed at either the Applecross Survey Site or the Elizabeth Quay Survey Site. When including the suitable DBH trees in the assessment, a total of 26 potentially significant tree groupings were identified and recorded across the remaining two Survey Sites, with seven at Ellam Street and 19 at Matilda Bay respectively. The majority of these trees were isolated individuals with a small number of small groupings of three to four. Most of these trees were also native species of older ages, size and condition compared to other surrounding flora species observed, with each of them offering potential foraging, temporary resting and nesting habitat for locally common bird species, as well as the identified black cockatoo trees offering the potential for lower value foraging and feeding and temporary resting habitat. The details of each group of potentially significant trees are provided in table format in Appendix D. It is noted that while other trees of smaller size and condition were observed at the Ellam Street and Matilda Bay Survey Sites, these were not deemed to have a significant size or condition to be assessed as of significance to each Survey Site as a source of fauna utilisation when compared to those identified and highlighted trees.

Database desktop searches across various state and federal records have identified a significant number of Threatened and Priority fauna species previously recorded or likely to occur within the study area, specifically 94 taxa of species and sub-species. However, such previous records were not located within the four Survey Sites themselves with great frequency and were concentrated within neighbouring areas of higher habitat value or established conservation reserves and parks.

Field surveys across all four Survey Sites recorded small numbers of predominantly locally common bird species, ranging from as few as four species at Elizabeth Quay to 13 species at Ellam Street. No EPBC Act or BC Act listed Threatened fauna or DBCA-listed Priority fauna were recorded. While the majority of the previously identified significant species from desktop assessment were assessed as unlikely to occur, a small number of species across the four Survey Sites were deemed likely to occur or possibly occurring, ranging from eight species at the Elizabeth Quay and Applecross Survey Sites, to nine species at Matilda Bay and Ellam Street. There were higher numbers of such species at both Matilda Bay and Ellam Street recorded as being likely to occur as opposed to possibly occurring. This is due to the higher density of re-planted native and exotic vegetation and scattered tree vegetation cover and the presence of small clusters of scattered existing trees. This may allow for species such as Osprey and Quenda to utilise those Survey Sites on a more frequent basis for temporary resting or foraging activity or as a means of navigating between neighbouring habitats of higher quality. In comparison, both the Applecross and Elizabeth Quay Survey Sites are less likely to contain habitat of benefit to such significant species due to the very poor quality of the habitats present, and thus are most likely to be utilised for temporary resting behaviour by locally common sea-birds and waterfowl.

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Appendices

Appendix A

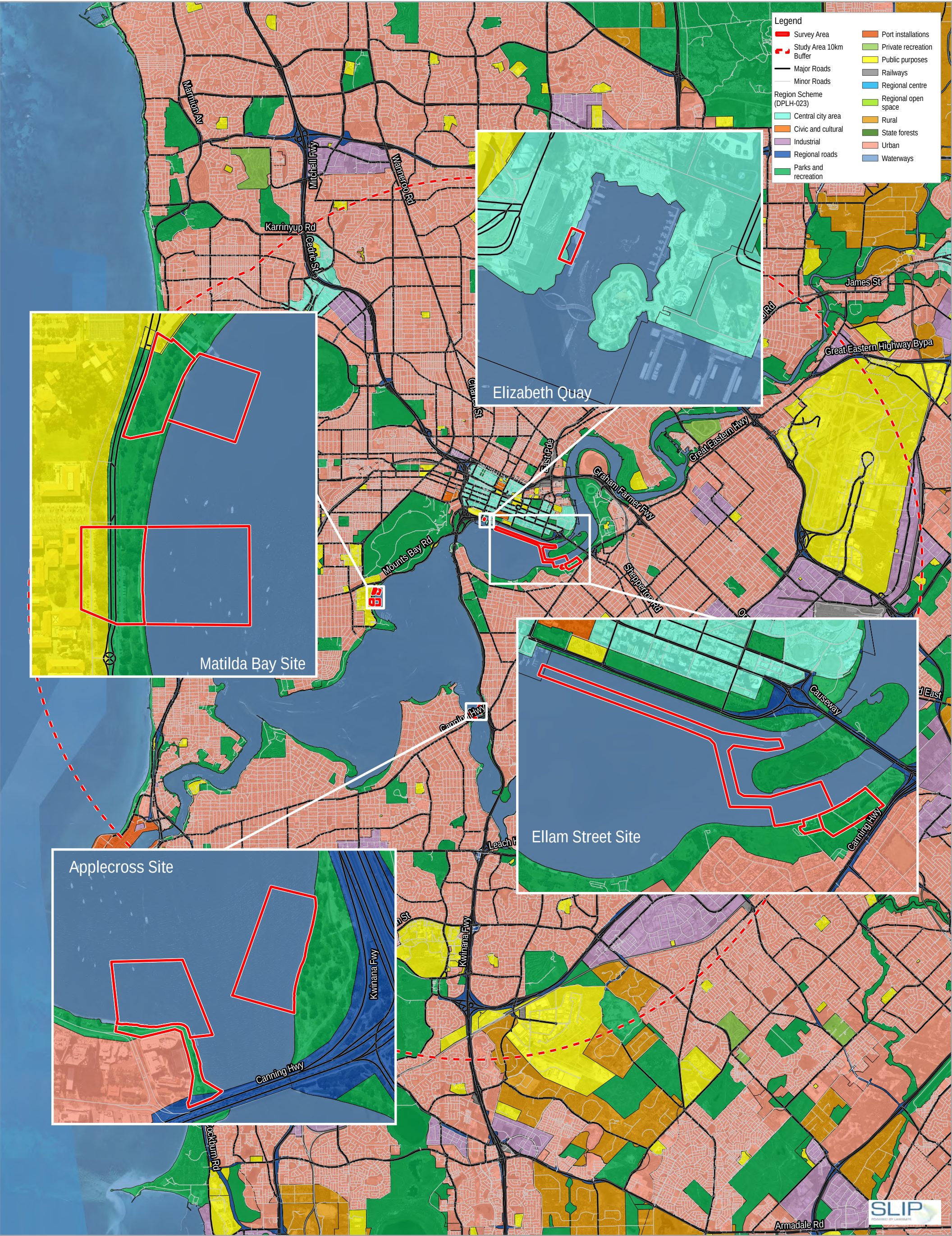
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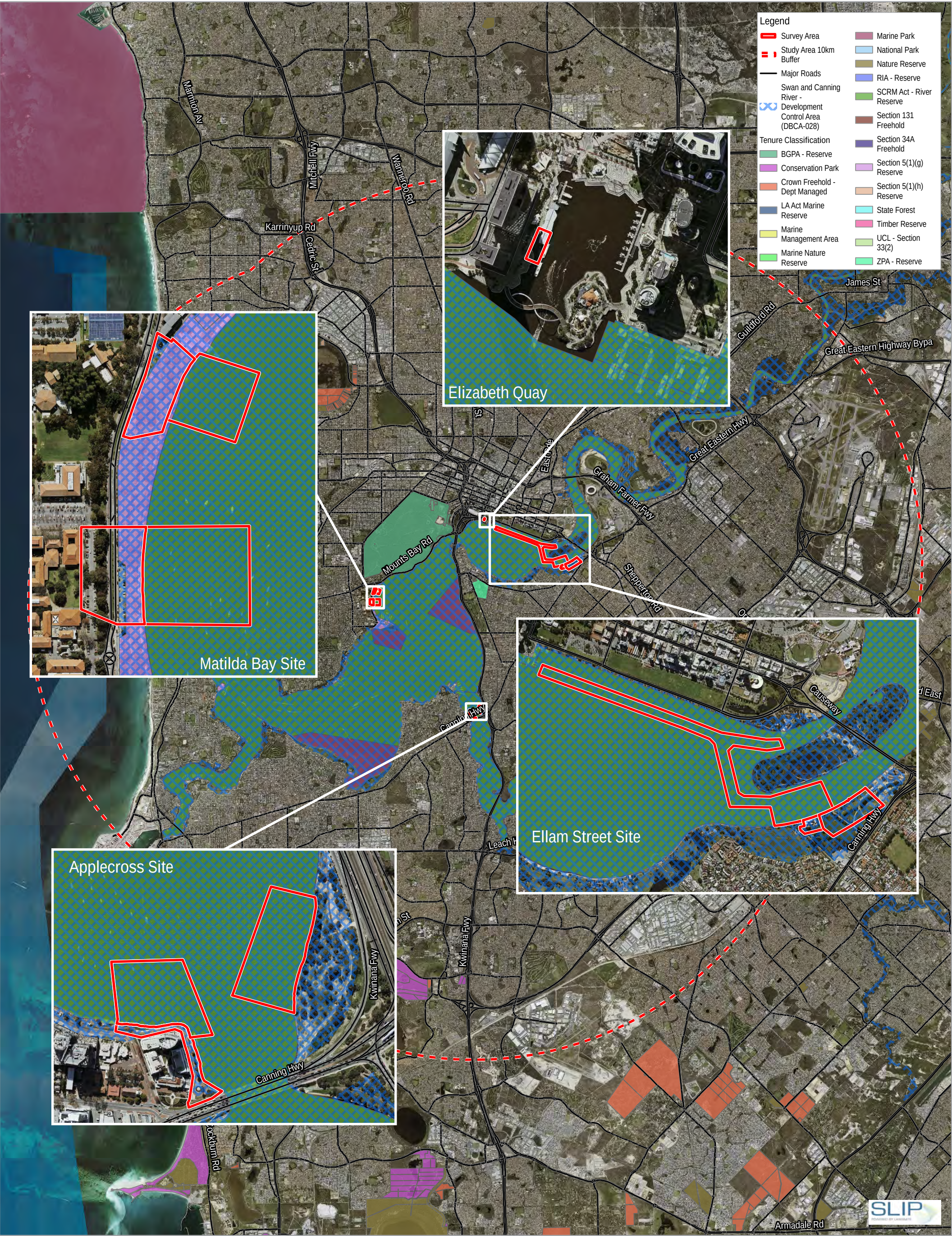
<i>Figure 1</i>	<i>Project Location</i>
<i>Figure 2</i>	<i>Survey Effort</i>
<i>Figure 3</i>	<i>Wetlands</i>
<i>Figure 4</i>	<i>Metropolitan Region Scheme</i>
<i>Figure 5</i>	<i>Conservation Reserves</i>
<i>Figure 6</i>	<i>Environmentally Sensitive Areas</i>
<i>Figure 7</i>	<i>Significant ecological communities</i>
<i>Figure 8</i>	<i>Perth Seagrass</i>
<i>Figure 9</i>	<i>Black Cockatoo Breeding and Roosting Sites</i>
<i>Figure 10</i>	<i>Vegetation Types</i>
<i>Figure 11</i>	<i>Fauna Habitat</i>
<i>Figure 12</i>	<i>Significant Trees</i>





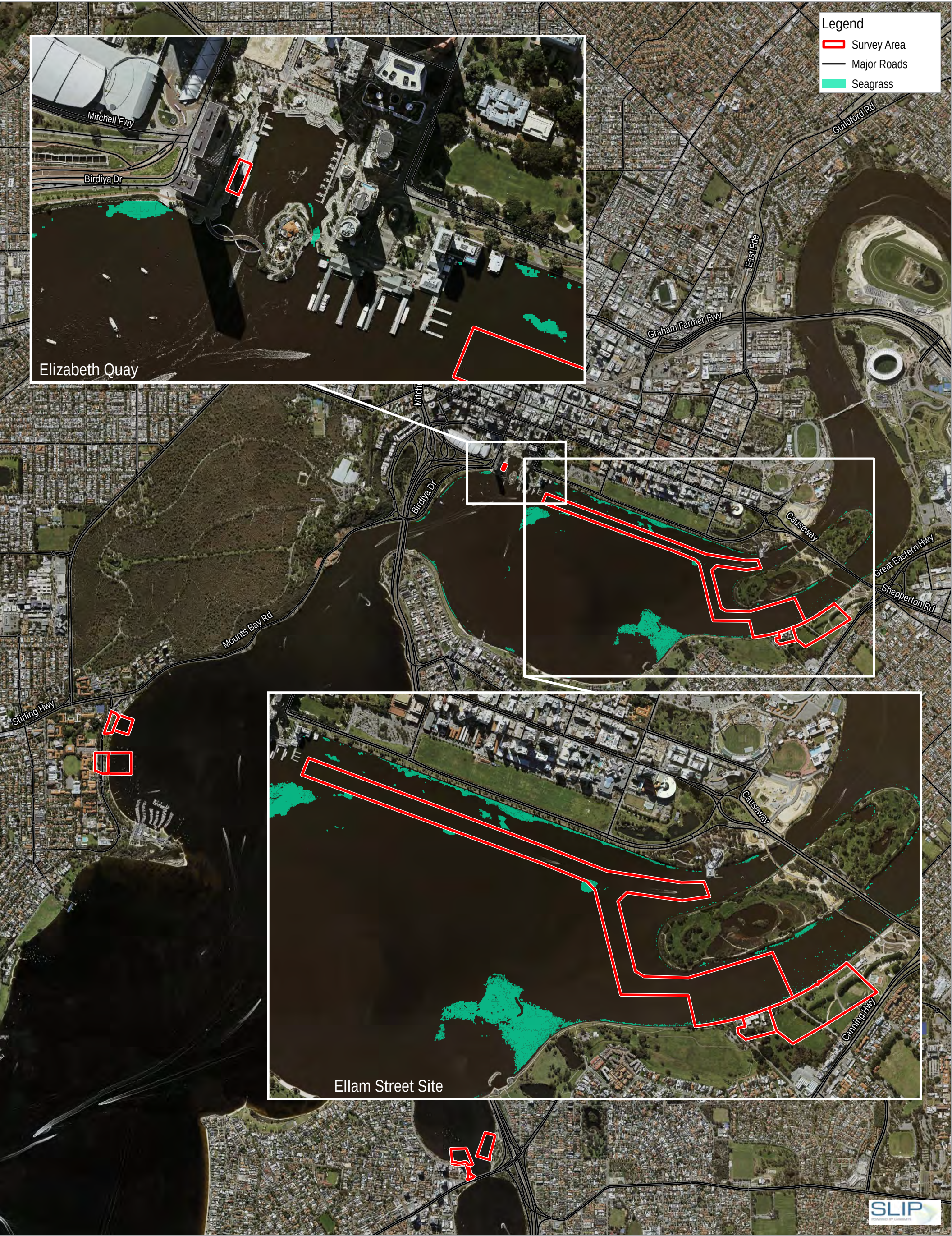












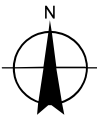




- Legend
- Survey Area
 - Major Roads
 - Parkland with planted trees over lawn
 - Replanting
 - Wetland shoreline
 - Open water
 - Cleared

Paper Size ISO A3
0 5 10 15 20
Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50



Public Transport Authority
Swan River Ferry Expansion
Ecology and EIA Support

Applecross Site
Vegetation Types

Project No. 12658767
Revision No. C
Date 2/04/2025

FIGURE 10A







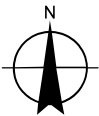
Legend

- Survey Area
- Major Roads
- Parkland with planted trees over lawn
- Replanting
- Wetland shoreline
- Open water
- Cleared



Paper Size ISO A3
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Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50



Public Transport Authority
Swan River Ferry Expansion
Ecology and EIA Support

Matilda Bay Site
Vegetation Types

Project No. 12658767
Revision No. C
Date 2/04/2025

FIGURE 10D











Legend

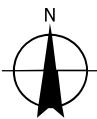
Survey Area

Paper Size ISO A3

0 5 10 15 20

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50



Public Transport Authority
Swan River Ferry Expansion
Ecology and EIA Support

Applecross Site
Significant Tree Locations

Project No. 12658767
Revision No. A
Date 17/04/2025



FIGURE 12A



Legend

 Survey Area





Appendix B

**Relevant legislation, conservation codes
and background information**

Relevant legislation

Federal *Environment Protection and Biodiversity Conservation Act 1999*

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Federal Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places, which are defined in the EPBC Act as Matters of National Environmental Significance (MNES).

The biological aspects listed as MNES include:

Nationally threatened flora and fauna species and ecological communities

Migratory species

A person must not undertake an action that has, will have, or is likely to have a significant impact (direct or indirect) on MNES, without approval from the Federal Minister for the Environment.

The EPBC Act is administered by the Department of Climate Change, Energy, the Environment and Water (DCCEEW).

State *Environmental Protection Act 1986*

The *Environmental Protection Act 1986* (EP Act) is the primary legislative Act dealing with the protection of the environment in Western Australia. The Act allows the Environmental Protection Authority (EPA), to prevent, control and abate pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment and for matters incidental to or connected with the foregoing. Part IV of the EP Act is administered by the EPA and makes provisions for the EPA to undertake environmental impact assessment of significant proposals, strategic proposals and land use planning schemes.

The Department of Water and Environment Regulation (DWER) is responsible for administering the clearing provisions of the EP Act (Part V). Clearing of native vegetation in Western Australia requires a permit from the DWER, unless exemptions apply. Applications for clearing permits are assessed by the Department and decisions are made to grant or refuse the application in accordance with the Act. When making a decision the assessment considers clearing against the ten clearing principles as specified in Schedule 5 of the EP Act:

2. Native vegetation should not be cleared if it comprises a high level of biodiversity.
3. Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a significance habitat for fauna indigenous to Western Australia.
4. Native vegetation should not be cleared if it includes, or is necessary, for the continued existence of rare flora.
5. Native vegetation should not be cleared if it comprises the whole or part of native vegetation in an area that has been extensively cleared.
6. Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.
7. Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.
8. Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.
9. Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.
10. Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.

11. Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.

Exemptions for clearing include clearing that is a requirement of a written law or authorised under certain statutory processes (listed in Schedule 6 of the EP Act) and exemptions for prescribed low impact day-to-day activities (prescribed in the Environmental Protection (Clearing of Native Vegetation) Regulations 2004); these exemptions do not apply in environmentally sensitive areas (ESAs).

State Biodiversity and Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BC Act) provides for the conservation and protection of biodiversity and biodiversity components, as well as the promotion of the ecologically sustainable use of biodiversity components in Western Australia. The BC Act replaces both the repealed *Wildlife Conservation Act 1950* (WC Act) and the *Sandalwood Act 1929* (Sandalwood Act), as well as their associated regulations. To attain the objectives of the BC Act, principles of ecological sustainable development have been established:

- Decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations
- If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation
- The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations
- The conservation of biodiversity and ecological integrity should be a fundamental consideration in decision-making
- Improved valuation, pricing and incentive mechanisms should be promoted.

The BC Act is administered by the Department of Biodiversity Conservation and Attractions (DBCA).

State Biosecurity and Agriculture Management Act 2007

The *Biosecurity and Agriculture Management Act 2007* (BAM Act) and associated regulations are administered by the Department of Primary Industries and Regional Development (DPIRD) and replace the repealed *Agriculture and Related Resources Protection Act 1976*. The main purposes of the BAM Act and its regulations are to:

- Prevent new animal and plant pests (vermin and weeds) and diseases from entering WA
- Manage the impact and spread of those pests already present in the state
- Safely manage the use of agricultural and veterinary chemicals
- Increased control over the sale of agricultural products that contain violative chemical residues.

The Western Australian Organism List (WAOL) provides the status of organisms which have been categorised under the BAM Act. A Declared Pest is a prohibited organism or an organism for which a declaration under Section 22(2) of the Act is in force. Declared Pests may be assigned a control category including: C1 (exclusion), C2 (eradication) and C3 (management). The category may apply to the whole of the State, LGAs, districts, individual properties or even paddocks, and all landholders are obliged to comply with the specific category of control. Categories of control are defined below.

DPIRD Categories for Declared Pests under the BAM Act

Control class code	Description
C1 (Exclusion)	Pests will be assigned to this category if they are not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.
C2 (Eradication)	Pests will be assigned to this category if they are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
C3 (Management)	Pests will be assigned to this category if they are established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.

Background information

Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESAs) are declared by the Minister for Environment under Section 51B of the EP Act. The Table below outlines the aspects of areas declared as ESA in the Environmental Protection (Environmentally Sensitive Areas) Notice 2005.

Aspects of ESAs

Aspects of Environmentally Sensitive Areas
A declared World Heritage property as defined in Section 13 of the EPBC Act.
An area that is included on the Register of the National Estate (RNE), because of its natural values, under the <i>Australian Heritage Commission Act 1975</i> of the Commonwealth (the RNE was closed in 2007 and is no longer a statutory list – all references to the RNE were removed from the EPBC Act on 19 February 2012).
A defined wetland and the area within 50 m of the wetland. Defined wetlands include Ramsar wetlands, conservation category wetlands and nationally important wetlands.
The area covered by vegetation within 50 m of rare flora, to the extent to which the vegetation is continuous with the vegetation in which the rare flora is located.
The area covered by a Threatened Ecological Community.
A Bush Forever Site listed in “Bush Forever” Volumes 1 and 2 (2000), published by the Western Australia Planning Commission, except to the extent to which the site is approved to be developed by the Western Australia Planning Commission.
The areas covered by the <i>Environmental Protection (Gnangara Mound Crown Land) Policy 1992</i> .
The areas covered by the <i>Environmental Protection (Western Swamp Tortoise Habitat) Policy 2002</i> .
The areas covered by the lakes to which the <i>Environmental Protection (Swan Coastal Plain Lakes) Policy 1992</i> (EPP Lakes) applies.
Protected wetlands as defined in the <i>Environmental Protection (South West Agricultural Zone Wetlands) Policy 1998</i> .

Reserves and conservation areas

Bush Forever

Bush Forever, which was released in December 2000 and proclaimed in 2010, is a Government initiative aimed to retain and protect regionally significant bushland on the Swan Coastal Plain within the Perth Metropolitan Region. Bush Forever aims to protect more than 51,000 hectares of regionally significant bushland within 287 sites across the metropolitan portion of the Swan Coastal Plain (Government of Western Australia (GoWA) 2000). Bush Forever sites constitute ESAs as declared by a notice under Section 51B of the EP Act.

Department of Biodiversity, Conservation and Attractions managed land and waters

DBCA manages lands and waters throughout Western Australia to conserve ecosystems and species, and to provide for recreation and appreciation of the natural environment. DBCA managed lands and waters include national parks, conservation parks and reserves, marine parks and reserves, regional parks, nature reserves, State forest and timber reserves. Access to, or through, some areas of DBCA managed lands may require a permit or could be restricted due to management activities. Proposed land use changes and development proposals that abut DBCA managed lands will generally be referred to DBCA throughout the assessment process.

Wetlands

Wetlands include not only lakes with open water, but areas of seasonally, intermittently or permanently waterlogged soil.

Ramsar Wetlands (Wetlands of International Importance)

The Convention of Wetlands of International Importance was signed in 1971 at the Iranian town of Ramsar. The Convention has since been referred to as the Ramsar Convention. Ramsar Listed wetlands are “sites containing representative, rare or unique wetlands, or wetlands that are important for conserving biological diversity ... because of their ecological, botanical, zoological, limnological or hydrological importance” (DAWE 2020b). Once a Ramsar Listed Wetland is designated, the country agrees to manage its conservation and ensure its wise use. Under the Convention, wise use is broadly defined as “maintaining the ecological character of a wetland” (DAWE 2020b).

Nationally important wetlands

Wetlands of national significance are listed under the Directory of Important Wetlands in Australia. Nationally important wetlands are wetlands which meet at least one of the following criteria (DAWE 2020a):

- It is a good example of a wetland type occurring within a biogeographic region in Australia
- It is a wetland which plays an important ecological or hydrological role in the natural functioning of a major wetland system/complex
- It is a wetland which is important as the habitat for animal taxa at a vulnerable stage in their life cycles, or provides a refuge when adverse conditions such as drought prevail
- The wetland supports one percent or more of the national populations of any native plant or animal taxa
- The wetland supports native plant or animal taxa or communities which are considered endangered or vulnerable at the national level
- The wetland is of outstanding historical or cultural significance.

Geomorphic wetlands

Categorisation of wetlands has been conducted by Hill et al. (1996), delineating Swan Coastal Plain wetlands into levels of protection and management categories. Conservation Category Wetlands are wetlands that support high levels of attributes and functions. Resource Enhancement Wetlands are those that have been partly modified but still support substantial functions and attributes. Multiple Use Wetlands are classified as those wetlands with few attributes that still provide important wetland functions. Multiple Use wetlands have few important ecological attributes and functions remaining.

The Geomorphic Wetlands Swan Coastal Plain dataset displays the location, boundary, geomorphic classification (wetland type) and management category of wetlands on the Swan Coastal Plain.

Vegetation extent and status

The National Objectives and Targets for Biodiversity Conservation 2001–2005 (Commonwealth of Australia 2001) recognise that the retention of 30 percent or more of the pre-clearing extent of each ecological community is necessary if Australia's biological diversity is to be protected. This is the threshold level below which species loss appears to accelerate exponentially and loss below this level should not be permitted. This level of recognition is in keeping with the targets recommended in the review of the National Strategy for the Conservation of Australia's Biological Diversity (ANZECC 2000).

The extent of remnant native vegetation in WA has been assessed by Shepherd et al. (2002) and the GoWA (2019), based on broadscale vegetation association mapping by Beard (various publications). The GoWA produces Statewide Vegetation Statistics Reports that are used for a number of purposes including conservation planning, land use planning and when assessing development applications. The reports are updated every 2-3 years.

Vegetation condition

The vegetation condition can be assessed in accordance with the vegetation condition rating scale for the South West and Interzone Botanical Provinces (EPA 2016a). The scale recognises the intactness of vegetation and consists of six rating levels as outlined below.

Vegetation condition rating scale for the South West and Interzone Botanical Provinces

Condition	South West and Interzone Botanical Provinces description
Pristine	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.
Very Good	Vegetation structure altered, obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.
Completely Degraded	The structure of vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

Conservation codes

Species of significant flora, fauna and communities are protected under both Federal and State Acts. The Federal EPBC Act provides a legal framework to protect and manage nationally important flora and communities. The State BC Act is the primary wildlife conservation legislation in Western Australia. Information on the conservation codes is summarised in the following sections.

Ecological communities

Significant communities

Ecological communities are defined as naturally occurring biological assemblages that occur in a particular type of habitat (English and Blyth 1997). Federally listed Threatened Ecological Communities (TECs) are protected under the EPBC Act. The BC Act provides for the Minister to list an ecological community as a TEC (section 27), or as a collapsed ecological community (section 31) statutory listing of State TECs by the Minister. The legislation also describes statutory processes for preparing recovery plans for TECs, the registration of their critical habitat, and penalties for unauthorised modification of TECs.

Possible TECs that do not meet survey criteria are added to the DBCA Priority Ecological Community (PEC) List under Priorities 1, 2 and 3. These are ecological communities that are adequately known; are rare but not threatened, or meet criteria for Near Threatened. PECs that have been recently removed from the threatened list are placed in Priority 4. These ecological communities require regular monitoring. Conservation dependent ecological communities are placed in Priority 5. PECs are not listed under any formal Federal or State legislation, however, may be listed as TECs under the EPBC Act.

Codes and definitions for TECs listed under the EPBC Act and/or BC Act

Categories	Definitions
Federal Government Conservation Categories (EPBC Act)	
Critically Endangered (CR)	An ecological community if, at that time, is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria (as outlined in Environment Protection and Biodiversity Conservation Regulations 2000).
Endangered *(EN)	An ecological community if, at that time: – is not critically endangered; and – is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria (as outlined in Environment Protection and Biodiversity Conservation Regulations 2000).
Vulnerable (VU)	An ecological community if, at that time: – is not critically endangered or endangered; and – is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria (as outlined in Environment Protection and Biodiversity Conservation Regulations 2000).
Western Australia Conservation Categories (BC Act)	
<u>Threatened Ecological Communities</u>	
Critically Endangered (CR)	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.
Endangered (EN)	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.
Vulnerable (VU)	An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured

Categories	Definitions
	and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.
<u>Collapsed ecological communities</u>	
An ecological community is eligible for listing as a collapsed ecological community at a particular time if, at that time, there is no reasonable doubt that the last occurrence of the ecological community has collapsed); or, the ecological community has been so extensively modified throughout its range that no occurrence of it is likely to recover – • its species composition or structure; or • its species composition and structure. Section 33 of the BC Act provides for a collapsed ecological community to be regarded as a threatened ecological community if it is discovered in a state that no longer makes it eligible for listing as a collapsed ecological community.	

Categories and definitions for PECs as listed by the DBCA

Category	Description
Priority 1	Poorly known ecological communities. Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤100 ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
Priority 2	Poorly known ecological communities. Communities that are known from few occurrences with a restricted distribution (generally ≤10 occurrences or a total area of ≤200 ha). At least some occurrences are not believed to be under immediate threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
Priority 3	Poorly known ecological communities. – Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: – communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; – communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.
Priority 4	Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring. – Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands. – Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. – Ecological communities that have been removed from the list of threatened communities during the past five years.
Priority 5	Conservation Dependent ecological communities. Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Other significant vegetation

Vegetation may be significant for a range of reasons other than a statutory listing. The EPA (2016a, b) states that significant vegetation may include vegetation that includes the following:

- Restricted distribution
- Degree of historical impact from threatening processes
- A role as a refuge
- Providing an important function required to maintain ecological integrity of a significant ecosystem
- Local endemism in restricted habitats
- Novel combinations of taxa
- A role as a key habitat for Threatened species or large population representing a significant proportion of the local to regional total population of a species
- Being representative of a vegetation unit in 'pristine' condition in a highly cleared landscape, recently discovered range extensions, or isolated outliers of the main range.

This may apply at a number of levels, so the unit may be significant when considered at the fine-scale (intra-locality), intermediate-scale (locality or inter-locality) or broad-scale (local to region).

Flora and fauna

Significant flora and fauna

Species of significant flora are protected under both Federal and State legislation. Any activities that are deemed to have a significant impact on species that are recognised by the EPBC Act, and/or the BC Act can warrant referral to DAWE and/or the EPA.

The Federal conservation level of flora and fauna species and their significance status is assessed under the EPBC Act. The significance levels for flora and fauna used in the EPBC Act align with the International Union for Conservation of Nature (IUCN) Red List criteria, which are internationally recognised as providing best practice for assigning the conservation status of species. The EPBC Act also protects land and migratory species that are listed under International Agreements. The list of migratory species established under section 209 of the EPBC Act comprises:

- Migratory species which are native to Australia and are included in the appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals Appendices I and II)
- Migratory species included in annexes established under the Japan-Australia Migratory Bird Agreement (JAMBA) and the China–Australia Migratory Bird Agreement (CAMBA)
- Native, migratory species identified in a list established under, or an instrument made under, an international agreement approved by the Minister, such as the republic of Korea–Australia Migratory Bird Agreement (ROKAMBA)

The State conservation level of flora and fauna species and their significance status also follows the IUCN Red List criteria. Under the BC Act flora and fauna can be listed as Threatened, Extinct and as Specially Protected species.

Threatened species are those species which have been adequately searched for and are deemed to be, in the wild, either rare, under identifiable threat of extinction, or otherwise in need of special protection, and have been gazetted as such. The assessment of the conservation status of Threatened species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria. Specially protected species meet one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection. Species that are listed as Threatened or Extinct species under the BC Act cannot also be listed as Specially Protected species.

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority

for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna.

Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.

Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.

For the purposes of this assessment, all species listed under the EPBC Act, BC Act and DBCA Priority species are considered significant.

Appendix C

Database Searches

TAXON	CLASS	CONS
<i>Crinia georgiana</i>	AMPHIBIAN	
<i>Crinia glauerti</i>	AMPHIBIAN	
<i>Crinia insignifera</i>	AMPHIBIAN	
<i>Crinia pseudinsignifera</i>	AMPHIBIAN	
<i>Heleioporus eyrei</i>	AMPHIBIAN	
<i>Heleioporus psammophilus</i>	AMPHIBIAN	
<i>Limnodynastes dorsalis</i>	AMPHIBIAN	
<i>Litoria adelaidensis</i>	AMPHIBIAN	
<i>Litoria moorei</i>	AMPHIBIAN	
<i>Myobatrachus gouldii</i>	AMPHIBIAN	
<i>Neobatrachus pelobatooides</i>	AMPHIBIAN	
<i>Pseudophryne guentheri</i>	AMPHIBIAN	
<i>Pseudophryne occidentalis</i>	AMPHIBIAN	
<i>Acanthagenys rufogularis</i>	BIRD	
<i>Acanthiza apicalis</i>	BIRD	
<i>Acanthiza chrysorrhoa</i>	BIRD	
<i>Acanthiza inornata</i>	BIRD	
<i>Acanthiza uropygialis</i>	BIRD	
<i>Acanthorhynchus superciliosus</i>	BIRD	
<i>Accipiter cirrocephalus</i>	BIRD	
<i>Accipiter cirrocephalus subsp. cirrocephalus</i>	BIRD	
<i>Accipiter fasciatus</i>	BIRD	
<i>Accipiter fasciatus subsp. didimus</i>	BIRD	
<i>Accipiter fasciatus subsp. fasciatus</i>	BIRD	
<i>Acrocephalus australis</i>	BIRD	
<i>Acrocephalus australis subsp. gouldi</i>	BIRD	
<i>Actitis hypoleucos</i>	BIRD	MI
<i>Aegotheles cristatus</i>	BIRD	
<i>Aegotheles cristatus subsp. cristatus</i>	BIRD	
<i>Amazona auropalliata</i>	BIRD	
<i>Anas castanea</i>	BIRD	
<i>Anas clypeata</i>	BIRD	
<i>Anas gracilis</i>	BIRD	

TAXON	CLASS	CONS
<i>Anas platyrhynchos</i>	BIRD	
<i>Anas rhynchos</i>	BIRD	
<i>Anas superciliosa</i>	BIRD	
<i>Anhinga melanogaster</i>	BIRD	
<i>Anhinga novaehollandiae</i>	BIRD	
<i>Anous tenuirostris subsp. melanops</i>	BIRD	EN
<i>Anser anser</i>	BIRD	
<i>Anthochaera carunculata</i>	BIRD	
<i>Anthochaera lunulata</i>	BIRD	
<i>Anthus australis</i>	BIRD	
<i>Apus pacificus</i>	BIRD	MI
<i>Aquila audax</i>	BIRD	
<i>Aquila morphnoides</i>	BIRD	
<i>Aquila morphnoides subsp. morphnoides</i>	BIRD	
<i>Ardea alba</i>	BIRD	
<i>Ardea garzetta</i>	BIRD	
<i>Ardea ibis</i>	BIRD	
<i>Ardea intermedia</i>	BIRD	
<i>Ardea modesta</i>	BIRD	
<i>Ardea novaehollandiae</i>	BIRD	
<i>Ardea pacifica</i>	BIRD	
<i>Ardea sacra</i>	BIRD	
<i>Ardenna carneipes</i>	BIRD	VU
<i>Ardeotis australis</i>	BIRD	
<i>Arenaria interpres</i>	BIRD	MI
<i>Argusianus argus</i>	BIRD	
<i>Artamus cinereus</i>	BIRD	
<i>Artamus cinereus subsp. melanops</i>	BIRD	
<i>Artamus cyanopterus</i>	BIRD	
<i>Artamus personatus</i>	BIRD	
<i>Aythya australis</i>	BIRD	
<i>Barnardius zonarius</i>	BIRD	
<i>Biziura lobata</i>	BIRD	
<i>Botaurus poiciloptilus</i>	BIRD	EN

TAXON	CLASS	CONS
<i>Burhinus grallarius</i>	BIRD	
<i>Cacatua galerita</i>	BIRD	
<i>Cacatua galerita subsp. galerita</i>	BIRD	
<i>Cacatua pastinator subsp. pastinator</i>	BIRD	CD
<i>Cacatua roseicapilla</i>	BIRD	
<i>Cacatua sanguinea</i>	BIRD	
<i>Cacatua sanguinea subsp. westralensis</i>	BIRD	
<i>Cacatua tenuirostris</i>	BIRD	
<i>Cacomantis flabelliformis</i>	BIRD	
<i>Cacomantis flabelliformis subsp. flabelliformis</i>	BIRD	
<i>Cacomantis pallidus</i>	BIRD	
<i>Calidris acuminata</i>	BIRD	MI
<i>Calidris alba</i>	BIRD	
<i>Calidris canutus</i>	BIRD	EN
<i>Calidris ferruginea</i>	BIRD	CR
<i>Calidris melanotos</i>	BIRD	MI
<i>Calidris ruficollis</i>	BIRD	MI
<i>Calidris subminuta</i>	BIRD	MI
<i>Calidris tenuirostris</i>	BIRD	CR
<i>Calonectris leucomelas</i>	BIRD	MI
<i>Calyptorhynchus banksii naso</i>	BIRD	VU
<i>Carduelis carduelis</i>	BIRD	
<i>Charadrius dubius</i>	BIRD	MI
<i>Charadrius leschenaultii</i>	BIRD	VU
<i>Charadrius melanops</i>	BIRD	
<i>Charadrius mongolus</i>	BIRD	EN
<i>Charadrius ruficapillus</i>	BIRD	
<i>Chenonetta jubata</i>	BIRD	
<i>Cheramoeca leucosterna</i>	BIRD	
<i>Chlidonias leucopterus</i>	BIRD	MI
<i>Chroicocephalus novaehollandiae</i>	BIRD	
<i>Chrysococcyx basalis</i>	BIRD	
<i>Chrysococcyx lucidus</i>	BIRD	
<i>Chrysococcyx lucidus subsp. plagosus</i>	BIRD	

TAXON	CLASS	CONS
<i>Cincloramphus cruralis</i>	BIRD	
<i>Cincloramphus mathewsi</i>	BIRD	
<i>Circus approximans</i>	BIRD	
<i>Circus assimilis</i>	BIRD	
<i>Cladorhynchus leucocephalus</i>	BIRD	
<i>Climacteris rufa</i>	BIRD	
<i>Collocalia esculenta</i>	BIRD	
<i>Colluricincla harmonica</i>	BIRD	
<i>Colluricincla harmonica subsp. rufiventris</i>	BIRD	
<i>Columba livia</i>	BIRD	
<i>Coracina maxima</i>	BIRD	
<i>Coracina novaehollandiae</i>	BIRD	
<i>Corvus bennetti</i>	BIRD	
<i>Corvus coronoides</i>	BIRD	
<i>Corvus splendens</i>	BIRD	
<i>Coturnix pectoralis</i>	BIRD	
<i>Coturnix ypsilophora</i>	BIRD	
<i>Cracticus nigrogularis</i>	BIRD	
<i>Cracticus torquatus</i>	BIRD	
<i>Cygnus atratus</i>	BIRD	
<i>Cygnus olor</i>	BIRD	
<i>Dacelo novaeguineae</i>	BIRD	
<i>Daphoenositta chrysoptera</i>	BIRD	
<i>Daption capense</i>	BIRD	
<i>Dasyornis longirostris</i>	BIRD	EN
<i>Dendrocygna arcuata</i>	BIRD	
<i>Dicaeum hirundinaceum</i>	BIRD	
<i>Dicrurus bracteatus subsp. bracteatus</i>	BIRD	
<i>Diomedea chlororhynchos</i>	BIRD	
<i>Diomedea chlororhynchos subsp. carteri</i>	BIRD	
<i>Diomedea chrysostoma</i>	BIRD	VU
<i>Diomedea exulans</i>	BIRD	VU
<i>Diomedea melanophris subsp. melanophris</i>	BIRD	VU
<i>Dromaius novaehollandiae</i>	BIRD	

TAXON	CLASS	CONS
<i>Egretta garzetta</i>	BIRD	
<i>Egretta novaehollandiae</i>	BIRD	
<i>Egretta sacra</i>	BIRD	
<i>Elanus axillaris</i>	BIRD	
<i>Elanus caeruleus</i>	BIRD	
<i>Elseya melanops</i>	BIRD	
<i>Eolophus roseicapilla</i>	BIRD	
<i>Eopsaltria australis</i> subsp. <i>griseogularis</i>	BIRD	
<i>Eopsaltria georgiana</i>	BIRD	
<i>Epthianura albifrons</i>	BIRD	
<i>Epthianura tricolor</i>	BIRD	
<i>Erythronyx cinctus</i>	BIRD	
<i>Eudyptes chrysocome</i> subsp. <i>moseleyi</i>	BIRD	
<i>Eudyptula minor</i> subsp. <i>novaehollandiae</i>	BIRD	
<i>Eurostopodus argus</i>	BIRD	
<i>Eurystomus orientalis</i>	BIRD	
<i>Falco berigora</i>	BIRD	
<i>Falco cenchroides</i>	BIRD	
<i>Falco hypoleucos</i>	BIRD	VU
<i>Falco longipennis</i>	BIRD	
<i>Falco peregrinus</i>	BIRD	OS
<i>Fringilla coelebs</i>	BIRD	
<i>Fulica atra</i>	BIRD	
<i>Fulmarus glacialis</i>	BIRD	
<i>Gallicolumba jobiensis</i>	BIRD	
<i>Gallinago hardwickii</i>	BIRD	MI
<i>Gallinago stenura</i>	BIRD	MI
<i>Gallinula tenebrosa</i>	BIRD	
<i>Gallinula ventralis</i>	BIRD	
<i>Gallirallus philippensis</i>	BIRD	
<i>Gallus gallus</i>	BIRD	
<i>Gavicalis virescens</i>	BIRD	
<i>Gelochelidon nilotica</i>	BIRD	MI
<i>Geopelia cuneata</i>	BIRD	

TAXON	CLASS	CONS
<i>Gerygone fusca</i>	BIRD	
<i>Glossopsitta concinna</i>	BIRD	
<i>Glossopsitta porphyrocephala</i>	BIRD	
<i>Gliciphila melanops</i>	BIRD	
<i>Gracula religiosa</i>	BIRD	
<i>Grallina cyanoleuca</i>	BIRD	
<i>Haematopus fuliginosus</i>	BIRD	
<i>Haematopus longirostris</i>	BIRD	
<i>Haliaeetus leucogaster</i>	BIRD	
<i>Haliastur sphenurus</i>	BIRD	
<i>Halobaena caerulea</i>	BIRD	
<i>Hamirostra isura</i>	BIRD	
<i>Hieraaetus morphnoides</i>	BIRD	
<i>Himantopus himantopus</i>	BIRD	
<i>Hirundo ariel</i>	BIRD	
<i>Hirundo neoxena</i>	BIRD	
<i>Hirundo nigricans</i>	BIRD	
<i>Hydroprogne caspia</i>	BIRD	MI
<i>Hylacola cauta</i> subsp. <i>whitlocki</i>	BIRD	
<i>Ixobrychus dubius</i>	BIRD	P4
<i>Ixobrychus flavicollis</i> subsp. <i>australis</i>	BIRD	P2
<i>Ixobrychus minutus</i> subsp. <i>dubius</i>	BIRD	
<i>Lalage tricolor</i>	BIRD	
<i>Larus dominicanus</i>	BIRD	
<i>Larus novaehollandiae</i>	BIRD	
<i>Larus pacificus</i>	BIRD	
<i>Leipoa ocellata</i>	BIRD	VU
<i>Leucosarcia melanoleuca</i>	BIRD	
<i>Lichenostomus leucotis</i>	BIRD	
<i>Lichenostomus ornatus</i>	BIRD	
<i>Lichenostomus virescens</i>	BIRD	
<i>Lichmera indistincta</i>	BIRD	
<i>Limosa lapponica</i>	BIRD	MI
<i>Limosa limosa</i>	BIRD	MI

TAXON	CLASS	CONS
<i>Limosa limosa</i> subsp. <i>melanuroides</i>	BIRD	
<i>Lonchura castaneothorax</i>	BIRD	
<i>Lophoictinia isura</i>	BIRD	
<i>Macronectes giganteus</i>	BIRD	MI
<i>Malacorhynchus membranaceus</i>	BIRD	
<i>Malurus elegans</i>	BIRD	
<i>Malurus lamberti</i>	BIRD	
<i>Malurus lamberti</i> subsp. <i>assimilis</i>	BIRD	
<i>Malurus leucopterus</i>	BIRD	
<i>Malurus leucopterus</i> subsp. <i>leuconotus</i>	BIRD	
<i>Malurus pulcherrimus</i>	BIRD	
<i>Malurus splendens</i>	BIRD	
<i>Manorina flavigula</i>	BIRD	
<i>Megalurus gramineus</i>	BIRD	
<i>Megalurus gramineus</i> subsp. <i>gramineus</i>	BIRD	
<i>Melanodryas cucullata</i>	BIRD	
<i>Melithreptus brevirostris</i>	BIRD	
<i>Melithreptus brevirostris</i> subsp. <i>leucogenys</i>	BIRD	
<i>Melithreptus chloropsis</i>	BIRD	
<i>Melithreptus lunatus</i>	BIRD	
<i>Melopsittacus undulatus</i>	BIRD	
<i>Merops ornatus</i>	BIRD	
<i>Microcarbo melanoleucos</i>	BIRD	
<i>Microeca fascinans</i>	BIRD	
<i>Milvus migrans</i>	BIRD	
<i>Morus serrator</i>	BIRD	
<i>Myiagra inquieta</i>	BIRD	
<i>Neophema elegans</i>	BIRD	
<i>Neophema petrophila</i>	BIRD	
<i>Ninox connivens</i>	BIRD	
<i>Ninox connivens</i> subsp. <i>connivens</i> (southwest subpop.)	BIRD	P3
<i>Ninox novaeseelandiae</i>	BIRD	
<i>Numenius madagascariensis</i>	BIRD	CR
<i>Numenius phaeopus</i>	BIRD	MI

TAXON	CLASS	CONS
<i>Nycticorax caledonicus</i>	BIRD	
<i>Nymphicus hollandicus</i>	BIRD	
<i>Oceanites marinus</i> subsp. <i>dulciae</i>	BIRD	
<i>Oceanites oceanicus</i>	BIRD	MI
<i>Ocyphaps lophotes</i>	BIRD	
<i>Oxyura australis</i>	BIRD	P4
<i>Pachycephala pectoralis</i>	BIRD	
<i>Pachycephala pectoralis</i> subsp. <i>fuliginosa</i>	BIRD	
<i>Pachycephala rufiventris</i>	BIRD	
<i>Pachycephala rufiventris</i> subsp. <i>rufiventris</i>	BIRD	
<i>Pachyptila belcheri</i>	BIRD	
<i>Pachyptila desolata</i>	BIRD	
<i>Pachyptila salvini</i>	BIRD	
<i>Pachyptila turtur</i>	BIRD	
<i>Pachyptila vittata</i>	BIRD	
<i>Padda oryzivora</i>	BIRD	
<i>Pandion cristatus</i>	BIRD	MI
<i>Pandion haliaetus</i>	BIRD	MI
<i>Pardalotus punctatus</i>	BIRD	
<i>Pardalotus punctatus</i> subsp. <i>punctatus</i>	BIRD	
<i>Pardalotus striatus</i>	BIRD	
<i>Pardalotus striatus</i> subsp. <i>westraliensis</i>	BIRD	
<i>Paroaria coronata</i>	BIRD	
<i>Passer domesticus</i>	BIRD	
<i>Pelecanoides urinatrix</i> subsp. <i>exsul</i>	BIRD	
<i>Pelecanus conspicillatus</i>	BIRD	
<i>Petrochelidon ariel</i>	BIRD	
<i>Petrochelidon nigricans</i>	BIRD	
<i>Petroica boodang</i>	BIRD	
<i>Petroica cucullata</i>	BIRD	
<i>Petroica goodenovii</i>	BIRD	
<i>Petroica multicolor</i> subsp. <i>campbelli</i>	BIRD	
<i>Phaethon rubricauda</i>	BIRD	MI, P4
<i>Phalacrocorax carbo</i>	BIRD	

TAXON	CLASS	CONS
<i>Phalacrocorax carbo</i> subsp. <i>novaehollandiae</i>	BIRD	
<i>Phalacrocorax fuscescens</i>	BIRD	
<i>Phalacrocorax melanoleucos</i>	BIRD	
<i>Phalacrocorax melanoleucos</i> subsp. <i>melanoleucos</i>	BIRD	
<i>Phalacrocorax sulcirostris</i>	BIRD	
<i>Phalacrocorax varius</i>	BIRD	
<i>Phalacrocorax varius</i> subsp. <i>hypoleucos</i>	BIRD	
<i>Phaps chalcoptera</i>	BIRD	
<i>Phoebetria fusca</i>	BIRD	EN
<i>Phylidonyris melanops</i>	BIRD	
<i>Phylidonyris nigra</i>	BIRD	
<i>Phylidonyris nigra</i> subsp. <i>gouldii</i>	BIRD	
<i>Phylidonyris novaehollandiae</i>	BIRD	
<i>Platalea flavipes</i>	BIRD	
<i>Platalea regia</i>	BIRD	
<i>Platycercus icterotis</i>	BIRD	
<i>Platycercus icterotis</i> subsp. <i>icterotis</i>	BIRD	P4
<i>Platycercus spurius</i>	BIRD	
<i>Platycercus zonarius</i>	BIRD	
<i>Platycercus zonarius</i> subsp. <i>semitorquatus</i>	BIRD	
<i>Plegadis falcinellus</i>	BIRD	MI
<i>Pluvialis fulva</i>	BIRD	MI
<i>Pluvialis squatarola</i>	BIRD	MI
<i>Podargus strigoides</i>	BIRD	
<i>Podiceps cristatus</i>	BIRD	
<i>Poephila bichenovii</i>	BIRD	
<i>Poephila cincta</i>	BIRD	
<i>Poliocephalus poliocephalus</i>	BIRD	
<i>Polytelis anthopeplus</i>	BIRD	
<i>Porphyrio porphyrio</i>	BIRD	
<i>Porzana fluminea</i>	BIRD	
<i>Porzana pusilla</i>	BIRD	
<i>Porzana tabuensis</i>	BIRD	
<i>Psephotus dissimilis</i>	BIRD	

TAXON	CLASS	CONS
<i>Psittacula eupatria</i>	BIRD	
<i>Psittacula krameri</i>	BIRD	
<i>Psittacus erithacus</i>	BIRD	
<i>Pterodroma brevirostris</i>	BIRD	
<i>Pterodroma lessonii</i>	BIRD	
<i>Pterodroma macroptera</i>	BIRD	
<i>Pterodroma macroptera</i> subsp. <i>macroptera</i>	BIRD	
<i>Pterodroma mollis</i>	BIRD	
<i>Ptilotula ornatus</i>	BIRD	
<i>Puffinus assimilis</i>	BIRD	
<i>Puffinus assimilis</i> subsp. <i>assimilis</i>	BIRD	
<i>Puffinus carneipes</i>	BIRD	
<i>Puffinus griseus</i>	BIRD	
<i>Puffinus huttoni</i>	BIRD	EN
<i>Puffinus pacificus</i>	BIRD	
<i>Purnella albifrons</i>	BIRD	
<i>Purpureicephalus spurius</i>	BIRD	
<i>Recurvirostra novaehollandiae</i>	BIRD	
<i>Rhipidura albiscapa</i>	BIRD	
<i>Rhipidura fuliginosa</i>	BIRD	
<i>Rhipidura leucophrys</i>	BIRD	
<i>Rostratula australis</i>	BIRD	EN
<i>Sericornis frontalis</i>	BIRD	
<i>Serinus canarius</i>	BIRD	
<i>Smicrornis brevirostris</i>	BIRD	
<i>Stagonopleura oculata</i>	BIRD	
<i>Stercorarius antarcticus</i>	BIRD	
<i>Sterna anaethetus</i> subsp. <i>anaethetus</i>	BIRD	
<i>Sterna bergii</i>	BIRD	
<i>Sterna caspia</i>	BIRD	
<i>Sterna dougallii</i>	BIRD	MI
<i>Sterna fuscata</i> subsp. <i>nubilosa</i>	BIRD	
<i>Sterna hybrida</i> subsp. <i>javanica</i>	BIRD	
<i>Sterna leucoptera</i>	BIRD	

TAXON	CLASS	CONS
<i>Sterna paradisaea</i>	BIRD	
<i>Sternula nereis</i>	BIRD	
<i>Sternula nereis</i> subsp. <i>nereis</i>	BIRD	MI
<i>Stictonetta naevosa</i>	BIRD	
<i>Strepera versicolor</i>	BIRD	
<i>Streptopelia chinensis</i>	BIRD	
<i>Streptopelia chinensis</i> subsp. <i>tigrina</i>	BIRD	
<i>Streptopelia senegalensis</i>	BIRD	
<i>Sturnus vulgaris</i>	BIRD	
<i>Sugomel niger</i>	BIRD	
<i>Sula serrator</i>	BIRD	
<i>Tachybaptus novaehollandiae</i>	BIRD	
<i>Tadorna radjah</i>	BIRD	
<i>Tadorna tadornoides</i>	BIRD	
<i>Taeniopygia guttata</i> subsp. <i>castanotis</i>	BIRD	
<i>Thalassarche carteri</i>	BIRD	EN
<i>Thalassarche chrysostoma</i>	BIRD	VU
<i>Thalassarche melanophris</i>	BIRD	EN
<i>Thalasseus bergii</i>	BIRD	MI
<i>Thinornis rubricollis</i>	BIRD	P4
<i>Threskiornis molucca</i>	BIRD	
<i>Threskiornis moluccus</i>	BIRD	
<i>Threskiornis spinicollis</i>	BIRD	
<i>Todiramphus sanctus</i>	BIRD	
<i>Todiramphus sanctus</i> subsp. <i>sanctus</i>	BIRD	
<i>Tribonyx ventralis</i>	BIRD	
<i>Trichoglossus haematodus</i>	BIRD	
<i>Trichoglossus moluccanus</i>	BIRD	
<i>Tringa brevipes</i>	BIRD	MI, P4
<i>Tringa glareola</i>	BIRD	MI
<i>Tringa guttifer</i>	BIRD	
<i>Tringa nebularia</i>	BIRD	MI
<i>Tringa stagnatilis</i>	BIRD	MI
<i>Turnix varia</i>	BIRD	

TAXON	CLASS	CONS
<i>Turnix varius</i>	BIRD	
<i>Turnix velox</i>	BIRD	
<i>Tyto alba</i>	BIRD	
<i>Vanellus miles</i>	BIRD	
<i>Vanellus tricolor</i>	BIRD	
<i>Xenus cinereus</i>	BIRD	MI
<i>Zanda baudinii</i>	BIRD	EN
<i>Zanda latirostris</i>	BIRD	EN
<i>Zosterops lateralis</i>	BIRD	
<i>Arctocephalus tropicalis</i>	MAMMAL	VU
<i>Austronomus australis</i>	MAMMAL	
<i>Balaenoptera physalus</i>	MAMMAL	EN
<i>Bos taurus</i>	MAMMAL	
<i>Canis lupus</i>	MAMMAL	
<i>Cercartetus concinnus</i>	MAMMAL	
<i>Chalinolobus gouldii</i>	MAMMAL	
<i>Chalinolobus morio</i>	MAMMAL	
<i>Dasyurus geoffroii</i>	MAMMAL	VU
<i>Equus caballus</i>	MAMMAL	
<i>Eubalaena australis</i>	MAMMAL	VU
<i>Felis catus</i>	MAMMAL	
<i>Funambulus pennanti</i>	MAMMAL	
<i>Globicephala macrorhynchus</i>	MAMMAL	
<i>Hydromys chrysogaster</i>	MAMMAL	P4
<i>Hydrurga leptonyx</i>	MAMMAL	
<i>Isoodon fusciventer</i>	MAMMAL	P4
<i>Macropus fuliginosus</i>	MAMMAL	
<i>Macrotis lagotis</i>	MAMMAL	VU
<i>Mus musculus</i>	MAMMAL	
<i>Mustela putorius</i>	MAMMAL	
<i>Myrmecobius fasciatus</i>	MAMMAL	EN
<i>Neophoca cinerea</i>	MAMMAL	VU
<i>Notamacropus irma</i>	MAMMAL	P4
<i>Nyctophilus geoffroyi</i>	MAMMAL	

TAXON	CLASS	CONS
<i>Nyctophilus gouldi</i>	MAMMAL	
<i>Nyctophilus major</i> subsp. <i>major</i>	MAMMAL	
<i>Oryctolagus cuniculus</i>	MAMMAL	
<i>Ovis aries</i>	MAMMAL	
<i>Ozimops kitcheneri</i>	MAMMAL	
<i>Phascogale tapoatafa</i> subsp. <i>tapoatafa</i>	MAMMAL	
<i>Phascogale tapoatafa</i> subsp. <i>wambenger</i>	MAMMAL	CD
<i>Pseudomys delicatulus</i>	MAMMAL	
<i>Rattus fuscipes</i>	MAMMAL	
<i>Rattus norvegicus</i>	MAMMAL	
<i>Rattus rattus</i>	MAMMAL	
<i>Setonix brachyurus</i>	MAMMAL	VU
<i>Sminthopsis griseoventer</i> subsp. <i>griseoventer</i>	MAMMAL	
<i>Sminthopsis murina</i>	MAMMAL	
<i>Stenella coeruleoalba</i>	MAMMAL	
<i>Sus scrofa</i>	MAMMAL	
<i>Tachyglossus aculeatus</i>	MAMMAL	
<i>Tadarida australis</i>	MAMMAL	
<i>Tarsipes rostratus</i>	MAMMAL	
<i>Trichosurus vulpecula</i>	MAMMAL	
<i>Tursiops aduncus</i>	MAMMAL	
<i>Tursiops truncatus</i>	MAMMAL	
<i>Vespadelus regulus</i>	MAMMAL	
<i>Vulpes vulpes</i>	MAMMAL	
<i>Acritoscincus trilineatus</i>	REPTILE	
<i>Acritoscincus trilineatus</i>	REPTILE	
<i>Anilius australis</i>	REPTILE	
<i>Antaresia stimsoni</i> subsp. <i>stimsoni</i>	REPTILE	
<i>Aprasia repens</i>	REPTILE	
<i>Brachyuropsis fasciolatus</i> subsp. <i>fasciolatus</i>	REPTILE	
<i>Brachyuropsis semifasciatus</i>	REPTILE	
<i>Caretta caretta</i>	REPTILE	EN
<i>Chelodina colliei</i>	REPTILE	
<i>Chelonia mydas</i>	REPTILE	VU

TAXON	CLASS	CONS
<i>Christinus marmoratus</i>	REPTILE	
<i>Cryptoblepharus buchananii</i>	REPTILE	
<i>Cryptoblepharus plagiocephalus</i>	REPTILE	
<i>Ctenophorus adelaidensis</i>	REPTILE	
<i>Ctenotus australis</i>	REPTILE	
<i>Ctenotus fallens</i>	REPTILE	
<i>Ctenotus gemmula</i>	REPTILE	
<i>Ctenotus impar</i>	REPTILE	
<i>Ctenotus labillardieri</i>	REPTILE	
<i>Ctenotus ora</i>	REPTILE	P3
<i>Cyclodomorphus celatus</i>	REPTILE	
<i>Delma fraseri</i>	REPTILE	
<i>Delma grayii</i>	REPTILE	
<i>Demansia psammophis</i>	REPTILE	
<i>Demansia psammophis</i> subsp. <i>reticulata</i>	REPTILE	
<i>Dendrelaphis punctulata</i>	REPTILE	
<i>Dermochelys coriacea</i>	REPTILE	VU
<i>Diplodactylus granariensis</i> subsp. <i>granariensis</i>	REPTILE	
<i>Diplodactylus lateroides</i>	REPTILE	
<i>Diplodactylus polyophthalmus</i>	REPTILE	
<i>Echiopsis curta</i>	REPTILE	
<i>Egernia kingii</i>	REPTILE	
<i>Egernia napoleonis</i>	REPTILE	
<i>Elapognathus coronatus</i>	REPTILE	
<i>Eretmochelys imbricata</i> subsp. <i>bissa</i>	REPTILE	
<i>Gehyra variegata</i>	REPTILE	
<i>Hemidactylus frenatus</i>	REPTILE	
<i>Hemiergis peronii</i>	REPTILE	
<i>Hemiergis quadrilineata</i>	REPTILE	
<i>Heteronotia binoei</i>	REPTILE	
<i>Hydrophis elegans</i>	REPTILE	
<i>Hydrophis ornatus</i>	REPTILE	
<i>Hydrophis platurus</i>	REPTILE	
<i>Lerista distinguenda</i>	REPTILE	

TAXON	CLASS	CONS
<i>Lerista elegans</i>	REPTILE	
<i>Lerista gerrardii</i>	REPTILE	
<i>Lerista lineata</i>	REPTILE	P3
<i>Lerista lineopunctulata</i>	REPTILE	
<i>Lerista praepedita</i>	REPTILE	
<i>Lialis burtonis</i>	REPTILE	
<i>Lissolepis luctuosa</i>	REPTILE	
<i>Lophognathus longirostris</i>	REPTILE	
<i>Lucasium alboguttatum</i>	REPTILE	
<i>Menetia greyii</i>	REPTILE	
<i>Morelia spilota</i> subsp. <i>imbricata</i>	REPTILE	
<i>Morethia lineoocellata</i>	REPTILE	
<i>Morethia obscura</i>	REPTILE	
<i>Neelaps bimaculatus</i>	REPTILE	
<i>Neelaps calonotos</i>	REPTILE	P3
<i>Notechis scutatus</i>	REPTILE	
<i>Parasuta gouldii</i>	REPTILE	
<i>Pletholax gracilis</i>	REPTILE	
<i>Pogona minor</i>	REPTILE	
<i>Pogona minor</i> subsp. <i>minor</i>	REPTILE	
<i>Pseudechis australis</i>	REPTILE	
<i>Pseudemydura umbrina</i>	REPTILE	CR
<i>Pseudonaja affinis</i>	REPTILE	
<i>Pseudonaja mengdeni</i>	REPTILE	
<i>Pseudonaja modesta</i>	REPTILE	
<i>Pygopus lepidopodus</i>	REPTILE	
<i>Ramphotyphlops australis</i>	REPTILE	
<i>Ramphotyphlops braminus</i>	REPTILE	
<i>Ramphotyphlops pinguis</i>	REPTILE	
<i>Ramphotyphlops waitii</i>	REPTILE	
<i>Simoselaps bertholdi</i>	REPTILE	
<i>Strophurus spinigerus</i>	REPTILE	
<i>Strophurus spinigerus</i> subsp. <i>inornatus</i>	REPTILE	
<i>Strophurus spinigerus</i> subsp. <i>spinigerus</i>	REPTILE	

TAXON	CLASS	CONS
<i>Tiliqua occipitalis</i>	REPTILE	
<i>Tiliqua rugosa</i>	REPTILE	
<i>Underwoodisaurus milii</i>	REPTILE	
<i>Varanus gouldii</i>	REPTILE	
<i>Varanus tristis</i>	REPTILE	

Please note that *NatureMap* and *Dandjoo* data contains some inaccuracies.

Appendix D

Flora data

- D-1 Naturemap and Dandjoo Database Search Flora Results**
- D-2 Flora species list by family**
- D-3 Flora likelihood of occurrence assessment guidelines**
- D-4 Flora likelihood of occurrence assessment**
- D-5 Significant Tree Data**

Terrestrial Flora Nature Map Desktop Result for all Swan River Survey Area

TAXON	CLASS	CONS
<i>Abutilon grandifolium</i>	DICOT	
<i>Acacia acuminata</i>	DICOT	
<i>Acacia applanata</i>	DICOT	
<i>Acacia barbinervis</i> subsp. <i>barbinervis</i>	DICOT	
<i>Acacia benthamii</i>	DICOT	P2
<i>Acacia blakelyi</i>	DICOT	
<i>Acacia cochlearis</i>	DICOT	
<i>Acacia consobrina</i>	DICOT	
<i>Acacia craspedocarpa</i>	DICOT	
<i>Acacia cyclops</i>	DICOT	
<i>Acacia dentifera</i>	DICOT	
<i>Acacia drewiana</i> subsp. <i>drewiana</i>	DICOT	
<i>Acacia drummondii</i> subsp. <i>drummondii</i>	DICOT	
<i>Acacia ericifolia</i>	DICOT	
<i>Acacia horridula</i>	DICOT	P3
<i>Acacia huegelii</i>	DICOT	
<i>Acacia incurva</i>	DICOT	
<i>Acacia iteaphylla</i>	DICOT	
<i>Acacia jibberdingensis</i>	DICOT	
<i>Acacia lasiocalyx</i>	DICOT	
<i>Acacia lasiocarpa</i>	DICOT	P1
<i>Acacia lasiocarpa</i> var. <i>bracteolata</i> long peduncle variant (G.J. Keighery 5026)	DICOT	
<i>Acacia lasiocarpa</i> var. <i>lasiocarpa</i>	DICOT	
<i>Acacia lasiocarpa</i> var. <i>sedifolia</i>	DICOT	
<i>Acacia littorea</i>	DICOT	
<i>Acacia longifolia</i>	DICOT	
<i>Acacia longifolia</i> subsp. <i>longifolia</i>	DICOT	
<i>Acacia longifolia</i> subsp. <i>sophorae</i>	DICOT	
<i>Acacia melanoxylon</i>	DICOT	
<i>Acacia microbotrya</i>	DICOT	
<i>Acacia nervosa</i>	DICOT	
<i>Acacia paradoxa</i>	DICOT	
<i>Acacia podalyriifolia</i>	DICOT	

TAXON	CLASS	CONS
<i>Acacia pulchella</i>	DICOT	
<i>Acacia pulchella</i> var. <i>glaberrima</i>	DICOT	
<i>Acacia pulchella</i> var. <i>pulchella</i>	DICOT	
<i>Acacia pycnocephala</i>	DICOT	
<i>Acacia restiacea</i>	DICOT	
<i>Acacia rostellifera</i>	DICOT	
<i>Acacia salicina</i>	DICOT	
<i>Acacia saligna</i>	DICOT	
<i>Acacia saligna</i> subsp. <i>lindleyi</i>	DICOT	
<i>Acacia saligna</i> subsp. <i>saligna</i>	DICOT	
<i>Acacia sessilis</i>	DICOT	
<i>Acacia stenoptera</i>	DICOT	
<i>Acacia subcaerulea</i>	DICOT	
<i>Acacia tetragonocarpa</i>	DICOT	
<i>Acacia trachyphloia</i>	DICOT	
<i>Acacia truncata</i>	DICOT	
<i>Acacia willdenowiana</i>	DICOT	
<i>Acacia xanthina</i>	DICOT	
<i>Acaena echinata</i>	DICOT	
<i>Acer negundo</i>	DICOT	
<i>Achillea millefolium</i>	DICOT	
<i>Acrotriche cordata</i>	DICOT	
<i>Actinotus glomeratus</i>	DICOT	
<i>Actinotus leucocephalus</i>	DICOT	
<i>Adenanthos barbiger</i>	DICOT	
<i>Adenanthos cygnorum</i>	DICOT	
<i>Adenanthos cygnorum</i> subsp. <i>cygnorum</i>	DICOT	
<i>Adenanthos obovatus</i>	DICOT	
<i>Aeonium arboreum</i>	DICOT	
<i>Aeonium haworthii</i>	DICOT	
<i>Ageratina adenophora</i>	DICOT	
<i>Agonis flexuosa</i>	DICOT	
<i>Agonis flexuosa</i> var. <i>flexuosa</i>	DICOT	
<i>Ailanthus altissima</i>	DICOT	

TAXON	CLASS	CONS
<i>Aizoon pubescens</i>	DICOT	
<i>Allocasuarina fraseriana</i>	DICOT	
<i>Allocasuarina huegeliana</i>	DICOT	
<i>Allocasuarina humilis</i>	DICOT	
<i>Allocasuarina lehmanniana</i> subsp. <i>lehmanniana</i>	DICOT	
<i>Allocasuarina microstachya</i>	DICOT	
<i>Alternanthera denticulata</i>	DICOT	
<i>Alternanthera nodiflora</i>	DICOT	
<i>Alyxia buxifolia</i>	DICOT	
<i>Amaranthus blitum</i>	DICOT	
<i>Amaranthus caudatus</i>	DICOT	
<i>Amaranthus cruentus</i>	DICOT	
<i>Amaranthus hybridus</i>	DICOT	
<i>Amaranthus lividus</i>	DICOT	
<i>Amaranthus powellii</i>	DICOT	
<i>Amaranthus viridis</i>	DICOT	
<i>Ambrosia psilostachya</i>	DICOT	
<i>Ammi majus</i>	DICOT	
<i>Amsinckia calycina</i>	DICOT	
<i>Amyema linophylla</i>	DICOT	
<i>Amyema linophylla</i> subsp. <i>linophylla</i>	DICOT	
<i>Amyema miquelii</i>	DICOT	
<i>Amyema preissii</i>	DICOT	
<i>Anagallis arvensis</i>	DICOT	
<i>Anagallis arvensis</i> var. <i>caerulea</i>	DICOT	
<i>Andersonia aristata</i>	DICOT	
<i>Andersonia gracilis</i>	DICOT	VU
<i>Andersonia involucrata</i>	DICOT	
<i>Andersonia lehmanniana</i>	DICOT	
<i>Angianthus cunninghamii</i>	DICOT	
<i>Angianthus micropodioides</i>	DICOT	P3
<i>Angianthus preissianus</i>	DICOT	
<i>Anisomeles farinacea</i>	DICOT	
<i>Anredera cordifolia</i>	DICOT	

TAXON	CLASS	CONS
<i>Anthocercis ilicifolia</i>	DICOT	
<i>Anthocercis ilicifolia</i> subsp. <i>ilicifolia</i>	DICOT	
<i>Anthocercis littorea</i>	DICOT	
<i>Anthotium junciforme</i>	DICOT	
<i>Aotus cordifolia</i>	DICOT	
<i>Aotus gracillima</i>	DICOT	
<i>Aotus procumbens</i>	DICOT	
<i>Aphanes arvensis</i>	DICOT	
<i>Apium annuum</i>	DICOT	
<i>Apium graveolens</i>	DICOT	
<i>Apium prostratum</i> subsp. <i>prostratum</i> var. <i>prostratum</i>	DICOT	
<i>Arctotheca calendula</i>	DICOT	
<i>Arctotheca populifolia</i>	DICOT	
<i>Arctotis stoechadifolia</i>	DICOT	
<i>Argemone albiflora</i> subsp. <i>albiflora</i>	DICOT	
<i>Argemone ochroleuca</i> subsp. <i>ochroleuca</i>	DICOT	
<i>Argyranthemum frutescens</i>	DICOT	
<i>Argyranthemum frutescens</i> subsp. <i>foeniculaceum</i>	DICOT	
<i>Astartea affinis</i>	DICOT	
<i>Astartea leptophylla</i>	DICOT	
<i>Astartea scoparia</i>	DICOT	
<i>Asteridea pulverulenta</i>	DICOT	
<i>Astroloma ciliatum</i>	DICOT	
<i>Astroloma foliosum</i>	DICOT	
<i>Astroloma macrocalyx</i>	DICOT	
<i>Astroloma microcalyx</i>	DICOT	
<i>Astroloma pallidum</i>	DICOT	
<i>Astroloma stomarrhena</i>	DICOT	
<i>Astroloma xerophyllum</i>	DICOT	
<i>Atriplex hypoleuca</i>	DICOT	
<i>Atriplex isatidea</i>	DICOT	
<i>Atriplex prostrata</i>	DICOT	
<i>Atriplex semibaccata</i>	DICOT	
<i>Auranticarpa rhombifolia</i>	DICOT	

TAXON	CLASS	CONS
<i>Babingtonia camphorosmae</i>	DICOT	
<i>Babingtonia pelloeae</i>	DICOT	
<i>Babingtonia urbana</i>	DICOT	P3
<i>Bacopa monnieri</i>	DICOT	
<i>Banksia armata</i> var. <i>armata</i>	DICOT	
<i>Banksia ashbyi</i>	DICOT	
<i>Banksia attenuata</i>	DICOT	
<i>Banksia dallanneyi</i>	DICOT	
<i>Banksia dallanneyi</i> subsp. <i>dallanneyi</i> var. <i>dallanneyi</i>	DICOT	
<i>Banksia fraseri</i> var. <i>fraseri</i>	DICOT	
<i>Banksia grandis</i>	DICOT	
<i>Banksia ilicifolia</i>	DICOT	
<i>Banksia incana</i>	DICOT	
<i>Banksia incana</i> var. <i>incana</i>	DICOT	
<i>Banksia littoralis</i>	DICOT	
<i>Banksia menziesii</i>	DICOT	
<i>Banksia nivea</i> subsp. <i>nivea</i>	DICOT	
<i>Banksia prionotes</i>	DICOT	
<i>Banksia pteridifolia</i> subsp. <i>vernalis</i>	DICOT	P3
<i>Banksia sceptrum</i>	DICOT	
<i>Banksia sessilis</i>	DICOT	
<i>Banksia sessilis</i> var. <i>cygnorum</i>	DICOT	
<i>Banksia sphaerocarpa</i>	DICOT	
<i>Banksia telmatiaea</i>	DICOT	
<i>Banksia undata</i> var. <i>undata</i>	DICOT	
<i>Banksia victoriae</i>	DICOT	
<i>Beaufortia elegans</i>	DICOT	
<i>Beaufortia squarrosa</i>	DICOT	
<i>Bellardia trixago</i>	DICOT	
<i>Bellardia viscosa</i>	DICOT	
<i>Berkheya rigida</i>	DICOT	
<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	DICOT	P3
<i>Beyeria viscosa</i>	DICOT	
<i>Bidens pilosa</i>	DICOT	

TAXON	CLASS	CONS
<i>Billardiera fraseri</i>	DICOT	
<i>Billardiera fusiformis</i>	DICOT	
<i>Boronia alata</i>	DICOT	
<i>Boronia crenulata</i> subsp. <i>crenulata</i> var. <i>crenulata</i>	DICOT	
<i>Boronia crenulata</i> subsp. <i>viminea</i>	DICOT	
<i>Boronia cymosa</i>	DICOT	
<i>Boronia dichotoma</i>	DICOT	
<i>Boronia purdieana</i> subsp. <i>purdieana</i>	DICOT	
<i>Boronia ramosa</i>	DICOT	
<i>Boronia ramosa</i> subsp. <i>anethifolia</i>	DICOT	
<i>Boronia scabra</i> subsp. <i>scabra</i>	DICOT	
<i>Boronia tenuis</i>	DICOT	P4
<i>Bossiaea eriocarpa</i>	DICOT	
<i>Bossiaea modesta</i>	DICOT	P2
<i>Bossiaea ornata</i>	DICOT	
<i>Brachychiton acerifolius</i> x <i>discolor</i>	DICOT	
<i>Brachychiton populneus</i>	DICOT	
<i>Brachychiton populneus</i> subsp. <i>populneus</i>	DICOT	
<i>Brachyloma preissii</i>	DICOT	
<i>Brachyscome bellidioides</i>	DICOT	
<i>Brachyscome iberidifolia</i>	DICOT	
<i>Brachyscome pusilla</i>	DICOT	
<i>Brassica barrelieri</i> subsp. <i>oxyrrhina</i>	DICOT	
<i>Brassica fruticulosa</i>	DICOT	
<i>Brassica rapa</i>	DICOT	
<i>Brassica tournefortii</i>	DICOT	
<i>Brassica</i> x <i>napus</i>	DICOT	
<i>Brassica</i> x <i>napus</i> x <i>rapa</i>	DICOT	
<i>Buddleja dysophylla</i>	DICOT	
<i>Buddleja madagascariensis</i>	DICOT	
<i>Buglossoides arvensis</i>	DICOT	
<i>Byblis gigantea</i>	DICOT	P3
<i>Cakile maritima</i>	DICOT	
<i>Calandrinia brevipedata</i>	DICOT	

TAXON	CLASS	CONS
<i>Calandrinia calyptrata</i>	DICOT	
<i>Calandrinia corrigioloides</i>	DICOT	
<i>Calandrinia liniflora</i>	DICOT	
<i>Calceolaria tripartita</i>	DICOT	
<i>Callistemon citrinus</i>	DICOT	
<i>Callistemon linearis</i>	DICOT	
<i>Callistemon phoeniceus</i>	DICOT	
<i>Callitriche stagnalis</i>	DICOT	
<i>Calothamnus gilesii</i>	DICOT	
<i>Calothamnus graniticus</i>	DICOT	
<i>Calothamnus graniticus</i> subsp. <i>leptophyllus</i>	DICOT	P4
<i>Calothamnus hirsutus</i>	DICOT	
<i>Calothamnus homalophyllus</i>	DICOT	
<i>Calothamnus lateralis</i>	DICOT	
<i>Calothamnus macrocarpus</i>	DICOT	P2
<i>Calothamnus quadrifidus</i>	DICOT	
<i>Calothamnus quadrifidus</i> subsp. <i>angustifolius</i>	DICOT	
<i>Calothamnus quadrifidus</i> subsp. <i>homalophyllus</i>	DICOT	
<i>Calothamnus quadrifidus</i> subsp. <i>quadrifidus</i>	DICOT	
<i>Calothamnus rupestris</i>	DICOT	
<i>Calothamnus sanguineus</i>	DICOT	
<i>Calothamnus validus</i>	DICOT	
<i>Calycopeplus paucifolius</i>	DICOT	
<i>Calytrix angulata</i>	DICOT	
<i>Calytrix aurea</i>	DICOT	
<i>Calytrix flavescens</i>	DICOT	
<i>Calytrix flavescens</i> x <i>fraseri</i>	DICOT	
<i>Calytrix fraseri</i>	DICOT	
<i>Calytrix glutinosa</i>	DICOT	
<i>Calytrix leschenaultii</i>	DICOT	
<i>Calytrix sapphirina</i>	DICOT	
<i>Calytrix sylvana</i>	DICOT	
<i>Campsis radicans</i>	DICOT	
<i>Campsis</i> x <i>tagliabuana</i>	DICOT	

TAXON	CLASS	CONS
<i>Cannabis sativa</i>	DICOT	
<i>Capsella bursa-pastoris</i>	DICOT	
<i>Cardamine hirsuta</i>	DICOT	
<i>Cardamine occulta</i>	DICOT	
<i>Cardiospermum grandiflorum</i>	DICOT	
<i>Carduus pycnocephalus</i>	DICOT	
<i>Carpobrotus edulis</i>	DICOT	
<i>Carpobrotus virescens</i>	DICOT	
<i>Cassutha flava</i>	DICOT	
<i>Cassutha glabella</i>	DICOT	
<i>Cassutha glabella forma casuarinae</i>	DICOT	
<i>Cassutha pomiformis</i>	DICOT	
<i>Cassutha racemosa</i>	DICOT	
<i>Cassutha racemosa forma pilosa</i>	DICOT	
<i>Cassutha racemosa forma racemosa</i>	DICOT	
<i>Casuarina cunninghamiana</i>	DICOT	
<i>Casuarina equisetifolia</i>	DICOT	
<i>Casuarina glauca</i>	DICOT	
<i>Casuarina glauca x obesa</i>	DICOT	
<i>Casuarina obesa</i>	DICOT	
<i>Catha edulis</i>	DICOT	
<i>Centaurea calcitrapa</i>	DICOT	
<i>Centaurea melitensis</i>	DICOT	
<i>Centaurea solstitialis</i>	DICOT	
<i>Centaurium erythraea</i>	DICOT	
<i>Centaurium tenuiflorum</i>	DICOT	
<i>Centella asiatica</i>	DICOT	
<i>Centipeda cunninghamii</i>	DICOT	
<i>Centranthus macrosiphon</i>	DICOT	
<i>Cerastium glomeratum</i>	DICOT	
<i>Chamaecytisus palmensis</i>	DICOT	
<i>Chamelaucium axillare x uncinatum</i>	DICOT	
<i>Chamelaucium sp. Winchester (C. Chapman s.n. PERTH 07879180)</i>	DICOT	
<i>Chamelaucium uncinatum</i>	DICOT	

TAXON	CLASS	CONS
<i>Cheiranthra preissiana</i>	DICOT	
<i>Chenopodium album</i>	DICOT	
<i>Chenopodium giganteum</i>	DICOT	
<i>Chenopodium glaucum</i>	DICOT	
<i>Chenopodium macrospermum</i>	DICOT	
<i>Chenopodium murale</i>	DICOT	
<i>Chondrilla juncea</i>	DICOT	
<i>Chorizema dicksonii</i>	DICOT	
<i>Chrysanthemoides monilifera</i> subsp. <i>monilifera</i>	DICOT	
<i>Chrysocoma coma-aurea</i>	DICOT	
<i>Chthonocephalus pseudevax</i>	DICOT	
<i>Cicendia filiformis</i>	DICOT	
<i>Cicer arietinum</i>	DICOT	
<i>Cichorium intybus</i>	DICOT	
<i>Cinnamomum camphora</i>	DICOT	
<i>Cirsium arvense</i> var. <i>arvense</i>	DICOT	
<i>Cirsium vulgare</i>	DICOT	
<i>Citrullus lanatus</i>	DICOT	
<i>Clematis linearifolia</i>	DICOT	
<i>Clematis pubescens</i>	DICOT	
<i>Coleonema pulchellum</i>	DICOT	
<i>Comesperma calymega</i>	DICOT	
<i>Comesperma ciliatum</i>	DICOT	
<i>Comesperma confertum</i>	DICOT	
<i>Comesperma flavum</i>	DICOT	
<i>Comesperma integerrimum</i>	DICOT	
<i>Comesperma polygaloides</i>	DICOT	
<i>Comesperma virgatum</i>	DICOT	
<i>Commersonia corniculata</i>	DICOT	
<i>Conospermum acerosum</i> subsp. <i>acerosum</i>	DICOT	
<i>Conospermum canaliculatum</i> subsp. <i>canaliculatum</i>	DICOT	
<i>Conospermum capitatum</i> subsp. <i>glabratum</i>	DICOT	
<i>Conospermum huegelii</i>	DICOT	
<i>Conospermum incurvum</i>	DICOT	

TAXON	CLASS	CONS
<i>Conospermum stoechadis</i>	DICOT	
<i>Conospermum stoechadis</i> subsp. <i>sclerophyllum</i>	DICOT	
<i>Conospermum stoechadis</i> subsp. <i>stoechadis</i>	DICOT	
<i>Conospermum triplinervium</i>	DICOT	
<i>Conospermum triplinervium</i> x <i>undulatum</i>	DICOT	
<i>Conospermum undulatum</i>	DICOT	VU
<i>Conospermum undulatum</i> hybrid	DICOT	
<i>Conostephium minus</i>	DICOT	
<i>Conostephium pendulum</i>	DICOT	
<i>Conostephium preissii</i>	DICOT	
<i>Conothamnus trinervis</i>	DICOT	
<i>Convolvulus sabatius</i> subsp. <i>mauritanicus</i>	DICOT	
<i>Conyza albida</i>	DICOT	
<i>Conyza bonariensis</i>	DICOT	
<i>Conyza canadensis</i> var. <i>canadensis</i>	DICOT	
<i>Conyza parva</i>	DICOT	
<i>Conyza sumatrensis</i>	DICOT	
<i>Corrigiola litoralis</i>	DICOT	
<i>Corymbia calophylla</i>	DICOT	
<i>Corymbia calophylla</i> x <i>ficifolia</i>	DICOT	
<i>Corymbia citriodora</i>	DICOT	
<i>Corymbia maculata</i>	DICOT	
<i>Cosmos bipinnatus</i>	DICOT	
<i>Cotoneaster pannosus</i>	DICOT	
<i>Cotula australis</i>	DICOT	
<i>Cotula bipinnata</i>	DICOT	
<i>Cotula coronopifolia</i>	DICOT	
<i>Cotula cotuloides</i>	DICOT	
<i>Cotula turbinata</i>	DICOT	
<i>Crassocephalum crepidioides</i>	DICOT	
<i>Crassula alata</i>	DICOT	
<i>Crassula alata</i> var. <i>alata</i>	DICOT	
<i>Crassula arborescens</i>	DICOT	
<i>Crassula colorata</i>	DICOT	

TAXON	CLASS	CONS
<i>Crassula colorata</i> var. <i>acuminata</i>	DICOT	
<i>Crassula colorata</i> var. <i>colorata</i>	DICOT	
<i>Crassula decumbens</i>	DICOT	
<i>Crassula decumbens</i> var. <i>decumbens</i>	DICOT	
<i>Crassula exserta</i>	DICOT	
<i>Crassula glomerata</i>	DICOT	
<i>Crassula natans</i>	DICOT	
<i>Crassula natans</i> var. <i>minus</i>	DICOT	
<i>Crassula thunbergiana</i>	DICOT	
<i>Crassula thunbergiana</i> subsp. <i>thunbergiana</i>	DICOT	
<i>Crepis foetida</i> subsp. <i>foetida</i>	DICOT	
<i>Cristonia biloba</i> subsp. <i>biloba</i>	DICOT	
<i>Croninia kingiana</i>	DICOT	
<i>Cryptandra arbutiflora</i>	DICOT	
<i>Cryptandra arbutiflora</i> var. <i>arbutiflora</i>	DICOT	
<i>Cryptandra arbutiflora</i> var. <i>tubulosa</i>	DICOT	
<i>Cryptandra humilis</i>	DICOT	
<i>Cryptandra mutila</i>	DICOT	
<i>Cryptandra scoparia</i>	DICOT	
<i>Cuphea hyssopifolia</i>	DICOT	
<i>Cuscuta campestris</i>	DICOT	
<i>Cuscuta epithymum</i>	DICOT	
<i>Cuscuta planiflora</i>	DICOT	
<i>Cyclospermum leptophyllum</i>	DICOT	
<i>Cymbalaria muralis</i> subsp. <i>muralis</i>	DICOT	
<i>Dampiera alata</i>	DICOT	
<i>Dampiera linearis</i>	DICOT	
<i>Dampiera pedunculata</i>	DICOT	
<i>Dampiera trigona</i>	DICOT	
<i>Dampiera triloba</i>	DICOT	P3
<i>Darwinia citriodora</i>	DICOT	
<i>Datura innoxia</i>	DICOT	
<i>Datura metel</i>	DICOT	
<i>Datura stramonium</i>	DICOT	

TAXON	CLASS	CONS
<i>Datura wrightii</i>	DICOT	
<i>Daucus glochidiatus</i>	DICOT	
<i>Daviesia angulata</i>	DICOT	
<i>Daviesia brachyphylla</i>	DICOT	
<i>Daviesia decurrens</i>	DICOT	
<i>Daviesia decurrens</i> subsp. <i>decurrens</i>	DICOT	
<i>Daviesia divaricata</i>	DICOT	
<i>Daviesia divaricata</i> subsp. <i>divaricata</i>	DICOT	
<i>Daviesia hakeoides</i> subsp. <i>hakeoides</i>	DICOT	
<i>Daviesia horrida</i>	DICOT	
<i>Daviesia incrassata</i> subsp. <i>incrassata</i>	DICOT	
<i>Daviesia nudiflora</i> subsp. <i>nudiflora</i>	DICOT	
<i>Daviesia pedunculata</i>	DICOT	
<i>Daviesia physodes</i>	DICOT	
<i>Daviesia podophylla</i>	DICOT	
<i>Daviesia triflora</i>	DICOT	
<i>Dichondra repens</i>	DICOT	
<i>Dicrastylis micrantha</i>	DICOT	P3
<i>Dicrastylis soliparma</i>	DICOT	
<i>Dillwynia cinerascens</i>	DICOT	
<i>Dillwynia dillwynioides</i>	DICOT	P3
<i>Dillwynia</i> sp. A Perth Flora (R. Coveny 8036)	DICOT	
<i>Diplolaena angustifolia</i>	DICOT	
<i>Diplopeltis huegelii</i>	DICOT	
<i>Diplopeltis huegelii</i> subsp. <i>huegelii</i>	DICOT	
<i>Diplopeltis huegelii</i> subsp. <i>lehmannii</i>	DICOT	
<i>Diplopeltis huegelii</i> var. <i>huegelii</i>	DICOT	
<i>Diplotaxis muralis</i>	DICOT	
<i>Diplotaxis tenuifolia</i>	DICOT	
<i>Dischisma arenarium</i>	DICOT	
<i>Dischisma capitatum</i>	DICOT	
<i>Distimake dissectus</i>	DICOT	
<i>Dittrichia graveolens</i>	DICOT	
<i>Dodonaea aptera</i>	DICOT	

TAXON	CLASS	CONS
<i>Dodonaea hackettiana</i>	DICOT	P4
<i>Dodonaea sinuolata</i> subsp. <i>sinuolata</i>	DICOT	
<i>Drosanthemum candens</i>	DICOT	
<i>Drosera bulbigena</i>	DICOT	
<i>Drosera drummondii</i>	DICOT	
<i>Drosera erythrorhiza</i>	DICOT	
<i>Drosera erythrorhiza</i> subsp. <i>erythrorhiza</i>	DICOT	
<i>Drosera gigantea</i>	DICOT	
<i>Drosera glanduligera</i>	DICOT	
<i>Drosera helodes</i>	DICOT	
<i>Drosera heterophylla</i>	DICOT	
<i>Drosera hirsuta</i>	DICOT	
<i>Drosera macrantha</i>	DICOT	
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	DICOT	
<i>Drosera menziesii</i>	DICOT	
<i>Drosera menziesii</i> subsp. <i>penicillaris</i>	DICOT	
<i>Drosera micrantha</i>	DICOT	
<i>Drosera microphylla</i>	DICOT	
<i>Drosera minutiflora</i>	DICOT	
<i>Drosera neesii</i>	DICOT	
<i>Drosera nitidula</i>	DICOT	
<i>Drosera occidentalis</i>	DICOT	P4
<i>Drosera paleacea</i> subsp. <i>paleacea</i>	DICOT	
<i>Drosera pallida</i>	DICOT	
<i>Drosera platystigma</i>	DICOT	
<i>Drosera porrecta</i>	DICOT	
<i>Drosera pulchella</i>	DICOT	
<i>Drosera ramellosa</i>	DICOT	
<i>Drosera rosulata</i>	DICOT	
<i>Drosera</i> sp. <i>Branched styles</i> (S.C. Coffey 193)	DICOT	
<i>Drosera</i> sp. <i>indet.</i>	DICOT	
<i>Drosera spilos</i>	DICOT	
<i>Drosera stolonifera</i>	DICOT	
<i>Drosera subhirtella</i>	DICOT	

TAXON	CLASS	CONS
<i>Drosera tubaestylis</i>	DICOT	
<i>Drosera zonaria</i>	DICOT	
<i>Dryandra armata</i>	DICOT	
<i>Dryandra lindleyana</i> subsp. <i>lindleyana</i> var. <i>lindleyana</i>	DICOT	
<i>Dryandra nivea</i>	DICOT	
<i>Dryandra sessilis</i>	DICOT	
<i>Dysphania ambrosioides</i>	DICOT	
<i>Dysphania glomulifera</i> subsp. <i>glomulifera</i>	DICOT	
<i>Dysphania multifida</i>	DICOT	
<i>Ecballium elaterium</i>	DICOT	
<i>Echium plantagineum</i>	DICOT	
<i>Eclipta prostrata</i>	DICOT	
<i>Elatine gratioloides</i>	DICOT	
<i>Epilobium billardioreanum</i> subsp. <i>cinereum</i>	DICOT	
<i>Epilobium billardioreanum</i> subsp. <i>intermedium</i>	DICOT	
<i>Epilobium ciliatum</i>	DICOT	
<i>Epilobium hirtigerum</i>	DICOT	
<i>Epilobium tetragonum</i>	DICOT	
<i>Epilobium tetragonum</i> subsp. <i>tetragonum</i>	DICOT	
<i>Eremaea asterocarpa</i>	DICOT	
<i>Eremaea asterocarpa</i> subsp. <i>asterocarpa</i>	DICOT	
<i>Eremaea fimbriata</i>	DICOT	
<i>Eremaea pauciflora</i>	DICOT	
<i>Eremaea pauciflora</i> subsp. <i>pauciflora</i>	DICOT	
<i>Eremaea pauciflora</i> var. <i>pauciflora</i>	DICOT	
<i>Eremophila glabra</i>	DICOT	
<i>Eremophila glabra</i> subsp. <i>albicans</i>	DICOT	
<i>Eremophila glabra</i> subsp. <i>chlorella</i>	DICOT	EN
<i>Erigeron karvinskianus</i>	DICOT	
<i>Eriostemon spicatus</i>	DICOT	
<i>Erodium botrys</i>	DICOT	
<i>Erodium cicutarium</i>	DICOT	
<i>Erodium cygnorum</i>	DICOT	
<i>Erodium moschatum</i>	DICOT	

TAXON	CLASS	CONS
<i>Eryngium pinnatifidum</i>	DICOT	
<i>Eryngium pinnatifidum</i> subsp. <i>palustre</i>	DICOT	P3
<i>Eryngium pinnatifidum</i> subsp. <i>Palustre</i> (G.J. Keighery 13459)	DICOT	P3
<i>Eryngium</i> sp. <i>Subdecumbens</i> (G.J. Keighery 5390)	DICOT	
<i>Erythrina crista-galli</i>	DICOT	
<i>Erythrina</i> x <i>sykesii</i>	DICOT	
<i>Eucalyptus arachnaea</i> subsp. <i>arachnaea</i>	DICOT	
<i>Eucalyptus camaldulensis</i> subsp. <i>camaldulensis</i>	DICOT	
<i>Eucalyptus camaldulensis</i> subsp. <i>obtus</i>	DICOT	
<i>Eucalyptus cladocalyx</i> subsp. <i>petila</i>	DICOT	
<i>Eucalyptus decipiens</i>	DICOT	
<i>Eucalyptus educta</i>	DICOT	P2
<i>Eucalyptus erythrocorys</i>	DICOT	
<i>Eucalyptus foecunda</i>	DICOT	
<i>Eucalyptus gomphocephala</i>	DICOT	
<i>Eucalyptus lansdowneana</i>	DICOT	
<i>Eucalyptus marginata</i>	DICOT	
<i>Eucalyptus marginata</i> subsp. <i>marginata</i>	DICOT	
<i>Eucalyptus petrensis</i>	DICOT	
<i>Eucalyptus rudis</i>	DICOT	
<i>Eucalyptus rudis</i> subsp. <i>rudis</i>	DICOT	
<i>Eucalyptus todtiana</i>	DICOT	
<i>Eucalyptus utilis</i>	DICOT	
<i>Eucalyptus</i> x <i>mundijongensis</i>	DICOT	P1
<i>Euchilopsis linearis</i>	DICOT	
<i>Euphorbia arborea</i>	DICOT	
<i>Euphorbia cyathophora</i>	DICOT	
<i>Euphorbia dendroides</i>	DICOT	
<i>Euphorbia helioscopia</i>	DICOT	
<i>Euphorbia hyssopifolia</i>	DICOT	
<i>Euphorbia lathyris</i>	DICOT	
<i>Euphorbia lathyrus</i>	DICOT	
<i>Euphorbia maculata</i>	DICOT	
<i>Euphorbia marginata</i>	DICOT	

TAXON	CLASS	CONS
<i>Euphorbia paralias</i>	DICOT	
<i>Euphorbia peplus</i>	DICOT	
<i>Euphorbia prostrata</i>	DICOT	
<i>Euphorbia terracina</i>	DICOT	
<i>Eutaxia virgata</i>	DICOT	
<i>Exocarpos sparteus</i>	DICOT	
<i>Fallopia convolvulus</i>	DICOT	
<i>Ficus carica</i>	DICOT	
<i>Ficus macrophylla</i>	DICOT	
<i>Foeniculum vulgare</i>	DICOT	
<i>Frankenia pauciflora</i>	DICOT	
<i>Fumaria bastardii</i>	DICOT	
<i>Fumaria capreolata</i>	DICOT	
<i>Fumaria densiflora</i>	DICOT	
<i>Fumaria muralis</i>	DICOT	
<i>Fumaria muralis</i> subsp. <i>muralis</i>	DICOT	
<i>Galinsoga parviflora</i>	DICOT	
<i>Galium aparine</i>	DICOT	
<i>Galium divaricatum</i>	DICOT	
<i>Galium murale</i>	DICOT	
<i>Gamochaeta coarctata</i>	DICOT	
<i>Gamochaeta pensylvanica</i>	DICOT	
<i>Gastrolobium acutum</i>	DICOT	
<i>Gastrolobium capitatum</i>	DICOT	
<i>Gastrolobium celsianum</i>	DICOT	
<i>Gastrolobium ebracteolatum</i>	DICOT	
<i>Gastrolobium linearifolium</i>	DICOT	
<i>Gastrolobium nervosum</i>	DICOT	
<i>Gastrolobium praemorsum</i>	DICOT	
<i>Gastrolobium spinosum</i>	DICOT	
<i>Gazania linearis</i>	DICOT	
<i>Geranium molle</i>	DICOT	
<i>Geranium solanderi</i>	DICOT	
<i>Glandularia aristigera</i>	DICOT	

TAXON	CLASS	CONS
<i>Glebionis coronaria</i>	DICOT	
<i>Gleditsia triacanthos</i>	DICOT	
<i>Glischrocaryon angustifolium</i>	DICOT	
<i>Glischrocaryon aureum</i>	DICOT	
<i>Gnephosis angianthoides</i>	DICOT	
<i>Gnephosis drummondii</i>	DICOT	
<i>Gnephosis tenuissima</i>	DICOT	
<i>Gomphocarpus fruticosus</i>	DICOT	
<i>Gomphocarpus physocarpus</i>	DICOT	
<i>Gompholobium aristatum</i>	DICOT	
<i>Gompholobium confertum</i>	DICOT	
<i>Gompholobium polymorphum</i>	DICOT	
<i>Gompholobium scabrum</i>	DICOT	
<i>Gompholobium shuttleworthii</i>	DICOT	
<i>Gompholobium tomentosum</i>	DICOT	
<i>Gonocarpus nodulosus</i>	DICOT	
<i>Gonocarpus paniculatus</i>	DICOT	
<i>Gonocarpus pithyoides</i>	DICOT	
<i>Goodenia incana</i>	DICOT	
<i>Goodenia micrantha</i>	DICOT	
<i>Goodenia pinifolia</i>	DICOT	
<i>Goodenia pulchella</i>	DICOT	
<i>Goodenia pulchella</i> subsp. <i>Coastal Plain A</i> (M. Hislop 634)	DICOT	
<i>Goodenia pulchella</i> subsp. <i>Coastal Plain B</i> (L.W. Sage 2336)	DICOT	
<i>Goodenia scapigera</i>	DICOT	
<i>Grammatotheca bergiana</i> var. <i>bergiana</i>	DICOT	
<i>Gratiola peruviana</i>	DICOT	
<i>Gratiola pubescens</i>	DICOT	
<i>Grevillea bipinnatifida</i>	DICOT	
<i>Grevillea bipinnatifida</i> subsp. <i>bipinnatifida</i>	DICOT	
<i>Grevillea crithmifolia</i>	DICOT	
<i>Grevillea curviloba</i> subsp. <i>incurva</i>	DICOT	EN
<i>Grevillea endlicheriana</i>	DICOT	
<i>Grevillea manglesii</i> subsp. <i>manglesii</i>	DICOT	P2

TAXON	CLASS	CONS
<i>Grevillea manglesii</i> subsp. <i>ornithopoda</i>	DICOT	
<i>Grevillea obtusifolia</i>	DICOT	
<i>Grevillea pilulifera</i>	DICOT	
<i>Grevillea preissii</i> subsp. <i>preissii</i>	DICOT	
<i>Grevillea synapheae</i> subsp. <i>synapheae</i>	DICOT	
<i>Grevillea thelemanniana</i>	DICOT	CR
<i>Grevillea thelemanniana</i> subsp. <i>preissii</i>	DICOT	
<i>Grevillea vestita</i>	DICOT	
<i>Grevillea vestita</i> subsp. <i>vestita</i>	DICOT	
<i>Guichenotia sarotes</i>	DICOT	
<i>Gyrostemon ramulosus</i>	DICOT	
<i>Hakea bucculenta</i>	DICOT	
<i>Hakea candolleana</i>	DICOT	
<i>Hakea ceratophylla</i>	DICOT	
<i>Hakea conchifolia</i>	DICOT	
<i>Hakea costata</i>	DICOT	
<i>Hakea erinacea</i>	DICOT	
<i>Hakea incrassata</i>	DICOT	
<i>Hakea lissocarpha</i>	DICOT	
<i>Hakea myrtoides</i>	DICOT	
<i>Hakea petiolaris</i>	DICOT	
<i>Hakea prostrata</i>	DICOT	
<i>Hakea ruscifolia</i>	DICOT	
<i>Hakea</i> sp. Eastern coastal plain (G.J. Keighery 8014)	DICOT	
<i>Hakea sulcata</i>	DICOT	
<i>Hakea trifurcata</i>	DICOT	
<i>Hakea undulata</i>	DICOT	
<i>Hakea varia</i>	DICOT	
<i>Haloragis scoparia</i>	DICOT	P1
<i>Hardenbergia comptoniana</i>	DICOT	
<i>Hedypnois rhagadioloides</i>	DICOT	
<i>Hedypnois rhagadioloides</i> subsp. <i>cretica</i>	DICOT	
<i>Helianthus annuus</i>	DICOT	
<i>Helianthus debilis</i> subsp. <i>cucumerifolius</i>	DICOT	

TAXON	CLASS	CONS
<i>Helianthus tuberosus</i>	DICOT	
<i>Helichrysum cordatum</i>	DICOT	
<i>Helichrysum luteoalbum</i>	DICOT	
<i>Heliophila pusilla</i>	DICOT	
<i>Heliotropium amplexicaule</i>	DICOT	
<i>Heliotropium curassavicum</i>	DICOT	
<i>Helminthotheca echioides</i>	DICOT	
<i>Hemiandra glabra</i>	DICOT	
<i>Hemiandra linearis</i>	DICOT	
<i>Hemiandra pungens</i>	DICOT	
<i>Hemiandra pungens</i> var. <i>glabra</i>	DICOT	
<i>Hemiandra</i> sp. Jurien (B.J. Conn & M.E. Tozer BJC 3885)	DICOT	
<i>Hemigenia incana</i>	DICOT	
<i>Hemigenia sericea</i>	DICOT	
<i>Hemiphora bartlingii</i>	DICOT	
<i>Hemiphora uncinata</i>	DICOT	
<i>Hibbertia amplexicaulis</i>	DICOT	
<i>Hibbertia aurea</i>	DICOT	
<i>Hibbertia commutata</i>	DICOT	
<i>Hibbertia cuneiformis</i>	DICOT	
<i>Hibbertia diamesogenos</i>	DICOT	
<i>Hibbertia huegelii</i>	DICOT	
<i>Hibbertia huegelii</i> complex	DICOT	
<i>Hibbertia hypericoides</i>	DICOT	
<i>Hibbertia hypericoides</i> subsp. <i>hypericoides</i>	DICOT	
<i>Hibbertia perfoliata</i>	DICOT	
<i>Hibbertia racemosa</i>	DICOT	
<i>Hibbertia spicata</i> subsp. <i>leptotheca</i>	DICOT	
<i>Hibbertia stellaris</i>	DICOT	
<i>Hibbertia striata</i>	DICOT	
<i>Hibbertia subvaginata</i>	DICOT	
<i>Hibbertia vaginata</i>	DICOT	
<i>Hibiscus diversifolius</i>	DICOT	
<i>Hibiscus diversifolius</i> subsp. <i>diversifolius</i>	DICOT	

TAXON	CLASS	CONS
<i>Hibiscus mutabilis</i>	DICOT	
<i>Hibiscus tridactylites</i>	DICOT	
<i>Homalanthus novo-guineensis</i>	DICOT	
<i>Homalosciadium homalocarpum</i>	DICOT	
<i>Homalospermum firmum</i>	DICOT	
<i>Hovea pungens</i>	DICOT	
<i>Hovea trisperma</i>	DICOT	
<i>Hovea trisperma</i> var. <i>trisperma</i>	DICOT	
<i>Hyalosperma cotula</i>	DICOT	
<i>Hybanthus calycinus</i>	DICOT	
<i>Hydrocotyle alata</i>	DICOT	
<i>Hydrocotyle blepharocarpa</i>	DICOT	
<i>Hydrocotyle bonariensis</i>	DICOT	
<i>Hydrocotyle callicarpa</i>	DICOT	
<i>Hydrocotyle diantha</i>	DICOT	
<i>Hydrocotyle hispidula</i>	DICOT	
<i>Hydrocotyle lemnoides</i>	DICOT	P4
<i>Hydrocotyle pilifera</i> var. <i>glabrata</i>	DICOT	
<i>Hydrocotyle ranunculoides</i>	DICOT	
<i>Hydrocotyle scutellifera</i>	DICOT	
<i>Hydrocotyle striata</i>	DICOT	P1
<i>Hydrocotyle tetragonocarpa</i>	DICOT	
<i>Hypericum canariense</i>	DICOT	
<i>Hypericum gramineum</i>	DICOT	
<i>Hypocalymma angustifolium</i>	DICOT	
<i>Hypocalymma angustifolium</i> subsp. <i>Swan Coastal Plain</i> (G.J. Keighery 16777)	DICOT	
<i>Hypocalymma robustum</i>	DICOT	
<i>Hypochaeris glabra</i>	DICOT	
<i>Hypochaeris radicata</i>	DICOT	
<i>Ipomoea batatas</i>	DICOT	
<i>Ipomoea cairica</i>	DICOT	
<i>Ipomoea indica</i>	DICOT	
<i>Isopogon asper</i>	DICOT	
<i>Isopogon drummondii</i>	DICOT	

TAXON	CLASS	CONS
<i>Isopogon dubius</i>	DICOT	
<i>Isopogon sphaerocephalus</i>	DICOT	
<i>Isotoma hypocrateriformis</i>	DICOT	
<i>Isotoma pusilla</i>	DICOT	
<i>Isotoma scapigera</i>	DICOT	
<i>Isotropis cuneifolia</i>	DICOT	
<i>Isotropis cuneifolia</i> subsp. <i>cuneifolia</i>	DICOT	
<i>Ixiolaena viscosa</i>	DICOT	
<i>Jacksonia angulata</i>	DICOT	
<i>Jacksonia densiflora</i>	DICOT	
<i>Jacksonia floribunda</i>	DICOT	
<i>Jacksonia furcellata</i>	DICOT	
<i>Jacksonia gracillima</i>	DICOT	P3
<i>Jacksonia lehmannii</i>	DICOT	
<i>Jacksonia restioides</i>	DICOT	
<i>Jacksonia sericea</i>	DICOT	P4
<i>Jacksonia sternbergiana</i>	DICOT	
<i>Kennedia coccinea</i>	DICOT	
<i>Kennedia prostrata</i>	DICOT	
<i>Kennedia rubicunda</i>	DICOT	
<i>Kennedia stirlingii</i>	DICOT	
<i>Kickxia elatine</i> subsp. <i>elatine</i>	DICOT	
<i>Kickxia spuria</i>	DICOT	
<i>Kunzea glabrescens</i>	DICOT	
<i>Kunzea micrantha</i>	DICOT	
<i>Kunzea micrantha</i> subsp. <i>micrantha</i>	DICOT	
<i>Kunzea micrantha</i> subsp. <i>petiolata</i>	DICOT	
<i>Labichea lanceolata</i>	DICOT	
<i>Labichea punctata</i>	DICOT	
<i>Lablab purpureus</i>	DICOT	
<i>Lachnostachys verbascifolia</i> var. <i>verbascifolia</i>	DICOT	
<i>Lactuca saligna</i>	DICOT	
<i>Lactuca serriola</i>	DICOT	
<i>Lactuca serriola</i> forma <i>serriola</i>	DICOT	

TAXON	CLASS	CONS
<i>Lagenophora huegelii</i>	DICOT	
<i>Lagunaria patersonia</i>	DICOT	
<i>Lambertia multiflora</i>	DICOT	
<i>Lambertia multiflora</i> var. <i>darlingensis</i>	DICOT	
<i>Lantana camara</i>	DICOT	
<i>Lantana camara</i> var. <i>camara</i>	DICOT	
<i>Lasiopetalum bracteatum</i>	DICOT	P4
<i>Lasiopetalum glabratum</i>	DICOT	
<i>Lasiopetalum glutinosum</i> subsp. <i>glutinosum</i>	DICOT	
<i>Lasiopetalum membranaceum</i>	DICOT	P3
<i>Lathyrus tingitanus</i>	DICOT	
<i>Latrobea tenella</i>	DICOT	
<i>Lavandula dentata</i> var. <i>candicans</i>	DICOT	
<i>Lawrencella rosea</i>	DICOT	
<i>Lawrencia spicata</i>	DICOT	
<i>Lawrencia squamata</i>	DICOT	
<i>Lechenaultia biloba</i>	DICOT	
<i>Lechenaultia expansa</i>	DICOT	
<i>Lechenaultia floribunda</i>	DICOT	
<i>Lechenaultia linarioides</i>	DICOT	
<i>Leonotis leonurus</i>	DICOT	
<i>Leonotis nepetifolia</i>	DICOT	
<i>Leontodon rhagadioloides</i>	DICOT	
<i>Leontodon saxatilis</i>	DICOT	
<i>Lepidium didymum</i>	DICOT	
<i>Lepidium pseudohyssopifolium</i>	DICOT	P1
<i>Lepidium rotundum</i>	DICOT	
<i>Leptomeria empetriiformis</i>	DICOT	
<i>Leptomeria pauciflora</i>	DICOT	
<i>Leptomeria preissiana</i>	DICOT	
<i>Leptospermum continentale</i>	DICOT	
<i>Leptospermum erubescens</i>	DICOT	
<i>Leptospermum laevigatum</i>	DICOT	
<i>Leptospermum spinescens</i>	DICOT	

TAXON	CLASS	CONS
<i>Leucaena leucocephala</i>	DICOT	
<i>Leucophyta brownii</i>	DICOT	
<i>Leucopogon aff. nutans</i>	DICOT	
<i>Leucopogon australis</i>	DICOT	
<i>Leucopogon conostephioides</i>	DICOT	
<i>Leucopogon glaucifolius</i>	DICOT	
<i>Leucopogon hirsutus</i>	DICOT	
<i>Leucopogon oliganthus</i>	DICOT	
<i>Leucopogon oxycedrus</i>	DICOT	
<i>Leucopogon parviflorus</i>	DICOT	
<i>Leucopogon polymorphus</i>	DICOT	
<i>Leucopogon propinquus</i>	DICOT	
<i>Leucopogon pulchellus</i>	DICOT	
<i>Leucopogon racemulosus</i>	DICOT	
<i>Leucopogon sprengeioides</i>	DICOT	
<i>Leucopogon squarrosus subsp. squarrosus</i>	DICOT	
<i>Leucopogon strictus</i>	DICOT	
<i>Leucopogon tenuis</i>	DICOT	
<i>Leucopogon verticillatus</i>	DICOT	
<i>Levenhookia preissii</i>	DICOT	P1
<i>Levenhookia pusilla</i>	DICOT	
<i>Levenhookia stipitata</i>	DICOT	
<i>Limonium hyblaeum</i>	DICOT	
<i>Linaria maroccana</i>	DICOT	
<i>Linum trigynum</i>	DICOT	
<i>Linum usitatissimum</i>	DICOT	
<i>Liparophyllum capitatum</i>	DICOT	
<i>Lobelia anceps</i>	DICOT	
<i>Lobelia gibbosa</i>	DICOT	
<i>Lobelia heterophylla</i>	DICOT	
<i>Lobelia rhombifolia</i>	DICOT	
<i>Lobelia rhytidosperra</i>	DICOT	
<i>Lobelia tenuior</i>	DICOT	
<i>Lobularia maritima</i>	DICOT	

TAXON	CLASS	CONS
<i>Logania vaginalis</i>	DICOT	
<i>Lotus angustissimus</i>	DICOT	
<i>Lotus hispidus</i>	DICOT	
<i>Lotus subbiflorus</i>	DICOT	
<i>Lotus uliginosus</i>	DICOT	
<i>Ludwigia repens</i>	DICOT	
<i>Lupinus angustifolius</i>	DICOT	
<i>Lupinus cosentinii</i>	DICOT	
<i>Lupinus luteus</i>	DICOT	
<i>Lycium ferocissimum</i>	DICOT	
<i>Lysiana casuarinae</i>	DICOT	
<i>Lysimachia arvensis</i>	DICOT	
<i>Lysimachia minima</i>	DICOT	
<i>Lysinema ciliatum</i>	DICOT	
<i>Lysinema elegans</i>	DICOT	
<i>Lysinema pentapetalum</i>	DICOT	
<i>Lythrum hyssopifolia</i>	DICOT	
<i>Lythrum junceum</i>	DICOT	
<i>Macarthuria australis</i>	DICOT	
<i>Macarthuria keigheryi</i>	DICOT	EN
<i>Macroptilium atropurpureum</i>	DICOT	
<i>Malleostemon tuberculatus</i>	DICOT	
<i>Malva arborea</i>	DICOT	
<i>Malva parviflora</i>	DICOT	
<i>Malva pseudolavatera</i>	DICOT	
<i>Malvaviscus arboreus</i>	DICOT	
<i>Marianthus erubescens</i>	DICOT	
<i>Matthiola incana</i>	DICOT	
<i>Mauranthemum paludosum</i>	DICOT	
<i>Medicago arabica</i>	DICOT	
<i>Medicago laciniata</i>	DICOT	
<i>Medicago littoralis</i>	DICOT	
<i>Medicago minima</i>	DICOT	
<i>Medicago polymorpha</i>	DICOT	

TAXON	CLASS	CONS
<i>Medicago sativa</i>	DICOT	
<i>Meionectes brownii</i>	DICOT	
<i>Melaleuca acerosa</i>	DICOT	
<i>Melaleuca acutifolia</i>	DICOT	
<i>Melaleuca armillaris</i> subsp. <i>armillaris</i>	DICOT	
<i>Melaleuca brevifolia</i>	DICOT	
<i>Melaleuca calothamnoides</i>	DICOT	
<i>Melaleuca cardiophylla</i>	DICOT	
<i>Melaleuca citrina</i>	DICOT	
<i>Melaleuca cuticularis</i>	DICOT	
<i>Melaleuca fulgens</i> subsp. <i>fulgens</i>	DICOT	
<i>Melaleuca huegelii</i>	DICOT	
<i>Melaleuca huegelii</i> subsp. <i>huegelii</i>	DICOT	
<i>Melaleuca incana</i> subsp. <i>incana</i>	DICOT	
<i>Melaleuca lanceolata</i>	DICOT	
<i>Melaleuca lateritia</i>	DICOT	
<i>Melaleuca linariifolia</i>	DICOT	
<i>Melaleuca megacephala</i>	DICOT	
<i>Melaleuca nervosa</i>	DICOT	
<i>Melaleuca nesophila</i>	DICOT	
<i>Melaleuca osullivanii</i>	DICOT	
<i>Melaleuca parviceps</i>	DICOT	
<i>Melaleuca pauciflora</i>	DICOT	
<i>Melaleuca pentagona</i> var. <i>pentagona</i>	DICOT	
<i>Melaleuca preissiana</i>	DICOT	
<i>Melaleuca quinquenervia</i>	DICOT	
<i>Melaleuca raphiophylla</i>	DICOT	
<i>Melaleuca ryeae</i>	DICOT	
<i>Melaleuca scabra</i>	DICOT	
<i>Melaleuca seriata</i>	DICOT	
<i>Melaleuca systema</i>	DICOT	
<i>Melaleuca teretifolia</i>	DICOT	
<i>Melaleuca thymoides</i>	DICOT	
<i>Melaleuca trichophylla</i>	DICOT	

TAXON	CLASS	CONS
<i>Melaleuca viminalis</i>	DICOT	P2
<i>Melaleuca viminea</i>	DICOT	
<i>Melaleuca viminea</i> subsp. <i>viminea</i>	DICOT	
<i>Melia azedarach</i>	DICOT	
<i>Melilotus albus</i>	DICOT	
<i>Melilotus indicus</i>	DICOT	
<i>Mentha spicata</i>	DICOT	
<i>Mentha x piperita</i> var. <i>citrata</i>	DICOT	
<i>Millotia myosotidifolia</i>	DICOT	
<i>Millotia tenuifolia</i>	DICOT	
<i>Minuartia mediterranea</i>	DICOT	
<i>Mirabilis jalapa</i>	DICOT	
<i>Mirbelia floribunda</i>	DICOT	
<i>Mirbelia spinosa</i>	DICOT	
<i>Misopates orontium</i>	DICOT	
<i>Mitrasacme paradoxa</i>	DICOT	
<i>Moenchia erecta</i>	DICOT	
<i>Momordica balsamina</i>	DICOT	
<i>Momordica charantia</i>	DICOT	
<i>Monoculus monstrosus</i>	DICOT	
<i>Monopsis debilis</i> var. <i>depressa</i>	DICOT	
<i>Monotaxis grandiflora</i>	DICOT	
<i>Monotaxis grandiflora</i> var. <i>grandiflora</i>	DICOT	
<i>Monotaxis occidentalis</i>	DICOT	
<i>Morus alba</i>	DICOT	
<i>Muehlenbeckia polybotrya</i>	DICOT	
<i>Myoporum caprarioides</i>	DICOT	
<i>Myoporum insulare</i>	DICOT	
<i>Myriocephalus occidentalis</i>	DICOT	
<i>Myriophyllum aquaticum</i>	DICOT	
<i>Myriophyllum crispatum</i>	DICOT	
<i>Myriophyllum tillaeoides</i>	DICOT	
<i>Needhamiella pumilio</i>	DICOT	
<i>Nemcia capitata</i>	DICOT	

TAXON	CLASS	CONS
<i>Nerium oleander</i>	DICOT	
<i>Nicandra physalodes</i>	DICOT	
<i>Nicotiana glauca</i>	DICOT	
<i>Nuytsia floribunda</i>	DICOT	
<i>Nymphaea odorata</i>	DICOT	
<i>Ocimum americanum</i>	DICOT	
<i>Oenothera affinis</i>	DICOT	
<i>Oenothera drummondii</i>	DICOT	
<i>Oenothera drummondii</i> subsp. <i>drummondii</i>	DICOT	
<i>Oenothera glazioviana</i>	DICOT	
<i>Oenothera jamesii</i>	DICOT	
<i>Oenothera laciniata</i>	DICOT	
<i>Oenothera mollissima</i>	DICOT	
<i>Oenothera speciosa</i>	DICOT	
<i>Oenothera stricta</i>	DICOT	
<i>Oenothera stricta</i> subsp. <i>stricta</i>	DICOT	
<i>Olax benthamiana</i>	DICOT	
<i>Olax scalariformis</i>	DICOT	
<i>Olea europaea</i>	DICOT	
<i>Olea europaea</i> subsp. <i>europaea</i>	DICOT	
<i>Olearia axillaris</i>	DICOT	
<i>Olearia elaeophila</i>	DICOT	
<i>Olearia paucidentata</i>	DICOT	
<i>Olearia rudis</i>	DICOT	
<i>Olearia</i> sp. Kennedy Range (G. Byrne 66)	DICOT	
<i>Opercularia apiciflora</i>	DICOT	
<i>Opercularia vaginata</i>	DICOT	
<i>Opuntia monacantha</i>	DICOT	
<i>Ornduffia albiflora</i>	DICOT	
<i>Ornduffia submersa</i>	DICOT	P4
<i>Ornithopus compressus</i>	DICOT	
<i>Ornithopus pinnatus</i>	DICOT	
<i>Ornithopus sativus</i>	DICOT	
<i>Orobanche minor</i>	DICOT	

TAXON	CLASS	CONS
<i>Osteospermum clandestinum</i>	DICOT	
<i>Osteospermum ecklonis</i>	DICOT	
<i>Oxalis bowiei</i>	DICOT	
<i>Oxalis caprina</i>	DICOT	
<i>Oxalis corniculata</i>	DICOT	
<i>Oxalis debilis</i> var. <i>corymbosa</i>	DICOT	
<i>Oxalis glabra</i>	DICOT	
<i>Oxalis perennans</i>	DICOT	
<i>Oxalis pes-caprae</i>	DICOT	
<i>Oxalis purpurea</i>	DICOT	
<i>Oxalis violacea</i>	DICOT	
<i>Ozothamnus cordatus</i>	DICOT	
<i>Papaver rhoeas</i>	DICOT	
<i>Papaver somniferum</i>	DICOT	
<i>Paraserianthes lophantha</i>	DICOT	
<i>Paraserianthes lophantha</i> subsp. <i>lophantha</i>	DICOT	
<i>Parentucellia latifolia</i>	DICOT	
<i>Parietaria cardiostegia</i>	DICOT	
<i>Parietaria debilis</i>	DICOT	
<i>Parietaria judaica</i>	DICOT	
<i>Parthenocissus quinquefolia</i>	DICOT	
<i>Parthenocissus tricuspidata</i>	DICOT	
<i>Passiflora filamentosa</i>	DICOT	
<i>Pastinaca sativa</i>	DICOT	
<i>Pavonia hastata</i>	DICOT	
<i>Pelargonium capitatum</i>	DICOT	
<i>Pelargonium havlasae</i>	DICOT	
<i>Pelargonium littorale</i>	DICOT	
<i>Pelargonium</i> x <i>asperum</i>	DICOT	
<i>Pelargonium</i> x <i>domesticum</i>	DICOT	
<i>Pericalymma ellipticum</i>	DICOT	
<i>Pericalymma ellipticum</i> var. <i>ellipticum</i>	DICOT	
<i>Pericalymma ellipticum</i> var. <i>floridum</i>	DICOT	
<i>Persicaria decipiens</i>	DICOT	

TAXON	CLASS	CONS
<i>Persicaria hydropiper</i>	DICOT	
<i>Persicaria lapathifolia</i>	DICOT	
<i>Persicaria maculosa</i>	DICOT	
<i>Persoonia elliptica</i>	DICOT	
<i>Persoonia macrostachya</i>	DICOT	
<i>Persoonia saccata</i>	DICOT	
<i>Petrophile axillaris</i>	DICOT	
<i>Petrophile biloba</i>	DICOT	
<i>Petrophile brevifolia</i>	DICOT	
<i>Petrophile brevifolia</i> subsp. <i>brevifolia</i>	DICOT	
<i>Petrophile juncifolia</i>	DICOT	
<i>Petrophile linearis</i>	DICOT	
<i>Petrophile macrostachya</i>	DICOT	
<i>Petrophile seminuda</i>	DICOT	
<i>Petrophile serruriae</i>	DICOT	
<i>Petrophile squamata</i> subsp. <i>northern</i> (J. Monks 40)	DICOT	
<i>Petrophile striata</i>	DICOT	
<i>Petrorhagia dubia</i>	DICOT	
<i>Petrorhagia velutina</i>	DICOT	
<i>Petunia axillaris</i>	DICOT	
<i>Petunia x atkinsiana</i>	DICOT	
<i>Phacelia tanacetifolia</i>	DICOT	
<i>Philotheca spicata</i>	DICOT	
<i>Phyla nodiflora</i>	DICOT	
<i>Phyla nodiflora</i> var. <i>nodiflora</i>	DICOT	
<i>Phyllangium paradoxum</i>	DICOT	
<i>Phyllanthus calycinus</i>	DICOT	
<i>Phyllanthus tenellus</i>	DICOT	
<i>Phyllopodium cordatum</i>	DICOT	
<i>Physalis angulata</i>	DICOT	
<i>Physalis peruviana</i>	DICOT	
<i>Phytolacca octandra</i>	DICOT	
<i>Picris compacta</i>	DICOT	
<i>Picris squarrosa</i>	DICOT	

TAXON	CLASS	CONS
<i>Pimelea angustifolia</i>	DICOT	
<i>Pimelea argentea</i>	DICOT	
<i>Pimelea calcicola</i>	DICOT	P3
<i>Pimelea ferruginea</i>	DICOT	
<i>Pimelea imbricata</i> var. <i>major</i>	DICOT	
<i>Pimelea imbricata</i> var. <i>piligera</i>	DICOT	
<i>Pimelea leucantha</i>	DICOT	
<i>Pimelea rosea</i>	DICOT	
<i>Pimelea rosea</i> subsp. <i>rosea</i>	DICOT	
<i>Pimelea spectabilis</i>	DICOT	
<i>Pimelea sulphurea</i>	DICOT	
<i>Pimelea sylvestris</i>	DICOT	
<i>Pithocarpa cordata</i>	DICOT	
<i>Pithocarpa pulchella</i>	DICOT	
<i>Pithocarpa pulchella</i> var. <i>melanostigma</i> / <i>pulchella</i> var. <i>pulchella</i>	DICOT	
<i>Pithocarpa pulchella</i> var. <i>pulchella</i>	DICOT	
<i>Pittosporum ligustrifolium</i>	DICOT	
<i>Pittosporum phylliraeoides</i>	DICOT	
<i>Pittosporum undulatum</i>	DICOT	
<i>Pityrodia axillaris</i>	DICOT	
<i>Pityrodia bartlingii</i>	DICOT	
<i>Plantago coronopus</i> subsp. <i>commutata</i>	DICOT	
<i>Plantago lanceolata</i>	DICOT	
<i>Plantago major</i>	DICOT	
<i>Platanus x hispanica</i>	DICOT	
<i>Platysace compressa</i>	DICOT	
<i>Platysace filiformis</i>	DICOT	
<i>Platysace juncea</i>	DICOT	
<i>Platysace ramosissima</i>	DICOT	P3
<i>Platytheca galioides</i>	DICOT	
<i>Podolepis capillaris</i>	DICOT	
<i>Podolepis gracilis</i>	DICOT	
<i>Podolepis lessonii</i>	DICOT	
<i>Podolepis nutans</i>	DICOT	

TAXON	CLASS	CONS
<i>Podotheca angustifolia</i>	DICOT	
<i>Podotheca chrysantha</i>	DICOT	
<i>Podotheca gnaphalioides</i>	DICOT	
<i>Pogonolepis stricta</i>	DICOT	
<i>Polycarpon tetraphyllum</i>	DICOT	
<i>Polygala myrtifolia</i>	DICOT	
<i>Polygonum arenastrum</i>	DICOT	
<i>Polygonum aviculare</i>	DICOT	
<i>Populus alba</i>	DICOT	
<i>Populus nigra</i> cv. <i>italica</i>	DICOT	
<i>Poranthera drummondii</i>	DICOT	
<i>Poranthera ericoides</i>	DICOT	
<i>Poranthera microphylla</i>	DICOT	
<i>Poranthera moorokatta</i>	DICOT	P2
<i>Proboscidea louisianica</i>	DICOT	
<i>Pseudognaphalium luteoalbum</i>	DICOT	
<i>Pterochaeta paniculata</i>	DICOT	
<i>Ptilotus declinatus</i>	DICOT	
<i>Ptilotus drummondii</i>	DICOT	
<i>Ptilotus drummondii</i> var. <i>drummondii</i>	DICOT	
<i>Ptilotus eremita</i>	DICOT	
<i>Ptilotus esquamatus</i>	DICOT	
<i>Ptilotus manglesii</i>	DICOT	
<i>Ptilotus polystachyus</i>	DICOT	
<i>Ptilotus sericostachyus</i> subsp. <i>roseus</i>	DICOT	
<i>Ptilotus sericostachyus</i> subsp. <i>sericostachyus</i>	DICOT	P1
<i>Ptilotus stirlingii</i> subsp. <i>stirlingii</i>	DICOT	
<i>Pultenaea ericifolia</i>	DICOT	
<i>Pultenaea reticulata</i>	DICOT	
<i>Quinetia urvillei</i>	DICOT	
<i>Ranunculus colonorum</i>	DICOT	
<i>Ranunculus muricatus</i>	DICOT	
<i>Ranunculus sessiliflorus</i> var. <i>sessiliflorus</i>	DICOT	
<i>Ranunculus trilobus</i>	DICOT	

TAXON	CLASS	CONS
<i>Raphanus raphanistrum</i>	DICOT	
<i>Raphanus sativus</i>	DICOT	
<i>Regelia ciliata</i>	DICOT	
<i>Regelia inops</i>	DICOT	
<i>Reseda lutea</i>	DICOT	
<i>Retama raetam</i>	DICOT	
<i>Rhagodia baccata</i>	DICOT	
<i>Rhagodia baccata</i> subsp. <i>baccata</i>	DICOT	
<i>Rhagodia baccata</i> subsp. <i>dioica</i>	DICOT	
<i>Rhagodia preissii</i> subsp. <i>preissii</i>	DICOT	
<i>Rhamnus alaternus</i>	DICOT	
<i>Rhodanthe chlorocephala</i> subsp. <i>rosea</i>	DICOT	
<i>Rhodanthe citrina</i>	DICOT	
<i>Rhodanthe corymbosa</i>	DICOT	
<i>Rhodanthe manglesii</i>	DICOT	
<i>Rhodanthe pyrethrum</i>	DICOT	
<i>Ricinocarpos glaucus</i>	DICOT	
<i>Ricinocarpos megalocarpus</i>	DICOT	
<i>Ricinocarpos undulatus</i>	DICOT	
<i>Ricinus communis</i>	DICOT	
<i>Robinia pseudoacacia</i>	DICOT	
<i>Roldana petasitis</i>	DICOT	
<i>Romneya coulteri</i>	DICOT	
<i>Rorippa nasturtium-aquaticum</i>	DICOT	
<i>Rosa chinensis</i> x <i>moschata</i>	DICOT	
<i>Rubus laudatus</i>	DICOT	
<i>Rumex acetosella</i>	DICOT	
<i>Rumex conglomeratus</i>	DICOT	
<i>Rumex crispus</i>	DICOT	
<i>Rumex hypogaeus</i>	DICOT	
<i>Rumex obtusifolius</i> subsp. <i>obtusifolius</i>	DICOT	
<i>Rumex pulcher</i>	DICOT	
<i>Rumex pulcher</i> subsp. <i>woodsii</i>	DICOT	
<i>Rumex sagittatus</i>	DICOT	

TAXON	CLASS	CONS
<i>Rumex vesicarius</i>	DICOT	
<i>Sagina apetala</i>	DICOT	
<i>Sagina procumbens</i>	DICOT	
<i>Salicornia quinqueflora</i>	DICOT	
<i>Salicornia quinqueflora</i> subsp. <i>quinqueflora</i>	DICOT	
<i>Salix babylonica</i>	DICOT	
<i>Salix cinerea</i>	DICOT	
<i>Salix humboldtiana</i>	DICOT	
<i>Salpichroa organifolia</i>	DICOT	
<i>Salsola australis</i>	DICOT	
<i>Salvia reflexa</i>	DICOT	
<i>Salvia verbenaca</i>	DICOT	
<i>Samolus junceus</i>	DICOT	
<i>Samolus repens</i>	DICOT	
<i>Samolus repens</i> var. <i>paucifolius</i>	DICOT	
<i>Samolus repens</i> var. <i>repens</i>	DICOT	
<i>Santalum acuminatum</i>	DICOT	
<i>Santalum spicatum</i>	DICOT	
<i>Sarcocornia quinqueflora</i>	DICOT	
<i>Scabiosa atropurpurea</i>	DICOT	
<i>Scaevola anchusifolia</i>	DICOT	
<i>Scaevola canescens</i>	DICOT	
<i>Scaevola crassifolia</i>	DICOT	
<i>Scaevola glandulifera</i>	DICOT	
<i>Scaevola lanceolata</i>	DICOT	
<i>Scaevola nitida</i>	DICOT	
<i>Scaevola phlebopetala</i>	DICOT	
<i>Scaevola repens</i>	DICOT	
<i>Scaevola repens</i> var. <i>angustifolia</i>	DICOT	
<i>Scaevola repens</i> var. <i>repens</i>	DICOT	
<i>Scaevola thesioides</i>	DICOT	
<i>Scaevola thesioides</i> subsp. <i>thesioides</i>	DICOT	
<i>Schenkia australis</i>	DICOT	
<i>Schinus terebinthifolia</i>	DICOT	

TAXON	CLASS	CONS
<i>Schinus terebinthifolius</i>	DICOT	
<i>Schoenolaena juncea</i>	DICOT	
<i>Scholtzia capitata</i>	DICOT	
<i>Scholtzia involucrata</i>	DICOT	
<i>Scholtzia laxiflora</i>	DICOT	
<i>Senecio angulatus</i>	DICOT	
<i>Senecio condylus</i>	DICOT	
<i>Senecio diaschides</i>	DICOT	
<i>Senecio elegans</i>	DICOT	
<i>Senecio glossanthus x lautus</i>	DICOT	
<i>Senecio hispidulus</i>	DICOT	
<i>Senecio multicaulis</i> subsp. <i>multicaulis</i>	DICOT	
<i>Senecio pinnatifolius</i>	DICOT	
<i>Senecio pinnatifolius</i> var. <i>latilobus</i>	DICOT	
<i>Senecio pinnatifolius</i> var. <i>maritimus</i>	DICOT	
<i>Senecio ramosissimus</i>	DICOT	
<i>Senecio vulgaris</i>	DICOT	
<i>Senegalia rugata</i>	DICOT	
<i>Senna artemisioides</i>	DICOT	
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	DICOT	
<i>Seringia integrifolia</i>	DICOT	
<i>Sida fallax</i>	DICOT	
<i>Sida hookeriana</i>	DICOT	
<i>Silene armeria</i>	DICOT	
<i>Silene calabrica</i>	DICOT	
<i>Silene gallica</i>	DICOT	
<i>Silene gallica</i> var. <i>gallica</i>	DICOT	
<i>Silene gallica</i> var. <i>quinquevulnera</i>	DICOT	
<i>Silene nocturna</i>	DICOT	
<i>Siloxerus filifolius</i>	DICOT	
<i>Siloxerus humifusus</i>	DICOT	
<i>Silybum marianum</i>	DICOT	
<i>Sisymbrium irio</i>	DICOT	
<i>Sisymbrium orientale</i>	DICOT	

TAXON	CLASS	CONS
<i>Solanum americanum</i>	DICOT	
<i>Solanum aviculare</i>	DICOT	
<i>Solanum giganteum</i>	DICOT	
<i>Solanum laciniatum</i>	DICOT	
<i>Solanum linnaeanum</i>	DICOT	
<i>Solanum lycopersicum</i>	DICOT	
<i>Solanum nigrum</i>	DICOT	
<i>Solanum sisymbriifolium</i>	DICOT	
<i>Solanum symonii</i>	DICOT	
<i>Solidago altissima</i> var. <i>pluricephala</i>	DICOT	
<i>Solidago canadensis</i>	DICOT	
<i>Solidago chilensis</i>	DICOT	
<i>Soliva sessilis</i>	DICOT	
<i>Sonchus asper</i>	DICOT	
<i>Sonchus hydrophilus</i>	DICOT	
<i>Sonchus oleraceus</i>	DICOT	
<i>Spergula arvensis</i>	DICOT	
<i>Spergularia brevifolia</i>	DICOT	
<i>Spergularia marina</i>	DICOT	
<i>Spergularia rubra</i>	DICOT	
<i>Sphaerolobium hygrophilum</i>	DICOT	
<i>Sphaerolobium linophyllum</i>	DICOT	
<i>Sphaerolobium macranthum</i>	DICOT	
<i>Sphaerolobium medium</i>	DICOT	
<i>Sphaerolobium vimineum</i>	DICOT	
<i>Spyridium globulosum</i>	DICOT	
<i>Spyridium tridentatum</i>	DICOT	
<i>Stachys arvensis</i>	DICOT	
<i>Stachystemon vermicularis</i>	DICOT	
<i>Stackhousia huegelii</i>	DICOT	
<i>Stackhousia monogyna</i>	DICOT	
<i>Stellaria media</i>	DICOT	
<i>Stellaria pallida</i>	DICOT	
<i>Stenanthemum humile</i>	DICOT	

TAXON	CLASS	CONS
<i>Stenanthemum notiale</i> subsp. <i>chamelum</i>	DICOT	
<i>Stenopetalum gracile</i>	DICOT	
<i>Stirlingia latifolia</i>	DICOT	
<i>Stirlingia simplex</i>	DICOT	
<i>Stylidium aceratum</i>	DICOT	P3
<i>Stylidium adpressum</i>	DICOT	
<i>Stylidium amoenum</i>	DICOT	
<i>Stylidium androsaceum</i>	DICOT	
<i>Stylidium araeophyllum</i>	DICOT	
<i>Stylidium asteroideum</i>	DICOT	P3
<i>Stylidium bicolor</i>	DICOT	
<i>Stylidium bindoon</i>	DICOT	
<i>Stylidium brunonianum</i>	DICOT	
<i>Stylidium carnosum</i>	DICOT	
<i>Stylidium cygnorum</i>	DICOT	
<i>Stylidium despectum</i>	DICOT	
<i>Stylidium dichotomum</i>	DICOT	
<i>Stylidium diuroides</i>	DICOT	
<i>Stylidium diuroides</i> subsp. <i>diuroides</i>	DICOT	
<i>Stylidium divaricatum</i>	DICOT	
<i>Stylidium eriopodum</i>	DICOT	
<i>Stylidium guttatum</i>	DICOT	
<i>Stylidium hesperium</i>	DICOT	
<i>Stylidium hispidum</i>	DICOT	
<i>Stylidium inundatum</i>	DICOT	
<i>Stylidium junceum</i> subsp. <i>junceum</i>	DICOT	
<i>Stylidium longitubum</i>	DICOT	P4
<i>Stylidium macrocarpum</i>	DICOT	
<i>Stylidium maritimum</i>	DICOT	P3
<i>Stylidium neurophyllum</i>	DICOT	
<i>Stylidium obtusatum</i>	DICOT	
<i>Stylidium paludicola</i>	DICOT	P3
<i>Stylidium perpusillum</i>	DICOT	
<i>Stylidium petiolare</i>	DICOT	

TAXON	CLASS	CONS
<i>Stylidium piliferum</i>	DICOT	
<i>Stylidium pubigerum</i>	DICOT	
<i>Stylidium pulchellum</i>	DICOT	
<i>Stylidium repens</i>	DICOT	
<i>Stylidium rigidulum</i>	DICOT	
<i>Stylidium roseoalatum</i>	DICOT	
<i>Stylidium scariosum</i>	DICOT	
<i>Stylidium schoenoides</i>	DICOT	
<i>Stylidium striatum</i>	DICOT	P4
<i>Stylidium thesioides</i>	DICOT	
<i>Stylidium utricularioides</i>	DICOT	
<i>Styphelia filifolia</i>	DICOT	P3
<i>Styphelia tenuiflora</i>	DICOT	
<i>Suaeda australis</i>	DICOT	
<i>Succowia balearica</i>	DICOT	
<i>Symphyotrichum squamatum</i>	DICOT	
<i>Synaphea acutiloba</i>	DICOT	
<i>Synaphea gracillima</i>	DICOT	
<i>Synaphea</i> sp. Fairbridge Farm (D. Papenfus 696)	DICOT	CR
<i>Synaphea spinulosa</i>	DICOT	
<i>Synaphea spinulosa</i> subsp. <i>spinulosa</i>	DICOT	
<i>Tagetes minuta</i>	DICOT	
<i>Taraxacum khatoonae</i>	DICOT	
<i>Taraxacum officinale</i>	DICOT	
<i>Taxandria linearifolia</i>	DICOT	
<i>Tecticornia halocnemoides</i>	DICOT	
<i>Tecticornia halocnemoides</i> subsp. <i>halocnemoides</i>	DICOT	
<i>Tecticornia indica</i> subsp. <i>bidens</i>	DICOT	
<i>Tecticornia lepidosperma</i>	DICOT	
<i>Tecticornia pergranulata</i>	DICOT	
<i>Tecticornia pergranulata</i> subsp. <i>pergranulata</i>	DICOT	
<i>Templetonia drummondii</i>	DICOT	
<i>Templetonia retusa</i>	DICOT	
<i>Tersonia cyathiflora</i>	DICOT	

TAXON	CLASS	CONS
<i>Tetragonia decumbens</i>	DICOT	
<i>Tetragonia nigrescens</i>	DICOT	
<i>Tetragonia tetragonoides</i>	DICOT	
<i>Tetratheca hirsuta</i> subsp. <i>hirsuta</i>	DICOT	
<i>Tetratheca hirsuta</i> subsp. <i>viminea</i>	DICOT	
<i>Tetratheca nuda</i>	DICOT	
<i>Thomasia cognata</i>	DICOT	
<i>Thomasia foliosa</i>	DICOT	
<i>Thomasia grandiflora</i>	DICOT	
<i>Thomasia macrocarpa</i>	DICOT	
<i>Thomasia paniculata</i>	DICOT	
<i>Thomasia pauciflora</i>	DICOT	
<i>Thomasia petalocalyx</i>	DICOT	
<i>Thomasia purpurea</i>	DICOT	
<i>Thomasia rulingioides</i>	DICOT	
<i>Thomasia triphylla</i>	DICOT	
<i>Threlkeldia diffusa</i>	DICOT	
<i>Thryptomene saxicola</i>	DICOT	
<i>Trachymene coerulea</i> subsp. <i>coerulea</i>	DICOT	
<i>Trachymene coerulea</i> var. <i>coerulea</i>	DICOT	
<i>Trachymene cyanopetala</i>	DICOT	
<i>Trachymene ornata</i>	DICOT	
<i>Trachymene pilosa</i>	DICOT	
<i>Tribulus terrestris</i>	DICOT	
<i>Trichocline spathulata</i>	DICOT	
<i>Trifolium angustifolium</i>	DICOT	
<i>Trifolium angustifolium</i> var. <i>angustifolium</i>	DICOT	
<i>Trifolium arvense</i>	DICOT	
<i>Trifolium arvense</i> var. <i>arvense</i>	DICOT	
<i>Trifolium campestre</i>	DICOT	
<i>Trifolium campestre</i> var. <i>campestre</i>	DICOT	
<i>Trifolium cernuum</i>	DICOT	
<i>Trifolium cherleri</i>	DICOT	
<i>Trifolium dubium</i>	DICOT	

TAXON	CLASS	CONS
<i>Trifolium fragiferum</i> var. <i>fragiferum</i>	DICOT	
<i>Trifolium glomeratum</i>	DICOT	
<i>Trifolium hirtum</i>	DICOT	
<i>Trifolium hybridum</i> var. <i>hybridum</i>	DICOT	
<i>Trifolium incarnatum</i> var. <i>incarnatum</i>	DICOT	
<i>Trifolium michelianum</i>	DICOT	
<i>Trifolium ornithopodioides</i>	DICOT	
<i>Trifolium pratense</i> var. <i>sativum</i>	DICOT	
<i>Trifolium repens</i>	DICOT	
<i>Trifolium repens</i> var. <i>repens</i>	DICOT	
<i>Trifolium resupinatum</i> var. <i>majus</i>	DICOT	
<i>Trifolium resupinatum</i> var. <i>resupinatum</i>	DICOT	
<i>Trifolium scabrum</i>	DICOT	
<i>Trifolium spumosum</i>	DICOT	
<i>Trifolium subterraneum</i>	DICOT	
<i>Trifolium suffocatum</i>	DICOT	
<i>Trifolium tomentosum</i>	DICOT	
<i>Trifolium tomentosum</i> var. <i>tomentosum</i>	DICOT	
<i>Tripterococcus brunonis</i>	DICOT	
<i>Tripterococcus</i> sp. (A.S. George 14234)	DICOT	
<i>Tripterococcus</i> sp. <i>Brachylobus</i> (A.S. George 14234)	DICOT	P4
<i>Trithuria bibracteata</i>	DICOT	
<i>Trithuria submersa</i>	DICOT	
<i>Tropaeolum majus</i>	DICOT	
<i>Tropaeolum pentaphyllum</i>	DICOT	
<i>Trymalium albicans</i>	DICOT	
<i>Trymalium floribundum</i>	DICOT	
<i>Trymalium ledifolium</i>	DICOT	
<i>Trymalium ledifolium</i> var. <i>ledifolium</i>	DICOT	
<i>Trymalium ledifolium</i> var. <i>rosmarinifolium</i>	DICOT	
<i>Trymalium odoratissimum</i> subsp. <i>odoratissimum</i>	DICOT	
<i>Ulex europaeus</i>	DICOT	
<i>Ulmus parvifolia</i>	DICOT	
<i>Urospermum picroides</i>	DICOT	

TAXON	CLASS	CONS
<i>Ursinia anthemoides</i>	DICOT	
<i>Ursinia anthemoides</i> subsp. <i>anthemoides</i>	DICOT	
<i>Urtica urens</i>	DICOT	
<i>Utricularia gibba</i>	DICOT	
<i>Utricularia inaequalis</i>	DICOT	
<i>Utricularia menziesii</i>	DICOT	
<i>Utricularia multifida</i>	DICOT	
<i>Utricularia tenella</i>	DICOT	
<i>Utricularia violacea</i>	DICOT	
<i>Utricularia volubilis</i>	DICOT	
<i>Velleia trinervis</i>	DICOT	
<i>Vellereophyton dealbatum</i>	DICOT	
<i>Verbascum thapsus</i> subsp. <i>thapsus</i>	DICOT	
<i>Verbascum virgatum</i>	DICOT	
<i>Verbena incompta</i>	DICOT	
<i>Verbena rigida</i> var. <i>rigida</i>	DICOT	
<i>Verbesina encelioides</i>	DICOT	
<i>Verbesina encelioides</i> var. <i>encelioides</i>	DICOT	
<i>Veronica aff. calycina</i> (BJK & NG 235)	DICOT	
<i>Veronica arvensis</i>	DICOT	
<i>Veronica distans</i>	DICOT	
<i>Veronica persica</i>	DICOT	
<i>Verticordia acerosa</i> var. <i>acerosa</i>	DICOT	
<i>Verticordia acerosa</i> var. <i>preissii</i>	DICOT	
<i>Verticordia densiflora</i>	DICOT	
<i>Verticordia densiflora</i> var. <i>densiflora</i>	DICOT	
<i>Verticordia drummondii</i>	DICOT	
<i>Verticordia eriocephala</i>	DICOT	
<i>Verticordia huegelii</i> var. <i>huegelii</i>	DICOT	
<i>Verticordia lindleyi</i> subsp. <i>lindleyi</i>	DICOT	P4
<i>Verticordia monadelpha</i>	DICOT	
<i>Verticordia monadelpha</i> var. <i>monadelpha</i>	DICOT	
<i>Verticordia nitens</i>	DICOT	
<i>Verticordia pennigera</i>	DICOT	

TAXON	CLASS	CONS
<i>Verticordia plumosa</i> var. <i>brachyphylla</i>	DICOT	
<i>Verticordia plumosa</i> var. <i>plumosa</i>	DICOT	
<i>Verticordia preissii</i>	DICOT	
<i>Verticordia venusta</i>	DICOT	P3
<i>Vicia benghalensis</i>	DICOT	
<i>Vicia hirsuta</i>	DICOT	
<i>Vicia sativa</i>	DICOT	
<i>Vicia sativa</i> subsp. <i>cordata</i>	DICOT	
<i>Vicia sativa</i> subsp. <i>nigra</i>	DICOT	
<i>Vicia sativa</i> subsp. <i>sativa</i>	DICOT	
<i>Vicia tetrasperma</i>	DICOT	
<i>Viminaria juncea</i>	DICOT	
<i>Wahlenbergia capensis</i>	DICOT	
<i>Wahlenbergia preissii</i>	DICOT	
<i>Waitzia citrina</i>	DICOT	
<i>Waitzia nitida</i>	DICOT	
<i>Waitzia suaveolens</i>	DICOT	
<i>Waitzia suaveolens</i> var. <i>suaveolens</i>	DICOT	
<i>Waltheria indica</i>	DICOT	
<i>Westringia dampieri</i>	DICOT	
<i>Wigandia urens</i> var. <i>caracasana</i>	DICOT	
<i>Wilsonia backhousei</i>	DICOT	
<i>Xanthium occidentale</i>	DICOT	
<i>Xanthium spinosum</i>	DICOT	
<i>Xanthosia ciliata</i>	DICOT	
<i>Xanthosia huegelii</i>	DICOT	
<i>Xylomelum occidentale</i>	DICOT	
<i>Youngia japonica</i>	DICOT	
<i>Zygophyllum fruticosum</i>	DICOT	
<i>Adiantum capillus-veneris</i>	FERN	P2
<i>Anogramma leptophylla</i>	FERN	
<i>Azolla rubra</i>	FERN	
<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	FERN	
<i>Cyathea cooperi</i>	FERN	

TAXON	CLASS	CONS
<i>Isoetes drummondii</i>	FERN	
<i>Marsilea mutica</i>	FERN	
<i>Phylloglossum drummondii</i>	FERN	
<i>Pleurosorus rutifolius</i>	FERN	
<i>Pteridium esculentum</i> subsp. <i>esculentum</i>	FERN	
<i>Salvinia molesta</i>	FERN	
<i>Schizaea fistulosa</i>	FERN	
<i>Selaginella gracillima</i>	FERN	
<i>Actinostrobus pyramidalis</i>	GYMNO	
<i>Callitris acuminata</i>	GYMNO	
<i>Callitris preissii</i>	GYMNO	
<i>Callitris pyramidalis</i>	GYMNO	
<i>Callitris roei</i>	GYMNO	
<i>Callitris verrucosa</i>	GYMNO	
<i>Macrozamia fraseri</i>	GYMNO	
<i>Macrozamia riedlei</i>	GYMNO	
<i>Pinus halepensis</i>	GYMNO	
<i>Anthoceros laevis</i>	LIVERWORT	
<i>Cephaloziella exiliflora</i>	LIVERWORT	
<i>Cephaloziella varians</i>	LIVERWORT	
<i>Chiloscyphus semiteres</i> var. <i>semiteres</i>	LIVERWORT	
<i>Marchantia berteroana</i>	LIVERWORT	
<i>Riccia bifurca</i>	LIVERWORT	
<i>Acanthocarpus canaliculatus</i>	MONOCOT	
<i>Acanthocarpus preissii</i>	MONOCOT	
<i>Agave americana</i>	MONOCOT	
<i>Agave angustifolia</i>	MONOCOT	
<i>Agrostocrinum hirsutum</i>	MONOCOT	
<i>Agrostocrinum scabrum</i> subsp. <i>scabrum</i>	MONOCOT	
<i>Aira caryophyllea</i>	MONOCOT	
<i>Aira cupaniana</i>	MONOCOT	
<i>Aira praecox</i>	MONOCOT	
<i>Albuca canadensis</i>	MONOCOT	
<i>Albuca flaccida</i>	MONOCOT	

TAXON	CLASS	CONS
<i>Alexgeorgea nitens</i>	MONOCOT	
<i>Allium ampeloprasum</i>	MONOCOT	
<i>Allium neapolitanum</i>	MONOCOT	
<i>Allium porrum</i>	MONOCOT	
<i>Allium triquetrum</i>	MONOCOT	
<i>Alocasia brisbanensis</i>	MONOCOT	
<i>Alopecurus myosuroides</i>	MONOCOT	
<i>Alstroemeria psittacina</i>	MONOCOT	
<i>Althenia australis</i>	MONOCOT	
<i>Althenia preissii</i>	MONOCOT	
<i>Amaryllis belladonna</i>	MONOCOT	
<i>Ammophila arenaria</i>	MONOCOT	
<i>Ammophila arenaria</i> subsp. <i>arenaria</i>	MONOCOT	
<i>Amphibolis antarctica</i>	MONOCOT	
<i>Amphibolis griffithii</i>	MONOCOT	
<i>Amphibromus nervosus</i>	MONOCOT	
<i>Amhipogon amhipogonoides</i>	MONOCOT	
<i>Amhipogon debilis</i>	MONOCOT	
<i>Amhipogon laguroides</i> subsp. <i>laguroides</i>	MONOCOT	
<i>Amhipogon turbinatus</i>	MONOCOT	
<i>Anarthria gracilis</i>	MONOCOT	
<i>Anigozanthos bicolor</i> subsp. <i>bicolor</i>	MONOCOT	
<i>Anigozanthos flavidus</i>	MONOCOT	
<i>Anigozanthos flavidus</i> x <i>manglesii</i>	MONOCOT	
<i>Anigozanthos humilis</i>	MONOCOT	
<i>Anigozanthos humilis</i> subsp. <i>humilis</i>	MONOCOT	
<i>Anigozanthos humilis</i> x <i>manglesii</i>	MONOCOT	
<i>Anigozanthos manglesii</i>	MONOCOT	
<i>Anigozanthos manglesii</i> subsp. <i>manglesii</i>	MONOCOT	
<i>Anigozanthos manglesii</i> x <i>viridis</i>	MONOCOT	
<i>Anigozanthos</i> sp.	MONOCOT	
<i>Anigozanthos viridis</i> subsp. <i>viridis</i>	MONOCOT	
<i>Aphelia cyperoides</i>	MONOCOT	
<i>Aphelia drummondii</i>	MONOCOT	

TAXON	CLASS	CONS
<i>Aponogeton hexatepalus</i>	MONOCOT	P4
<i>Arnocrinum preissii</i>	MONOCOT	
<i>Arrhenatherum elatius</i> var. <i>bulbosum</i>	MONOCOT	
<i>Arthropodium capillipes</i>	MONOCOT	
<i>Arundo donax</i>	MONOCOT	
<i>Asparagus aethiopicus</i>	MONOCOT	
<i>Asparagus asparagoides</i>	MONOCOT	
<i>Asparagus declinatus</i>	MONOCOT	
<i>Asparagus officinalis</i>	MONOCOT	
<i>Asparagus plumosus</i>	MONOCOT	
<i>Asphodelus fistulosus</i>	MONOCOT	
<i>Austrostipa campylachne</i>	MONOCOT	
<i>Austrostipa compressa</i>	MONOCOT	
<i>Austrostipa elegantissima</i>	MONOCOT	
<i>Austrostipa flavescens</i>	MONOCOT	
<i>Austrostipa hemipogon</i>	MONOCOT	
<i>Austrostipa mollis</i>	MONOCOT	
<i>Austrostipa mundula</i>	MONOCOT	P3
<i>Austrostipa nitida</i>	MONOCOT	
<i>Austrostipa semibarbata</i>	MONOCOT	
<i>Austrostipa variabilis</i>	MONOCOT	
<i>Avellinia michelii</i>	MONOCOT	
<i>Avena barbata</i>	MONOCOT	
<i>Avena fatua</i>	MONOCOT	
<i>Axonopus fissifolius</i>	MONOCOT	
<i>Babiana angustifolia</i>	MONOCOT	
<i>Babiana nana</i>	MONOCOT	
<i>Babiana tubulosa</i> var. <i>tubiflora</i>	MONOCOT	
<i>Baeometra uniflora</i>	MONOCOT	
<i>Baumea arthropphylla</i>	MONOCOT	
<i>Baumea articulata</i>	MONOCOT	
<i>Baumea juncea</i>	MONOCOT	
<i>Baumea laxa</i>	MONOCOT	
<i>Baumea preissii</i>	MONOCOT	

TAXON	CLASS	CONS
<i>Baumea rubiginosa</i>	MONOCOT	
<i>Baumea vaginalis</i>	MONOCOT	
<i>Blancoa canescens</i>	MONOCOT	
<i>Bolboschoenus caldwellii</i>	MONOCOT	
<i>Bolboschoenus fluviatilis</i>	MONOCOT	P1
<i>Borya scirpoidea</i>	MONOCOT	
<i>Borya sphaerocephala</i>	MONOCOT	
<i>Brachypodium distachyon</i>	MONOCOT	
<i>Briza maxima</i>	MONOCOT	
<i>Briza minor</i>	MONOCOT	
<i>Bromus alopecuroides</i>	MONOCOT	
<i>Bromus arenarius</i>	MONOCOT	
<i>Bromus catharticus</i>	MONOCOT	
<i>Bromus diandrus</i>	MONOCOT	
<i>Bromus hordeaceus</i>	MONOCOT	
<i>Bromus madritensis</i>	MONOCOT	
<i>Bromus rubens</i>	MONOCOT	
<i>Burchardia bairdiae</i>	MONOCOT	
<i>Burchardia congesta</i>	MONOCOT	
<i>Burchardia multiflora</i>	MONOCOT	
<i>Burchardia umbellata</i>	MONOCOT	
<i>Caesia micrantha</i>	MONOCOT	
<i>Caesia occidentalis</i>	MONOCOT	
<i>Caladenia arenicola</i>	MONOCOT	
<i>Caladenia arenicola x georgei</i>	MONOCOT	
<i>Caladenia arenicola x huegelii</i>	MONOCOT	
<i>Caladenia arenicola x paludosa</i>	MONOCOT	
<i>Caladenia denticulata</i>	MONOCOT	
<i>Caladenia discoidea</i>	MONOCOT	
<i>Caladenia ferruginea</i>	MONOCOT	
<i>Caladenia flava</i>	MONOCOT	
<i>Caladenia flava</i> subsp. <i>flava</i>	MONOCOT	
<i>Caladenia georgei</i>	MONOCOT	
<i>Caladenia hirta</i> subsp. <i>hirta</i>	MONOCOT	

TAXON	CLASS	CONS
<i>Caladenia huegelii</i>	MONOCOT	CR
<i>Caladenia latifolia</i>	MONOCOT	
<i>Caladenia longicauda</i>	MONOCOT	
<i>Caladenia longicauda</i> subsp. <i>calcigena</i>	MONOCOT	
<i>Caladenia longicauda</i> subsp. <i>longicauda</i>	MONOCOT	
<i>Caladenia longicauda</i> x <i>paludosa</i>	MONOCOT	
<i>Caladenia longiclavata</i>	MONOCOT	
<i>Caladenia marginata</i>	MONOCOT	
<i>Caladenia nobilis</i>	MONOCOT	
<i>Caladenia paludosa</i>	MONOCOT	
<i>Caladenia pectinata</i>	MONOCOT	
<i>Caladenia reptans</i> subsp. <i>reptans</i>	MONOCOT	
<i>Caladenia vulgata</i>	MONOCOT	
<i>Caladenia</i> x <i>spectabilis</i>	MONOCOT	
<i>Caladenia xantha</i>	MONOCOT	
<i>Calectasia grandiflora</i>	MONOCOT	P2
<i>Calectasia narragara</i>	MONOCOT	
<i>Calochilus stramenicola</i>	MONOCOT	
<i>Canna</i> x <i>generalis</i>	MONOCOT	
<i>Carex appressa</i>	MONOCOT	
<i>Carex divisa</i>	MONOCOT	
<i>Carex fascicularis</i>	MONOCOT	
<i>Carex preissii</i>	MONOCOT	
<i>Carex tereticaulis</i>	MONOCOT	P3
<i>Carex thecata</i>	MONOCOT	
<i>Cartonema philydroides</i>	MONOCOT	
<i>Catapodium rigida</i>	MONOCOT	
<i>Catapodium rigidum</i>	MONOCOT	
<i>Caustis dioica</i>	MONOCOT	
<i>Cenchrus clandestinus</i>	MONOCOT	
<i>Cenchrus echinatus</i>	MONOCOT	
<i>Cenchrus longisetus</i>	MONOCOT	
<i>Cenchrus macrourus</i>	MONOCOT	
<i>Cenchrus purpureus</i>	MONOCOT	

TAXON	CLASS	CONS
<i>Cenchrus setaceus</i>	MONOCOT	
<i>Cenchrus spinifex</i>	MONOCOT	
<i>Centrolepis aristata</i>	MONOCOT	
<i>Centrolepis drummondiana</i>	MONOCOT	
<i>Centrolepis inconspicua</i>	MONOCOT	
<i>Centrolepis mutica</i>	MONOCOT	
<i>Centrolepis polygyna</i>	MONOCOT	
<i>Chaetanthus aristatus</i>	MONOCOT	
<i>Chamaescilla corymbosa</i>	MONOCOT	
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	MONOCOT	
<i>Chasmanthe floribunda</i>	MONOCOT	
<i>Chloris gayana</i>	MONOCOT	
<i>Chordifex sinuosus</i>	MONOCOT	
<i>Chorizandra enodis</i>	MONOCOT	
<i>Coix lacryma-jobi</i>	MONOCOT	
<i>Colocasia esculenta</i> var. <i>esculenta</i>	MONOCOT	
<i>Commelina benghalensis</i>	MONOCOT	
<i>Conostylis aculeata</i>	MONOCOT	
<i>Conostylis aculeata</i> subsp. <i>aculeata</i>	MONOCOT	
<i>Conostylis aculeata</i> subsp. <i>cygnorum</i>	MONOCOT	
<i>Conostylis aculeata</i> subsp. <i>preissii</i>	MONOCOT	
<i>Conostylis aculeata</i> X <i>candicans</i>	MONOCOT	
<i>Conostylis aurea</i>	MONOCOT	
<i>Conostylis bracteata</i>	MONOCOT	P3
<i>Conostylis candicans</i>	MONOCOT	
<i>Conostylis candicans</i> subsp. <i>calcicola</i>	MONOCOT	
<i>Conostylis candicans</i> subsp. <i>candicans</i>	MONOCOT	
<i>Conostylis caricina</i>	MONOCOT	
<i>Conostylis festucacea</i> subsp. <i>festucacea</i>	MONOCOT	
<i>Conostylis juncea</i>	MONOCOT	
<i>Conostylis setigera</i>	MONOCOT	
<i>Conostylis setigera</i> subsp. <i>setigera</i>	MONOCOT	
<i>Conostylis setosa</i>	MONOCOT	
<i>Conostylis</i> sp.	MONOCOT	

TAXON	CLASS	CONS
<i>Cortaderia selloana</i> subsp. <i>selloana</i>	MONOCOT	
<i>Corynotheca micrantha</i>	MONOCOT	
<i>Corynotheca micrantha</i> var. <i>elongata</i>	MONOCOT	
<i>Corynotheca micrantha</i> var. <i>micrantha</i>	MONOCOT	
<i>Cyanella hyacinthoides</i>	MONOCOT	
<i>Cyanicula gemmata</i>	MONOCOT	
<i>Cyanicula sericea</i>	MONOCOT	
<i>Cyathochaeta avenacea</i>	MONOCOT	
<i>Cyathochaeta clandestina</i>	MONOCOT	
<i>Cyathochaeta teretifolia</i>	MONOCOT	P3
<i>Cycnogeton huegelii</i>	MONOCOT	
<i>Cycnogeton lineare</i>	MONOCOT	
<i>Cynodon dactylon</i>	MONOCOT	
<i>Cyperus brevifolius</i>	MONOCOT	
<i>Cyperus congestus</i>	MONOCOT	
<i>Cyperus eragrostis</i>	MONOCOT	
<i>Cyperus gymnocaulos</i>	MONOCOT	
<i>Cyperus involucratus</i>	MONOCOT	
<i>Cyperus laevigatus</i>	MONOCOT	
<i>Cyperus papyrus</i>	MONOCOT	
<i>Cyperus polystachyos</i>	MONOCOT	
<i>Cyperus tenellus</i>	MONOCOT	
<i>Cyperus tenuiflorus</i>	MONOCOT	
<i>Cyperus vaginatus</i>	MONOCOT	
<i>Cyperus vorsteri</i>	MONOCOT	
<i>Cyrtostylis huegelii</i>	MONOCOT	
<i>Cyrtostylis robusta</i>	MONOCOT	
<i>Cyrtostylis tenuissima</i>	MONOCOT	
<i>Cytogonidium leptocarpoides</i>	MONOCOT	
<i>Dactyloctenium australe</i>	MONOCOT	
<i>Danthonia occidentalis</i>	MONOCOT	
<i>Dasypogon bromeliifolius</i>	MONOCOT	
<i>Dasypogon obliquifolius</i>	MONOCOT	
<i>Desmocladus asper</i>	MONOCOT	

TAXON	CLASS	CONS
<i>Desmocladius fasciculatus</i>	MONOCOT	
<i>Desmocladius flexuosus</i>	MONOCOT	
<i>Desmocladius lateriflorus</i>	MONOCOT	
<i>Deyeuxia quadriseta</i>	MONOCOT	
<i>Dianella revoluta</i>	MONOCOT	
<i>Dianella revoluta</i> var. <i>divaricata</i>	MONOCOT	
<i>Dichelachne crinita</i>	MONOCOT	
<i>Dichopogon capillipes</i>	MONOCOT	
<i>Dichopogon preissii</i>	MONOCOT	
<i>Dielsia stenostachya</i>	MONOCOT	
<i>Digitaria aequiglumis</i>	MONOCOT	
<i>Digitaria ciliaris</i>	MONOCOT	
<i>Digitaria didactyla</i>	MONOCOT	
<i>Digitaria eriantha</i>	MONOCOT	
<i>Digitaria sanguinalis</i>	MONOCOT	
<i>Digitaria violascens</i>	MONOCOT	
<i>Dioscorea hastifolia</i>	MONOCOT	
<i>Disa bracteata</i>	MONOCOT	
<i>Diuris corymbosa</i>	MONOCOT	
<i>Diuris decremenda</i>	MONOCOT	
<i>Diuris drummondii</i>	MONOCOT	EN
<i>Diuris laxiflora</i>	MONOCOT	
<i>Diuris longifolia</i>	MONOCOT	
<i>Diuris magnifica</i>	MONOCOT	
<i>Diuris purdiei</i>	MONOCOT	EN
<i>Drakaea elastica</i>	MONOCOT	CR
<i>Drakaea glyptodon</i>	MONOCOT	
<i>Drakaea livida</i>	MONOCOT	
<i>Drakaea micrantha</i>	MONOCOT	EN
<i>Echinochloa colona</i>	MONOCOT	
<i>Echinochloa crus-galli</i>	MONOCOT	
<i>Echinochloa crus-pavonis</i>	MONOCOT	
<i>Echinochloa pyramidalis</i>	MONOCOT	
<i>Echinochloa telmatophila</i>	MONOCOT	

TAXON	CLASS	CONS
<i>Egeria densa</i>	MONOCOT	
<i>Ehrharta brevifolia</i>	MONOCOT	
<i>Ehrharta brevifolia</i> var. <i>brevifolia</i>	MONOCOT	
<i>Ehrharta brevifolia</i> var. <i>cuspidata</i>	MONOCOT	
<i>Ehrharta calycina</i>	MONOCOT	
<i>Ehrharta longiflora</i>	MONOCOT	
<i>Eleocharis acuta</i>	MONOCOT	
<i>Eleocharis keigheryi</i>	MONOCOT	VU
<i>Eleusine indica</i>	MONOCOT	
<i>Elythranthera brunonis</i>	MONOCOT	
<i>Elythranthera emarginata</i>	MONOCOT	
<i>Empodisma gracillimum</i>	MONOCOT	
<i>Epiblema grandiflorum</i>	MONOCOT	
<i>Eragrostis cilianensis</i>	MONOCOT	
<i>Eragrostis curvula</i>	MONOCOT	
<i>Eragrostis elongata</i>	MONOCOT	
<i>Eragrostis tenuifolia</i>	MONOCOT	
<i>Eriachne ovata</i>	MONOCOT	
<i>Eriochilus dilatatus</i>	MONOCOT	
<i>Eriochilus dilatatus</i> subsp. <i>multiflorus</i>	MONOCOT	
<i>Eriochilus helonomos</i>	MONOCOT	
<i>Eriochilus scaber</i> subsp. <i>scaber</i>	MONOCOT	
<i>Eriochilus tenuis</i>	MONOCOT	
<i>Eustachys distichophylla</i>	MONOCOT	
<i>Ferraria crispa</i>	MONOCOT	
<i>Ferraria crispa</i> subsp. <i>crispa</i>	MONOCOT	
<i>Festuca arundinacea</i>	MONOCOT	
<i>Festuca rubra</i>	MONOCOT	
<i>Ficinia nodosa</i>	MONOCOT	
<i>Fimbristylis velata</i>	MONOCOT	
<i>Freesia</i> aff. <i>leichtlinii</i>	MONOCOT	
<i>Freesia alba</i> x <i>leichtlinii</i>	MONOCOT	
<i>Freesia leichtlinii</i>	MONOCOT	
<i>Furcraea foetida</i>	MONOCOT	

TAXON	CLASS	CONS
<i>Furcraea selloa</i>	MONOCOT	
<i>Gahnia decomposita</i>	MONOCOT	
<i>Gahnia trifida</i>	MONOCOT	
<i>Gladiolus angustus</i>	MONOCOT	
<i>Gladiolus carneus</i>	MONOCOT	
<i>Gladiolus caryophyllaceus</i>	MONOCOT	
<i>Gladiolus undulatus</i>	MONOCOT	
<i>Glyceria declinata</i>	MONOCOT	
<i>Haemodorum brevisepalum</i>	MONOCOT	
<i>Haemodorum laxum</i>	MONOCOT	
<i>Haemodorum loratum</i>	MONOCOT	P3
<i>Haemodorum paniculatum</i>	MONOCOT	
<i>Haemodorum simplex</i>	MONOCOT	
<i>Haemodorum spicatum</i>	MONOCOT	
<i>Hemarthria uncinata</i> var. <i>uncinata</i>	MONOCOT	
<i>Hensmania turbinata</i>	MONOCOT	
<i>Hesperantha falcata</i>	MONOCOT	
<i>Holcus lanatus</i>	MONOCOT	
<i>Hordeum glaucum</i>	MONOCOT	
<i>Hordeum leporinum</i>	MONOCOT	
<i>Hordeum marinum</i>	MONOCOT	
<i>Hordeum vulgare</i>	MONOCOT	
<i>Hydrilla verticillata</i>	MONOCOT	
<i>Hyparrhenia hirta</i>	MONOCOT	
<i>Hypolaena exsulca</i>	MONOCOT	
<i>Hypolaena fastigiata</i>	MONOCOT	
<i>Hypolaena pubescens</i>	MONOCOT	
<i>Hypolaena robusta</i>	MONOCOT	P4
<i>Isolepis cernua</i> var. <i>cernua</i>	MONOCOT	
<i>Isolepis cernua</i> var. <i>setiformis</i>	MONOCOT	
<i>Isolepis cyperoides</i>	MONOCOT	
<i>Isolepis hookeriana</i>	MONOCOT	
<i>Isolepis marginata</i>	MONOCOT	
<i>Isolepis oldfieldiana</i>	MONOCOT	

TAXON	CLASS	CONS
<i>Isolepis prolifera</i>	MONOCOT	
<i>Isolepis stellata</i>	MONOCOT	
<i>Ixia maculata</i>	MONOCOT	
<i>Ixia paniculata</i>	MONOCOT	
<i>Ixia polystachya</i>	MONOCOT	
<i>Johnsonia pubescens</i>	MONOCOT	
<i>Johnsonia pubescens</i> subsp. <i>cygnorum</i>	MONOCOT	P2
<i>Johnsonia pubescens</i> subsp. <i>pubescens</i>	MONOCOT	
<i>Juncus acutus</i>	MONOCOT	
<i>Juncus acutus</i> subsp. <i>acutus</i>	MONOCOT	
<i>Juncus amabilis</i>	MONOCOT	
<i>Juncus bufonius</i>	MONOCOT	
<i>Juncus capitatus</i>	MONOCOT	
<i>Juncus holoschoenus</i>	MONOCOT	
<i>Juncus kraussii</i>	MONOCOT	
<i>Juncus kraussii</i> subsp. <i>australiensis</i>	MONOCOT	
<i>Juncus microcephalus</i>	MONOCOT	
<i>Juncus oxycarpus</i>	MONOCOT	
<i>Juncus pallidus</i>	MONOCOT	
<i>Juncus pauciflorus</i>	MONOCOT	
<i>Juncus usitatus</i>	MONOCOT	
<i>Kingia australis</i>	MONOCOT	
<i>Lachenalia aloides</i>	MONOCOT	
<i>Lachenalia bulbifera</i>	MONOCOT	
<i>Lachenalia mutabilis</i>	MONOCOT	
<i>Lachenalia reflexa</i>	MONOCOT	
<i>Lachnagrostis filiformis</i>	MONOCOT	
<i>Lachnagrostis plebeia</i>	MONOCOT	
<i>Lagurus ovatus</i>	MONOCOT	
<i>Landoltia punctata</i>	MONOCOT	
<i>Laxmannia grandiflora</i> subsp. <i>grandiflora</i>	MONOCOT	
<i>Laxmannia ramosa</i>	MONOCOT	
<i>Laxmannia ramosa</i> subsp. <i>ramosa</i>	MONOCOT	
<i>Laxmannia sessiliflora</i> subsp. <i>australis</i>	MONOCOT	

TAXON	CLASS	CONS
<i>Laxmannia squarrosa</i>	MONOCOT	
<i>Lemna disperma</i>	MONOCOT	
<i>Lepidobolus preissianus</i>	MONOCOT	
<i>Lepidobolus preissianus</i> subsp. <i>preissianus</i>	MONOCOT	
<i>Lepidosperma angustatum</i>	MONOCOT	
<i>Lepidosperma asperatum</i>	MONOCOT	
<i>Lepidosperma calcicola</i>	MONOCOT	
<i>Lepidosperma costale</i>	MONOCOT	
<i>Lepidosperma gladiatum</i>	MONOCOT	
<i>Lepidosperma gladiatum</i> x <i>angustatum</i>	MONOCOT	
<i>Lepidosperma leptostachyum</i>	MONOCOT	
<i>Lepidosperma longitudinale</i>	MONOCOT	
<i>Lepidosperma oldhamii</i>	MONOCOT	
<i>Lepidosperma pubisquameum</i>	MONOCOT	
<i>Lepidosperma resinosum</i>	MONOCOT	
<i>Lepidosperma scabrum</i>	MONOCOT	
<i>Lepidosperma</i> sp. (coastal terete variant) (BJK&NG 231)	MONOCOT	
<i>Lepidosperma</i> sp. Coastal Dunes (R.J. Cranfield 9963)	MONOCOT	
<i>Lepidosperma squamatum</i>	MONOCOT	
<i>Lepidosperma striatum</i>	MONOCOT	
<i>Leporella fimbriata</i>	MONOCOT	
<i>Leptocarpus canus</i>	MONOCOT	
<i>Leptocarpus coangustatus</i>	MONOCOT	
<i>Leptocarpus decipiens</i>	MONOCOT	
<i>Leptocarpus kraussii</i>	MONOCOT	
<i>Leptocarpus laxus</i>	MONOCOT	
<i>Leptocarpus roycei</i>	MONOCOT	
<i>Leptocarpus scariosus</i>	MONOCOT	
<i>Leptocarpus tenax</i>	MONOCOT	
<i>Leptocarpus tephrius</i>	MONOCOT	
<i>Leptoceras menziesii</i>	MONOCOT	
<i>Lepyrodis glauca</i>	MONOCOT	
<i>Lepyrodis macra</i>	MONOCOT	
<i>Lepyrodis muiirii</i>	MONOCOT	

TAXON	CLASS	CONS
<i>Leucojum aestivum</i>	MONOCOT	
<i>Limnobiium laevigatum</i>	MONOCOT	
<i>Lolium loliaceum</i>	MONOCOT	
<i>Lolium multiflorum</i>	MONOCOT	
<i>Lolium perenne</i>	MONOCOT	
<i>Lolium perenne x rigidum</i>	MONOCOT	
<i>Lolium remotum</i>	MONOCOT	
<i>Lolium rigidum</i>	MONOCOT	
<i>Lolium temulentum forma arvense</i>	MONOCOT	
<i>Lolium temulentum forma temulentum</i>	MONOCOT	
<i>Lolium x hybridum</i>	MONOCOT	
<i>Lomandra caespitosa</i>	MONOCOT	
<i>Lomandra hermaphrodita</i>	MONOCOT	
<i>Lomandra maritima</i>	MONOCOT	
<i>Lomandra micrantha</i> subsp. <i>micrantha</i>	MONOCOT	
<i>Lomandra nigricans</i>	MONOCOT	
<i>Lomandra odora</i>	MONOCOT	
<i>Lomandra preissii</i>	MONOCOT	
<i>Lomandra purpurea</i>	MONOCOT	
<i>Lomandra sericea</i>	MONOCOT	
<i>Lomandra sonderi</i>	MONOCOT	
<i>Lomandra spartea</i>	MONOCOT	
<i>Lomandra suaveolens</i>	MONOCOT	
<i>Loxocarya fasciculata</i>	MONOCOT	
<i>Loxocarya flexuosa</i>	MONOCOT	
<i>Luzula meridionalis</i>	MONOCOT	
<i>Lyginia barbata</i>	MONOCOT	
<i>Lyginia imberbis</i>	MONOCOT	
<i>Lyperanthus nigricans</i>	MONOCOT	
<i>Megathyrsus maximus</i> var. <i>maximus</i>	MONOCOT	
<i>Melinis minutiflora</i>	MONOCOT	
<i>Melinis repens</i>	MONOCOT	
<i>Mesomelaena pseudostygia</i>	MONOCOT	
<i>Mesomelaena tetragona</i>	MONOCOT	

TAXON	CLASS	CONS
<i>Microlaena stipoides</i>	MONOCOT	
<i>Microtis arenaria</i>	MONOCOT	
<i>Microtis atrata</i>	MONOCOT	
<i>Microtis cupularis</i>	MONOCOT	
<i>Microtis media</i>	MONOCOT	
<i>Microtis media</i> subsp. <i>densiflora</i>	MONOCOT	
<i>Microtis media</i> subsp. <i>media</i>	MONOCOT	
<i>Miscanthus sinensis</i>	MONOCOT	
<i>Moraea flaccida</i>	MONOCOT	
<i>Moraea lewisiae</i>	MONOCOT	
<i>Moraea ochroleuca</i>	MONOCOT	
<i>Moraea setifolia</i>	MONOCOT	
<i>Musa acuminata</i>	MONOCOT	
<i>Muscari comosum</i>	MONOCOT	
<i>Myrsiphyllum asparagoides</i>	MONOCOT	
<i>Najas marina</i>	MONOCOT	
<i>Narcissus papyraceus</i>	MONOCOT	
<i>Narcissus tazetta</i> subsp. <i>aureus</i>	MONOCOT	
<i>Narcissus tazetta</i> subsp. <i>italicus</i>	MONOCOT	
<i>Narcissus tazetta</i> subsp. <i>tazetta</i>	MONOCOT	
<i>Neurachne alopecuroidea</i>	MONOCOT	
<i>Nothoscordum gracile</i>	MONOCOT	
<i>Ornithogalum arabicum</i>	MONOCOT	
<i>Orthrosanthus laxus</i>	MONOCOT	
<i>Orthrosanthus laxus</i> var. <i>laxus</i>	MONOCOT	
<i>Ottelia ovalifolia</i>	MONOCOT	
<i>Ottelia ovalifolia</i> subsp. <i>ovalifolia</i>	MONOCOT	
<i>Panicum miliaceum</i>	MONOCOT	
<i>Panicum repens</i>	MONOCOT	
<i>Paracaleana hortiorum</i>	MONOCOT	
<i>Parapholis incurva</i>	MONOCOT	
<i>Paspalidium clementii</i>	MONOCOT	
<i>Paspalum dilatatum</i>	MONOCOT	
<i>Paspalum distichum</i>	MONOCOT	

TAXON	CLASS	CONS
<i>Paspalum notatum</i>	MONOCOT	
<i>Paspalum urvillei</i>	MONOCOT	
<i>Paspalum vaginatum</i>	MONOCOT	
<i>Patersonia juncea</i>	MONOCOT	
<i>Patersonia occidentalis</i>	MONOCOT	
<i>Patersonia occidentalis</i> var. <i>angustifolia</i>	MONOCOT	
<i>Patersonia occidentalis</i> var. <i>occidentalis</i>	MONOCOT	
<i>Pauridia glabella</i> var. <i>glabella</i>	MONOCOT	
<i>Pauridia occidentalis</i>	MONOCOT	
<i>Pauridia vaginata</i> var. <i>vaginata</i>	MONOCOT	
<i>Pennisetum setaceum</i>	MONOCOT	
<i>Pentameris pallida</i>	MONOCOT	
<i>Pentaschistis airoides</i>	MONOCOT	
<i>Phalaris angusta</i>	MONOCOT	
<i>Phalaris aquatica</i>	MONOCOT	
<i>Phalaris canariensis</i>	MONOCOT	
<i>Phalaris minor</i>	MONOCOT	
<i>Phalaris paradoxa</i>	MONOCOT	
<i>Pheladenia deformis</i>	MONOCOT	
<i>Philydrella drummondii</i>	MONOCOT	
<i>Philydrella pygmaea</i>	MONOCOT	
<i>Philydrella pygmaea</i> subsp. <i>pygmaea</i>	MONOCOT	
<i>Phlebocarya ciliata</i>	MONOCOT	
<i>Phlebocarya filifolia</i>	MONOCOT	
<i>Phleum arenarium</i>	MONOCOT	
<i>Phoenix canariensis</i>	MONOCOT	
<i>Piptatherum miliaceum</i>	MONOCOT	
<i>Poa annua</i>	MONOCOT	
<i>Poa bulbosa</i>	MONOCOT	
<i>Poa drummondiana</i>	MONOCOT	
<i>Poa homomalla</i>	MONOCOT	
<i>Poa poiiformis</i>	MONOCOT	
<i>Poa porphyroclados</i>	MONOCOT	
<i>Poa pratensis</i>	MONOCOT	

TAXON	CLASS	CONS
<i>Polypogon monspeliensis</i>	MONOCOT	
<i>Posidonia australis</i>	MONOCOT	
<i>Posidonia ostenfeldii</i>	MONOCOT	
<i>Potamogeton crispus</i>	MONOCOT	
<i>Potamogeton ochreatus</i>	MONOCOT	
<i>Prasophyllum cyphochilum</i>	MONOCOT	
<i>Prasophyllum drummondii</i>	MONOCOT	
<i>Prasophyllum drummondii x regium</i>	MONOCOT	
<i>Prasophyllum elatum</i>	MONOCOT	
<i>Prasophyllum fimbria</i>	MONOCOT	
<i>Prasophyllum gibbosum</i>	MONOCOT	
<i>Prasophyllum giganteum</i>	MONOCOT	
<i>Prasophyllum gracile</i>	MONOCOT	
<i>Prasophyllum hians</i>	MONOCOT	
<i>Prasophyllum macrostachyum</i>	MONOCOT	
<i>Prasophyllum odoratissimum</i>	MONOCOT	
<i>Prasophyllum parvifolium</i>	MONOCOT	
<i>Prasophyllum plumiforme</i>	MONOCOT	
<i>Prasophyllum regium</i>	MONOCOT	
<i>Pterostylis aff. nana</i>	MONOCOT	
<i>Pterostylis aspera</i>	MONOCOT	
<i>Pterostylis atosanguinea</i>	MONOCOT	
<i>Pterostylis barbata</i>	MONOCOT	
<i>Pterostylis brevisepala</i>	MONOCOT	
<i>Pterostylis dilatata</i>	MONOCOT	
<i>Pterostylis erubescens</i>	MONOCOT	
<i>Pterostylis glebosa</i>	MONOCOT	
<i>Pterostylis nana</i>	MONOCOT	
<i>Pterostylis orbiculata</i>	MONOCOT	
<i>Pterostylis pyramidalis</i>	MONOCOT	
<i>Pterostylis recurva</i>	MONOCOT	
<i>Pterostylis sanguinea</i>	MONOCOT	
<i>Pterostylis sp. crinkled leaf (G.J. Keighery 13426)</i>	MONOCOT	
<i>Pterostylis vittata</i>	MONOCOT	

TAXON	CLASS	CONS
<i>Pyrorchis nigricans</i>	MONOCOT	
<i>Romulea flava</i>	MONOCOT	
<i>Romulea flava</i> var. <i>minor</i>	MONOCOT	
<i>Romulea rosea</i>	MONOCOT	
<i>Romulea rosea</i> var. <i>australis</i>	MONOCOT	
<i>Romulea rosea</i> var. <i>communis</i>	MONOCOT	
<i>Rostraria cristata</i>	MONOCOT	
<i>Ruppia megacarpa</i>	MONOCOT	
<i>Ruppia polycarpa</i>	MONOCOT	
<i>Rytidosperma caespitosum</i>	MONOCOT	
<i>Rytidosperma occidentale</i>	MONOCOT	
<i>Rytidosperma setaceum</i>	MONOCOT	
<i>Sagittaria platyphylla</i>	MONOCOT	
<i>Schoenoplectus pungens</i>	MONOCOT	
<i>Schoenoplectus tabernaemontani</i>	MONOCOT	
<i>Schoenus andrewsii</i>	MONOCOT	
<i>Schoenus asperocarpus</i>	MONOCOT	
<i>Schoenus benthamii</i>	MONOCOT	P3
<i>Schoenus bifidus</i>	MONOCOT	
<i>Schoenus brevisetis</i>	MONOCOT	
<i>Schoenus caespititius</i>	MONOCOT	
<i>Schoenus capillifolius</i>	MONOCOT	P3
<i>Schoenus clandestinus</i>	MONOCOT	
<i>Schoenus curvifolius</i>	MONOCOT	
<i>Schoenus discifer</i>	MONOCOT	
<i>Schoenus efoliatus</i>	MONOCOT	
<i>Schoenus elegans</i>	MONOCOT	
<i>Schoenus grammatophyllus</i>	MONOCOT	
<i>Schoenus grandiflorus</i>	MONOCOT	
<i>Schoenus laevigatus</i>	MONOCOT	
<i>Schoenus lanatus</i>	MONOCOT	
<i>Schoenus latitans</i>	MONOCOT	
<i>Schoenus natans</i>	MONOCOT	P4
<i>Schoenus pedicellatus</i>	MONOCOT	

TAXON	CLASS	CONS
<i>Schoenus pennisetis</i>	MONOCOT	P3
<i>Schoenus plumosus</i>	MONOCOT	
<i>Schoenus rigens</i>	MONOCOT	
<i>Schoenus sculptus</i>	MONOCOT	
<i>Schoenus</i> sp. Waroona (G.J. Keighery 12235)	MONOCOT	P3
<i>Schoenus subbarbatus</i>	MONOCOT	
<i>Schoenus subbulbosus</i>	MONOCOT	
<i>Schoenus subfascicularis</i>	MONOCOT	
<i>Schoenus subflavus</i>	MONOCOT	
<i>Secale cereale</i>	MONOCOT	
<i>Setaria italica</i>	MONOCOT	
<i>Setaria palmifolia</i>	MONOCOT	
<i>Setaria parviflora</i>	MONOCOT	
<i>Setaria sphacelata</i>	MONOCOT	
<i>Sisyrinchium rosulatum</i>	MONOCOT	
<i>Sorghum bicolor</i>	MONOCOT	
<i>Sorghum halepense</i>	MONOCOT	
<i>Sorghum x drummondii</i>	MONOCOT	
<i>Sowerbaea laxiflora</i>	MONOCOT	
<i>Sparaxis bulbifera</i>	MONOCOT	
<i>Sparaxis pillansii</i>	MONOCOT	
<i>Spinifex hirsutus</i>	MONOCOT	
<i>Spinifex hirsutus x sericeus</i>	MONOCOT	
<i>Spinifex longifolius</i>	MONOCOT	
<i>Spinifex longifolius x sericeus</i>	MONOCOT	
<i>Spinifex sericeus</i>	MONOCOT	
<i>Spinifex sericeus x longifolius</i>	MONOCOT	
<i>Spinifex x alterniflorus</i>	MONOCOT	
<i>Sporobolus africanus</i>	MONOCOT	
<i>Sporobolus virginicus</i>	MONOCOT	
<i>Stenotaphrum secundatum</i>	MONOCOT	
<i>Stipa compressa</i>	MONOCOT	
<i>Stipa drummondii</i>	MONOCOT	
<i>Stipa elegantissima</i>	MONOCOT	

TAXON	CLASS	CONS
<i>Stipa flavescent</i>	MONOCOT	
<i>Stipa hemipogon</i>	MONOCOT	
<i>Stipa mollis</i>	MONOCOT	
<i>Stuckenia pectinata</i>	MONOCOT	
<i>Stypandra glauca</i>	MONOCOT	
<i>Tetraria australiensis</i>	MONOCOT	
<i>Tetraria octandra</i>	MONOCOT	
<i>Thalassodendron pachyrhizum</i>	MONOCOT	
<i>Thelymitra antennifera</i>	MONOCOT	
<i>Thelymitra benthamiana</i>	MONOCOT	
<i>Thelymitra campanulata</i>	MONOCOT	
<i>Thelymitra cornicina</i>	MONOCOT	
<i>Thelymitra crinita</i>	MONOCOT	
<i>Thelymitra flexuosa</i>	MONOCOT	
<i>Thelymitra flexuosa x vulgaris</i>	MONOCOT	
<i>Thelymitra macrophylla</i>	MONOCOT	
<i>Thelymitra mucida</i>	MONOCOT	
<i>Thelymitra spiralis</i>	MONOCOT	
<i>Thelymitra tigrina</i>	MONOCOT	
<i>Thelymitra variegata</i>	MONOCOT	CR
<i>Thelymitra villosa</i>	MONOCOT	
<i>Thelymitra vulgaris</i>	MONOCOT	
<i>Thinopyrum distichum</i>	MONOCOT	
<i>Thysanotus anceps</i>	MONOCOT	P3
<i>Thysanotus arbuscula</i>	MONOCOT	
<i>Thysanotus arenarius</i>	MONOCOT	
<i>Thysanotus asper</i>	MONOCOT	
<i>Thysanotus manglesianus</i>	MONOCOT	
<i>Thysanotus multiflorus</i>	MONOCOT	
<i>Thysanotus patersonii</i>	MONOCOT	
<i>Thysanotus sp. Badgingarra (E.A. Griffin 2511)</i>	MONOCOT	P2
<i>Thysanotus sp. Coastal plain (N.H. Brittan 66/63)</i>	MONOCOT	
<i>Thysanotus sp. manglesianus/patersonii group</i>	MONOCOT	
<i>Thysanotus sparteus</i>	MONOCOT	

TAXON	CLASS	CONS
<i>Thysanotus tenellus</i>	MONOCOT	
<i>Thysanotus thyrsoideus</i>	MONOCOT	
<i>Thysanotus triandrus</i>	MONOCOT	
<i>Trachyandra divaricata</i>	MONOCOT	
<i>Tradescantia fluminensis</i>	MONOCOT	
<i>Tremulina tremula</i>	MONOCOT	
<i>Tribolium uniolae</i>	MONOCOT	
<i>Tribonanthes australis</i>	MONOCOT	
<i>Tribonanthes australis x brachypetala</i>	MONOCOT	
<i>Tribonanthes australis x longipetala</i>	MONOCOT	
<i>Tribonanthes brachypetala</i>	MONOCOT	
<i>Tribonanthes longipetala</i>	MONOCOT	
<i>Tribonanthes violacea</i>	MONOCOT	
<i>Tricoryne elatior</i>	MONOCOT	
<i>Tricoryne humilis</i>	MONOCOT	
<i>Tricoryne tenella</i>	MONOCOT	
<i>Tricostularia neesii</i>	MONOCOT	
<i>Tricostularia neesii</i> var. <i>neesii</i>	MONOCOT	
<i>Triglochin isingiana</i>	MONOCOT	
<i>Triglochin minutissima</i>	MONOCOT	
<i>Triglochin mucronata</i>	MONOCOT	
<i>Triglochin muelleri</i>	MONOCOT	
<i>Triglochin nana</i>	MONOCOT	
<i>Triglochin striata</i>	MONOCOT	
<i>Triglochin trichophora</i>	MONOCOT	
<i>Trisetum flavescens</i>	MONOCOT	
<i>Triticum aestivum</i>	MONOCOT	
<i>Tritonia gladiolaris</i>	MONOCOT	
<i>Typha domingensis</i>	MONOCOT	
<i>Typha orientalis</i>	MONOCOT	
<i>Typhonium peltandroides</i>	MONOCOT	P1
<i>Urochilus sanguineus</i>	MONOCOT	
<i>Vallisneria australis</i>	MONOCOT	
<i>Vallisneria nana</i>	MONOCOT	

TAXON	CLASS	CONS
<i>Vulpia bromoides</i>	MONOCOT	
<i>Vulpia fasciculata</i>	MONOCOT	
<i>Vulpia membranacea</i>	MONOCOT	
<i>Vulpia myuros</i>	MONOCOT	
<i>Vulpia myuros forma megalura</i>	MONOCOT	
<i>Vulpia myuros forma myuros</i>	MONOCOT	
<i>Watsonia aletroides</i>	MONOCOT	
<i>Watsonia borbonica</i>	MONOCOT	
<i>Watsonia marginata</i>	MONOCOT	
<i>Watsonia meriana</i> var. <i>bulbillifera</i>	MONOCOT	
<i>Watsonia meriana</i> var. <i>meriana</i>	MONOCOT	
<i>Watsonia versfeldii</i>	MONOCOT	
<i>Wurmbea dioica</i>	MONOCOT	
<i>Wurmbea dioica</i> subsp. <i>alba</i>	MONOCOT	
<i>Wurmbea monantha</i>	MONOCOT	
<i>Xanthorrhoea brunonis</i>	MONOCOT	
<i>Xanthorrhoea brunonis</i> subsp. <i>brunonis</i>	MONOCOT	
<i>Xanthorrhoea brunonis</i> subsp. <i>semibarbata</i>	MONOCOT	
<i>Xanthorrhoea preissii</i>	MONOCOT	
<i>Zantedeschia aethiopica</i>	MONOCOT	
<i>Barbula calycina</i>	MOSS	
<i>Bryoerythrophyllum dubium</i>	MOSS	
<i>Bryum argenteum</i>	MOSS	
<i>Bryum lanatum</i>	MOSS	
<i>Campylopus flindersii</i>	MOSS	
<i>Campylopus introflexus</i>	MOSS	
<i>Ceratodon purpureus</i> subsp. <i>convolutus</i>	MOSS	
<i>Dicranoloma diaphanoneuron</i>	MOSS	
<i>Didymodon australasiae</i>	MOSS	
<i>Didymodon torquatus</i>	MOSS	
<i>Fabronia hampeana</i>	MOSS	P2
<i>Fissidens curvatus</i> var. <i>curvatus</i>	MOSS	
<i>Fissidens megalotis</i>	MOSS	
<i>Fissidens taylorii</i> var. <i>taylorii</i>	MOSS	

TAXON	CLASS	CONS
<i>Funaria hygrometrica</i>	MOSS	
<i>Gemmabryum dichotomum</i>	MOSS	
<i>Gemmabryum pachythecum</i>	MOSS	
<i>Gemmabryum preissianum</i>	MOSS	
<i>Gymnostomum calcareum</i>	MOSS	
<i>Leptobryum pyriforme</i>	MOSS	
<i>Leptodontium paradoxum</i>	MOSS	
<i>Pleuridium ecklonii</i>	MOSS	
<i>Pseudocrossidium hornschruchianum</i>	MOSS	
<i>Ptychostomum angustifolium</i>	MOSS	
<i>Racopilum cuspidigerum</i> var. <i>convolutaceum</i>	MOSS	
<i>Rosulabryum albolimbatum</i>	MOSS	
<i>Rosulabryum billardieri</i>	MOSS	
<i>Rosulabryum billardierii</i>	MOSS	
<i>Rosulabryum campylothecium</i>	MOSS	
<i>Rosulabryum torquescens</i>	MOSS	
<i>Sematophyllum homomallum</i>	MOSS	
<i>Syntrichia antarctica</i>	MOSS	
<i>Syntrichia pagorum</i>	MOSS	
<i>Tayloria octoblepharum</i>	MOSS	
<i>Tortella rubripes</i>	MOSS	
<i>Tortula muralis</i>	MOSS	
<i>Trichostomum eckelianum</i>	MOSS	
<i>Weissia controversa</i>	MOSS	
<i>Zygodon menziesii</i>	MOSS	

Flora Species list by family across Applecross Survey Areas

Family	Species	Common Name	Status
Arecaceae	<i>Phoenix canariensis</i>	Canary Islands Date Palm	*
Asteraceae	<i>Cotula turbinata</i>		*
Casuarinaceae	<i>Casuarina cunninghamiana</i>	River Oak	*
Casuarinaceae	<i>Casuarina obesa</i>		
Juncaceae	<i>Juncus kraussii</i>		
Juncaceae	<i>Juncus pallidus</i>		
Poaceae	<i>Hordeum murinum</i>		*

Flora Species list by family across Elizabeth Quay Survey Areas

Family	Species	Common Name	Status
Chenopodiaceae	<i>Atriplex prostrata</i>		*
Juncaceae	<i>Juncus kraussii</i>		
Moraceae	<i>Ficus carica</i>	Common Fig	*
Myrtaceae	<i>Agonis flexuosa</i>	Peppermint	
Myrtaceae	<i>Melaleuca quinquenervia</i>	Broad-leaved Paperbark	*

Flora Species list by family across Ellam Street Survey Areas

Family	Species	Common Name	Status
Arecaceae	<i>Phoenix canariensis</i>	Canary Islands Date Palm	*
Asteraceae	<i>Cotula turbinata</i>		*
Casuarinaceae	<i>Casuarina cunninghamiana</i>	River Oak	*
Chenopodiaceae	<i>Atriplex prostrata</i>		*
Chenopodiaceae	<i>Suaeda australis</i>		
Chenopodiaceae	<i>Rhagodia baccata</i>	Berry Saltbush	
Cyperaceae	<i>Machaerina juncea</i>		
Juncaceae	<i>Juncus kraussii</i>		
Moraceae	<i>Ficus carica</i>	Common Fig	*
Myrtaceae	<i>Agonis flexuosa</i>	Peppermint	
Myrtaceae	<i>Corymbia calophylla</i>	Marri	
Myrtaceae	<i>Eucalyptus camaldulensis</i>	River Gum	*
Myrtaceae	<i>Eucalyptus gomphocephala</i>	Tuart	
Myrtaceae	<i>Eucalyptus rudis</i>	Flooded Gum	
Myrtaceae	<i>Melaleuca lanceolata</i>		
Myrtaceae	<i>Melaleuca quinquenervia</i>	Broad-leaved Paperbark	*
Myrtaceae	<i>Melaleuca raphiophylla</i>	Swamp Paperbark	
Poaceae	<i>Hordeum murinum</i>		*
Proteaceae	<i>Banksia attenuata</i>	Candle-stick Banksia	

Flora Species list by family across Matilda Bay Survey Areas

Family	Species	Common Name	Status
Arecaceae	<i>Phoenix canariensis</i>	Canary Islands Date Palm	*
Asteraceae	<i>Cotula turbinata</i>		*
Casuarinaceae	<i>Casuarina cunninghamiana</i>	River Oak	*
Casuarinaceae	<i>Casuarina obesa</i>		
Chenopodiaceae	<i>Atriplex prostrata</i>		*
Moraceae	<i>Ficus carica</i>	Common Fig	*
Myrtaceae	<i>Agonis flexuosa</i>	Peppermint	
Myrtaceae	<i>Corymbia calophylla</i>	Marri	
Myrtaceae	<i>Eucalyptus camaldulensis</i>	River Gum	*
Myrtaceae	<i>Eucalyptus gomphocephala</i>	Tuart	
Myrtaceae	<i>Eucalyptus marginata</i>	Jarraah	
Myrtaceae	<i>Eucalyptus rudis</i>	Flooded Gum	
Myrtaceae	<i>Melaleuca lanceolata</i>		
Myrtaceae	<i>Melaleuca quinquenervia</i>	Broad-leaved Paperbark	*
Myrtaceae	<i>Melaleuca viminalis</i>		
Plantanaceae	<i>Plantanus acerifolia</i>	London Plane	*
Poaceae	<i>Hordeum murinum</i>		*
Proteaceae	<i>Banksia attenuata</i>	Candle-stick Banksia	

Flora likelihood of occurrence assessment guidelines

Likelihood of occurrence	Guideline
Known	Species recorded within study area from field survey results.

Likelihood of occurrence	Guideline
Likely	Species previously recorded within 10 km and large areas of suitable habitat occur in the study area.
Possible	Species previously recorded within 10 km and areas of suitable habitat occur/may occur in the study area.
Unlikely	Species previously recorded within 10 km, but suitable habitat does not occur in the study area.
Highly unlikely	Species not previously recorded within 10 km, suitable habitat does not occur in the study area and/or the study area is outside the natural distribution of the species.
Other considerations	Intensity of survey, availability of access, growth form type, recorded flowering times, cryptic nature of species

Source information - desktop searches

PMST – MNES Protected Matters Search Tool (PMST) to identify flora listed under the EPBC Act potentially occurring within the study area

DBCA – DBCA (2025) Threatened and Priority flora database search within the Study Area.

NM – DBCA *NatureMap and Dandjoo Database search*.

Flora likelihood of occurrence assessment for significant flora

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Amanitaceae	<i>Amanita brunneola</i>	P2		Agaricoid species that reaches 42-52 mm diameter, 4-5 mm thick, convex becoming plane, buff to milky coffee, margin very slightly appendiculate when young, surface tacky. Favours Banksia Woodland predominantly.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	TPFL, Naturemap
Amanitaceae	<i>Amanita carneiphylla</i>	P3		Pileus species reaching 70 mm in diameter, 12 mm thick, white, plane with decurved margin, margin not appendiculate, and surface dry. The species typically prefers Eucalypt woodlands.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	TPFL, WAHerb, Naturemap
Amanitaceae	<i>Amanita cretaceaverruca</i>	P2		A species with pileus reaching 40-51 mm diameter, 3 mm thick, convex becoming plane with decurved margin, margin appendiculate, clay buff to fawn, paler at margin. Species has a preference for flooded gum and Melaleuca woodlands.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Amanitaceae	<i>Amanita drummondii</i>	P3		A species with Pileus 50 mm in diameter, hazel in centre, paler towards the margin, 4 mm thick, striate margin surface slightly tacky when moist, no smell on leaves. The species has a preference for Eucalypt woodlands.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Amanitaceae	<i>Amanita fibrilloses</i>	P3		Agaricoid species reaching 65 mm in diameter, 7 mm thick, plane with depressed centre and decurved margin, margin slightly striate. The species has a preference for wet Eucalypt woodlands	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Amanitaceae	<i>Amanita preissii</i>	P3		Agaricoid species with pileus reaching more than 80mm in diameter, cream plane, with decurved margin and slightly raised centre, and margin not striated. The species has a preference for a variety of Eucalypt and Agonis woodlands.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	TPFL, WAHerb, Naturemap
Amanitaceae	<i>Amanita quenda</i>	P1		Agaricoid species with pileus reaching more than 85mm wide, 3 mm thick, convex, pale clay buff to hazel at margin. The species has a preference for moist Marri-dominant woodlands.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Amanitaceae	<i>Amanita wadjukiorum</i>	P3		Agaricoid species with the pileus reaching 90 mm in diameter, milky coffee coloured plane with depressed centre and upturned margin, dry, and the margin not striated. The species has a preference for Eucalypt woodlands.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Amanitaceae	<i>Amanita wadulawitu</i>	P2		An Agaricoid species with a pileus reaching up to 60mm in diameter, white, plane with depressed centre, margin appendiculate, a distinct mushroom smell, and the context white and unchanging. The species has a preference for both Eucalypt and Marri woodlands.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Amaryllidaceae	<i>Proiphys kimberleyensis</i>	P1		A species of Geophyte lily growing up to 70 cm with flowers white and sweetly scented occurring from September to December. The species has a preference for Basalt terrain and has been found among open woodlands.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Apiaceae	<i>Platysace ramosissima</i>	P3		A perennially, clumping shrub species reaching 60cm in height, with white flowers occurring from September to January. The species has a preference for grey-white sands and along undulating plains.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Apiaceae	<i>Eryngium pinnatifidum subsp. Palustre</i>	P3		This is a little studied sprawling shrub species reaching a maximum of 30cm tall with pink flowers. Soil preference appears to be for sandy/loam.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Apiaceae	<i>Eryngium sp. Subdecumbens</i>	P3		This is a perennial herb species with tubular leaves and growing to 40cm tall. Flowers are pale-blue in colour, occurring from September to January, with soil preference for grey sands and clay soils, and typically found along flat, alluvial plains.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Aponogetonaceae	<i>Aponogeton hexatepalus</i>	P4		This is a perennial aquatic herb species with tuberous floating leaves and white and green flowers. Habitat preference is for brown clay soils along claypans.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	TPFL, WAHerb, Naturemap
Araceae	<i>Lazarum peltandroides</i>	P1		A Geophyte species growing up to 30 cm tall. The spathe is dark maroon-red adaxially, reddish green abaxially, and with flowers that are cream with a dark red apex, occurring between August and February.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	TPFL, Naturemap
Araceae	<i>Lazarum nudibaccatum</i>	P1		This is a tuberous, perennial species of geophyte growing up to 25 cm. Leaves vary entirely and ovate to linearly 3-lobed, and the flowers are reddish-brown, occurring between August and February. The species has a preference for darker clay soils.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Araliaceae	<i>Hydrocotyle lemnoides</i>	P4		This is an aquatic, annual floating herb species with red, brown and purple flowers. Habitat preference is for brown clay soils along established wetlands and swamps.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	TPFL, WAHerb, Naturemap
Araliaceae	<i>Hydrocotyle striata</i>	P1		This is a species of prostrate, annually occurring herb reaching 30cm in diameter with fleshy, lobed leaves. The species has a habitat and soil preference for black, sandy soils and undulating creek lines or open forests.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Asparagaceae	<i>Thysanotus anceps</i>	P3		This is a species of leafless, erect perennial monocot plant with purple flowers typically occurring between November to February. The species has a preference for gravel-like sandy soils in low, open heath and woodland.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Asteraceae	<i>Angianthus micropodioides</i>	P3		Erect or decumbent annual, herb, 0.03-0.15 m high. Fl. yellow-white, Nov to Dec or Jan to Feb. Saline sandy soils. River edges, saline depressions, claypans.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap TPFL

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Asteraceae	<i>Millotia tenuifolia</i> <i>var. laevis</i>	P2		A small species of upright, annual herb reaching 0.1m high with white-yellow flowers, occurring between September and December. The species has a preference for lighter coloured, sandy soils.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAherb, Naturemap
Asteraceae	<i>Schoenia filifolia</i> <i>subsp. subulifolia</i>	EN	EN	A small, rare species of annually occurring herb reaching a height to 50 mm, with flowers yellow, occurring between September and December. There is a particular preference for darker loam and clay soils.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAherb, Naturemap
Brassicaceae	<i>Lepidium pseudohyssopifolium</i>	P1		Erect annual or perennial, herb, to 0.4(-0.6) m high. Fl. Jun to Sep. Swampy ground.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAherb, Naturemap
Byblidaceae	<i>Byblis gigantea</i>	P3		Small, branched perennial, herb (or sub-shrub), to 0.45 m high. Fl. pink-purple/white, Sep to Dec or Jan. Sandy-peat swamps. Seasonally wet areas.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAherb, Naturemap, T PFL

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Celastraceae	<i>Tripterococcus</i> sp. <i>Brachylobus</i> (A.S. George 14234)	P4		This is an erect, perennially occurring herb species reaching 80cm in height with yellow flowers. The species has a preference for grey, sandy clay soils and can be found along flats and plains.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	TPFL, WAHerb, Naturemap
Centrolepidoceae	<i>Centrolepis milleri</i>	P3		A very small, erect, annually occurring herb growing to 6 cm tall, with plants a distinct red colour. The species has a particular preference for sandy soils and sandplains and has been observed after fire events.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Chenopodiaceae	<i>Dysphania congestiflora</i>	P3		A species of erect, annually occurring herb reaching 5 cm tall, with yellow flowers occurring between July and December. There is a species preference for floodplains and clay soils.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Chenopodiaceae	<i>Tecticornia mellarium</i>	P1		A low species of subshrub growing up to 25 cm high, with articles glaucous blue in colour. There is a particular species preference for salt-lakes.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Cyperaceae	<i>Bolboschoenus fluviatilis</i>	P1		Perennial, rhizomatous sedge to 2m high. Littoral zone of Swan River, floodplain, river banks in mud.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Naturemap, WAHerb
Cyperaceae	<i>Carex tereticaulis</i>	P3		This is a species of erect, tufted sedge growing to 1.5m tall and with green flowers. The species prefers brown, sandy clay soils and is often found along creek banks and along the edge of water courses.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	TPFL, WAHerb, Naturemap
Cyperaceae	<i>Cyathochaeta teretifolia</i>	P3		Rhizomatous, clumped, robust perennial, grass-like or herb (sedge), to 2 m high, to 1.0 m wide. Fl. brown. Grey sand, sandy clay. Swamps, creek edges.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Naturemap, WAHerb

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Cyperaceae	<i>Eleocharis keigheryi</i>	VU	VU	This is an erect, annual, aquatic sedge species growing up to 45cm tall, with green to yellow coloured flowers. It favours wet, grey clay soils and is typically found in wet, inundated flats and clay pans.	Highly Unlikely. No suitable habitat occurs, no DBCA records are present within 10km of the current Survey Areas and the Survey Areas is to the very outer limits of the species' known range.	Highly Unlikely. No suitable habitat occurs, no DBCA records are present within 10km of the current Survey Areas and the Survey Areas is to the very outer limits of the species' known range.	Highly Unlikely. No suitable habitat occurs, no DBCA records are present within 10km of the current Survey Areas and the Survey Areas is to the very outer limits of the species' known range.	Highly Unlikely. No suitable habitat occurs, no DBCA records are present within 10km of the current Survey Areas and the Survey Areas is to the very outer limits of the species' known range.	PMST
Cyperaceae	<i>Lepidosperma rostratum</i>	EN	EN	This is a species of tufted perennial sedge growing up to 60cm tall with brown flowers and with low overall abundance in its known distribution. It has a preference for seasonal, grey clay soils and is found mostly in flat wetlands.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Cyperaceae	<i>Morelotia australiensis</i>	VU	VU	This is a species of rhizomatous, tufted perennial herb reaching a maximum height of 30cm. It prefers grey and brown sandy clay soils and is most often found on flat plains.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	PMST, WA Herb

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Cyperaceae	<i>Netrostylis sp.</i> <i>Chandala</i>	P2		A species of erect, clumping sedge, growing up to 1.2 m high with delicate brown flowers, and very fine leaves. The species has a preference for darker, peaty soils.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Cyperaceae	<i>Schoenus benthamii</i>	P3		This is a species of upright, tufted sedge growing to 20cm tall with brown/green flowers and in typically low abundance. It has a preference for damp, dark-coloured clay soils and is typically found along flat, seasonal wetland environments.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Cyperaceae	<i>Schoenus capillifolius</i>	P3		Semi-aquatic tufted annual, grass-like or herb (sedge), 0.05 m high. Fl. green, Oct to Nov. Brown mud. Claypans.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Cyperaceae	<i>Schoenus natans</i>	P4		This is a species of annually occurring semi-aquatic herb with filamentous leaves, white stigmas and red-brown flowers occurring between September and November. The species prefers brown clay sands and has often been found within seasonal wetlands and clay pans.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Cyperaceae	<i>Schoenus pennisetis</i>	P3		This is a species of small, low-growing, annual sedge with a green-brown inflorescence when in fruit. It has a preference for grey-brown sandy loam soils and is typically found on seasonally wet and flat terrain.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	TPFL, WA Herb, Naturemap
Cyperaceae	<i>Schoenus sp. Waroona</i>	P3		This is a species of small, annually occurring herb with green flowers that does not exceed 10cm in height. It has a preference for dark brown and grey clay soils and is typically found in wet clay pans.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Dasypogonaceae	<i>Calectasia grandiflora</i>	P2		Rhizomatous, perennial, herb (or undershrub), to 0.65 m high, without stilt roots. Fl. blue/purple, Jun to Nov. White, grey or yellow sand, sandy clay, gravel, laterite, granite. Swampy areas, rock outcrops, flats, slopes, ridges.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Dilleniaceae	<i>Hibbertia leptotheca</i>	P3		Small spreading shrub to 0.3 m high. Coastal and near coastal sites growing in sand over limestone in coastal heaths and thickets usually dominated by species of Melaleuca and Acacia (Thiele 2019).	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, TPFL, Naturemap

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Droseraceae	<i>Drosera occidentalis</i>	P4		This is a species of rosetted, perennial herb with white flowers. It has a preference for grey-brown sandy clay soils and is typically found in seasonally flooded flats and wetlands.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Ericaceae	<i>Andersonia gracilis</i>	VU	EN	Slender erect or open straggly shrub, 0.1-0.5(-1) m high. Fl. white-pink-purple, Sep to Nov. White/grey sand, sandy clay, gravelly loam. Winter-wet areas, near swamps.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	PMST, WAHerb, Naturemap
Ericaceae	<i>Leucopogon sp. Busseleton</i>	P2		A larger species of spreading shrub growing to 1m tall, with single stems and white flowers occurring from September to November. The species has a preference for dark and wetter, moistened sandy soils, and is found typically within seasonal swamps and flooded flats.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Ericaceae	<i>Styphelia filifolia</i>	P3		This is a species of erect, well-branched shrub with white flowers and distinctive, asymmetric green fruit. It has a preference for deep, yellow sands and is typically found along flat sandplains.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Euphorbiaceae	<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	P3		Dioecious or sometimes monoecious, open spreading, erect or prostrate shrubs to 0.7 m high (Halford and Henderson 2008).	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	TPFL WAHerb Naturemap
Fabaceae	<i>Acacia aphylla</i>	EN	EN	This is a larger species of blue-grey shrub reaching 2m tall with flowers that are more brightly yellow than other <i>Acacia</i> species. It has a preference for clay loam and laterite soils and is typically found along ridges and granite outcrops.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Fabaceae	<i>Acacia benthamii</i>	P2		Shrub, ca 1 m high. Fl. yellow, Aug to Sep. Sand. Typically on limestone breakaways.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Fabaceae	<i>Acacia declinata</i>	P4		A spreading, open shrub species growing up to 50 cm high and 1 m across, with anther filaments bright yellow and bright yellow flowers occurring between August and December. The species has a preference for loam-type soils as well as both flats and slopes.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Fabaceae	<i>Acacia denticulosa</i>	VU	VU	Erect, diffuse, spindly shrub, 1-4 m high. Fl. yellow, Sep to Oct. Sand, loam, clay. Granite outcrops, rarely on sandplains.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WASHerb, Naturemap
Fabaceae	<i>Acacia drummondii</i> <i>subsp. elegans</i> <i>Porongurup variant</i>	P4		A medium shrub species growing up to 3 m high, with flowers pale yellow and elongated, occurring from August and December. The species has a preference for clay-based soils.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WASHerb, Naturemap
Fabaceae	<i>Acacia horridula</i>	P3		Harsh, slender, single-stemmed shrub, 0.3-0.6(-1) m high. Fl. yellow, May to Aug. Gravelly soils over granite, sand. Rocky hillsides.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WASHerb, Naturemap
Fabaceae	<i>Acacia inophloia</i>	P3		A larger species of shrub growing up to 3.5 m tall, with red, straggly, minni ritchi bark, furry pods and small yellow flowers occurring between August and December. The species has a preference for sand and granite soil types.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WASHerb, Naturemap

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Fabaceae	<i>Acacia lasiocarpa</i> <i>var. bracteolata</i> <i>long peduncle</i> <i>variant</i>	P1		This is an open, spiky and slender shrub species, growing up to 1.5m tall. The soil preference for this species varies from gravel-like sands to brown sandy loams and has been most often located along flat plains.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAherb, Naturemap
Fabaceae	<i>Acacia leptospermoides</i> <i>subsp. obovata</i>	P2		A medium sized erect shrub species growing up to 2m high and 0.75m wide with flowers yellow, occurring between July and December. The species has a preference for sandy soils and sandplain and hillside terrains.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAherb, Naturemap
Fabaceae	<i>Acacia pharangites</i>	EN	EN	A rare species of sparse, spindly, open shrub growing up to 2.5 m high and 0.5 m wide with yellow flowers occurring between August and December. The species has a preference for darker coloured, loamy soils.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAherb, Naturemap
Fabaceae	<i>Acacia sp.</i> <i>Yinnetharra</i>	P1		A medium-sized tree growing up to 12m, mostly 8m tall, with woody grey fissured bark, long and weeping phyllodes and bright yellow flowers with a preference for red clay soils.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAherb, Naturemap

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Fabaceae	<i>Dillwynia dillwynioides</i>	P3		Decumbent or erect, slender shrub, 0.3-1.2 m high. Fl. red & yellow/orange, Aug to Dec. Sandy soils. Winter-wet depressions.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Naturemap, WAHerb
Fabaceae	<i>Jacksonia gracillima</i>	P3		This is a species of low spreading shrub with distinct grey-green and pungent branchlets with orange flowers. The species has a preference for grey-brown sandy loam soils and has been recorded in both low-lying sandplains and floodplains.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Naturemap, WAHerb
Fabaceae	<i>Jacksonia sericea</i>	P4		Low spreading shrub, to 0.6 m high. Fl. orange, usually Dec or Jan to Feb. Calcareous & sandy soils.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	TPFL WAHerb, Naturemap
Fabroniaceae	<i>Fabronia hampeana</i>	P2		A white species of fertile moss typically found on mid-sized tree trunks within Banksia woodlands. The stems of the tree species typically need to be well developed and large enough to provide shade for persistence.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	TPFL, WAHerb, Naturemap

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Goodeniaceae	<i>Dampiera triloba</i>	P3		Erect perennial, herb or shrub, to 0.5 m high. Fl. blue, Aug to Dec. Dark brown/black peaty soils, edge of wetlands.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Naturemap, WAHerb
Haemodoraceae	<i>Anigozanthos viridis</i> subsp. <i>terraspectans</i>	VU	VU	Rhizomatous, perennial, herb, 0.05-0.2 m high. Fl. green/yellow-green, Aug to Sep. Grey sand, clay loam. Winter-wet depressions.	Highly Unlikely. No suitable habitat occurs, no DBCA records are present within 10km of the current Survey Areas and the Survey Areas is to the very outer limits of the species' known range.	Highly Unlikely. No suitable habitat occurs, no DBCA records are present within 10km of the current Survey Areas and the Survey Areas is to the very outer limits of the species' known range.	Highly Unlikely. No suitable habitat occurs, no DBCA records are present within 10km of the current Survey Areas and the Survey Areas is to the very outer limits of the species' known range.	Highly Unlikely. No suitable habitat occurs, no DBCA records are present within 10km of the current Survey Areas and the Survey Areas is to the very outer limits of the species' known range.	PMST
Haemodoraceae	<i>Conostylis bracteata</i>	P3		Rhizomatous, tufted or shortly proliferous perennial, grass-like or herb, 0.2-0.45 m high. Fl. yellow, Aug to Sep. Sand, limestone. Consolidated sand dunes.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Haloragaceae	<i>Haloragis scoparia</i>	P1		This is a species of perennial herb reaching up to 50cm tall and with noticeably red stems and bright red and green leaves. The species has a strong preference for clay loam soils and has most typically been found along plains and flats, particularly within Yalgorup National Park.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Hemerocallidaceae	<i>Johnsonia pubescens</i> subsp. <i>cygnorum</i>	P2		Tufted perennial, herb, 0.15-0.25 m high. Fl. white-green, Sep. Grey-white-yellow sand. Flats, seasonally-wet sites.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Naturemap, T PFL,
Lamiaceae	<i>Dicrastylis micrantha</i>	P3		Spreading shrub, 0.4-1 m high, stem hairs dentritic, to 1.3 mm long, with a single terminal gland and sub-basal whorl of branches. Fl. white, Sep to Dec. Red sand. Sandplains.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Lamiaceae	<i>Hemigenia exilis</i>	P4		A sparsely leaved, erect, woody, divaricate open shrub species growing up to 1.5m tall and with purple flowers occurring between September and December. The species has a preference for red and brown clay soils.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Macarthuriaceae	<i>Macarthuria keigheryi</i>	EN	EN	Erect or spreading perennial, herb or shrub, 0.2-0.4 m high, 0.3-0.6 m wide. Fl. Sep to Dec or Feb to Mar. White or grey sand.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, PMST TPFL
Malvaceae	<i>Lasiopetalum bracteatum</i>	P4		This is a species of erect, single stemmed shrub with visibly bright pink flowers and growing to 1 metre tall. It has been shown to prefer sandy granite soil types and has most commonly been recorded along hilltop and outcrops.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Malvaceae	<i>Lasiopetalum glutinosum</i> subsp. <i>glutinosum</i>	P3		Shrub to 1.5 m. Fl. pink- purple. Granite outcrops, granitic soils, clayey sand with laterite.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Malvaceae	<i>Commersonia erythrogyna</i>	EN	EN	This is a rare species of erect, single stemmed shrub growing up to 1.5m tall and 2m wide with spindly plants and a preference for brown, peaty soils and hillsides and slopes.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Malvaceae	<i>Lasiopetalum membranaceum</i>	P3		Multi-stemmed shrub, 0.2-1 m high. Fl. pink-blue- purple, Sep to Dec. Sand over limestone.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	TPFL WAHerb, Naturemap
Menyathaceae	<i>Ornduffia submersa</i>	P4		An aquatic, perennial floating herb species typically found in shallow water with prominent white flowers. The species prefers seasonally inundated creeks and wetlands.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb
Montiaceae	<i>Calandrinia uncinella</i>	P1		A semi-erect succulent herb species with reddish fruits and white flowers. The species prefers silty loam and clay soils and is typically found in wet, seasonal inundated plains and flats.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Myrtaceae	<i>Babingtonia urbana</i>	P3		An open, sprawling shrub species reaching a maximum of 1m tall with numerous slender branches and pink flowers. It prefers dark, brown clay soils and has typically been found in swamps and seasonally wet flats.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Myrtaceae	<i>Calothamnus graniticus</i> subsp. <i>leptophyllus</i>	P4		Erect, multi-stemmed shrub, 1-2 m high. Fl. red, Jun to Aug. Clay over granite, lateritic soils. Hillsides.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Myrtaceae	<i>Calothamnus macrocarpus</i>	P2		Erect shrub, 0.4-2(-3) m high. Fl. red, Feb or Apr or Aug to Dec. Rocky quartzite soils, sand. Slopes.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Myrtaceae	<i>Calytrix breviseta</i> subsp. <i>breviseta</i>	EN	EN	A sprawling, open shrub species growing up to 40 cm high and 30 cm across, with tiny clubbed leaves 1 - 2 mm long, and purple flowers occurring from September to April. There is a species preference for lighter coloured sandy loam soils.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	PMST
Myrtaceae	<i>Calothamnus macrocarpus</i>	P4		A species of slender, erect shrub with single stem at base, growing up to 3-4 m high and 3 m wide, with red flowers occurring between July and January. The species has a preference for sandier soils.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Myrtaceae	<i>Chamelaucium erythrochlorum</i>	P4		An erect, compact, perennial shrub species growing up to 70 cm high and 80 cm wide, with red flowers occurring between September and February. The species prefers both sandy and gravel-type soils.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Myrtaceae	<i>Chamelaucium floriferum subsp. diffusum</i>	P2		A perennial compact shrub species growing up to 1.7m tall and 1.5m wide, with white flowers occurring between May and January. The species has a preference for darker sandy and gravel-type soils.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Myrtaceae	<i>Darwinia acerosa</i>	EN	EN	A rare species of low spreading shrub growing up to 0.5m high and 1.0m wide, with pink and green flowers occurring between August and December. The species has a preference for darker soils and has most often been found within hills and slopes.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Myrtaceae	<i>Darwinia leiostyla</i>	P4		A species of slender, erect shrub growing up to 0.5m-1 m tall. Flower heads nodding and varying in colour from pale to deep pink from September to December. The species has a preference for rocky and clay-based soils.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Myrtaceae	<i>Darwinia masonii</i>	EN	EN	This is rare, erect shrub species growing to between 0.5 to 1.6 m tall, with flowers red in colour occurring between September and December. The species has a preference for orange and brown loam-type soils.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Myrtaceae	<i>Darwinia sp. Gibson</i>	P1		A species of multi-stemmed, spreading shrub with erect new growth, growing up to 50cm tall and with yellow flowers occurring from June to December. The species has a preference for darker coloured loam soils and has often been located within salt-plains and salt-lakes.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Myrtaceae	<i>Darwinia sphaerica</i>	P2		A species of compact, low shrub, growing up to 30 cm high and 45 cm wide, with flowers white, and strongly and sweetly scented, that occur between August and December.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Myrtaceae	<i>Darwinia wittwerorum</i>	EN	EN	A rare species of 40cm tall, upright, bushy multi-stemmed woody shrub, with linear leaves deep green in colour, and flowers with red and cream bracts occurring between August and December. The species has a preference for clay and loam soils and has often been found along slopes and gullies.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Myrtaceae	<i>Eucalyptus caesia</i> <i>subsp. boodjin</i>	P2		An erect, open Mallee tree species, reaching 5m high and 3m wide, with bark that is minni-ritchi in type, and smooth upper trunk. The species has often been found within granite outcrops and granite-based terrain.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Myrtaceae	<i>Eucalyptus caesia</i> <i>subsp. caesia</i>	P4		A species of sprawling Mallee growing up to 11m tall. Bark is minni-ritchi in type throughout, with the leaves slightly glossy, and dark olive green in colour. The species has a preference for granite-based terrain and courser sandy soils.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Myrtaceae	<i>Eucalyptus caesia</i> <i>subsp. magna</i>	P4		A species of sprawling Mallee growing up to 16m tall, with bark amorphic at base of larger mallees, otherwise minni-ritchi in bark type and reddish in colour. The leaves are dull and blue-green in colour. The species has a preference for granite-based terrain and courser sandy soils.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Myrtaceae	<i>Eucalyptus educta</i>	P2		(Straggling & spreading mallee), 3-5 m high, bark rough, 'minni-ritchi'. Fl. cream-yellow, Apr. Shallow soils. Granite rocks.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Myrtaceae	<i>Eucalyptus foecunda</i> subsp. <i>foecunda</i>	P4		(Mallee) or tree (occasionally), to 5 m high, bark smooth above with rough flaky bark at base, grey over pale copper. Fl. white-cream, Aug or Jan to Feb. White, grey, yellow, brown, orange or red sand over limestone. Sand dunes and plains, limestone ridges, cliffs & hills, road verges.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Myrtaceae	<i>Eucalyptus kruseana</i>	P4		A species of open Mallee growing up to 5 m tall, with bark rougher in texture on lower stems. All parts glaucous, and flowers are yellow in colour with a species preference for red-brown loam-type soils.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Myrtaceae	<i>Eucalyptus rhodantha</i> var. <i>rhodantha</i>	EN	EN	A rare species of Mallee tree with silver grey leaves growing up to 5m tall with red flowers occurring between September and December. There appears to be a preference for darker coloured, sandy loam soils but it is relatively poorly studied.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Myrtaceae	<i>Eucalyptus x balanites</i>	EN	EN	An erect, open mallee species averaging 2-5m tall, with rough grey-brown bark and orange oil glands. The species prefers gravel-type, grey sands and has typically low abundance levels, with most recordings along gentle slopes of open woodland.	Highly Unlikely. No suitable habitat occurs, no DBCA records are present within 10km of the current Survey Areas and the Survey Areas is to the very outer limits of the species' known range.	Highly Unlikely. No suitable habitat occurs, no DBCA records are present within 10km of the current Survey Areas and the Survey Areas is to the very outer limits of the species' known range.	Highly Unlikely. No suitable habitat occurs, no DBCA records are present within 10km of the current Survey Areas and the Survey Areas is to the very outer limits of the species' known range.	Highly Unlikely. No suitable habitat occurs, no DBCA records are present within 10km of the current Survey Areas and the Survey Areas is to the very outer limits of the species' known range.	PMST
Myrtaceae	<i>Eucalyptus x mundijongensis</i>	P1		Tree, to 25 m high, bark fibrous, fissured, grey; branchlets smooth. Loam. Paddocks.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	TPFL WAHerb, Naturemap

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Myrtaceae	<i>Hypocalymma inopinatum</i>	P2		A species of spindly, erect shrub growing up to 1.5m tall with flowers pink in colour occurring between September and December. There appears to be a preference for white, shallow sandy soils, although records and studies are comparatively few.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Myrtaceae	<i>Hypocalymma magnificum</i>	EN	EN	A rare species of open, erect to spreading, woody multi-stemmed, medium sized shrub growing from up to 60 cm tall and 40cm wide with pink flowers occurring between August and December.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Myrtaceae	<i>Hypocalymma quadrangulare</i>	P3		A low-lying, erect shrub species growing up to 0.7m tall with yellow flowers occurring between September and December. The species has most often been found within Banksia woodlands.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Myrtaceae	<i>Malleostemon nephroideus</i>	P3		A species of low ,compact, rounded shrub, growing up to 0.5 m high and 1m wide with pink flowers occurring between September and December. The species has a preference for sandplains and lighter coloured sandy soils.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Myrtaceae	<i>Pileanthus bellus</i>	P3		This is an open, slender, branching shrub species growing up to 3m high and 1 m wide with flowers pink in colour occurring between September and December. The species has a preference for white and yellow, lighter coloured coloured sandy soils.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAherb
Myrtaceae	<i>Verticordia amphigia</i>	P3		An erect species of shrub growing up to 1m high, with frilly-edged petals and yellow flowers occurring between September and January. The species has a preference for darker coloured clay soils.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAherb, Naturemap
Myrtaceae	<i>Verticordia citrella</i>	P2		This is a species of erect, slender shrub growing up to 70cm tall with a single stem and with flowers yellow in colour occurring from September to January. The species has a preference for gravel and loam-based soils.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAherb, Naturemap
Myrtaceae	<i>Verticordia dasystylis subsp. kalbarriensis</i>	P3		A species of dense, small shrub growing up to 50cm tall, compact in nature with small white flowers occurring between September to April. The species has a preference for heavy clay-based soils.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAherb, Naturemap

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Myrtaceae	<i>Verticordia fragrans</i>	P3		An erect, sprawling shrub species growing up to 1.5m tall with pale pink flowers occurring between June and December. The species has shown a preference for deep, white and grey sandy soils.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WA Herb, Naturemap
Myrtaceae	<i>Verticordia galeata</i>	P2		A species of erect, rounded shrub growing up to 70 cm tall, with flowers yellow in colour, occurring between September and December. The species has a preference for red and brown sandy soils and sandstone-based terrain.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Myrtaceae	<i>Verticordia halophila</i>	P2		An erect, low-lying shrub species growing up to 75 cm high with flowers pink in colour, occurring between September and December. The species has a preference for open scrublands and white, sandy soils.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Myrtaceae	<i>Verticordia lindleyi</i> subsp. <i>lindleyi</i>	P4		A species of slender, erect, dwarf shrub with low-spreading twigs reaching 50cm tall and with pink and purple flowers. The species has a preference for deep, grey sandy soils and is most often found along flat sand-plains among Melaleuca and Eucalypt communities.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Naturemap, TPFL, WAHerb

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Myrtaceae	<i>Verticordia polytricha</i>	P4		This is a multi-branched shrub species growing up to 1.4 m tall and with creamy-white flowers, occurring between September and December. The species has a particular preference for sandy soils.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb, Naturemap
Orchidaceae	<i>Caladenia huegelii</i>	CR	EN	Tuberous, perennial, herb, 0.25-0.6 m high. Fl. green & cream & red, Sep to Oct. Grey or brown sand, clay loam.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	WAHerb PMST, Naturemap 10km
Orchidaceae	<i>Diuris drummondii</i>	VU	VU	Tuberous, perennial, herb, 0.5-1.05 m high. Fl. yellow, Nov to Dec or Jan. Low-lying depressions, swamps.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	PMST, Naturemap PMST, WAHerb

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Orchidaceae	<i>Diuris micrantha</i>	VU	VU	Tuberous, perennial, herb, 0.3-0.6 m high. Fl. yellow & brown, Sep to Oct. Brown loamy clay. Winter-wet swamps, in shallow water.	Highly Unlikely. No suitable habitat occurs, no DBCA records are present within 10km of the current Survey Areas and the Survey Areas is to the very outer limits of the species' known range.	Highly Unlikely. No suitable habitat occurs, no DBCA records are present within 10km of the current Survey Areas and the Survey Areas is to the very outer limits of the species' known range.	Highly Unlikely. No suitable habitat occurs, no DBCA records are present within 10km of the current Survey Areas and the Survey Areas is to the very outer limits of the species' known range.	Highly Unlikely. No suitable habitat occurs, no DBCA records are present within 10km of the current Survey Areas and the Survey Areas is to the very outer limits of the species' known range.	PMST
Orchidaceae	<i>Diuris purdiei</i>	EN	EN	Tuberous, perennial, herb, 0.15-0.35 m high. Fl. yellow, Sep to Oct. Grey-black sand, moist. Winter-wet swamps.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	PMST, WAHerb
Orchidaceae	<i>Drakaea elastica</i>	CR	EN	Tuberous, perennial, herb, 0.12-0.3 m high. Fl. red & green & yellow, Oct to Nov. White or grey sand. Low-lying situations adjoining winter-wet swamps.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	PMST, TPFL, Naturemap

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Orchidaceae	<i>Drakaea micrantha</i>	EN	VU	Tuberous, perennial, herb, 0.15-0.3 m high. Fl. red & yellow, Sep to Oct. White-grey sand.	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	Unlikely No suitable habitat present within Survey Areas	PMST, WAHerb
Orchidaceae	<i>Thelymitra stellata</i>	EN	EN	Tuberous, perennial, herb, 0.15-0.25 m high. Fl. yellow & brown, Oct to Nov. Sand, gravel, lateritic loam.	Highly Unlikely. Species habitat (sandy laterite substrates) does not occur within the Survey Areas. No previous record within 5 km.	Highly Unlikely. Species habitat (sandy laterite substrates) does not occur within the Survey Areas. No previous record within 5 km.	Highly Unlikely. Species habitat (sandy laterite substrates) does not occur within the Survey Areas. No previous record within 5 km.	Highly Unlikely. Species habitat (sandy laterite substrates) does not occur within the Survey Areas. No previous record within 5 km.	PMST
Orchidaceae	<i>Thelymitra variegata</i>	P2		Tuberous, perennial, herb, 0.1-0.35 m high. Fl. orange & red & purple & pink, Jun to Sep. Sandy clay, sand, laterite.	Unlikely. Species habitat (sandy laterite substrates) unlikely to occur within the Survey Areas. No previous record within 5 km.	Unlikely. Species habitat (sandy laterite substrates) unlikely to occur within the Survey Areas. No previous record within 5 km.	Unlikely. Species habitat (sandy laterite substrates) unlikely to occur within the Survey Areas. No previous record within 5 km.	Unlikely. Species habitat (sandy laterite substrates) unlikely to occur within the Survey Areas. No previous record within 5 km.	WAHerb, Naturemap

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Phyllanthaceae	<i>Poranthera moorokatta</i>	P2		Erect annual herb, 16 mm to 47 mm tall It grows in open Banksia menziesii -B. attenuata woodland on white silica sand in open spaces between shrubs, not in shaded areas or in areas of high litter cover (Barrett 2012)	Unlikely. Habitat required for this species was not recorded within the Survey Areas, additionally Survey Areas is too degraded to support this species.	Unlikely. Habitat required for this species was not recorded within the Survey Areas, additionally Survey Areas is too degraded to support this species.	Unlikely. Habitat required for this species was not recorded within the Survey Areas, additionally Survey Areas is too degraded to support this species.	Unlikely. Habitat required for this species was not recorded within the Survey Areas, additionally Survey Areas is too degraded to support this species.	WAHerb, Naturemap
Poaceae	<i>Austrostipa mundula</i>	P3		Perennial tufted grass to 0.7 m. In association with limestone.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Naturemap, WAHerb
Proteaceae	<i>Adenanthos cygnorum subsp. chamaephyton</i>	P3		A species of decumbent, prostrate shrub, reaching and average of 50 cm high, with leaves dark green and flowers greenish in colour occurring between September and March. The species has a preference for laterite-type soils.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	WAHerb, Naturemap

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Proteaceae	<i>Banksia anatona</i>	EN	EN	A tall, upright and prickly-leaved shrub growing up to 2m tall, with dense light green leaves and yellow flowers occurring between September and April. The species has a preference for grey and white sandy soils, though is increasingly rare and uncommon.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	WAHerb, Naturemap
Proteaceae	<i>Banksia arborea</i>	P4		A species or erect, tall shrub growing up to 5m tall with prominent yellow flowers occurring from September to April. The species appears to be tolerant of a number of different soil types as well as ironstone formations and outcrops.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	WAHerb, Naturemap
Proteaceae	<i>Banksia bella</i>	P4		A species of erect, perennial, compact shrub growing up to 1m high and 1.5m wide, with yellow flowers occurring between September to April. The species has a preference for gravel-type soils and ironstone formations.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	WAHerb, Naturemap
Proteaceae	<i>Banksia densa</i>	P2		A species of compact, upright shrub growing up to 80cm with several stems. The leaves more or less glaucous and the flowers are pale yellow, and scented, occurring between August and February.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	WAHerb, Naturemap

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Proteaceae	<i>Banksia epimicta</i>	P2		A species of prostrate, spreading shrub with underground stem, averaging 30m high and 50cm wide. Flower bracts are large up to 8 cm long, and yellow in colour, occurring between August and February. The species has a preference for brown, sandy loam soils.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	WAHerb, Naturemap
Proteaceae	<i>Banksia fraseri</i> var. <i>oxycedra</i>	P3		A species of tall, erect spreading shrub growing up to 3m high and 2 m wide, with both yellow-to-orange flowers occurring between August and February. There is a species preference for gravel-type soils and laterite landscapes.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	WAHerb, Naturemap
Proteaceae	<i>Banksia lepidorhiza</i>	EN	EN	This is a rare species of prostrate species of shrub growing up to 30cm, with underground stems and buds, dull-green leaves and yellow flowers typically occurring between August and November. The species has a particular preference for gravelly sands.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	WAHerb, Naturemap

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Proteaceae	<i>Banksia nivea</i> <i>subsp. uliginosa</i>	EN	EN	An erect, compact, underground stemmed, perennial shrub species reaching a height of 50 cm tall and width to 50 cm with prominent flowers yellowish-red in colour with a strong sweet smell, occurring between July and February. The species has a preference for clay soils over laterite formations.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	WASHerb, Naturemap
Proteaceae	<i>Banksia oligantha</i>	EN	EN	An erect shrub species growing up to 3m tall with bark that is grey and fissured at the base and lower parts of branches, and becoming smooth in upper parts, and with yellowish flowers occurring between June and December. The species has a preference for grey and white sandy soils and sharing areas with other Banksia-dominated woodlands and shrublands.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	WASHerb, Naturemap
Proteaceae	<i>Banksia pteridifolia</i> <i>subsp. vernalis</i>	P3		A prostrate shrub species reaching approximately 30cm high, with yellow inflorescences and blue-green leaves. It inhabits areas of varying dry sandy soils and has often been recorded on hillsides and slopes amongst other Banksia species.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	WASHerb, Naturemap

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Proteaceae	<i>Banksia serratuloides subsp. perissa</i>	EN	EN	A rare species of erect, compact shrub growing up to 1m high and 1m wide, with yellow flowers occurring between August and December. The species has a preference for white and grey sandy soils over laterite formations.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	WASHerb, Naturemap
Proteaceae	<i>Banksia montana</i>	EN	EN	An increasingly rare species of erect, spindly shrub, growing up to 2.5m tall and 1m wide, with a long leafless stem and yellow flowers occurring between August and December. The species has a preference for darker coloured, sandy clay and can be found amongst rockier and hillier terrain.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	WASHerb, Naturemap
Proteaceae	<i>Banksia shanklandiorum</i>	P4		A species of dense shrub growing to 1.5 m high and 1 m wide with large yellow flowers with brown bracts, occurring between July and December, and leaves that are prickly, large and long. There is a species preference for brown and white sandy soils.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	WASHerb, Naturemap

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Proteaceae	<i>Banksia squarrosa</i> <i>subsp. argillacea</i>	EN	EN	A rare species of large, sprawling shrub growing up to 3 m tall with yellow flowers occurring from May to December. The species has been recorded in a variety of soil types and has often been found within laterite and ironstone terrains.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	WAHerb, Naturemap
Proteaceae	<i>Conospermum undulatum</i>	VU	VU	Erect, compact shrub, 0.6-2 m high. Fl. white-other, May to Oct. Grey or yellow-orange clayey sand.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	PMST, Naturemap TPFL, WAHerb
Proteaceae	<i>Grevillea asparagoides</i>	P3		A species of erect shrub growing up to 2m tall with leaves around 3.5cm long that are rigid, narrow, with divided inflorescence, and red flowers occurring between June and December. There is a species preference for yellow and brown sandy soils.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	WAHerb, Naturemap
Proteaceae	<i>Grevillea batrachioides</i>	EN	EN	An increasingly rare and uncommon, erect shrub species averaging 1m tall, with large, pale red flowers, with leaves that are pungent, and deeply lobed. It has been most often recorded on sandstone outcrops and sloping terrain.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	WAHerb, Naturemap

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Proteaceae	<i>Grevillea curviloba</i>	EN	EN	Prostrate to erect shrub, 0.1-2.5 m high. Fl. white-cream, Aug to Oct. Grey sand, sandy loam. Winter-wet heath.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Naturemap PMST, WAHerb
Proteaceae	<i>Grevillea granulosa</i>	P3		An erect, compact shrub species growing up to 1m tall and 1m across with red flowers occurring between August and November. The species has a preference for grey and sandy loam type soils.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	WAHerb, Naturemap
Proteaceae	<i>Grevillea maxwellii</i>	EN	EN	A rare species of erect, spreading shrub growing up to 1m tall, with red flowers occurring between August and November. There is a preference for darker loam-clay soils and rocky terrains.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	WAHerb, Naturemap
Proteaceae	<i>Grevillea pimeleoides</i>	P4		This is a comparatively rare single-stemmed Grevillia species growing to 2m in height. It has typically been found among powder-bark wandoo woodland communities, and more often in dry and gravel-type soils.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	WAHerb, Naturemap

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Proteaceae	<i>Grevillea thelemanniana</i>	CR	CR	This is a very rare, large, spreading shrub species, growing over 1.5 metres tall, with divided leaves and prominent red flowers. It has a preference for clay-type soils and is typically restricted to wet swamplands and seasonal wetlands.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	TPFL, WAHerb, Naturemap
Proteaceae	<i>Grevillea ornithopoda</i>	P2		Slender, erect shrub to 3 m. Riverbanks, dunes, creek edge in red brown loam over clay.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Naturemap, WAHerb
Proteaceae	<i>Grevillea prostrata</i>	P4		A species of spreading, prostrate shrub reaching up to 1m in diameter, with stems partly buried in the ground and with white flowers with pink fringes and fern-like leaves. There is a species preference for brown and yellow sandy soils.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	WAHerb, Naturemap
Proteaceae	<i>Grevillea pythara</i>	EN	EN	A rare, highly localised, root suckering shrub species reaching a maximum of 30cm tall, with flowers orange-pale red in colour occurring from August to November. The species has a preference for brown, sandy loam soils.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	WAHerb, Naturemap

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Proteaceae	<i>Hakea brachyptera</i>	P3		A species of low, dwarf-shrub species growing to a maximum of 1m high and 1m wide, and with pink flowers occurring between September and November. The species has a preference for white, sandy soils.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	WAHerb, Naturemap
Proteaceae	<i>Isopogon autumnalis</i>	P3		A multi-stemmed open shrub species growing to 1m tall with pale yellow flowers. The species can be found typically in dry, yellow to grey sandy soils, and along flats and well drained plains.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	WAHerb, Naturemap
Proteaceae	<i>Lambertia echinata</i> <i>subsp. echinata</i>	EN	EN	A prickly shrub species reaching a maximum of 1.5m tall with rough, fissured, grey bark, stems to 10 cm in diameter, and leaves that are trident shaped. The flowers are orange-red in colour and occur between September and November. The species has a preference for brown loam-type soils.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	WAHerb, Naturemap
Proteaceae	<i>Lambertia echinata</i> <i>subsp. occidentalis</i>	EN	EN	A rare and increasingly uncommon, tall shrub species growing up to 2.5m, with pungent pointed leaves ranging from entire to trident shaped, and yellow flowers occurring from April to December. There is a species preference for grey and white sandy soils.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	WAHerb, Naturemap

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Proteaceae	<i>Persoonia chapmaniana</i>	P3		A species of slender, erect shrub growing to 2m high, with flowers that are yellow to orange in colour occurring between September and November. The species has a preference for sandy soils of varying colours and has mostly been recorded in open woodlands.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	WAHerb, Naturemap
Proteaceae	<i>Synaphea</i> sp. Fairbridge Farm (D. Papenfus 696)	CR	CR	Dense, clumped shrub, to 0.3 m high, to 0.4 m wide. Fl. yellow, Oct. Sandy with laterite pebbles. Near winter-wet flats, in low woodland with weedy grasses.	Highly Unlikely. Species habitat (sandy laterite substrates) does not occur within the Survey Areas. No previous record within 10 km.	Highly Unlikely. Species habitat (sandy laterite substrates) does not occur within the Survey Areas. No previous record within 10 km.	Highly Unlikely. Species habitat (sandy laterite substrates) does not occur within the Survey Areas. No previous record within 10 km.	Highly Unlikely. Species habitat (sandy laterite substrates) does not occur within the Survey Areas. No previous record within 10 km.	PMST
Pteridaceae	<i>Adiantum capillus- veneris</i>	P2		Rhizomatous, perennial, herb or (fern), 0.1-0.2 m high, frond 1-2-pinnate; stipe blackish-brown, hard, glossy; sori marginal between sinuses, oblong. Moist, sheltered sites in gorges and on cliff walls.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Naturemap, WAHerb

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Restionaceae	<i>Hypolaena robusta</i>	P4		Dioecious rhizomatous, perennial, herb, ca 0.5 m high. Fl. Sep to Oct. White sand. Sandplains.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	WAHerb, Naturemap
Rutaceae	<i>Boronia clavata</i> <i>subsp. clavata</i>	EN	EN	A rare sub-species of erect shrub growing to 2m tall, with yellowish-green flowers occurring from September to December. The species prefers sandy loam soils and has been recorded often along alluvial plains.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	WAHerb, Naturemap
Rutaceae	<i>Cyanothamnus tenuis</i>	P4		Procumbent to erect shrub to 0.4 m high. Granite, laterite.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Naturemap, WAHerb
Sapindaceae	<i>Dodonaea hackettiana</i>	P4		Erect shrub or tree, 1-5 m high. Fl. yellow-green/red, mainly Jul to Oct. Sand. Outcropping limestone.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	TPFL WAHerb, Naturemap

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Scrophulariaceae	<i>Eremophila glabra</i> <i>subsp. chlorella</i>	EN	EN	This is a rare, woody, dense shrub species growing to 60cm tall with green fruits and yellow-green flowers. It can be found in soils that are both sandy grey and clay-based, and have been sparsely recorded within seasonal wetlands and dampened flats and plains.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	PMST, TPFL, WAHerb, Naturemap
Scrophulariaceae	<i>Eremophila lucida</i>	P1		A species of tall, slender and spindly shrub growing up to 3m high and 2m wide, with bark that is rough and fissured at the base but otherwise smooth. Flowers are light pink in colour and occurring between September and November. The species has a preference for light brown sandy soils.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	WAHerb, Naturemap
Stylidiaceae	<i>Stylidium aceratum</i>	P3		A small, erect, annually occurring herb species reaching up to 8cm tall with pink flowers. The species has a preference for lightly coloured clay soils and seasonal wetlands and seasonally inundated flats.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	WAHerb, Naturemap
Stylidiaceae	<i>Stylidium longitubum</i>	P4		A species of annually occurring, small erect shrub, not exceeding 10cm in height, and with white and purple flowers. The species has a preference for lightly coloured clay soils and seasonal wetlands and seasonally inundated flats.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	TPFL, WAHerb, Naturemap

Family	Taxon	BC Act/ DBCA	EPBC Act	Description	LOO – Elizabeth Quay	LOO - Applecross	LOO- Ellam St	LOO – Matilda Bay	Source
Stylidiaceae	<i>Stylidium maritimum</i>	P3		Caespitose perennial, herb, 0.3-0.7 m high. Occurs on sand over limestone. Dune slopes and flats. Coastal heath and shrubland, open Banksia woodland.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Naturemap, WAHerb, TPFL
Stylidiaceae	<i>Stylidium paludicola</i>	P3		Reed-like perennial, herb, 0.35-1 m high, Inflorescence racemose. Fl. pink, Oct to Dec. Peaty sand over clay. Winter wet habitats. Marri and Melaleuca woodland, Melaleuca shrubland.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Naturemap, WAHerb
Thymelaeaceae	<i>Pimelea calcicola</i>	P3		Erect to spreading shrub, 0.2-1 m high. Fl. pink, Sep to Nov. Sand. Coastal limestone ridges.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Naturemap, WAHerb
Stylidiaceae	<i>Levenhookia preissii</i>	P1		Annual (ephemeral), herb, 0.03-0.17 m high. Fl. pink-red, Sep to Dec or Jan. Grey or black, peaty sand. Swamps.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Unlikely. No suitable habitat recorded within the Survey Areas.	Naturemap, WAHerb

Significant Tree Data Across all Survey Sites of the Survey Area

Site Name	Tree ID	Classification (Native or Non-Native)	Species	Fauna Use/Fauna Significance	Latitude	Longitude	DBH (mm)	Datum	Accuracy
Ellam Street	ELLAMDBH	Native	<i>Eucalyptus gomphocephala</i>	Potential Black Cockatoo Foraging/Feeding and Breeding Tree, native bird species resting and foraging habitat	- 31.9717	115.8806	840	GDA20 20	+/- 5m
Ellam Street	ELLAMDBH2	Native	<i>Eucalyptus gomphocephala</i>	Potential Black Cockatoo Foraging/Feeding and Breeding Tree, native bird species resting and foraging habitat	- 31.9715	115.8807	760	GDA20 20	+/- 5m
Ellam Street	ELLAM 8	Native	<i>Agonis flexuosa</i>	Potential native bird resting, nesting and foraging habitat	- 31.9709	115.8809	920	GDA20 20	+/- 5m
Ellam Street	ELLAM037	Native	<i>Agonis flexuosa</i>	Potential native bird resting, nesting and foraging habitat	- 31.9715	115.8808	885	GDA20 20	+/- 5m
Ellam Street	ELLAMMORTONBAY	Non-native	<i>Ficus sp.</i>	Potential native bird resting, nesting and foraging habitat	- 31.9716	115.8800	1240	GDA20 20	+/- 5m
Ellam Street	ELLAMPEPP	Native	<i>Agonis flexuosa</i> x 3	Potential native bird resting, nesting and foraging habitat	- 31.9704	115.8833	665 ave	GDA20 20	+/- 5m
Ellam Street	ELLAMSTPEPP2	Native	<i>Agonis flexuosa</i> x 3	Potential Black Cockatoo Foraging/Feeding and Breeding Tree, native bird species resting and foraging habitat	- 31.9699	115.8842	835 ave	GDA20 20	+/- 5m
Matilda Bay	MATILDADBH4	Native	<i>Corymbia calophylla</i>	Potential Black Cockatoo Foraging/Feeding and Breeding Tree, native bird species resting and foraging habitat	- 31.9764	115.8218	1004	GDA20 20	+/- 5m
Matilda Bay	MATILDADBH5	Native	<i>Corymbia calophylla</i>	Potential Black Cockatoo Foraging/Feeding and Breeding Tree, native bird	- 31.9765	115.8217	907	GDA20 20	+/- 5m

Site Name	Tree ID	Classification (Native or Non-Native)	Species	Fauna Use/Fauna Significance	Latitude	Longitude	DBH (mm)	Datum	Accuracy
				species resting and foraging habitat					
Matilda Bay	MATILDADBH6	Native	<i>Eucalyptus marginata</i>	Potential Black Cockatoo Foraging/Feeding and Breeding Tree, native bird species resting and foraging habitat	- 31.9766	115.8215	923	GDA20 20	+/- 5m
Matilda Bay	MATILDADBH7	Native	<i>Eucalyptus marginata</i>	Potential Black Cockatoo Foraging/Feeding and Breeding Tree, native bird species resting and foraging habitat	- 31.9772	115.8213	843	GDA20 20	+/- 5m
Matilda Bay	MATILDADBH8	Native	<i>Eucalyptus gomphocephala</i>	Potential Black Cockatoo Foraging/Feeding and Breeding Tree, native bird species resting and foraging habitat	- 31.9772	115.8212	795	GDA20 20	+/- 5m
Matilda Bay	MATILDADBH	Native	<i>Eucalyptus gomphocephala</i>	Potential Black Cockatoo Foraging/Feeding and Breeding Tree, native bird species resting and foraging habitat	- 31.9772	115.8213	904	GDA20 20	+/- 5m
Matilda Bay	MATILDADBH9	Native	<i>Corymbia calophylla</i>	Potential Black Cockatoo Foraging/Feeding and Breeding Tree, native bird species resting and foraging habitat	- 31.9773	115.8211	872	GDA20 20	+/- 5m
Matilda Bay	MATILDADBH10	Native	<i>Corymbia calophylla</i>	Potential Black Cockatoo Foraging/Feeding and Breeding Tree, native bird species resting and foraging habitat	- 31.9774	115.8212	971	GDA20 20	+/- 5m
Matilda Bay	MATILDADBH11	Native	<i>Eucalyptus marginata</i>	Potential Black Cockatoo Foraging/Feeding and Breeding Tree, native bird species resting and foraging habitat	- 31.9774	115.8211	946	GDA20 20	+/- 5m
Matilda Bay	MATILDADBH12	Native	<i>Corymbia calophylla</i>	Potential Black Cockatoo Foraging/Feeding and	- 31.9775	115.821	826	GDA20 20	+/- 5m

Site Name	Tree ID	Classification (Native or Non-Native)	Species	Fauna Use/Fauna Significance	Latitude	Longitude	DBH (mm)	Datum	Accuracy
				Breeding Tree, native bird species resting and foraging habitat					
Matilda Bay	MATILDADBH13	Native	<i>Eucalyptus gomphocephala</i>	Potential Black Cockatoo Foraging/Feeding and Breeding Tree, native bird species resting and foraging habitat	- 31.9776	115.821	796	GDA20 20	+/- 5m
Matilda Bay	MATILDADBH14	Native	<i>Corymbia calophylla</i>	Potential Black Cockatoo Foraging/Feeding and Breeding Tree, native bird species resting and foraging habitat	- 31.9778	115.8211	595	GDA20 20	+/- 5m
Matilda Bay	DBH18	Native	<i>Corymbia calophylla</i>	Potential Black Cockatoo Foraging/Feeding and Breeding Tree, native bird species resting and foraging habitat	- 31.9800	115.8203	716	GDA20 20	+/- 5m
Matilda Bay	DBH19	Native	<i>Corymbia calophylla</i>	Potential Black Cockatoo Foraging/Feeding and Breeding Tree, native bird species resting and foraging habitat	- 31.9795	115.8208	670	GDA20 20	+/- 5m
Matilda Bay	DBH20	Native	<i>Eucalyptus gomphocephala</i>	Potential Black Cockatoo Foraging/Feeding and Breeding Tree, native bird species resting and foraging habitat	- 31.9796	115.821	764	GDA20 20	+/- 5m
Matilda Bay	REPLANTED1	Native	<i>Melaleuca lanceolata</i>	Potential native bird resting, nesting and foraging habitat	- 31.9799	115.8204	859	GDA20 20	+/- 5m
Matilda Bay	REPLANT2	Native	<i>Agonis flexuosa x 2</i>	Potential native bird resting, nesting and foraging habitat	- 31.9794	115.8205	878 ave	GDA20 20	+/- 5m
Matilda Bay	REPLANT3	Native	<i>Melaleuca lanceolata</i>	Potential native bird resting, nesting and foraging habitat	- 31.9801	115.8203	750	GDA20 20	+/- 5m

Site Name	Tree ID	Classification (Native or Non-Native)	Species	Fauna Use/Fauna Significance	Latitude	Longitude	DBH (mm)	Datum	Accuracy
Matilda Bay	SHORE1	Non-Native	<i>Plantanus x acerifolia</i> x 4	Potential native bird resting and nesting habitat	- 31.9803	115.821	725 ave.	GDA20 20	+/- 5m

Appendix E

Fauna data

E-1 Fauna species list

E-2 Fauna Likelihood of occurrence assessment

Opportunistic Fauna Species List by Species Group – Elizabeth Quay

Common name	Scientific name	Status	Record type	Frequency
Birds				
Darter	<i>Anhinga novaehollandiae</i>	Native	Observed	3
Domestic Pigeon	<i>Columba livia</i>	Int.	Observed	7
Pied Cormorant	<i>Microcarbo melanoleucos</i>	Native	Observed	1
Silver Gull	<i>Chroicocephalus novaehollandiae</i>	Native	Observed	12

Opportunistic Fauna Species List by Species Group – Applecross

Common name	Scientific name	Status	Record type	Frequency
Birds				
Australian Pelican	<i>Pelecanus conspicillatus</i>	Native	Observed	2
Australian Raven	<i>Corvus coronoides</i>	Native	Heard Calling	1
Black Swan	<i>Cygnus atratus</i>	Native	Observed	15
Darter	<i>Anhinga novaehollandiae</i>	Native	Observed	3
Rainbow Lorikeet	<i>Trichoglossus moluccanus</i>	Int.	Observed	4
Silver Gull	<i>Chroicocephalus novaehollandiae</i>	Native	Observed	7
Whistling Kite	<i>Haliastur sphenurus</i>	Native	Observed	1
White-faced Heron	<i>Egretta novaehollandiae</i>	Native	Observed	1
Mammals				
Indo-Pacific Bottlenose Dolphin	<i>Tursiops aduncus</i>	Native	Observed	4

Opportunistic Fauna Species List by Species Group – Ellam St

Common name	Scientific name	Status	Record type	Frequency
Birds				
Australian Magpie	<i>Gymnorhina tibicen</i>	Native	Observed	7
Australian Raven	<i>Corvus coronoides</i>	Native	Observed	1
Black-faced Cuckoo-Shrike	<i>Coracina novaehollandiae</i>	Native	Observed	1
Darter	<i>Anhinga novaehollandiae</i>	Native	Observed	1
Galah	<i>Eolophus roseicapilla</i>	Native	Observed	1
Laughing Dove	<i>Streptopelia senegalensis</i>	Int.	Observed	3
New-Holland Honeyeater	<i>Phylidonyris novaehollandiae</i>	Native	Observed	4
Rainbow Lorikeet	<i>Trichoglossus moluccanus</i>	Int.	Observed	11
Red Wattlebird	<i>Anthochaera carunculata</i>	Native	Observed	2
Silvereye	<i>Zosterops lateralis</i>	Native	Observed	5

Common name	Scientific name	Status	Record type	Frequency
Silver Gull	<i>Chroicocephalus novaehollandiae</i>	Native	Observed	1
Welcome Swallow	<i>Hirundo neoxena</i>	Native	Observed	2
Willy Wagtail	<i>Rhipidura leucophrys</i>	Native	Observed	11

Opportunistic Fauna Species List by Species Group – Matilda Bay

Common name	Scientific name	Status	Record type	Frequency
Birds				
Australian Magpie	<i>Gymnorhina tibicen</i>	Native	Observed	2
Australian Raven	<i>Corvus coronoides</i>	Native	Observed	4
Australian Wood Duck	<i>Chenonetta jubata</i>	Native	Observed	1
Black Swan	<i>Cygnus atratus</i>	Native	Observed	12
Long-billed Corella	<i>Cacatua tenuirostris</i>	Int.	Observed	20
Pacific Black Duck	<i>Anas superciliosa</i>	Native	Observed	61
Rainbow Lorikeet	<i>Trichoglossus moluccanus</i>	Int.	Observed	1
Red Wattlebird	<i>Anthochaera carunculata</i>	Native	Observed	10
Silvereye	<i>Zosterops lateralis</i>	Native	Observed	2
Silver Gull	<i>Chroicocephalus novaehollandiae</i>	Native	Observed	18
Willy Wagtail	<i>Rhipidura leucophrys</i>	Native	Observed	2

Fauna likelihood of occurrence assessment

Fauna likelihood of occurrence assessment guidelines

Assessment outcome	Description
Known	Species recorded during the field survey or from recent, reliable records from within or close proximity to the Survey Areas.
Likely	Species are likely to occur in the Survey Areas where there is suitable habitat within the Survey Areas and there are recent records of occurrence of the species in close proximity to the Survey Areas. OR Species known distribution overlaps with the Survey Areas and there is suitable habitat within the Survey Areas.
Possible	Species are possible to occur in the Survey Areas where there may be suitable habitat within the Survey Areas, or that suitable habitat does occur but in small quantities, and there are recent records of occurrence of the species in close proximity to the Survey Areas.
Unlikely	Species assessed as unlikely include those species previously recorded within 40 km of the Survey Areas however: There is limited (i.e. the type, quality and quantity of the habitat is generally poor or restricted) habitat in the Survey Areas. The suitable habitat within the Survey Areas is isolated from other areas of suitable habitat and the species has no capacity to migrate into the Survey Areas. OR Those species that have a known distribution overlapping with the Survey Areas however: There is limited habitat in the Survey Areas (i.e., the type, quality and quantity of the habitat is generally poor or restricted). The suitable habitat within the Survey Areas is isolated from other areas of suitable habitat and the species has no capacity to migrate into the Survey Areas.
Highly unlikely	Species that are considered highly unlikely to occur in the Survey Areas include: Those species that have no suitable habitat within the Survey Areas. Those species that have become locally extinct or are not known to have ever been present in the region of the Survey Areas.

Source information - desktop searches

NM – *DBCA NatureMap/Dandjoo* (accessed February 2025)

PMST – MNES Protected Matters Search Tool (PMST) to identify fauna listed under the EPBC Act potentially occurring within the Survey Areas (accessed February 2025).

Significant fauna – Likelihood of occurrence across Survey Area

Species name	Common name	Status		Habitat requirements	LOO – Elizabeth Quay	LOO - Applecross	LOO – Ellam St	LOO – Matilda Bay	Source
		State	Federal						
BIRDS									
<i>Actitis hypoleucos</i>	Common Sandpiper	MI	MI	Habitat for the Common Sandpiper is varied: coastal and interior wetlands – narrow muddy edges of billabongs, river pools, mangroves, among rocks and snags, reefs or rocky beaches. Avoids wide open mudflats. This species is widespread and scattered, common on the north and west coasts and uncommon in the south-east and interior (Morcombe 2004).	Unlikely. Known to occur locally, within 5 km radius due to proximity to Lake Herdsman and Swan Rv estuarine habitat. However, Lake Monger lacks suitable shallow extensive shoreline. Any visitation would be infrequent vagrant occurrence.	Unlikely. Known to occur locally, within 5 km radius due to proximity to Lake Herdsman and Swan Rv estuarine habitat. However, Lake Monger lacks suitable shallow extensive shoreline. Any visitation would be infrequent vagrant occurrence.	Unlikely. Known to occur locally, within 5 km radius due to proximity to Lake Herdsman and Swan Rv estuarine habitat. However, Lake Monger lacks suitable shallow extensive shoreline. Any visitation would be infrequent vagrant occurrence.	Unlikely. Known to occur locally, within 5 km radius due to proximity to Lake Herdsman and Swan Rv estuarine habitat. However, Lake Monger lacks suitable shallow extensive shoreline. Any visitation would be infrequent vagrant occurrence.	PMST, DBCA
<i>Anous stolidus</i>	Common Noddy	MI	MI	The Common Noddy is found in tropical and sub-tropical seas off the west, north and east coasts of Australia, from the Abrolhos Islands in WA to the islands of the Great Barrier Reef in Qld, as well as Norfolk and Lord Howe Islands. Some are seen almost annually in NSW as far south as Sydney. It also ranges across tropical parts of the Pacific, Indian and Atlantic Oceans (DCCEW 2022).	Highly Unlikely. No suitable habitat for the species occurs and records for the species are very few.	Highly Unlikely. No suitable habitat for the species occurs and records for the species are very few.	Highly Unlikely. No suitable habitat for the species occurs and records for the species are very few.	Highly Unlikely. No suitable habitat for the species occurs and records for the species are very few.	PMST, DBCA
<i>Anous tenuirostris melanops</i>	Australian Lesser Noddy	VU	VU	The Australian subspecies of the Australian lesser noddy <i>A. t. melanops</i> breeds only on three islands in the Houtman Abrolhos, off Western Australia, where it nests in mangroves. The birds remain near the breeding islands all year (Higgins and Davies 1996).	Highly Unlikely. No suitable habitat for the species occurs and records for the species are very few.	Highly Unlikely. No suitable habitat for the species occurs and records for the species are very few.	Highly Unlikely. No suitable habitat for the species occurs and records for the species are very few.	Highly Unlikely. No suitable habitat for the species occurs and records for the species are very few.	PMST
<i>Arenaria interpres</i>	Ruddy Turnstone	VU, MI	VU, MI	In Australia, Ruddy Turnstones are widespread around the coast of the mainland and off-shore islands. They breed on the northern coasts of Europe, Asia and North America. They are found on coastlines around the world, when not breeding or on passage. They are found singly or in small groups along the coastline and only occasionally inland. They are mainly found on exposed rocks or reefs, often with shallow pools, and on beaches. In the north, they are found in a wider range of habitats, including mudflats (DEE 2019b).	Highly Unlikely. No suitable habitat for the species occurs and records for the species are very few.	Highly Unlikely. No suitable habitat for the species occurs and records for the species are very few.	Highly Unlikely. No suitable habitat for the species occurs and records for the species are very few.	Highly Unlikely. No suitable habitat for the species occurs and records for the species are very few.	PMST, DBCA
<i>Ardenna carneipes</i>	Flesh-footed Shearwater	MI	MI	The Flesh-footed Shearwater is a large (length 40–47 cm; wingspan 99–107 cm; weight 510–750 g), broad-winged, blackish-brown shearwater with dark brown irides, a pale-horn bill (tipped black) and flesh-pink legs and feet (Johnstone & Storr 1998; Marchant & Higgins 1990). Individuals are typically solitary at sea, although flocks of hundreds of birds can form around sources of food, and at dusk when individuals raft together offshore from their breeding islands (Bartle 1974; Johnstone & Storr 1998; Marchant & Higgins 1990; Warham 1958). The Flesh-footed Shearwater mainly occurs in the subtropics over continental shelves and slopes and occasionally inshore waters. Individuals also pass through the tropics and over deeper waters when on migration (Brooke 2004; Marchant & Higgins 1990;). Pairs breed on islands in burrows on sloping ground in coastal forest, scrubland, shrubland or grassland (Marchant & Higgins 1990).	Highly Unlikely. No suitable habitat for the species occurs and records for the species are very few.	Highly Unlikely. No suitable habitat for the species occurs and records for the species are very few.	Highly Unlikely. No suitable habitat for the species occurs and records for the species are very few.	Highly Unlikely. No suitable habitat for the species occurs and records for the species are very few.	PMST, DBCA

Species name	Common name	Status		Habitat requirements	LOO – Elizabeth Quay	LOO - Applecross	LOO – Ellam St	LOO – Matilda Bay	Source
		State	Federal						
<i>Ardenna grisea</i>	Sooty Shearwater	VU, MI	VU, MI	The Sooty Shearwater is a large, robust sea bird, with a wingspan up to 105 cm and a weight of up to 1 kg. The head, upper body, upper wing and tail of the Sooty Shearwater are uniformly dark brown-grey. The Sooty Shearwater is found in the southern hemisphere during summer, where the species breeds around New Zealand, southern Australia and southern South America. During winter (non-breeding season) most birds move to the North Pacific Ocean, but some move into the North Atlantic Ocean, or remain in the southern hemisphere (Marchant & Higgins 1990). During the southern hemisphere summer, the species ranges from breeding islands south to Antarctic waters (as far as the iceberg-belt), although some remain in northern hemisphere. The Sooty Shearwater breeds mainly on subtropical and sub-Antarctic islands, as well as on the mainland of New Zealand. Birds nest in burrows or rock crevices on coastal slopes, ridges and cliff tops, in herbfields, tussock grassland or forest. Areas with waterlogged or shallow soils and/or dense vegetation are avoided.	Highly Unlikely. No suitable habitat for the species occurs and records for the species are very few.	Highly Unlikely. No suitable habitat for the species occurs and records for the species are very few.	Highly Unlikely. No suitable habitat for the species occurs and records for the species are very few.	Highly Unlikely. No suitable habitat for the species occurs and records for the species are very few.	PMST, DBCA
<i>Halobaena caerulea</i>	Blue Petrel	VU	VU	The Blue Petrel has a global distribution throughout the southern oceans from the pack ice edge up to about 30 degrees south. Breeding sites include Macquarie Island (Australia); the Crozet and Kerguelen Islands in the French Southern Territories; Marion and Prince Edward Islands (South Africa); South Georgia; Diego Ramirez Cape Horn, and the Hermite and Wollaston Groups of islands (Chile).	Highly Unlikely. No suitable habitat for the species occurs there are no species records within 10km of any of the Survey Areas.	Highly Unlikely. No suitable habitat for the species occurs there are no species records within 10km of any of the Survey Areas.	Highly Unlikely. No suitable habitat for the species occurs there are no species records within 10km of any of the Survey Areas.	Highly Unlikely. No suitable habitat for the species occurs there are no species records within 10km of any of the Survey Areas.	PMST
<i>Ninox connivens connivens</i>	Barking Owl (southwest population)	P3		The southwest subspecies of the Barking Owl is found in the lower south-west region and is very scarce. There is little known about the subspecies (Nevill 2008). Barking Owls are found in open woodlands and the edges of forests, often adjacent to farmland. They are less likely to use the interior of forested habitat. They are usually found in habitats that are dominated by eucalyptus species, particularly red gum, and, in the tropics, paperbark species. They prefer woodlands and forests with a high density of large trees and particularly sites with hollows that are used by the owls as well as their prey. Habitat preference is strongly biased towards areas that provide a high density of large trees greater than 60cm diameter and a high density of hollow trees of a range of sizes, including large hollows greater than 15cm diameter which are suitable nesting places for Barking Owls. Roost sites are often located near waterways or wetlands.	Highly Unlikely. The Survey Areas lacks suitable extensive forest or dense woodland scrub as it is located inner Perth metro area.	Unlikely. The Survey Areas lacks suitable extensive forest or dense woodland scrub as it is located inner Perth metro area.	Unlikely. The Survey Areas lacks suitable extensive forest or dense woodland scrub as it is located inner Perth metro area.	Unlikely. The Survey Areas lacks suitable extensive forest or dense woodland scrub as it is located inner Perth metro area.	DBCA
<i>Cacatua pastinator pastinator</i>	Muir's Corella	CD		Muir's Corella lives in woodland on the drier, eastern side of the main forest block in the south west, in woodlands that are dominated by Wandoo (<i>E. wandoo</i>), Marri, (<i>Corymbia calophylla</i>), or Jarrah, (<i>Eucalyptus marginata</i>). Most suitable habitat for this species now consists of remnant patches that occur in or adjacent to farmland, or along roadsides, paddock boundaries or watercourses, and sometimes as a few, isolated shade trees in otherwise cleared paddocks (Garnett & Crowley 2000). The bird nests in large hollows in trees at least 160 years old. It now has a restricted distribution in the Tone Bridge, Rocky Gully, Frankland River and Lake Muir area (TSSC 2016a).	Unlikely Restricted to a localised area of the southern Jarrah forest, and recordings have been very rare and occasional as a vagrant occurrence.	Unlikely. Restricted to a localised area of the southern Jarrah forest, and recordings have been very rare and occasional as a vagrant occurrence.	Unlikely, Restricted to a localised area of the southern Jarrah forest, and recordings have been very rare and occasional as a vagrant occurrence.	Unlikely. Restricted to a localised area of the southern Jarrah forest, and recordings have been very rare and occasional as a vagrant occurrence.	DBCA, Naturemap
<i>Calyptorhynchus banksia naso</i>	Forest Red-tailed Black Cockatoo	Vu	Vu	Forest Red-tailed Black Cockatoo typically occurs in dense Jarrah (<i>Eucalyptus marginata</i>), Karri (<i>E. diversicolor</i>) and Marri (<i>Corymbia calophylla</i>) forests, however the species also occurs in a range of other forest and woodland types, including Blackbutt (<i>E. patens</i>), Wandoo (<i>E. wandoo</i>), Tuart (<i>E. gomphocephala</i>), Albany Blackbutt, Yate (<i>E. cornuta</i>), and Flooded Gum (<i>E. rudis</i>) (DSEWPaC, 2012). Habitats also tend to have an understorey of Banksia spp., Persoonia spp., Allocasuarina spp. The Forest red-tailed Black Cockatoo generally nests in hollows in live or dead trees of marri, karri, wandoo, bullich, blackbutt, tuart and jarrah (DSEWPaC 2012).	Possible. Numerous recordings within the Survey Areas with potentially suitable feeding and foraging trees nearby, and known roosting sites within 12km of the current Survey Areas.	Possible. Numerous recordings within the Survey Areas with potentially suitable feeding and foraging trees nearby, and known roosting sites within 12km of the current Survey Areas.	Likely. Numerous recordings within the Survey Areas with potentially suitable feeding and foraging trees nearby, and known roosting sites within 12km of the current Survey Areas.	Likely. Numerous recordings within the Survey Areas with potentially suitable feeding and foraging trees nearby, and known roosting sites within 12km of the current Survey Areas.	PMST, DBCA

Species name	Common name	Status		Habitat requirements	LOO – Elizabeth Quay	LOO - Applecross	LOO – Ellam St	LOO – Matilda Bay	Source
		State	Federal						
<i>Zanda baudinii</i>	Baudin's Cockatoo	En	En	Baudin's Black Cockatoo occurs in high-rainfall areas, usually at sites that are heavily forested and dominated by Marri (<i>Corymbia calophylla</i>) and Eucalyptus species, especially Karri (<i>E. diversicolor</i>) and Jarrah (<i>E. marginata</i>). The species also occurs in woodlands of Wandoo (<i>E. wandoo</i>), Blackbutt (<i>E. patens</i>), Flooded Gum (<i>E. rudis</i>), and Yate (<i>E. cornuta</i>) . Baudin's Black Cockatoo breeds in the Jarrah, Marri and Karri forests of the deep south-west in areas averaging more than 750 mm of rainfall annually. The range of the species extends from Albany northward to Gidgegannup and Mundaring (east of Perth), and inland to the Stirling Ranges and near Boyup Brook. Preferred roosts are in areas with a dense canopy close to permanent sources of water, that provide the birds with protection from weather conditions (DSEWPac, 2012).	Possible. Known to occur locally at least on an occasional basis. Sometime as mixed flock with Carnaby's Cockatoo.	Likely. Known to occur locally at least on an occasional basis. Sometime as mixed flock with Carnaby's Cockatoo.	Likely. Known to occur locally at least on an occasional basis. Sometime as mixed flock with Carnaby's Cockatoo.	Likely. Known to occur locally at least on an occasional basis. Sometime as mixed flock with Carnaby's Cockatoo.	DBCA
<i>Zanda latirostris</i>	Carnaby's Cockatoo	En	En	This species mainly occurs in uncleared or remnant native eucalypt woodlands and in shrubland or kwongan heathland dominated by Hakea, Dryandra, Banksia and Grevillea species. The species also occurs in forests containing Marri (<i>Corymbia calophylla</i>), Jarrah (<i>Eucalyptus marginata</i>) or Karri (<i>E. diversicolor</i>). Breeding usually occurs in the Wheatbelt region of Western Australia, with flocks moving to the higher rainfall coastal areas to forage after the breeding season. Feeds on the seeds of a variety of native plants, including Allocasuarina, Banksia, Dryandra, Eucalyptus, Grevillea and Hakea, and some introduced plants (DSEWPac, 2012).	Possible. Known to occur locally on a regular basis, although may not forage frequently due to paucity of foraging habitat. Numerous recordings within the Survey Areas with potentially suitable feeding and foraging trees nearby, and known roosting sites within 12km of the current Survey Areas.	Likely. Known to occur locally on a regular basis, although may not forage frequently due to paucity of foraging habitat. Numerous recordings within the Survey Areas with potentially suitable feeding and foraging trees nearby, and known roosting sites within 12km of the current Survey Areas.	Likely. Known to occur locally on a regular basis, although may not forage frequently due to paucity of foraging habitat. Numerous recordings within the Survey Areas with potentially suitable feeding and foraging trees nearby, and known roosting sites within 12km of the current Survey Areas.	Likely. Known to occur locally on a regular basis, although may not forage frequently due to paucity of foraging habitat. Numerous recordings within the Survey Areas with potentially suitable feeding and foraging trees nearby, and known roosting sites within 12km of the current Survey Areas.	DBCA
<i>Falco peregrinus</i>	Peregrine Falcon	OS		The Peregrine Falcon is seen occasionally anywhere in the south-west of Western Australia. It is found everywhere from woodlands to open grasslands and coastal cliffs - though less frequently in desert regions. The species nests primarily on ledges of cliffs, shallow tree hollows, and ledges of building in cities. (Morcombe, 2004).	Possible. Known to occur locally based on nearby database records within urban and neighbourhood sites, though this will be more of a fly-over utilisation with regards to the current Survey Areas.	Likely. Known to occur locally based on nearby database records within urban and neighbourhood sites, though this will be more of a fly-over utilisation with regards to the current Survey Areas.	Likely. Known to occur locally based on nearby database records within urban and neighbourhood sites, though this will be more of a fly-over utilisation with regards to the current Survey Areas.	Likely. Known to occur locally based on nearby database records within urban and neighbourhood sites, though this will be more of a fly-over utilisation with regards to the current Survey Areas.	DBCA, Naturemap
<i>Falco hypoleucos</i>	Grey falcon	Vu		Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast. (Birdlife International, 2023)	Highly Unlikely. The survey area is beyond the known range. Any occurrence would be as vagrant.	Highly Unlikely. The survey area is beyond the known range. Any occurrence would be as vagrant.	Unlikely. The survey area is beyond the known range. Any occurrence would be as vagrant.	Unlikely. The survey area is beyond the known range. Any occurrence would be as vagrant.	DBCA

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		State	Federal						
<i>Leipoa ocellata</i>	Malleefowl	Vu	Vu & Mi	The Malleefowl generally occurs in semi-arid areas of Western Australia, from Carnarvon to southeast of the Eyre Bird Observatory (south-east Western Australia). It occupies shrublands and low woodlands that are dominated by mallee vegetation, as well as native pine <i>Callitris</i> woodlands, <i>Acacia</i> shrublands, Broombush <i>Melaleuca uncinata</i> vegetation or coastal heathlands. The nest is a large mound of sand or soil and organic matter (Jones and Goth 2008; Morcombe, 2004).	Highly Unlikely. Locally and regionally extinct. Survey Areas is beyond the current known range and lack of suitable habitat.	Highly Unlikely. Locally and regionally extinct. Survey Areas is beyond the current known range and lack of suitable habitat.	Highly Unlikely. Locally and regionally extinct. Survey Areas is beyond the current known range and lack of suitable habitat.	Highly Unlikely. Locally and regionally extinct. Survey Areas is beyond the current known range and lack of suitable habitat.	PMST, DBCA
<i>Tyto novaehollandiae subsp. novaehollandiae</i>	Masked Owl (southern subsp)	P3		The Masked Owl is found across a range of habitats from wet sclerophyll forest, dry sclerophyll forest, non-eucalypt dominated forest, scrub and cleared land with remnant old growth trees. There are however several aspects of habitat preference which appear to be common: the Masked Owl requires large hollows in old growth eucalypts for nesting; it often favours areas with dense understorey or ecotones comprising dense and sparse ground cover, they are often recorded foraging within 100-300m of the boundary of two vegetation types (Bell & Mooney, 2002).	Unlikely. The Survey Areas lacks suitable extensive forest or dense woodland scrub as it is located in inner Perth metro area, and records within 10km of the Survey Areas are comparatively few.	Unlikely. The Survey Areas lacks suitable extensive forest or dense woodland scrub as it is located in inner Perth metro area, and records within 10km of the Survey Areas are comparatively few.	Unlikely. The Survey Areas lacks suitable extensive forest or dense woodland scrub as it is located in inner Perth metro area, and records within 10km of the Survey Areas are comparatively few.	Unlikely. The Survey Areas lacks suitable extensive forest or dense woodland scrub as it is located in inner Perth metro area, and records within 10km of the Survey Areas are comparatively few.	DBCA
<i>Apus pacificus</i>	Fork-tailed Swift	MI	Mi	In south-west WA there are sparsely scattered records along the south coast, ranging from the Eyre Bird Observatory and west to Denmark. They are widespread in coastal and sub-coastal areas between Augusta and Carnarvon, including some on nearshore and offshore islands. This species is almost exclusively aerial, flying less than 1 m to at least 300 m above ground. This species is considered rare in the south-west region (DSEWPac 2013).	Unlikely. Wide-ranging and occasionally recorded locally within close proximity to current Survey Areas, however forages aerially and would not utilise habitat currently found.	Unlikely. Wide-ranging and occasionally recorded locally within close proximity to current Survey Areas, however forages aerially and would not utilise habitat currently found.	Unlikely. Wide-ranging and occasionally recorded locally within close proximity to current Survey Areas, however forages aerially and would not utilise habitat currently found.	Unlikely. Wide-ranging and occasionally recorded locally within close proximity to current Survey Areas, however forages aerially and would not utilise habitat currently found.	DBCA
<i>Botaurus poiciloptilus</i>	Australasian Bittern	En	En	The Australasian Bittern occurs mainly in densely vegetated freshwater wetlands and, rarely, in estuaries or tidal wetlands. The species favours foraging in tall, dense vegetation in shallow permanent or seasonal fresh water. In the southwest of Western Australia the Bittern is now largely confined to coastal areas especially along the south coast where it is found in beds of tall rush mixed with or near short fine sedge or open pools (Burbridge 2004). It also occurs around swamps, lakes, pools, rivers and channels fringed with <i>lignum Muehlenbeckia</i> , canegrass <i>Eragrostis</i> or other dense vegetation (Marchant & Higgins 1990). It occasionally ventures into areas of open water or onto banks.	Unlikely. Wetland habitat within Survey Areas is not suitable to sustain any population for feeding, foraging or breeding behaviour and records within 10km of the Survey Areas are relatively few. Any occurrence would be as vagrant.	Unlikely. Wetland habitat within Survey Areas is not suitable to sustain any population for feeding, foraging or breeding behaviour and records within 10km of the Survey Areas are relatively few. Any occurrence would be as vagrant.	Unlikely. Wetland habitat within Survey Areas is not suitable to sustain any population for feeding, foraging or breeding behaviour and records within 10km of the Survey Areas are relatively few. Any occurrence would be as vagrant.	Unlikely. Wetland habitat within Survey Areas is not suitable to sustain any population for feeding, foraging or breeding behaviour and records within 10km of the Survey Areas are relatively few. Any occurrence would be as vagrant.	DBCA

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		State	Federal						
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	MI	MI	In Australasia, the Sharp-tailed Sandpiper prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline saltlakes inland. They also occur in saltworks and sewage farms. They use flooded paddocks, sedgelands and other ephemeral wetlands, but leave when they dry. They use intertidal mudflats in sheltered bays, inlets, estuaries or seashores, and also swamps and creeks lined with mangroves. Sometimes they occur on rocky shores (DotE 2016). They are found throughout many wetlands on the Swan Coastal Plain, in Perth lakes with wet grassed margins and receding waters, Vasse and Harvey Estuaries, and the Busselton wetlands, but are less common on the south coast until the Esperance region (Nevill 2013).	Unlikely. Known to occur locally, with historical recordings within 5km of current Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline. Any visitation would be infrequent vagrant occurrence.	Unlikely. Known to occur locally, with historical recordings within 5km of current Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline. Any visitation would be infrequent vagrant occurrence.	Unlikely. Known to occur locally, with historical recordings within 5km of current Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline. Any visitation would be infrequent vagrant occurrence.	Unlikely. Known to occur locally, with historical recordings within 5km of current Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline. Any visitation would be infrequent vagrant occurrence.	DBCA
<i>Calidris alba</i>	Sanderling	MI	MI	In Australia, the species is almost always found on the coast, mostly on open sandy beaches exposed to open sea-swell, and also on exposed sandbars and spits, and shingle banks, where they forage in the wave-wash zone and amongst rotting seaweed. Sanderlings also occur on beaches that may contain wave-washed rocky outcrops. Less often the species occurs on more sheltered sandy shorelines of estuaries, inlets and harbours (DEE 2019b).	Unlikely. Known to occur locally, with historical recordings within 5km of current Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline. Any visitation would be infrequent vagrant occurrence.	Unlikely. Known to occur locally, with historical recordings within 5km of current Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline. Any visitation would be infrequent vagrant occurrence.	Unlikely. Known to occur locally, with historical recordings within 5km of current Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline. Any visitation would be infrequent vagrant occurrence.	Unlikely. Known to occur locally, with historical recordings within 5km of current Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline. Any visitation would be infrequent vagrant occurrence.	PMST
<i>Calidris canutus</i>	Red Knot	VU, MI	VU, MI	In Australasia, the Red Knot mainly inhabits intertidal mudflats, sandflats and sandy beaches of sheltered coasts, in estuaries, bays, inlets, lagoons and harbours; sometimes on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms or coral reefs. They are occasionally seen on terrestrial saline wetlands near the coast, such as lakes, lagoons, pools and pans, and recorded on sewage ponds and saltworks, but rarely use freshwater swamps. They rarely use inland lakes or swamps (DCCEEW 2022). They are found near mudflats and estuaries from Murchison to Bunbury but are then uncommon from Wilson Inlet to Esperance. In the Perth region they are mainly found in Alfred Cove and Peel Inlet (Nevill 2013).	Unlikely. The Survey Areas lacks suitable shallow extensive shoreline. Any visitation would be infrequent vagrant occurrence.	Unlikely. The Survey Areas lacks suitable shallow extensive shoreline. Any visitation would be infrequent vagrant occurrence.	Unlikely. The Survey Areas lacks suitable shallow extensive shoreline. Any visitation would be infrequent vagrant occurrence.	Unlikely. The Survey Areas lacks suitable shallow extensive shoreline. Any visitation would be infrequent vagrant occurrence.	PMST
<i>Calidris pugnax</i>	Ruff	MI	MI	In Australia, the Ruff is found on generally fresh, brackish of saline wetlands with exposed mudflats at the edges. It is found in terrestrial wetlands including lakes, swamps, pools, lagoons, tidal rivers, swampy fields and floodlands. They are occasionally seen on sheltered coasts, in harbours, estuaries, seashores and are known to visit sewage farms and saltworks. They are sometimes found on wetlands surrounded by dense vegetation including grass, sedges, saltmarsh and reeds. They have been observed on sand spits and other sandy habitats including shingles. The Ruff forages on exposed mudflats, in shallow water and occasionally on dry mud. They have been observed foraging in dry waterside plants and in swampy areas next to aeration tanks in sewage farms. They prefer to roost amongst shorter vegetation (Higgins & Davies 1996).	Unlikely. The Survey Areas lacks suitable shallow extensive shoreline. Any visitation would be infrequent vagrant occurrence.	Unlikely. The Survey Areas lacks suitable shallow extensive shoreline. Any visitation would be infrequent vagrant occurrence.	Unlikely. The Survey Areas lacks suitable shallow extensive shoreline. Any visitation would be infrequent vagrant occurrence.	Unlikely. The Survey Areas lacks suitable shallow extensive shoreline. Any visitation would be infrequent vagrant occurrence.	PMST

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		State	Federal						
<i>Calidris ferruginea</i>	Curlew Sandpiper	Cr & IA	Cr & Mi	Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in both fresh and brackish waters. Occasionally they are recorded around floodwaters (DSEWPaC 2013).	Unlikely. Known to occur locally, with DBCA records within 5km of current Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging. Any visitation would be infrequent vagrant occurrence.	Unlikely. Known to occur locally, with DBCA records within 5km of current Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging. Any visitation would be infrequent vagrant occurrence.	Unlikely. Known to occur locally, with DBCA records within 5km of current Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging. Any visitation would be infrequent vagrant occurrence.	Unlikely. Known to occur locally, with DBCA records within 5km of current Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging. Any visitation would be infrequent vagrant occurrence.	DCBA
<i>Calidris melanotos</i>	Pectoral Sandpiper	MI	MI	In Australasia, the Pectoral Sandpiper prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. The species is usually found in coastal or near coastal habitat but occasionally found further inland. It prefers wetlands that have open fringing mudflats and low, emergent or fringing vegetation, such as grass or samphire. The species has also been recorded in swamp overgrown with lignum. They forage in shallow water or soft mud at the edge of wetlands (Higgins & Davies 1996).	Unlikely. Known to occur locally, with DBCA records within 5km of current Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging. Any visitation would be infrequent vagrant occurrence.	Unlikely. Known to occur locally, with DBCA records within 5km of current Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging. Any visitation would be infrequent vagrant occurrence.	Unlikely. Known to occur locally, with DBCA records within 5km of current Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging. Any visitation would be infrequent vagrant occurrence.	Unlikely. Known to occur locally, with DBCA records within 5km of current Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging. Any visitation would be infrequent vagrant occurrence.	PMST, DBCA
<i>Calidris ruficollis</i>	Red-necked Stint	IA	IA : Mi	The Red-necked Stint can be found in fresh and saline water, but primarily in coastal regions (Nevill 2013). It is mostly found in areas including sheltered inlets, bays, lagoons and estuaries with intertidal mudflats, often near spits, islets and banks and, sometimes, on protected sandy or coralline shores. Occasionally they have been recorded on exposed or ocean beaches, and on stony or rocky shores, reefs or shoals. They also occur in saltworks and sewage farms; saltmarsh; ephemeral or permanent shallow wetlands near the coast or inland, including lagoons, lakes, swamps, riverbanks, waterholes, bore drains, dams, soaks and pools in saltflats. They have occasionally been recorded on dry gibber plains, with little or no perennial vegetation (DotE 2016). They are common in many parts of the southwest, and can be found in the Murchison down to Busselton and Augusta to Cape Arid, and on islands, particularly Rottnest (Nevill 2013).	Unlikely. Known to occur locally, with DBCA records within 5km of current Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging. Any visitation would be infrequent vagrant occurrence.	Unlikely. Known to occur locally, with DBCA records within 5km of current Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging. Any visitation would be infrequent vagrant occurrence.	Unlikely. Known to occur locally, with DBCA records within 5km of current Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging. Any visitation would be infrequent vagrant occurrence.	Unlikely. Known to occur locally, with DBCA records within 5km of current Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging. Any visitation would be infrequent vagrant occurrence.	PMST, DBCA

Species name	Common name	Status		Habitat requirements	LOO – Elizabeth Quay	LOO - Applecross	LOO – Ellam St	LOO – Matilda Bay	Source
		State	Federal						
<i>Calidris subminuta</i>	Long-toed Stint	MI	MI	In WA the species is found mainly along the coast, with a few scattered inland records. On the south coast the Long-toed Stint is found from Esperance to Albany and inland to Lake Cassencarry and Dumbleyung. On the south-west coast the species is known from the Vasse River estuary, Guraga Lake and the Namming Nature Reserve. The species has occasionally been recorded in the Gascoyne Region, around Lake Wooleen, Meeberrie Station and McNeill Claypan. It is widespread around the Pilbara region and the Kimberley Division between Karratha and Wyndham-Kununurra (DEE 2019b). It occurs in a variety of terrestrial wetlands. They prefer shallow freshwater or brackish wetlands including lakes, swamps, river floodplains, streams, lagoons and sewage ponds.	Unlikely. Known to occur locally, with DBCA records within 5km of current Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging. Any visitation would be infrequent vagrant occurrence.	Unlikely. Known to occur locally, with DBCA records within 5km of current Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging. Any visitation would be infrequent vagrant occurrence.	Unlikely. Known to occur locally, with DBCA records within 5km of current Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging. Any visitation would be infrequent vagrant occurrence.	Unlikely. Known to occur locally, with DBCA records within 5km of current Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging. Any visitation would be infrequent vagrant occurrence.	PMST, DBCA
<i>Calidris tenuirostris</i>	Great Knot	VU, MI	VU, MI	The Great Knot has been recorded around the entirety of the Australian coast, with a few scattered records inland. It is now absent from some sites along the south coast where it used to be a regular visitor (Garnett and Crowley 2000). The greatest numbers are found in northern Australia; where the species is common on the coasts of the Pilbara and Kimberley, from the Dampier Archipelago to the Northern Territory border, and in the Northern Territory from Darwin and Melville Island, through Arnhem Land to the south-east Gulf of Carpentaria. In Australasia, the species typically prefers sheltered coastal habitats, with large intertidal mudflats or sandflats. This includes inlets, bays, harbors, estuaries, and lagoons (DEE 2019b).	Unlikely. Known to occur locally, with DBCA records within 5km of current Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging. Any visitation would be infrequent vagrant occurrence.	Unlikely. Known to occur locally, with DBCA records within 5km of current Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging. Any visitation would be infrequent vagrant occurrence.	Unlikely. Known to occur locally, with DBCA records within 5km of current Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging. Any visitation would be infrequent vagrant occurrence.	Unlikely. Known to occur locally, with DBCA records within 5km of current Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging. Any visitation would be infrequent vagrant occurrence.	PMST, DBCA
<i>Charadrius bicinctus</i>	Double-banded Plover	MI	MI	The Double-banded Plover breeds only in New Zealand, where it is widespread. In the non-breeding season, part of the population remains in New Zealand, while the remainder migrates to Australia. The Double-banded Plover is found on littoral, estuarine and fresh or saline terrestrial wetlands and also saltmarsh, grasslands and pasture. It occurs on muddy, sandy, shingled or sometimes rocky beaches, bays and inlets, harbours and margins of fresh or saline terrestrial wetlands such as lakes, lagoons and swamps, shallow estuaries and rivers. The species is sometimes associated with coastal lagoons, inland salt lakes and saltworks. It is also found on seagrass beds, which, when exposed at low tide, remain heavily saturated or have numerous water-filled depressions (DEE 2018).	Highly Unlikely. The Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging, and no records confirmed within 10km of the Survey Areas. Any visitation would be infrequent vagrant occurrence.	Highly Unlikely. The Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging, and no records confirmed within 10km of the Survey Areas. Any visitation would be infrequent vagrant occurrence.	Highly Unlikely. The Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging, and no records confirmed within 10km of the Survey Areas. Any visitation would be infrequent vagrant occurrence.	Highly Unlikely. The Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging, and no records confirmed within 10km of the Survey Areas. Any visitation would be infrequent vagrant occurrence.	PMST

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		State	Federal						
<i>Charadrius cucullatus</i>	Hooded Plover	P4		The hooded plover is a small Australian beach nesting bird. It mainly occurs on wide beaches backed by dunes with large amounts of seaweed and jetsam, creek mouths and inlet entrances. Nests are found above the high water mark on flat beaches, on stony terraces, or on sparsely vegetated dunes. As the hooded plover occurs on beaches, it is easily disturbed by human activities, particularly off-leash domestic dogs.	Highly Unlikely. The Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging, and only four records confirmed within 10km of the Survey Areas. Any visitation would be infrequent vagrant occurrence.	Highly Unlikely. The Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging, and only four records confirmed within 10km of the Survey Areas. Any visitation would be infrequent vagrant occurrence.	Highly Unlikely. The Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging, and only four records confirmed within 10km of the Survey Areas. Any visitation would be infrequent vagrant occurrence.	Highly Unlikely. The Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging, and only four records confirmed within 10km of the Survey Areas. Any visitation would be infrequent vagrant occurrence.	Naturemap, DBCA
<i>Charadrius dubius</i>	Little Ringed Plover	MI	MI	While the majority of the population of Little Ringed Plovers will spend the northern winters in Africa, southward of the Sahara desert, a small number will migrate to northern Australia. In Australia they are occasionally found along the coastline, mostly of the northern part of the continent. Outside the breeding season Little Ringed Plovers have a preference for beaches with sand dunes and marshes. They are also regularly found in sewage treatment plants (DECCEW, 2022).	Highly Unlikely. The Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging, and only one record confirmed within 10km of the Survey Areas. Any visitation would be infrequent vagrant occurrence.	Highly Unlikely. The Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging, and only one record confirmed within 10km of the Survey Areas. Any visitation would be infrequent vagrant occurrence.	Highly Unlikely. The Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging, and only one record confirmed within 10km of the Survey Areas. Any visitation would be infrequent vagrant occurrence.	Highly Unlikely. The Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging, and only one record confirmed within 10km of the Survey Areas. Any visitation would be infrequent vagrant occurrence.	PMST, DBCA
<i>Charadrius mongolus</i>	Lesser Sand Plover	EN, MI	EN, MI	Within Australia, the Lesser Sand-Plover is widespread in coastal regions and has been recorded in all states. It mainly occurs in northern and eastern Australia, in southeastern parts of the Gulf of Carpentaria, western Cape York Peninsula and islands in Torres Strait, and along the entire east coast, though it occasionally also occurs inland. It is most numerous in Queensland and NSW. The species has also been recorded on Lord Howe Island, Norfolk Island and Christmas Island, Indian Ocean. In non-breeding grounds in Australia, this species usually occurs in coastal littoral and estuarine environments. It inhabits large intertidal sandflats or mudflats in sheltered bays, harbors and estuaries, and occasionally sandy ocean beaches, coral reefs, wave-cut rock platforms and rocky outcrops. It also sometime occurs in short saltmarsh or among mangroves. The species also inhabits saltworks and near-coastal saltpans, brackish swamps and sandy or silt islands in riverbeds (Marchant & Higgins 1993). In north-western Australia, the species appears to use the Port Hedland saltworks in preference to nearby beaches (DCCEW, 2022).	Highly Unlikely. The Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging, and no records confirmed within 10km of the Survey Areas. Any visitation would be infrequent vagrant occurrence.	Highly Unlikely. The Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging, and no records confirmed within 10km of the Survey Areas. Any visitation would be infrequent vagrant occurrence.	Highly Unlikely. The Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging, and no records confirmed within 10km of the Survey Areas. Any visitation would be infrequent vagrant occurrence.	Highly Unlikely. The Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging, and no records confirmed within 10km of the Survey Areas. Any visitation would be infrequent vagrant occurrence.	PMST

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		State	Federal						
<i>Charadrius leschenaultii</i>	Greater Sand Plover	VU, MI	VU, MI	In Australia, the Greater Sand Plover occurs in coastal areas in all states, though the greatest numbers occur in northern Australia, especially the north-west (Marchant & Higgins 1993). In northern Australia, the species is especially widespread between North West Cape and Roebuck Bay in WA; there are sparsely scattered records from the largely inaccessible area between Roebuck Bay and Darwin, but it often occurs in the Top End of the Northern Territory, including on Groote Eylandt (DCCEEW 2022).	Highly Unlikely. The Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging, and only two records confirmed within 10km of the Survey Areas. Any visitation would be infrequent vagrant occurrence.	Highly Unlikely. The Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging, and only two records confirmed within 10km of the Survey Areas. Any visitation would be infrequent vagrant occurrence.	Highly Unlikely. The Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging, and only two records confirmed within 10km of the Survey Areas. Any visitation would be infrequent vagrant occurrence.	Highly Unlikely. The Survey Areas lacks suitable shallow extensive shoreline for consistent feeding and foraging, and only two records confirmed within 10km of the Survey Areas. Any visitation would be infrequent vagrant occurrence.	PMST, DBCA
<i>Chlidonias leucopterus</i>	White-Winged Black Tern	MI	MI	White-winged Black Terns are non-breeding migrants to Australia from the North. They arrive anywhere along the tropical coast of Australia and disperse around basically the entire Australian seaboard, including the East coast of Tasmania and many small offshore islands. They can be found farther inland, in parts of the Great Dividing Range and in particular in the central part of the Murray-Darling Basin near the NSW/VIC border. There are also White-winged Black Terns in an area around Perth, WA. Elsewhere on the continent White-winged Black Terns are found only rarely, and never in the great deserts of WA/SA/NT or the Nullarbor. White-winged Black Terns live around lakes including ephemeral lakes, in estuaries and in coastal waters (DCCEEW 2022).	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km the Survey Areas in the last century.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km the Survey Areas in the last century.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km the Survey Areas in the last century.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km the Survey Areas in the last century.	DBCA
<i>Diomedea amsterdamensis</i>	Amsteram Albatross	EN, MI	EN, MI	The Amsterdam Albatross is a huge, full-bodied albatross with extremely long wings (wing span 2.5–3.5 m) and a short, wedge-shaped tail. The bill is very large and pink, with a bulbous tip (Marchant & Higgins 1990). The subspecies is similar in appearance to the Wandering Albatross with uniform dark brown plumage, and a contrasting clown-like white mask extending from the top of the bill, behind the eyes, around the cheeks and under the chin, and white underwings (Pizzey & Knight 1999). The Amsterdam Albatross is a marine, pelagic seabird. It nests in open patchy vegetation (among tussocks, ferns or shrubs) near exposed ridges or hillocks (Weimerskirch et al. 1985). It sleeps and rests on ocean waters when not breeding (Marchant & Higgins 1990). The Amsterdam Albatross is a non-resident visitor to Australia, and may occur in south-west and south Australian waters (Pizzey & Knight 1999). The similarity of the Amsterdam Albatross to juvenile Wandering Albatross makes identification at sea difficult, and may obscure distribution information of this subspecies. There are a few records of this subspecies off New Zealand, and one bird was captured on a longline fishing vessel operating south of Tasmania (Gales 1998).	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	PMST
<i>Diomedea exulans</i>	Wandering Albatross	VU, MI	VU, MI	The Wandering Albatross has the longest wing-span of any ocean bird, spanning 2.5 - 3.5 m. In flight, the Wandering Albatross may appear somewhat humpbacked, and with pink toes visible. Adults have a white or pale back, extending along the dorsal surface of the wings near the body, and white underwings. Except in fully mature old males, the white tail will have black edges. Up close, the bill is large, shapely, and pale-flesh coloured; and the white plumage of the head and body have very fine grey barring (Pizzey & Knight 1999). The Wandering Albatross is solitary or gregarious at sea. It breeds in colonies (Marchant & Higgins 1990). On breeding islands, the Wandering Albatross nests on coastal or inland ridges, slopes, plateaux and plains, often on marshy ground (Falla 1937; Warham & Bell 1979). Nests of the Wandering Albatross are sited on moss terraces, in dense tussocks, and often in loose aggregations on the west (windward) side of islands. It prefers open or patchy vegetation (tussocks, ferns or shrubs), and it requires nesting areas that are near exposed ridges or hillocks so that it can take off (Warham & Bell 1979). The Wandering Albatross breeds on Macquarie Island (Environment Australia 1999; Marchant & Higgins 1990). A single breeding pair has also been recorded on Heard Island (Woehler 1991). It feeds in Australian portions of the Southern Ocean (Nicholls et al. 1995, 1997).	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	PMST

Species name	Common name	Status		Habitat requirements	LOO – Elizabeth Quay	LOO - Applecross	LOO – Ellam St	LOO – Matilda Bay	Source
		State	Federal						
<i>Diomedea epomophora</i>	Southern Royal Albatross	VU, MI	VU, MI	Originally considered a polytypic species, the Royal Albatross was split into <i>D. epomophora</i> (Southern Royal Albatross) and <i>D. sanfordi</i> (Northern Royal Albatross) in 1998 by Robertson and Nunn based on several key morphological differences between the two taxa. The Southern Royal Albatross is a New Zealand endemic breeder, breeding only on Campbell Island (99% of the population) and in the Auckland Islands. However, migratory and foraging individuals have been sighted across both coasts of Southern Australia due to the species' wide-ranging feeding behaviour over wide open seas (DCCEEW 2022)..	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	PMST
<i>Diomedea sanfordi</i>	Northern Royal Albatross	EN, MI	EN, MI	Adult Northern Royal Albatross have a white head, neck, body and tail, sharply contrasting against the black wings. The underwing is white except for a dark trailing edge and a large dark tip. Juvenile Northern Royal Albatrosses have indistinct brown mottling on the crown, and pronounced black mottling on the lower back and rump, and a narrow black terminal band on the tail. The bill is large, with a bulbous tip, pinkish coloured horn and a diagnostic black cutting edge on the upper mandible. In breeding birds, the bill may flush to a brighter pink. The iris is brown, and the feet and legs are pinkish to blueish-white, with blueish webs (Marchant & Higgins 1990). The Northern Royal Albatross is marine, pelagic and aerial. Its habitat includes subantarctic, subtropical, and occasionally Antarctic waters (Marchant & Higgins 1990). It occurs where the surface temperature of the water is between 6–20 °C (Barton 1977, 1980; Jehl 1973; Szijj 1967). The Northern Royal Albatross ranges widely over the Southern Ocean, with individuals seen in Australian waters off south-eastern Australia (Environment Australia 2001f).	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	PMST
<i>Gallinago megala</i>	Swinhoe's Snipe	MI	MI	During the non-breeding season Swinhoe's Snipe occurs at the edges of wetlands, such as wet paddy fields, swamps, and freshwater streams. The species is also known to occur in grasslands, drier cultivated areas (including crops of rapeseed and wheat) and market gardens (Higgins & Davies 1996). Habitat specific to Australia includes the dense clumps of grass and rushes round the edges of fresh and brackish wetlands. This includes swamps, billabongs, river pools, small streams and sewage ponds. They are also found in drying claypans and inundated plains pitted with crab holes (Higgins & Davies 1996).	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	PMST
<i>Gallinago stenura</i>	Pin-tail Snipe	MI	MI	In WA the species was reported at Pilbara, Port Headland, Myaree Pool, Maitland River and near Karratha. During non-breeding period the Pin-tailed Snipe occurs most often in or at the edges of shallow freshwater swamps, ponds and lakes with emergent, sparse to dense cover of grass/sedge or other vegetation (DEE 2019b).	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	PMST
<i>Numenius minutus</i>	Little Curlew	MI	MI	Little Curlews generally spend the non-breeding season in northern Australia from Port Hedland in WA to the Queensland coast (Minton 2002 pers. comm.). There are records of the species from inland Australia, and widespread but scattered records on the east coast. The Little Curlew is most often found feeding in short, dry grassland and sedgeland, including dry floodplains and blacksoil plains, which have scattered, shallow freshwater pools or areas seasonally inundated. Open woodlands with a grassy or burnt understory, dry saltmarshes, coastal swamps, mudflats or sandflats of estuaries or beaches on sheltered coasts, mown lawns, gardens, recreational areas, ovals, racecourses and verges of roads and airstrips are also used (Higgins & Davies 1996).	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	PMST

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		State	Federal						
<i>Numenius madagascariensis</i>	Eastern Curlew	CR, MI	CR, MI	The Eastern Curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass. Occasionally, the species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets. The birds are often recorded among saltmarsh and on mudflats fringed by mangroves, sometimes within the mangroves, and in coastal saltworks and sewage farms. In the South-West, Eastern Curlews are recorded from Eyre, and there are scattered records from Stokes Inlet to Peel Inlet (Marchant & Higgins 1993). They are uncommon further south of Geraldton, but can be spotted in Alfred Cove, Peel Inlet and the Albany region (Nevill 2013).	Unlikely. The Survey Areas lacks suitable shallow extensive shoreline, and only four confirmed DBCA records have been made within 10km of the Survey Areas. Any visitation would be infrequent vagrant occurrence.	Unlikely. The Survey Areas lacks suitable shallow extensive shoreline, and only four confirmed DBCA records have been made within 10km of the Survey Areas. Any visitation would be infrequent vagrant occurrence.	Unlikely. The Survey Areas lacks suitable shallow extensive shoreline, and only four confirmed DBCA records have been made within 10km of the Survey Areas. Any visitation would be infrequent vagrant occurrence.	Unlikely. The Survey Areas lacks suitable shallow extensive shoreline, and only four confirmed DBCA records have been made within 10km of the Survey Areas. Any visitation would be infrequent vagrant occurrence.	PMST, DBCA
<i>Numenius phaeopus</i>	Whimbrel	MI	MI	The Whimbrel is often found on the intertidal mudflats of sheltered coasts. It is also found in harbours, lagoons, estuaries and river deltas, often those with mangroves, but also open, un-vegetated mudflats. It is occasionally found on sandy or rocky beaches, on coral or rocky islets, or on intertidal reefs and platforms. It has been infrequently recorded using saline or brackish lakes near coastal areas. It also used salt flats with saltmarsh, or saline grasslands with standing water left after high spring-tides, and in similar habitats in sewage farms and salt fields (Higgins & Davies 1996). There are a small number of inland records from saline lakes and cane grass swamps. It has also been recorded in coastal dunes and a football field.	Unlikely. The Survey Areas lacks suitable mudflats and feeding habitat, and only four confirmed DBCA records have been made within 10km of the Survey Areas. Any visitation would be infrequent vagrant occurrence.	Unlikely. The Survey Areas lacks suitable mudflats and feeding habitat, and only four confirmed DBCA records have been made within 10km of the Survey Areas. Any visitation would be infrequent vagrant occurrence.	Unlikely. The Survey Areas lacks suitable mudflats and feeding habitat, and only four confirmed DBCA records have been made within 10km of the Survey Areas. Any visitation would be infrequent vagrant occurrence.	Unlikely. The Survey Areas lacks suitable mudflats and feeding habitat, and only four confirmed DBCA records have been made within 10km of the Survey Areas. Any visitation would be infrequent vagrant occurrence..	PMST, DBCA
<i>Limosa lapponica menzbieri</i>	Northern Siberian Bar-tailed Godwit	EN & MI	EN & MI	The Bar-tailed godwit occurs mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. It has also been recorded in coastal sewage farms and saltworks, saltlakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats. It is widespread around the coast, from Eyre to Derby (TSSC 2016b). They are uncommon in the south west, but can be sighted from Geraldton to Bunbury, at Alfred Cove, and then at a few estuaries on the south coast including Kalgan River Mouth and Oyster Harbour (Nevill 2013).	Unlikely. The Survey Areas lacks suitable mudflats and feeding habitat, although numerous DCBA recordings have been made historically at neighbouring sites.	Unlikely. The Survey Areas lacks suitable mudflats and feeding habitat, although numerous DCBA recordings have been made historically at neighbouring sites.	Unlikely. The Survey Areas lacks suitable mudflats and feeding habitat, although numerous DCBA recordings have been made historically at neighbouring sites.	Unlikely. The Survey Areas lacks suitable mudflats and feeding habitat, although numerous DCBA recordings have been made historically at neighbouring sites.	PMST, DBCA

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<i>Limosa limosa</i>	Black-tailed Godwit	EN & MI	EN & MI	Black-tailed Godwits arrive in Australia each year in August from breeding grounds in the northern hemisphere. Birds are more numerous in northern Australia. Black-tailed Godwits inhabit estuarine mudflats, beaches and mangroves. They are common in coastal areas around Australia. They are social birds and are often seen in large flocks and in the company of other waders (Birdlife Australia 2019).	Unlikely. The Survey Areas lacks suitable mudflats and feeding habitat, and only five confirmed DBCA records have been made within 10km of the Survey Areas. Any visitation would be infrequent vagrant occurrence.	Unlikely. The Survey Areas lacks suitable mudflats and feeding habitat, and only five confirmed DBCA records have been made within 10km of the Survey Areas. Any visitation would be infrequent vagrant occurrence.	Unlikely. The Survey Areas lacks suitable mudflats and feeding habitat, and only five confirmed DBCA records have been made within 10km of the Survey Areas. Any visitation would be infrequent vagrant occurrence.	Unlikely. The Survey Areas lacks suitable mudflats and feeding habitat, and only five confirmed DBCA records have been made within 10km of the Survey Areas. Any visitation would be infrequent vagrant occurrence..	PMST, DBCA
<i>Macronectes halli</i>	Northern Giant Petrel	VU, MI	VU, MI	The range of the Northern Giant-Petrel is circumpolar, encompassing all southern oceans and coastal waters around the southern continents. Northern Giant-Petrels reach the Australian coastline anywhere up to a few hundred km South of the tropic of Capricorn on both the East coast and the West coast. Northern Giant-Petrels breed on numerous offshore islands.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	PMST
<i>Macronectes giganteus</i>	Southern Giant Petrel	EN & MI	EN & MI	The Southern Giant Petrel is the largest petrel, and has been described as looking like a small, ungainly brown albatross with a massive greenish-tipped straw coloured bill, surmounted by a large single nostril-tube (Pizzey & Knight 1999). Mature adults are grey-brown with a faded and mottled-white head, neck and breast. The underwing has a pale leading edge, near the body, which should aid in discrimination from the Northern Giant Petrel, in which this area is dark brown (Pizzey & Knight 1999). The Southern Giant-Petrel is marine bird that occurs in Antarctic to subtropical waters. In summer, it mainly occurs over Antarctic waters, and it is widespread south as far as the pack-ice and onto the Antarctic continent (Marchant & Higgins 1990). The Southern Giant-Petrel breeds on the Antarctic Continent, Peninsula and islands, and on subantarctic islands and South America. The large nests are normally built in exposed areas of open vegetation (Voisin 1988) or, in Antarctic colonies, of no vegetation (E.J. Woehler, AAD 2002, pers. comm.). In the southern Antarctic zone, it nests in exposed snow- and ice-free coastal areas, open gravel areas rocky bluffs, outcrops, ridges, slopes, mounds, raised beaches, open flats, edges of plateaux or offshore rocks from five to 120 m above sea level. Colonies often nest near a steep drop or on slope. The Southern Giant-Petrel breeds on six subantarctic and Antarctic islands in Australian territory; Macquarie Island, Heard Island and McDonald Island in the Southern Ocean, and Giganteus Island, Hawker Island, and Frazier Island in the Australian Antarctic Territories (EABG 2001, Woehler et al. 2001; Woehler et al. in press).	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	PMST, DBCA

Species name	Common name	Status		Habitat requirements	LOO – Elizabeth Quay	LOO - Applecross	LOO – Ellam St	LOO – Matilda Bay	Source
		State	Federal						
<i>Oxyura australis</i>	Blue billed Duck	P4		The blue-billed duck is a small Australian almost entirely aquatic duck, with both the male and female growing to a length of 40 cm. The male has a slate-blue bill which changes to bright blue during the breeding season (Morcombe 2004). The blue-billed duck is endemic to Australia's temperate regions, ranging from the southwest of Western Australia, extending to southern Queensland, through New South Wales and Victoria, to Tasmania. The species is readily seen on freshwater lakes and billabongs where deep fresh water is present (Morcombe 2004).	Possible. Numerous records DBCA records and known to occur locally, although lack of core, lake and freshwater habitat suggests that occurrence would be temporary as fly-over or brief foraging behaviour.	Possible. Numerous records DBCA records and known to occur locally, although lack of core, lake and freshwater habitat suggests that occurrence would be temporary as fly-over or brief foraging behaviour.	Possible. Numerous records DBCA records and known to occur locally, although lack of core, lake and freshwater habitat suggests that occurrence would be temporary as fly-over or brief foraging behaviour.	Possible. Numerous records DBCA records and known to occur locally, although lack of core, lake and freshwater habitat suggests that occurrence would be temporary as fly-over or brief foraging behaviour.	DBCA
<i>Pandion haliaetus</i>	Osprey	MI	MI	Eastern Ospreys occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. They are mostly found in coastal areas but occasionally travel inland along major rivers, particularly in northern Australia. They require extensive areas of open fresh, brackish or saline water for foraging (Marchant & Higgins 1993). They frequent a variety of wetland habitats including inshore waters, reefs, bays, coastal cliffs, beaches, estuaries, mangrove swamps, broad rivers, reservoirs and large lakes and waterholes. They exhibit a preference for coastal cliffs and elevated islands in some parts of their range, but may also occur on low sandy, muddy or rocky shores and over coral cays.	Likely. Numerous records DBCA records and known to occur locally, and coastal, open brackish and saline waters mean that that occurrence is likely, although mostly temporary as fly-over or brief foraging behaviour.	Likely. Numerous records DBCA records and known to occur locally, and coastal, open brackish and saline waters mean that that occurrence is likely, although mostly temporary as fly-over or brief foraging behaviour.	Likely. Numerous records DBCA records and known to occur locally, and coastal, open brackish and saline waters mean that that occurrence is likely, although mostly temporary as fly-over or brief foraging behaviour.	Likely. Numerous records DBCA records and known to occur locally, and coastal, open brackish and saline waters mean that that occurrence is likely, although mostly temporary as fly-over or brief foraging behaviour.	PMST
<i>Phaethon rubricauda westralis</i>	Red-tailed Tropicbird (Indian Ocean), Indian Ocean Red-tailed Tropicbird	EN & M	EN & MI	In Australia, it nests on Queensland's coral islands (including Raine Island and Lady Elliot Island), and Ashmore Reef and Rottnest Island off Western Australia, as well as Sugarloaf Rock at Cape Naturaliste and Busselton on the Western Australian coastline itself, and the offshore territories of the Cocos (Keeling) Islands, Norfolk and Lord Howe islands. In New Zealand territory it breeds on the Kermadec Islands. It frequents areas of ocean with water temperatures from 24 to 30 °C (75 to 86 °F) and salinity under 35% in the southern hemisphere and 33.5% in the northern hemisphere. In the Pacific Ocean, the southern boundary of its range runs along the 22 °C (72 °F) summer surface isotherm The warm waters of the Leeuwin Current facilitate the species nesting at Cape Leeuwin in southwestern Australia, yet is only a rare visitor to New South Wales at corresponding latitudes on the Australian east coast (Higgins et al 1990).	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	PMST
<i>Phalaropus lobatus</i>	Red-necked Phalarope	MI	MI	During non-breeding period the Red-necked Phalarope occurs mainly at sea. In Australia it is recorded at both inland and coastal lakes/swamps, including highly saline waters and artificial wetlands, notably saltfields (Higgins & Davies 1996).	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	PMST

Species name	Common name	Status		Habitat requirements	LOO – Elizabeth Quay	LOO - Applecross	LOO – Ellam St	LOO – Matilda Bay	Source
		State	Federal						
<i>Plegadis falcinellus</i>	Glossy Ibis	MI	MI	Within Australia, the Glossy Ibis is generally located east of the Kimberley. The species is also known to be patchily distributed in the rest of Western Australia. Its preferred habitat for foraging and breeding are freshwater marshes at the edges of lakes and rivers, lagoons, floodplains, wet meadows, swamps, reservoirs, sewerage ponds, rice-fields and cultivated areas under irrigation (DSEWPac 2013).	Unlikely. While numerous DBCA records have been made within 5km of the Survey Areas, suitable freshwater lakes and river habitat is not present for regular feeding and foraging.	Unlikely. While numerous DBCA records have been made within 5km of the Survey Areas, suitable freshwater lakes and river habitat is not present for regular feeding and foraging.	Unlikely. While numerous DBCA records have been made within 5km of the Survey Areas, suitable freshwater lakes and river habitat is not present for regular feeding and foraging.	Unlikely. While numerous DBCA records have been made within 5km of the Survey Areas, suitable freshwater lakes and river habitat is not present for regular feeding and foraging.	DBCA
<i>Pterodroma mollis</i>	Soft Plumaged Petrel	VU	VU	The Soft-plumaged Petrel is generally found over temperate and subantarctic waters in the South Atlantic, southern Indian and western South Pacific Oceans. The species is a regular and quite common visitor to southern Australian seas but is more common in the west than in the south and south-east (Marchant & Higgins 1990). In the southern Indian Ocean, the species is most numerous between 30° and 50°S from the South African to the west Australian coasts. The species is possibly common in seas south-west of Australia.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	PMST
<i>Rostratula australis</i>	Australian Painted Snipe	En	En	The Australian Painted Snipe generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. Australian Painted Snipe breeding habitat requirements may be quite specific: shallow wetlands with areas of bare wet mud and both upper and canopy cover nearby. The species rarely occurs in south-western Australia, where it was once more common (Marchant & Higgins 1993; Garnett and Crowley 2000).	Unlikely. Habitat not considered suitable for regular feeding and foraging. Any occurrence would be as infrequent visitor.	Unlikely. Habitat not considered suitable for regular feeding and foraging. Any occurrence would be as infrequent visitor.	Unlikely. Habitat not considered suitable for regular feeding and foraging. Any occurrence would be as infrequent visitor.	Unlikely. Habitat not considered suitable for regular feeding and foraging. Any occurrence would be as infrequent visitor.	PMST, DBCA
<i>Tringa brevipes</i>	Grey-tailed Tattler	MI	MI	Within Australia, the Grey-tailed Tattler has a primarily northern coastal distribution and is found in most coastal regions. It is found in the south-west between Augusta and Cervantes (DAWE 2021d).	Unlikely. Habitat not considered suitable for regular feeding and foraging. Any occurrence would be as infrequent visitor.	Unlikely. Habitat not considered suitable for regular feeding and foraging. Any occurrence would be as infrequent visitor.	Unlikely. Habitat not considered suitable for regular feeding and foraging. Any occurrence would be as infrequent visitor.	Unlikely. Habitat not considered suitable for regular feeding and foraging. Any occurrence would be as infrequent visitor.	PMST, DBCA

Species name	Common name	Status		Habitat requirements	LOO – Elizabeth Quay	LOO - Applecross	LOO – Ellam St	LOO – Matilda Bay	Source
		State	Federal						
<i>Tringa glareola</i>	Wood Sandpiper	MI	MI	The Wood Sandpiper uses well-vegetated, shallow, freshwater wetlands, such as swamps, billabongs, lakes, pools and waterholes. They are typically associated with emergent, aquatic plants or grass, and dominated by taller fringing vegetation, such as dense stands of rushes or reeds, shrubs, or dead or live trees, especially Melaleuca and River Red Gums E. camaldulensis. They also frequent inundated grasslands, short herbage or wooded floodplains, where floodwaters are temporary or receding. They can occasionally be found at drying or stony small wetlands, but rarely use brackish wetlands, or dry stunted saltmarsh. They can also use artificial wetlands, including open sewage ponds, reservoirs, large farm dams, and bore drains (DotE 2016). In WA, they can be found in many of Perth's wetlands including drainage channels, in Wheatbelt inland ephemeral lakes if they are not too saline, but are uncommon on the south coast (Nevill 2013).	Unlikely. Known to occur locally with recent DBCA records within 5km of the Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline habitat. Any visitation would be infrequent vagrant occurrence.	Unlikely. Known to occur locally with recent DBCA records within 5km of the Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline habitat. Any visitation would be infrequent vagrant occurrence.	Unlikely. Known to occur locally with recent DBCA records within 5km of the Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline habitat. Any visitation would be infrequent vagrant occurrence.	Unlikely. Known to occur locally with recent DBCA records within 5km of the Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline habitat. Any visitation would be infrequent vagrant occurrence.	PMST, DBCA
<i>Tringa totanus</i>	Common Redshank	MI	MI	In Australia, the Common Redshank has been recorded at scattered locations. In WA the species is vagrant to the south-west with records at Peel Inlet, Coodanup, the Gascoyne region, Coral Bay and Carnarvon (Higgins & Davis 1996). It is regular and widespread in the northwest, from the Dampier Salt fields to Roebuck Bay and Broome. The Common Redshank is found at sheltered coastal wetlands such as bays, river estuaries, lagoons, inlets and saltmarsh (with bare open flats and banks of mud or sand). They are also found around salt lakes, freshwater lagoons, artificial wetlands and saltworks and sewage farms (Higgins & Davies 1996).	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	PMST
<i>Tringa nebularia</i>	Common Greenshank	MI	Mi	The Common Greenshank does not breed in Australia; however, the species occurs in all types of wetlands and has the widest distribution of any shorebird in Australia (DSEWPaC 2013).	Unlikely. Known to occur locally with recent DBCA records within 5km of the Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline habitat. Any visitation would be infrequent vagrant occurrence.	Unlikely. Known to occur locally with recent DBCA records within 5km of the Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline habitat. Any visitation would be infrequent vagrant occurrence.	Unlikely. Known to occur locally with recent DBCA records within 5km of the Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline habitat. Any visitation would be infrequent vagrant occurrence.	Unlikely. Known to occur locally with recent DBCA records within 5km of the Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline habitat. Any visitation would be infrequent vagrant occurrence.	DBCA
<i>Tringa stagnatilis</i>	Marsh Sandpiper	MI	MI	The Marsh Sandpiper lives in permanent or ephemeral wetlands of varying salinity, including swamps, lagoons, billabongs, salt pans, saltmarshes, estuaries, pools on inundated floodplains, and intertidal mudflats and also regularly at sewage farms and saltworks. They are recorded less often at reservoirs, waterholes, soaks, bore-drain swamps and flooded inland lakes. In north Australia they prefer intertidal mudflats (Higgins & Davies 1996), although surveys in Kakadu National Park recorded more birds around shallow freshwater lakes than in areas influenced by tide. At the Top End they often use ephemeral pools on inundated freshwater and tidal floodplains (Higgins & Davies 1996). They are found infrequently around mangroves (Higgins & Davies 1996).	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	PMST

Species name	Common name	Status		Habitat requirements	LOO – Elizabeth Quay	LOO - Applecross	LOO – Ellam St	LOO – Matilda Bay	Source
		State	Federal						
<i>Dasyornis longirostris</i>	Western bristlebird	EN	EN	The Western Bristlebird is restricted to low dense coastal heathland reaching up to 1.5m in height. Vegetation species typically include Baxter's Banksia (<i>Banksia baxteri</i>), Dryandra-leaved Banksia (<i>B. dryandroides</i>), Candlestick Banksia (<i>B. attenuata</i>) or Scarlet Banksia (<i>B. coccinea</i>)), paperbarks (such as <i>Melaleuca striata</i> or <i>M. thymoides</i>), hakeas (such as Hood Leaved Hakea (<i>Hakea cucullata</i>), or Two-leaf Hakea (<i>H. trifurcata</i>)), <i>Lambertia</i> spp., <i>Dryandra</i> spp., <i>Adenanthos</i> spp., <i>Leptospermum</i> spp., <i>Daviesia reversifolia</i> and Dwarf Sheoak (<i>Allocasuarina humilis</i>). (DCCEEW)	Highly unlikely. Locally and regionally extinct. Survey Areas is beyond the current known range and lack of suitable habitat.	Highly unlikely. Locally and regionally extinct. Survey Areas is beyond the current known range and lack of suitable habitat.	Highly unlikely. Locally and regionally extinct. Survey Areas is beyond the current known range and lack of suitable habitat.	Highly unlikely. Locally and regionally extinct. Survey Areas is beyond the current known range and lack of suitable habitat.	DBCA
<i>Hydroprogne caspia</i>	Caspian tern	MI	MI	The Caspian Tern is mostly associated with sheltered coasts such as harbours, bays, estuaries, etc. They can also be found in inland terrestrial wetlands (saline or fresh) or man-made bodies of water (lakes or reservoirs). (DCCEEW).	Possible. Known to occur locally with 10 DBCA records within 10km of the Survey Areas. The open water aspects of the Survey Areas provide the potential to occur on an occasional basis for feeding and foraging.	Possible. Known to occur locally with 10 DBCA records within 10km of the Survey Areas. The open water aspects of the Survey Areas provide the potential to occur on an occasional basis for feeding and foraging.	Possible. Known to occur locally with 10 DBCA records within 10km of the Survey Areas. The open water aspects of the Survey Areas provide the potential to occur on an occasional basis for feeding and foraging.	Possible. Known to occur locally with 10 DBCA records within 10km of the Survey Areas. The open water aspects of the Survey Areas provide the potential to occur on an occasional basis for feeding and foraging.	PMST, DBCA
<i>Onychoprion anaethetus</i>	Bridled Tern	MI	MI	The species forages in offshore, continental shelf waters and is only rarely recorded along mainland coasts, even those adjacent or close to breeding colonies (though note breeding on mainland in Western Australia just mentioned). At least, the southern populations migrate north after breeding. The species is a vagrant to southern and south-eastern Australian waters outside the breeding range (Barrett et al. 2003; Blakers et al. 1984; Bonnin 1968, 1969, 1982; Higgins & Davies 1996; Hulsman & Langham 1985; Johnstone & Storr 1998). In Western Australia, breeding is widespread from islands off Cape Leeuwin (extending round the southern coast to Seal Rocks) north to Shark Bay and in Pilbara region and Kimberley Division. At sea, distribution extends from Cape Leeuwin north to Dirk Hartog Island, with isolated mainland coastal records at Point Maud and Ningaloo, and from Barrow Island to the Dampier Archipelago, and at sea off the Kimberley coast from waters west of the Dampier Peninsula to Ashmore Reef and Joseph Bonaparte Gulf (Barrett et al. 2003; Blakers et al. 1984; Higgins & Davies 1996; Johnstone & Storr 1998). In the Northern Territory, most breeding colonies are in the eastern portion of the territory, with main colonies being off north-eastern Arnhem Land, and on south-eastern Groote Eylandt and the Sir Edward Pellew Group.	Unlikely. Known to occur locally in neighbouring areas. However, the Survey Areas lacks suitable shallow extensive shoreline and coastal habitat. Any visitation would be infrequent vagrant occurrence.	Unlikely. Known to occur locally in neighbouring areas. However, the Survey Areas lacks suitable shallow extensive shoreline and coastal habitat. Any visitation would be infrequent vagrant occurrence.	Unlikely. Known to occur locally in neighbouring areas. However, the Survey Areas lacks suitable shallow extensive shoreline and coastal habitat. Any visitation would be infrequent vagrant occurrence.	Unlikely. Known to occur locally in neighbouring areas. However, the Survey Areas lacks suitable shallow extensive shoreline and coastal habitat. Any visitation would be infrequent vagrant occurrence.	PMST, DBCA
<i>Pachyptila turtur subantarctica</i>	Fairy Prion (Southern)	VU	VU	The fairy prion (southern) breeds on Macquarie Island and a number of other subantarctic islands outside of Australia. There are 80 to 250 breeding pairs in Australia and a global population of 80 000. In Australia, breeding is recorded on two rock stacks off Macquarie Island and on the nearby Bishop and Clerk Island. he subspecies digs burrows among rocks or low vegetation in which to nest. Burrows may be dug below mat forming herbs. The species feeds by plucking food from the ocean surface. Some individuals may migrate towards New Zealand and southern Australia in winter.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	PMST

Species name	Common name	Status		Habitat requirements	LOO – Elizabeth Quay	LOO - Applecross	LOO – Ellam St	LOO – Matilda Bay	Source
		State	Federal						
<i>Phoebetria fusca</i>	Sooty albatross	Mi	Mi	The Sooty Albatross is a Marine and pelagic species, tolerating a wide range of salinities and se surface temperatures. The species typically occurs 35°S in subtropical and subantarctic waters but is in greatest abundance near the Subtropical Convergence. (DCCEEW)	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	PMST, DBCA
<i>Platycercus icterotis xanthogenys</i>	Western Rosella	P4		Western Rosellas are found in open eucalypt forests and timbered areas, including cultivated land and orchards.	Unlikely. Suitable habitat does not occur within Survey Areas and only one confirmed record has been made within 10km of the current Survey Areas.	Unlikely. Suitable habitat does not occur within Survey Areas and only one confirmed record has been made within 10km of the current Survey Areas.	Unlikely. Suitable habitat does not occur within Survey Areas and only one confirmed record has been made within 10km of the current Survey Areas.	Unlikely. Suitable habitat does not occur within Survey Areas and only one confirmed record has been made within 10km of the current Survey Areas.	DBCA
<i>Pluvialis fulva</i>	Pacific Golden Plover	MI	MI	The Pacific Golden Plover breeds on the Arctic tundra in western Alaska. It winters in South America and islands of the Pacific Ocean to India, Indonesia and Australia. In Australia it is widespread along the coastline. Pacific Golden Plovers usually occur on beaches, mudflats and sandflats (sometimes in vegetation such as mangroves, low saltmarsh such as Sarcocornia, or beds of seagrass) in sheltered areas including harbours, estuaries and lagoons, and also in evaporation ponds in saltworks. The species is also sometimes recorded on islands, sand and coral cays and exposed reefs and rocks (DEE 2019b).	Unlikely. Suitable mudflats, salt-flats and sheltered coastal habitat is not present, and less than 10 DBCA records have been made within 10km of the Survey Areas.	Unlikely. Suitable mudflats, salt-flats and sheltered coastal habitat is not present, and less than 10 DBCA records have been made within 10km of the Survey Areas.	Unlikely. Suitable mudflats, salt-flats and sheltered coastal habitat is not present, and less than 10 DBCA records have been made within 10km of the Survey Areas.	Unlikely. Suitable mudflats, salt-flats and sheltered coastal habitat is not present, and less than 10 DBCA records have been made within 10km of the Survey Areas.	PMST, DBCA
<i>Pluvialis squatarola</i>	Grey plover	MI	MI	The Grey Plover inhabits entirely coastal areas where they typically reside in sheltered areas such as estuaries and lagoons with mudflats and sandflats. (DCCEEW)	Unlikely. Known to occur locally, with numerous DBCA records within a 5km radius of the current Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline. Any visitation would be infrequent vagrant occurrence.	Unlikely. Known to occur locally, with numerous DBCA records within a 5km radius of the current Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline. Any visitation would be infrequent vagrant occurrence.	Unlikely. Known to occur locally, with numerous DBCA records within a 5km radius of the current Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline. Any visitation would be infrequent vagrant occurrence.	Unlikely. Known to occur locally, with numerous DBCA records within a 5km radius of the current Survey Areas. However, the Survey Areas lacks suitable shallow extensive shoreline. Any visitation would be infrequent vagrant occurrence.	PMST, DBCA

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		State	Federal						
<i>Sterna dougallii</i>	Roseate Tern	MI	MI	The Roseate Tern occurs in coastal and marine areas in subtropical and tropical seas. The species inhabits rocky and sandy beaches, coral reefs, sand cays and offshore islands. Birds rarely occur in inshore waters or near the mainland, usually venturing into these areas only accidentally, when nesting islands are nearby (Higgins & Davies 1996).	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	PMST
<i>Sternula albifrons</i>	Little Tern	MI	MI	In Australia, Little Terns inhabit sheltered coastal environments, including lagoons, estuaries, river mouths and deltas, lakes, bays, harbours and inlets, especially those with exposed sandbanks or sand-spits, and also on exposed ocean beaches (DCCEEW 2022).	Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	PMST
<i>Sternula nereis nereis</i>	Australian Fairy Tern	VU	VU	The Fairy Tern is approximately 22–27 cm in length, 70 g in weight and has a wingspan of 44–53 cm (Higgins & Davies 1996). The Fairy Tern is bulky and round bodied (Simpson & Day 2004). The breeding plumage of both sexes is pale grey-white, with a black crown, nape, ear coverts and patch in front of the eyes (square to round in shape). The forehead is white and the bill is orange-yellow (Higgins & Davies 1996). Legs are dull yellow and the iris is dark brown (Lindsey 1986a). The species is gregarious and often found in flocks of 50–150 birds. However the bird is also seen singularly or in pairs (Higgins & Davies 1996). The Fairy Tern (Australian) nests on sheltered sandy beaches, spits and banks above the high tide line and below vegetation. The subspecies has been found in embayments of a variety of habitats including offshore, estuarine or lacustrine (lake) islands, wetlands and mainland coastline (Higgins & Davies 1996; Lindsey 1986a). The bird roosts on beaches at night (Higgins & Davies 1996). Within Australia, the Fairy Tern occurs along the coasts of Victoria, Tasmania, South Australia and Western Australia; occurring as far north as the Dampier Archipelago near Karratha.	Unlikely. The Survey Areas lacks consistent, suitable habitat for feeding and nesting only 6 confirmed DBCA records have been made within 10km of the Survey Areas.	Unlikely. The Survey Areas lacks consistent, suitable habitat for feeding and nesting only 6 confirmed DBCA records have been made within 10km of the Survey Areas.	Unlikely. The Survey Areas lacks consistent, suitable habitat for feeding and nesting only 6 confirmed DBCA records have been made within 10km of the Survey Areas.	Unlikely. The Survey Areas lacks consistent, suitable habitat for feeding and nesting only 6 confirmed DBCA records have been made within 10km of the Survey Areas.	PMST, DBCA
<i>Thalassarche carteri</i>	Indian Yellow-Nosed Albatross	VU, MI	VU, MI	<i>Thalassarche carteri</i> breeds on Amsterdam, Crozet Islands, Kerguelen Islands, and St Paul Islands (French Southern Territories) and on Prince Edward Island (South Africa). Breeding It breeds on slopes or cliffs, typically in bare, rocky areas but sometimes in tussock-grass and ferns (Brooke 2004). Foraging range Satellite-tracking of birds from Amsterdam Island has shown that breeding birds forage up to 1,500 km from the colony (Pinaud and Weimerskirch 2007). (Birdlife 2020). In Australian territory, Grey-headed Albatross breed on the southern and western flanks of Petrel Peak, Macquarie Island (Copson 1988). The Grey-headed Albatross has bred in this same restricted area on Macquarie Island for at least the past 30 years (Terauds et al. 2005).	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	PMST, DBCA

Species name	Common name	Status		Habitat requirements	LOO – Elizabeth Quay	LOO - Applecross	LOO – Ellam St	LOO – Matilda Bay	Source
		State	Federal						
<i>Thalassarche chrysostoma</i>	Grey-headed Albatross	VU	VU	The Grey-headed Albatross is a medium sized albatross with a length of 70–85 cm, a wingspan of 1.8–2.05 m, males weigh 3.4–3.7 kg and females weigh 3–3.6 kg (Marchant & Higgins 1990). Adults have a distinct combination of a wholly grey head, neck and mantle, and a black bill with narrow yellow stripes along the culmen and the bottom of the lower mandible. Like the majority of albatross, the Grey-headed Albatross is marine, pelagic and migratory. Its habitat includes subantarctic, subtropical, and occasionally Antarctic waters in the Pacific, Indian, Atlantic and Southern Oceans (del Hoyo et al. 1992; Marchant & Higgins 1990). In Australian territory, Grey-headed Albatross breed on the southern and western flanks of Petrel Peak, Macquarie Island (Copson 1988). The Grey-headed Albatross has bred in this same restricted area on Macquarie Island for at least the past 30 years (Terauds et al. 2005).	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	DBCA
<i>Thalassarche impavida</i>	Campbell Albatross	VU, MI	VU, MI	The Campbell Albatross is a medium sized albatross, with a wingspan of 210–250 cm. Like the Black-browed Albatross (<i>Thalassarche melanophris</i>), adult Campbell Albatross have a white head with a distinctive black brow, bright yellow-orange bill and broad black leading edge on the underwing. The Campbell Albatross differs from the Black-browed Albatross in having a heavier black brow (more extensive in front of the eye); a honey coloured (not dark-brown) iris; slightly broader black leading edge on underwing; and a series of bold streaks running from the elbow and extending inwards to the base of the wing, creating an isolated white patch in the centre of the wing-pit (Marchant & Higgins 1990). The Campbell Albatross is a marine sea bird inhabiting sub-Antarctic and subtropical waters from pelagic to shelf-break water habitats (Marchant & Higgins 1990). The Campbell Albatross breed on Campbell Island (Marchant & Higgins 1990). They make their nests on tussock-covered ledges and terraces of cliffs, slopes and hills, overlooking the sea or valleys, and on the summits of rocky islets (Bailey & Sorenson 1962; Downes et al. 1959; Weimerskirch et al. 1986). The Campbell Albatross is a non-breeding visitor to Australian waters. After breeding, birds move north and may enter Australia's temperate shelf waters (Marchant & Higgins 1990).	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	PMST
<i>Thalassarche melanophris</i>	Black-browed Albatross	VU, MI	VU, MI	The Black-browed Albatross is 80–95 cm in length, has a mass of 3–5 kg and a wingspan of 210–250 cm (Marchant & Higgins 1990). Adults of either gender are white with dark-brown irides; an orange-yellow bill; a black brow, back, upperwing and tail; broad black edges to the underwing; and bluish-grey legs and feet (Brooke 2004; Marchant & Higgins 1990). Juvenile and immature birds can be distinguished from the adults by the colour and pattern of the plumage and by the darker bill which has a black tip (Brooke 2004; Marchant & Higgins 1990). The Black-browed Albatross is a marine species that inhabits Antarctic, subantarctic and temperate waters and occasionally enters the tropics (Brooke 2004; Marchant & Higgins 1990; Tickell 2000; Woehler et al. 1991). It can tolerate a broad range of sea-surface temperatures from 0–24° C (Ainley et al. 1984; Bierman & Voous 1950; Brown et al. 1975; Grindley 1981; Reid et al. 2002), and it forages around the breaks of continental and island shelves and across nearby underwater banks (Prince et al. 1998; Reid et al. 2002; Terauds et al. 2006; Weimerskirch et al. 1988, 1997), but also frequents other marine habitats, such as oceanic waters (Reid et al. 2002; Terauds et al. 2006; Woehler et al. 1991) and the iceberg belt at the limit of the Antarctic pack ice (Falla 1937; Hicks 1973; Murphy 1936; Raymond & Woehler 2003; Woehler et al. 2003). The Black-browed Albatross breeds on subantarctic and peri-antarctic islands (Marchant & Higgins 1990) in colonies located on terraces of coastal cliffs, slopes of nearby hills, summits of rocky islets or on flat or gently-sloping ground. The Black-browed Albatross breeds within Australian jurisdiction on Heard Island (Kirkwood & Mitchell 1992; Woehler 2006; Woehler et al. 2002), McDonald Islands (Gales 1998; Woehler 2006; Woehler et al. 2002), Macquarie Island (Copson 1988; Gales 1998; Scott 1994c) and Bishop and Clerk Islets (Scott 1994c; Gales 1998).	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	PMST, DBCA

Species name	Common name	Status		Habitat requirements	LOO – Elizabeth Quay	LOO - Applecross	LOO – Ellam St	LOO – Matilda Bay	Source
		State	Federal						
<i>Thalassarche steadi</i>	White-capped Albatross	VU, MI	VU, MI	The White-capped Albatross has a grey back and wings; faint or absent greyish wash on cheeks; and a white head, neck and rump. The underwing is mostly white with a narrow black margin and a small dark notch at the wing-pit. The bill is pale greyish straw colour, with a yellowish tip (Pizzey & Knight 1999). There is also a thin black eyebrow and a delicate, grey wash over the face.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	Highly Unlikely. The Survey Areas lacks suitable habitat and, and no DBCA records have been made within 10km of the Survey Areas.	PMST
<i>Thalasseus bergii</i>	Crested tern	MI	MI	This species inhabits tropical and subtropical coastlines, foraging in the shallow waters of lagoons, coral reefs, estuaries, bays, harbours and inlets, along sandy, rocky, coral or muddy shores, on rocky outcrops in open sea, in mangrove swamps and also far out to sea on open water. It shows a preference for nesting on offshore islands, low-lying coral reefs, sandy or rocky coastal islets, coastal spits, lagoon mudflats, and artificial islets in salt pans and sewage works within 3 km of the coast. (BirdLife International, 2023)	Possible. Known to occur locally with numerous DBCA records within 5km of the Survey Areas. While suitable habitat for foraging and feeding is not present in quantity, there is the potential for occasional visitation.	Possible. Known to occur locally with numerous DBCA records within 5km of the Survey Areas. While suitable habitat for foraging and feeding is not present in quantity, there is the potential for occasional visitation.	Likely. Known to occur locally with numerous DBCA records within 5km of the Survey Areas and there is potential for occasional feeding and foraging utilisation,.	Likely. Known to occur locally with numerous DBCA records within 5km of the Survey Areas and there is potential for occasional feeding and foraging utilisation,.	DBCA
<i>Ixobrychus dubius</i>	Australian little bittern	P4		The Australian Little Bittern occurs in diverse freshwater swamp habitats, mainly where tall rushes, reeds, Typha (cumbungi), shrub thickets or other dense cover is inundated by at least 30 cm of water. It can be found in vast swamps, but unlike the Australasian Bittern, it often inhabits small patches of dense wetland vegetation such as Typha along drains or in small urban lakes. (Birdlife Australia, 2023)	Unlikely. Suitable wetland and swamp habitat is not present and no DBCA records have been made within 10km of the Survey Areas for 50 years.	Unlikely. Suitable wetland and swamp habitat is not present and no DBCA records have been made within 10km of the Survey Areas for 50 years.	Unlikely. Suitable wetland and swamp habitat is not present and no DBCA records have been made within 10km of the Survey Areas for 50 years.	Unlikely. Suitable wetland and swamp habitat is not present and no DBCA records have been made within 10km of the Survey Areas for 50 years.	DBCA
<i>Xenus cinereus</i>	Terek Sandpiper	VU, MI	VU, MI	In Australia, the Terek Sandpiper has a primarily coastal distribution, with occasional records inland. It is more widespread and common in northern and eastern Australia than southern Australia (DEE 2018). The Terek Sandpiper mostly forages in the open, on soft wet intertidal mudflats or in sheltered estuaries, embayments, harbours or lagoons. The species has also been recorded on islets, mudbanks, sandbanks and spits, and near mangroves and occasionally in samphire (Halosarcia spp.). Birds are seldom near the edge of water, however, birds may wade into the water (Marchant & Higgins 1993).	Highly Unlikely. Suitable habitat for the species does not occur, no DBCA recordings have been made within 10km and the Survey Areas are to the very outer limits of the species known range.	Highly Unlikely. Suitable habitat for the species does not occur, no DBCA recordings have been made within 10km and the Survey Areas are to the very outer limits of the species known range.	Highly Unlikely. Suitable habitat for the species does not occur, no DBCA recordings have been made within 10km and the Survey Areas are to the very outer limits of the species known range.	Highly Unlikely. Suitable habitat for the species does not occur, no DBCA recordings have been made within 10km and the Survey Areas are to the very outer limits of the species known range.	PMST
MAMMALS									

Species name	Common name	Status		Habitat requirements	LOO – Elizabeth Quay	LOO - Applecross	LOO – Ellam St	LOO – Matilda Bay	Source
		State	Federal						
<i>Bettongia penicillata ogilbyi</i>	Woylie	EN	EN	Preferred habitat for the Woylie includes dense undergrowth, logs and rock-cavities and occasionally in burrows (Burbidge 2004). Scattered Woylie populations may be found throughout the Jarrah Forest in the south-west corner of WA. Extant naturally occurring populations of the species are restricted to three small wheatbelt reserves – Dryandra Woodland, Tutanning Nature Reserve and Perup Forest. All are characterised by the presence of thickets of the plant Gastrolobium (Van Dyck and Strahan 2008). The species is now restricted to forests and areas where predation has been controlled (or excluded). It rests during the day in a well-concealed nest, built over a shallow depression. The nest is most commonly built using long strands, of grasses, but other material such as strips of bark are also used (in the forest) or dried seagrass and/or triodia (in arid coastal areas) (Freegard 2007).	Highly unlikely. The Survey Areas is beyond the current range and lacks suitable habitat.	Highly unlikely. The Survey Areas is beyond the current range and lacks suitable habitat.	Highly unlikely. The Survey Areas is beyond the current range and lacks suitable habitat.	Highly unlikely. The Survey Areas is beyond the current range and lacks suitable habitat.	PMST
<i>Dasyurus geoffroii</i>	Chuditch	Vu	Vu	The Chuditch inhabits eucalypt forest (especially Jarrah, Eucalyptus marginata), dry woodland and mallee shrublands. In Jarrah Forest, Chuditch populations occur in both moist, densely vegetated, steeply sloping forest and drier, open, gently sloping forest. Most diurnal resting sites in sclerophyll forest consist of hollow logs or earth burrows (Van Dyke & Strahan, 2008). The species can travel large distances, has a large home range and is sparsely populated through a large portion of its range.	Highly unlikely. The Survey Areas is beyond the current range and lacks suitable habitat.	Highly unlikely. The Survey Areas is beyond the current range and lacks suitable habitat.	Highly unlikely. The Survey Areas is beyond the current range and lacks suitable habitat.	Highly unlikely. The Survey Areas is beyond the current range and lacks suitable habitat.	PMST, DBCA
<i>Hydromys chrysogaster</i>	Water-rat, rakali	P4		Water-rats live primarily in a wide variety of freshwater habitats, from sub-alpine streams and other inland waterways to lakes, swamps, farm dams and irrigation channels and are thought to be one of the few native species to have at least partially benefited from human encroachment (Gardner and Serena, 1995).	Unlikely. Despite known locally for within 5km of the Survey Areas, the Survey Areas lacks suitable habitat and wetland connectivity, and no evidence of feeding or foraging presence was present during field surveys within the Survey Areas.	Unlikely. Despite known locally for within 5km of the Survey Areas, the Survey Areas lacks suitable habitat and wetland connectivity, and no evidence of feeding or foraging presence was present during field surveys within the Survey Areas.	Unlikely. Despite known locally for within 5km of the Survey Areas, the Survey Areas lacks suitable habitat and wetland connectivity, and no evidence of feeding or foraging presence was present during field surveys within the Survey Areas.	Unlikely. Despite known locally for within 5km of the Survey Areas, the Survey Areas lacks suitable habitat and wetland connectivity, and no evidence of feeding or foraging presence was present during field surveys within the Survey Areas.	DBCA
<i>Isoodon obesulus fusciventer</i>	Quenda	P4		The Quenda prefers dense scrubby, often swampy, vegetation with dense cover up to one metre high. However, it also occurs in woodlands, and may use less ideal habitat where this habitat occurs adjacent to the thicker, more desirable vegetation. The species often feeds in adjacent forest and woodland that is burnt on a regular basis and in areas of pasture and cropland lying close to dense cover (Van Dyck and Strahan, 2008).	Unlikely Survey Areas lacks suitable habitat and bushland connectivity without adequate cover and local urban vegetation to allow persistence and utilisation as a linkage corridor.	Unlikely Survey Areas lacks suitable habitat and bushland connectivity without adequate cover and local urban vegetation to allow persistence and utilisation as a linkage corridor.	Possible. Survey Areas lacks suitable habitat and bushland connectivity, however there is the potential for utilising the Survey Areas as an occasional foraging or linkage purpose in revegetated sections.	Possible. Survey Areas lacks suitable habitat and bushland connectivity, however there is the potential for utilising the Survey Areas as an occasional foraging or linkage purpose in revegetated sections.	DBCA

Species name	Common name	Status		Habitat requirements	LOO – Elizabeth Quay	LOO - Applecross	LOO – Ellam St	LOO – Matilda Bay	Source
		State	Federal						
<i>Notamacropus irma</i>	Western Brush Wallaby	P4		The Western Brush Wallaby is found primarily in open forest or woodland, particularly favouring open, seasonally wet flats with low grasses and open scrubby thickets. It is also found in some areas of mallee and heathland, and is uncommon in karri forest (DEC, 2012b; Van Dyck & Strahan, 2008).	Highly Unlikely The Survey Areas lacks suitable habitat and the Survey Areas is outside of the current typical species range, with previous records now quite old.	Highly Unlikely. The Survey Areas lacks suitable habitat and the Survey Areas is outside of the current typical species range, with previous records now quite old.	Highly Unlikely. The Survey Areas lacks suitable habitat and the Survey Areas is outside of the current typical species range, with previous records now quite old.	Highly Unlikely. The Survey Areas lacks suitable habitat and the Survey Areas is outside of the current typical species range, with previous records now quite old.	DBCA
<i>Phascogale tapoatafa wambenger</i>	south-western brush-tailed phascogale, wambenger	CD		The southwest Western Australia Brush-tailed Phascogale have been observed in dry sclerophyll forests and open woodlands that contain hollow-bearing trees. Records are less common in high rainfall areas. (DPAW, 2012)	Highly Unlikely The Survey Areas lacks suitable habitat and the Survey Areas is outside of the current typical species range, with previous records now quite old.	Highly Unlikely. The Survey Areas lacks suitable habitat and the Survey Areas is outside of the current typical species range, with previous records now quite old.	Highly Unlikely. The Survey Areas lacks suitable habitat and the Survey Areas is outside of the current typical species range, with previous records now quite old.	Highly Unlikely. The Survey Areas lacks suitable habitat and the Survey Areas is outside of the current typical species range, with previous records now quite old.	DBCA
<i>Pseudocheirus occidentalis</i>	Western Ringtail Possum	CR	CR	The Western Ringtail Possum occurs in and near coastal Peppermint Tree (<i>Agonis flexuosa</i>) forest and Tuart (<i>Eucalyptus gomphocephala</i>) dominated forest with a Peppermint Tree understorey from Bunbury to Albany. Also occurs in Jarrah (<i>Eucalyptus marginata</i>) forest and Jarrah-Marri (<i>Corymbia calophylla</i>) forest associated with Peppermint Tree (Van Dyck & Strahan 2008).	Highly Unlikely The Survey Areas lacks suitable habitat and the Survey Areas is outside of the current typical species range, with previous records now quite old.	Highly Unlikely. The Survey Areas lacks suitable habitat and the Survey Areas is outside of the current typical species range, with previous records now quite old.	Highly Unlikely. The Survey Areas lacks suitable habitat and the Survey Areas is outside of the current typical species range, with previous records now quite old.	Highly Unlikely. The Survey Areas lacks suitable habitat and the Survey Areas is outside of the current typical species range, with previous records now quite old.	PMST, DBCA
REPTILES									
<i>Ctenotus ora</i>	Coastal Plains skink	P3		The coastal plains skink (<i>Ctenotus ora</i>) is a species of lined or striped Ctenotus skinks, found on the Swan Coastal Plain south of Perth, Western Australia growing to around 6 centimetres in length from snout to vent (Wilson & Swan, 2012). It is dark in colour, with a continuous white dorsolateral stripe. The species has only been found in low numbers in a small stretch of sand dunes on the Swan Coastal Plain south of Perth, Western Australia, between Dunsborough and Mandurah (ALA, 2024).	Unlikely The Survey Areas lacks suitable habitat in terms of sandy coastal habitat with dunes and well vegetated woodlands and sandplains, and previous DBCA records are quite old.	Unlikely The Survey Areas lacks suitable habitat in terms of sandy coastal habitat with dunes and well vegetated woodlands and sandplains, and previous DBCA records are quite old.	Unlikely The Survey Areas lacks suitable habitat in terms of sandy coastal habitat with dunes and well vegetated woodlands and sandplains, and previous DBCA records are quite old.	Unlikely The Survey Areas lacks suitable habitat in terms of sandy coastal habitat with dunes and well vegetated woodlands and sandplains, and previous DBCA records are quite old.	DBCA

Species name	Common name	Status		Habitat requirements	LOO – Elizabeth Quay	LOO - Applecross	LOO – Ellam St	LOO – Matilda Bay	Source
		State	Federal						
<i>Lerista lineata</i>	Perth Slider	P3		A slender species of skink endemic to Western Australia with two digits on forelimbs, three on hindlimbs, fused eyelids and broad, black lateral stripe. This species has a strong habitat preference for sandy, coastal heath and shrubland, particularly between Perth and Mandurah (Wilson & Swan, 2013).	Unlikely The Survey Areas lacks suitable habitat in terms of sandy coastal habitat with dunes and well vegetated shrubs, and previous DBCA records are quite old.	Unlikely The Survey Areas lacks suitable habitat in terms of sandy coastal habitat with dunes and well vegetated shrubs, and previous DBCA records are quite old.	Unlikely The Survey Areas lacks suitable habitat in terms of sandy coastal habitat with dunes and well vegetated shrubs, and previous DBCA records are quite old.	Unlikely The Survey Areas lacks suitable habitat in terms of sandy coastal habitat with dunes and well vegetated shrubs, and previous DBCA records are quite old.	DBCA
<i>Neelaps calonotos</i>	Black-striped snake	P3		This Black-striped Snake is restricted to the sandy coastal strip near Perth, between Mandurah and Lancelin. It occurs on dunes and sandplains vegetated with heaths and eucalypt/banksia woodlands. This species is seriously threatened by increasing development within its restricted distribution (Wilson and Swan, 2013).	Unlikely The Survey Areas lacks suitable habitat in terms of sandy coastal habitat with dunes and well vegetated woodlands and sandplains, and previous DBCA records are quite old.	Unlikely The Survey Areas lacks suitable habitat in terms of sandy coastal habitat with dunes and well vegetated woodlands and sandplains, and previous DBCA records are quite old.	Unlikely The Survey Areas lacks suitable habitat in terms of sandy coastal habitat with dunes and well vegetated woodlands and sandplains, and previous DBCA records are quite old.	Unlikely The Survey Areas lacks suitable habitat in terms of sandy coastal habitat with dunes and well vegetated woodlands and sandplains, and previous DBCA records are quite old.	DBCA
INVERTEBRATES									
<i>Euoplos inornatus</i>	Inornate trapdoor spider (northern Jarrah Forest)	P3		Northern Jarrah Forrest vegetation comprises Jarrah-Marri Forest in the west with Bullich and Blackbutt in the valleys grading to Wandoo and Marri woodlands in the east with Powder bark on breakaways. There are extensive but localised sand sheets with Banksia low woodlands. Heath is found on granite rocks and as a common understorey of forests and woodlands in the north and east (DPAW, 2002)	Highly Unlikely The Survey Areas lacks suitable habitat and only two confirmed records have been made within 10km of the Survey Areas, with none within the past decade.	Highly Unlikely The Survey Areas lacks suitable habitat and only two confirmed records have been made within 10km of the Survey Areas, with none within the past decade.	Highly Unlikely The Survey Areas lacks suitable habitat and only two confirmed records have been made within 10km of the Survey Areas, with none within the past decade.	Highly Unlikely The Survey Areas lacks suitable habitat and only two confirmed records have been made within 10km of the Survey Areas, with none within the past decade.	DBCA
<i>Hesperocolletes douglasi</i>	Douglas' Broad-headed Bee	CR	CR	This is a highly localised and endemic bee species that is about the same size as a honeybee (body length approximately 12 mm), generally black and brown and moderately hairy” (Houston 2014). It is a moderate-sized, non-metallic species similar in appearance to bees from the genera Trichocolletes, Paracolletes and Leioproctus (Michener 2007). As with the majority of native bees, this species is solitary, with each female constructing its own nest and rearing its own offspring and male bees playing no part in nest construction or brood care, ground-nesting and univoltine (single generation per year) with the emergence of adult bees timed to coincide with flowering of the food plants. The most recently found specimens were collected on a Pepper and Salt shrub (<i>Philotheca spicata</i>) during a survey of plant-pollinator interaction networks in Banksia woodland remnants in the Swan Coastal Plain (SCP) in the Perth Region for a PhD research project on the spatial energetics of pollination failure in habitat restoration.	Highly Unlikely The Survey Areas lacks suitable habitat and no confirmed records have been made within 10km of the Survey Areas.	Highly Unlikely The Survey Areas lacks suitable habitat and no confirmed records have been made within 10km of the Survey Areas.	Highly Unlikely The Survey Areas lacks suitable habitat and no confirmed records have been made within 10km of the Survey Areas.	Highly Unlikely The Survey Areas lacks suitable habitat and no confirmed records have been made within 10km of the Survey Areas.	PMST

Species name	Common name	Status		Habitat requirements	LOO – Elizabeth Quay	LOO - Applecross	LOO – Ellam St	LOO – Matilda Bay	Source
		State	Federal						
<i>Leioproctus douglasiellus</i>	Native Short-tongued Bee	CR	CR	<i>Leioproctus douglasiellus</i>, is a small black bee which belongs to a group of species characterised by short tongues. Female specimens are 8 mm in length, with a wing length of almost 5 mm (DEC, 2009). <i>L. douglasiellus</i> is now thought to occur in three locations within the Perth metropolitan area ranging from Cannington to Forrestdale, as reported in the 2006-2008 Rare Native Bee Survey results conducted by the Western Australian Department of Environment and Conservation (DEC) (Swan Region) (DEC, 2009). The current extent of occurrence is 24.3 km², the area of occupancy is 0.2 km², and there has been an inferred decline of suitable habitat since surveys undertaken in 1954 due to a large portion of the Swan Coastal Plain being significantly altered, especially around the Perth metropolitan area where the only known populations of the species occur (DEC, 2009). Specimens of <i>L. douglasiellus</i> have been collected on two plant species, both of which are on the DEC Priority Flora list: <i>Goodenia filiformis</i> (Priority 3) and <i>Anthotium junciforme</i> (Priority 4) (DEC, 2009).	Highly Unlikely The Survey Areas lacks suitable habitat and only two records of the species have been made, both of which have occurred only in high diversity and high biodiversity value wetlands.	Highly Unlikely The Survey Areas lacks suitable habitat and only two records of the species have been made, both of which have occurred only in high diversity and high biodiversity value wetlands.	Highly Unlikely The Survey Areas lacks suitable habitat and only two records of the species have been made, both of which have occurred only in high diversity and high biodiversity value wetlands.	Highly Unlikely The Survey Areas lacks suitable habitat and only two records of the species have been made, both of which have occurred only in high diversity and high biodiversity value wetlands.	PMST, DBCA
<i>Hylaeus globuliferus</i>	Woolybush bee	P3		Hylaeus globuliferus is known to be associated with <i>Adenanthos cygnorum</i> and <i>Banksia attenuata</i> amongst other native plants (Houston 2018)	Highly Unlikely The Survey Areas lacks suitable habitat and only one confirmed record of the species has been made within 10km of the current Survey Areas, which is more than 50 years old.	Highly Unlikely The Survey Areas lacks suitable habitat and only one confirmed record of the species has been made within 10km of the current Survey Areas, which is more than 50 years old.	Highly Unlikely The Survey Areas lacks suitable habitat and only one confirmed record of the species has been made within 10km of the current Survey Areas, which is more than 50 years old.	Highly Unlikely The Survey Areas lacks suitable habitat and only one confirmed record of the species has been made within 10km of the current Survey Areas, which is more than 50 years old.	DBCA
<i>Idiosoma sigillatum</i>	Swan Coastal Plain shield-backed trapdoor spider	P3		This trapdoor species is native to the Swan Coastal Plain, and favours low lying coastal plain systems, mainly covered with woodlands. Preferred habitats include those dominated by <i>Banksia</i> or <i>Tuart</i> on sandy soils, <i>Casuarina obesa</i> on outwash plains, and paperbark in swampy areas. In the east, the plain rises to duricrusted Mesozoic sediments dominated by Jarrah woodland. (DPAW, 2002)	Unlikely Even though the species is known locally from numerous neighbouring woodlands and protected sites within 5km of the Current Survey Areas, the Survey Areas itself lacks suitable habitat of any kind for persistence.	Unlikely Even though the species is known locally from numerous neighbouring woodlands and protected sites within 5km of the Current Survey Areas, the Survey Areas itself lacks suitable habitat of any kind for persistence.	Unlikely Even though the species is known locally from numerous neighbouring woodlands and protected sites within 5km of the Current Survey Areas, the Survey Areas itself lacks suitable habitat of any kind for persistence.	Unlikely Even though the species is known locally from numerous neighbouring woodlands and protected sites within 5km of the Current Survey Areas, the Survey Areas itself lacks suitable habitat of any kind for persistence.	DBCA
<i>Synemon gratiosa</i>	Graceful Sunmoth	P4		Graceful Sun Moth is associated with two habitat types: Coastal heathland on Quindalup dunes where it is restricted to secondary sand dunes due to the abundance of the preferred host plant <i>Lomandra maritima</i>. Targeted surveys by WA DEC in 2010 indicate that Graceful Sun Moth is recorded at substantially higher rates on the <i>L. maritima</i> habitat and is therefore more numerous/dense in this coastal habitat (WA DEC 2011). <i>Banksia</i> woodland on Spearwood and Bassendean dunes, where the second known host plant <i>L. hermaphrodita</i> is widespread. The relative contribution of the <i>Banksia</i> woodland (<i>L. hermaphrodita</i>) habitat to the total population and area of occupied habitat of the Graceful Sun Moth is small (WA DEC 2011).	Unlikely The Survey Areas lacks suitable habitat, and only three recent records have been made within 10km of the Survey Areas.	Unlikely The Survey Areas lacks suitable habitat, and only three recent records have been made within 10km of the Survey Areas.	Unlikely The Survey Areas lacks suitable habitat, and only three recent records have been made within 10km of the Survey Areas.	Unlikely The Survey Areas lacks suitable habitat, and only three recent records have been made within 10km of the Survey Areas.	DBCA

Species name	Common name	Status		Habitat requirements	LOO – Elizabeth Quay	LOO - Applecross	LOO – Ellam St	LOO – Matilda Bay	Source
		State	Federal						
<i>Westralunio carteri</i>	Carter's freshwater mussel	Vu	Vu	Carter's Freshwater Mussel is usually found in freshwater river pools. They are most common in areas with muddy, silty and sandy bottoms and flowing permanent water. Environmental tolerances of <i>W. carteri</i> are not precisely known but they can be found where water temperatures range from 4° C to over 30° C. Formerly this species occurred widely through the southwest including interior rivers of southwest such as Avon, Murray and Blackwood, however Salination of many waterways has severely reduced this species distribution (DCCEEW 2022).	Highly unlikely The Survey Areas lacks suitable habitat and all recent nearby records are of translocations at specific, core habitat locations.	Highly unlikely The Survey Areas lacks suitable habitat and all recent nearby records are of translocations at specific, core habitat locations.	Highly unlikely The Survey Areas lacks suitable habitat and all recent nearby records are of translocations at specific, core habitat locations.	Highly unlikely The Survey Areas lacks suitable habitat and all recent nearby records are of translocations at specific, core habitat locations.	PMST, DBCA



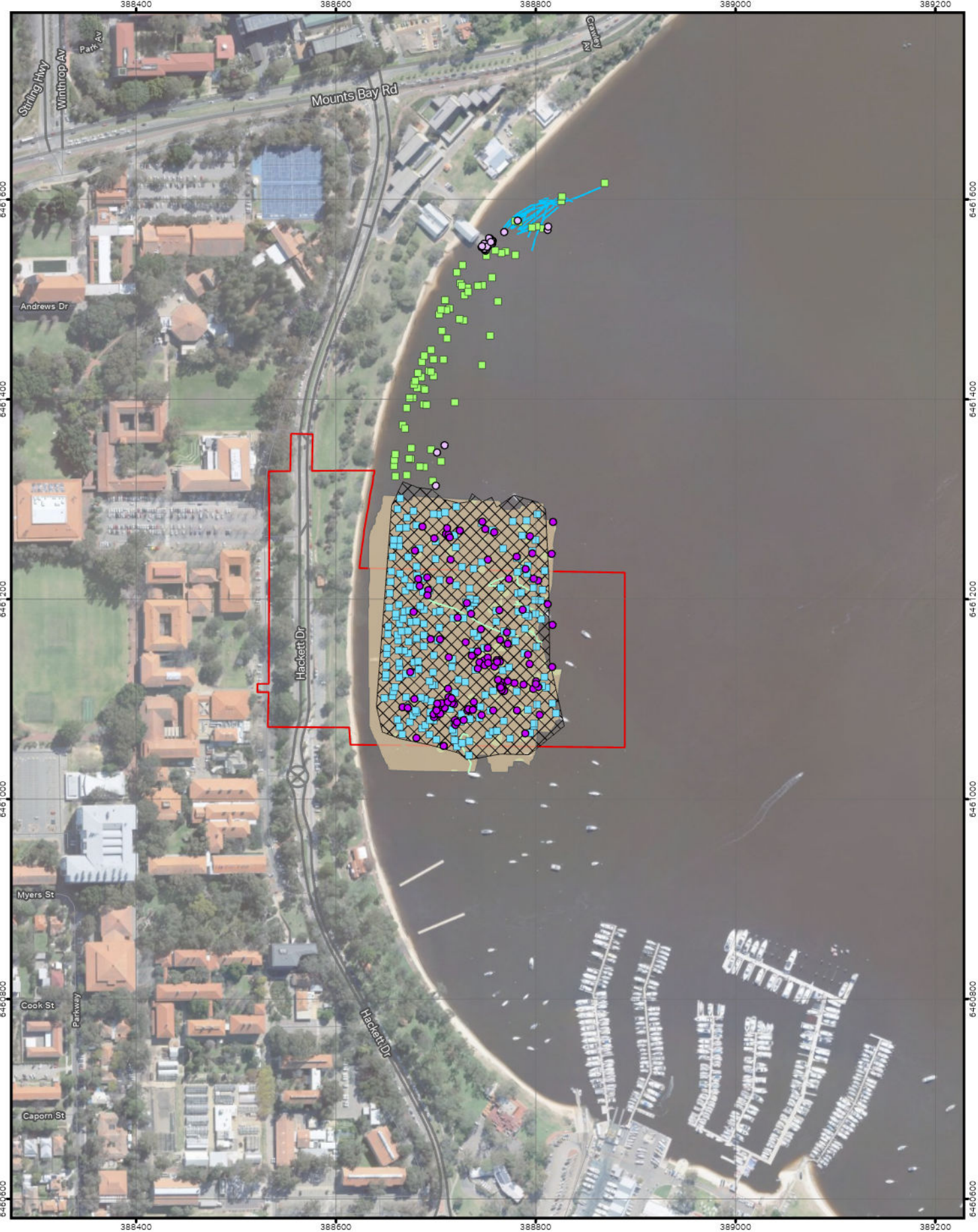
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Appendix C

Seabed Features





AECOM Delivering a better world

PROJECT ID 60752828 CREATED BY JOHNSTONES2
DATE MODIFIED 09 APR 2026 APPROVED BY M. DUNLOP

1:5,000
(when printed at A4)

0 20 40 60 80
metres
GDA2020 MGA ZONE 50

DATA SOURCES: Bathymetry: Based on information provided by and with the permission of the Western Australian Geospatial Information Authority (MAGNETIC) (2018).
Seabed Type: Derived from Bathymetry & DATC 2480 (small scale) DEP QUESY. Other: Major Roads, Main Roads, Private & Highway, RDS, Local Highway Vector.

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LEGEND

Seabed Feature

Magnetic Anomaly

Seabed Feature - Area 3B

Magnetic Anomaly - Area 3B

Seabed Feature

Seabed Feature - Area 3B

Magnetic Anomaly - Area 3B

Seabed Type

Alluvial Sediments

Seabed Feature

Scour

Development Envelope

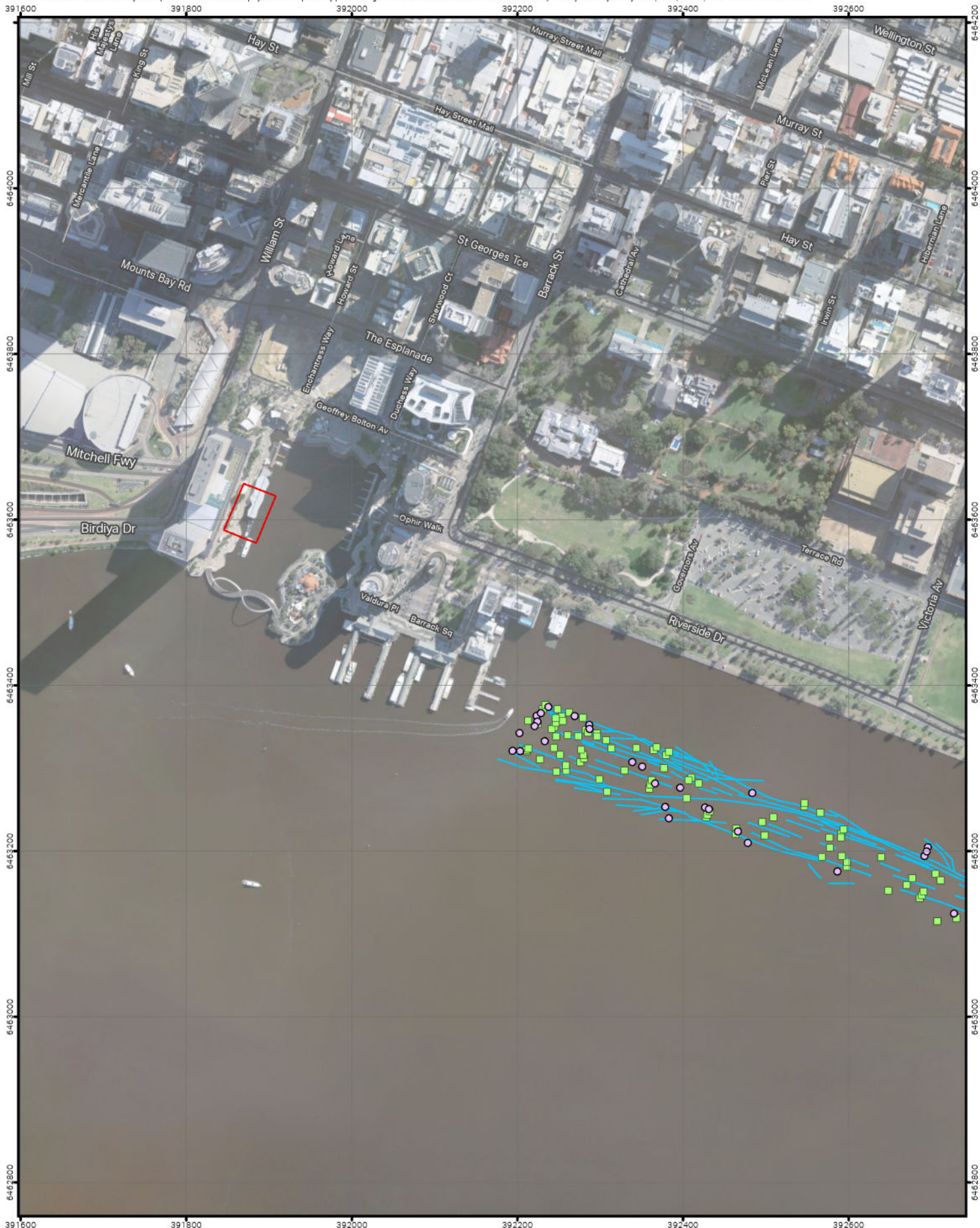
Bathymetry
Matilda Bay Site

PUBLIC TRANSPORT AUTHORITY

METRONET ON SWAN FERRY
OPERATIONS - ENVIRONMENTAL
IMPACT ASSESSMENT

Figure
5b

A4 size



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DATE MODIFIED 09 APR 2026 APPROVED BY M. DUNLOP

1:6,000
metres
GDA2020 MGA ZONE 50

DATA SOURCES: Best Data (3) Based on information provided by and with the permission of the Western Australian Land Information Authority (LIDAR) 2018
Service Layer Credits: Topography & DATC 2483 (small scale) DEP QDSY1 (Chorus) Minor Roads, Main Roads, Fireworks & Highway, BMS, 10448 (Kings) Vector

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LEGEND

- Seabed Feature
- Magnetic Anomaly
- Seabed Feature
- Development Envelope

Bathymetry Elizabeth Quay Site

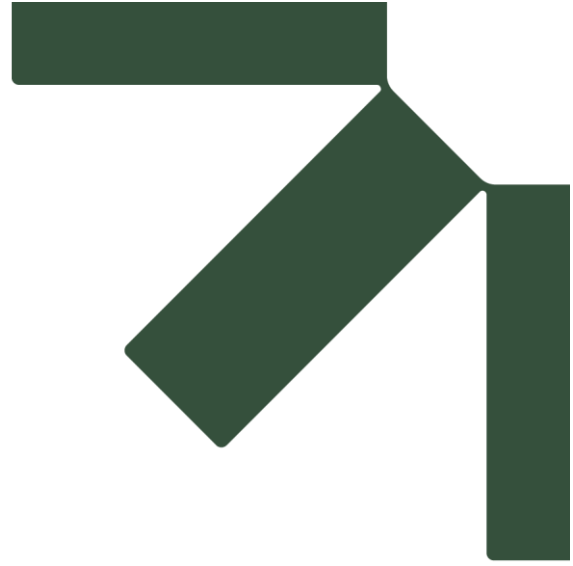
PUBLIC TRANSPORT AUTHORITY

**METRONET ON SWAN FERRY
OPERATIONS - ENVIRONMENTAL
IMPACT ASSESSMENT**

Figure
5c

About AECOM

AECOM is the world's trusted infrastructure consulting firm, delivering professional services throughout the project lifecycle – from advisory, planning, design and engineering to program and construction management. On projects spanning transportation, buildings, water, new energy and the environment, our public- and private-sector clients trust us to solve their most complex challenges. Our teams are driven by a common purpose to deliver a better world through our unrivaled technical and digital expertise, a culture of equity, diversity and inclusion, and a commitment to environmental, social and governance priorities. AECOM is a Fortune 500 firm and its Professional Services business had revenue of \$14.1 billion in fiscal year 2024. See how we are delivering sustainable legacies for generations to come at aecom.com and [@AECOM](https://twitter.com/AECOM).



Appendix L EV Fire Risk Assessment

Ferry Operations Development Application

METRONET on Swan Ferry Service Expansion

Public Transport Authority of Western Australia

SLR Project No.: 675.V25085.00EA1

21 August 2026

Ferry Expansion Project – Electric Ferries and associated charging infrastructure.

Fire Safety Engineering memo

Introduction

As part of the expansion of the Public Transport Authority (PTA) Ferry operations it is understood that new electric ferries will be introduced as well as the charging infrastructure to support the fleet. New terminals will be introduced at Applecross and Matilda Bay with existing berths at Barrack St Jetty and Elizabeth Quay used to moor the ferries and provide access for the public. Trickle feed charging facilities will be provided at Barrack Street, Elizabeth Quay and Applecross terminals, whilst a high capacity charging facility will be provided at Matilda Bay. To service the high capacity charging at Matilda Bay a services building will be constructed containing high voltage transformers and switch gear located on the first floor with public toilets, bike store and Western Power transformer on the ground floor.

This document outlines the new risks introduced by the provision of electric ferries and the supporting charging facilities and provides recommendations for inclusion in the facility and ferry designs.

Flint Engineering have provided preliminary advice for information for PTA only, based on the information available to us at SWTC formulation stage. It is noted that electric vehicles are a new technology, and research and guidance on appropriate fire mitigation measures are evolving. As the project moves into Detailed Design stage, the appointed design team will be required to carry out an assessment of the hazard associated with EV ferries to confirm that the risk to occupant life safety is addressed so far as is reasonably practicable, and to demonstrate that the requirements of the National Construction Code have been met. This advice note is for information only and is not sufficient to be relied upon by the design team as the project progresses.

Literature Review

Data on EV fires is limited, with data on EV ferries even more scarce due to the relative newness of the technology. The literature review in the attachment to this letter, broadly looks at the incidence of fires involving EV's, factors impacting the occurrence of EV fire, incidence of fires involving EV charging docks, and the severity of fires involving EVs. Whilst the literature is focused on road vehicles the broad conclusions from the literature are applicable to the EV technology in general and to that end has applicability to the EV ferries. The conclusions from this review are:

- Current data does not indicate that electric vehicles are more likely to experience fire than other conventional vehicles. It is considered that this finding can extend to Electric Ferries. However, it is noted that data is extremely limited, and this finding may change with time.
- Fires involving EVs incur different hazards than fires in conventional vehicles, including thermal runaway, toxic and flammable gases and vapours, high voltage electricity, stranded energy,

secondary ignition, hazardous materials, projectiles, and potentially extreme fire behaviour, including vapour cloud explosions in confined spaces.

- Fires involving EVs are likely to have similar heat release rates to conventional vehicles unless thermal runaway involves the battery pack in which case a higher HRR and a higher fire growth rate may be expected.
- Fires involving EVs are expected to have a higher likelihood of fire spread to adjacent combustibles than conventional vehicles given that a jet-flame may be present.
- Fires involving EVs are expected to have more toxic smoke with the presence of hydrogen fluoride.
- Fires involving EVs may require additional fire-fighting resources

Relevant Published Guidance on EVs

AFAC Requirements

AFAC has issued a position statement on the design of buildings to contain Electric Vehicles, “Electric Vehicles (EV) and EV Charging Equipment in the Built Environment”, dated 2022. This position statement advises that there are several hazards that would not be present for an internal combustion engine vehicle (ICEV) including “*exposure to high voltage direct current (DC) and alternating current (AC) electricity, ... potential for vapour cloud explosion, ... significant fire duration (4+ hours) and protracted incident, ... potential for secondary ignition, ... potential for stranded electrical energy*”. Whilst the paper does not assess the severity of these consequences compared to the consequences of ICEV, these are hazards that are generally not expected in fires involving ICEV.

“AFAC considers the implementation of Clauses E1.10 and E2.3 as appropriate mechanisms by which to document and address any requirements for the implementation of proposed or associated installations of EVs and EV charging equipment within the built environment in consideration of their assessment of the relevant NCC performance requirements.”

BCA 2019 Amendment 1 Clauses E1.10 and E2.3 (Provision for special hazards) states that additional firefighting provisions and smoke hazard management measures may be necessary due to the special type of material used in a building. However, what measurements should be adopted are not explicated stated in the BCA. It is also noted that the ferry terminals do not fit neatly in the building classification of the building code, and will require input from a building certifier to establish appropriateness and applicability as the design progresses.

AFAC outlines that the following considerations should be assessed during the design stage (AFAC, 2022 (1)):

- *Location of EV charging stations and the proximity to other vehicles, exits, other fire safety systems, building utilities and critical infrastructure. Note: open air or external charging points should always be considered before installation of internal charging points.*
- *Establishing that the appropriate fire resistance (FRL) is applied to building elements.*
- *Suitability of fire safety systems and their location in proximity to the risk, including fire hydrants, fire detection systems, occupant warning systems, automatic fire sprinkler systems, and ventilation and smoke hazard management systems.*
- *The adequacy of vehicle separation to prevent fire spread with respect to directional flame jetting in EV fires. This includes special considerations for vehicle access in stacked parking arrangements or automatic vehicle parking systems.*
- *Intervention capabilities of the local fire authority*
- *Potential for contaminated fire-water run-off*
- *Provision of remote emergency shutdown controls and/or automatic shutdown for EV charging stations.*
- *Vehicle impact protection (e.g. bollards) for EV charging stations.*

- Application of any best practice standards for EV charging equipment.
- Implementation of a regular maintenance schedule for EV charging equipment.

AFAC has also published a procedural document titled “Incidents involving Electric Vehicles” (AFAC, 2022 (2)), which states *“Water is the recommended medium in Australia and New Zealand for extinguishing a lithium-ion battery involved in fire. Extinguishing strategies are to be established by the IC, with consideration that foam will not provide any additional extinguishing capability but may inhibit conducting thermal checks. Carbon dioxide and dry chemical powder extinguishers have no cooling effect and are deemed ineffective for controlling a battery involved in fire.”* (AFAC, 2022 (2))

DFES Requirements

DFES has not issued a position statement on Electric Vehicles to date. However, their standard response to buildings that involve Electric Vehicles is as follows:

“Given the known concerns with controlling and extinguishing a Lithium-Ion Battery Fire DFES request that where the building is proposed to contain EVs and/or EV charging system/s in carparks the Building Surveyor considers the suitability of the minimum Deemed to Satisfy provisions and BCA Clause E1.10 and E2.3 in providing adequate levels of protection for occupants and Fire Brigade intervention.”

The implications of Clause E1.10 and E2.3 to the design are outlined in Section 0.

A meeting was held between PTA, Flint Engineering and DFES on 25/02/2026; the intent of the meeting was to understand DFES requirements for firefighting related to electric ferries, and to understand what fire safety measures would support their operations. A summary of the key issues raised by DFES provided below:

- Plasma runaway is a concern with EVs and presents challenges for firefighting.
- Battery fires produce toxic smoke. The application of water can help to dilute the plume to allow people in the vicinity to safely move away.
- EV fires typically require large volumes of water. The measured flow rates at Matilda Bay would not be sufficient to feed the attending DFES appliance to apply to a fire. Investigation into alternative water supply with minimum compliant flow and pressure will be required.
- Fire water run off can be highly toxic due to contaminants from the batteries. Management of fire-fighting water run-off should therefore be considered. Fire fighting water run off could be from a fire at the dock location involving an EV Ferry, or could be a fire in the services building located on the foreshore area containing the charging infrastructure. This will require special consideration in the marine environment. Input from an environmental consultant should be sought on this topic.
- The location of the batteries in the ferries should be reviewed with the intent of elevating them out of the bilge of the boat to allow for better fire fighter response.
- Isolation switches for both the charging point and the charging infrastructure should be provided in a location which is readily accessible by an attending brigade.
- Consideration of the suitability of any suppression system proposed for the battery enclosure on the ferry. Water is believed to be the best cooling agent for battery fires.
- Signage to indicate the location of the charging infrastructure.

For the Ferry Terminals, particularly Matilda Bay with the high capacity charging, although the openness of the design and the proposed fire safety measures will assist in fire brigade response, a risk assessment should be undertaken for the proposed works and provided to DFES for formal comment along with any other performance based solutions deemed required by the building certifier.

ABCB Requirements

To support Australians making the switch to EVs, the NCC is requiring new buildings to be ready for EV charging. To help industry, the ABCB has published a new advisory note (Version 1.0 dated June 2023).

The advisory note includes 15 recommendations to support safer EV charging, which are summarised as follows:

- *Master Isolation: Provide a master isolation switch with signage at fire indicator panel/Fire Detection Indicator Control Equipment (FDCIE) or building entrance.*
- *RCM Tick compliance: Use chargers that have the Regulatory Compliance Mark (RCM).*
- *Emergency services information pack (ESIP): ESIPs developed for each site and provided for first responders.*
- *Break glass fire alarm: Provide additional break glass unit (BGU).*
- *Placarding site: Provide placarding/signage to identify each EV charge points.*
- *Collision protection: Provide vehicle impact bollards or stops.*
- *Block plans: Block plans should be updated for existing sites to clearly show the location of charging hubs and master isolation.*
- *AS/NZS 3000 App P compliance: Mode 3 and 4 chargers should only be installed by a qualified person and in accordance with AS/NZS 3000 Appendix P*
- *Proximity to evacuation routes and flammable risks: Carefully assess proximity to avoid blocking evacuation routes or placing chargers too close to other flammable risks.*
- *Regular maintenance: Ensure the owner of the charging unit understands and meets their maintenance obligations.*
- *Complex buildings: Complex buildings and higher-risk environments should seek comprehensive, specialist fire safety assessment and advice.*
- *Directional signage: Directional signage to be provided – to the charging units and to the emergency exits.*
- *Smart charging: Where possible, prioritise the use of ‘Smart charging’ to enable remote monitoring and access to disconnect power supply to a connected EV. This gives emergency responders another potential method of shutdown from unit to EV. Encourage operators to monitor for faults and provide early intervention when detected.*
- *Placarding at site entrance: Sites with 5 or more Mode 3 or 4 chargers to install ground level or other appropriate level placards to indicate which entrance is most closely located to EV charging hub.*
- *Pre-incident plans (PIP): Where 5 or more chargers are installed, then building owners should invite local fire crews to attend a site familiarisation visit in order to develop a pre-incident plan (PIP).*

Identified Fire Hazards

Based on the information gathered above related to the fire hazards associated with Electric Vehicles, many of which would be relevant to electric ferries, the primary fire hazards that will be introduced through the adoption of EV technology in the Transperth ferry fleet have been identified as follows:

1. Fire starting in an EV ferry moored at a dock
2. Fire starting in an EV ferry enroute between docks
3. Fire starting in the high capacity charging equipment in the services building
4. Fire starting in a dock charging station

A fire starting in an EV ferry docked connected to a charger is considered the most likely scenario, based on the information provided in the literature review that suggests that between 20-30% of EV fires occur during charging or shortly after.

The degree of harm that may result from the hazard has been identified in **Table 1**.

Table 1: Consequences of Identified Fire Hazards

#	Fire scenario	Potential consequences
1	Fire starting in an EV ferry moored at a charging bay	• There is a potential risk to occupant life safety to multiple people due to one way travel from the floating dock and potential

		fire severity. Note that Ferries could be charging during normal operational times. • Significant quantities of smoke may be generated as the seat of the fire is likely to be shielded. HF is expected to be present in the smoke. Natural ventilation is expected to assist with smoke build-up. • It may take extended time for the fire to be extinguished by DFES (4 hr). Significant quantities of water may be required. Contaminated run-off water expected to discharge to the Swan River. • Impact to ferry service a ferry(ies) may be lost or damaged reducing capacity. Fire damage to floating pontoon would be a likely outcome as well.
2	Fire starting in an EV ferry enroute between docks	• There is a potential risk to occupant life safety as occupants may be required to evacuate overboard into the river. This risk is also present with conventional diesel ferries currently in operation however the risk of fire start may be different for EV ferries. This would need to be investigate by future design team. • Significant quantities of smoke may be generated as the seat of the fire is likely to be shielded. HF is expected to be present in the smoke. Natural ventilation is expected to assist with smoke build-up. • It will take an extended time for the fire to be attended by another water craft which could assist in any type of fire fighting. Again, this risk is no different to the risk of the existing ferry fleet however the contaminants present in the EV ferry fire are likely to be different to that of a diesel ferry fire and should be considered through an environmental assessment.
3	Fire starting in an EV charging infrastructure in services building	• Structural damage could occur, however introduced FRLs will assist in minimizing fire spread to the lower level. • Fire spread to adjacent areas may occur due to unprotected penetrations. • Impact to Ferry Service as high capacity charging will be lost
4	Fire starting in a charging station on floating pontoon	• Fire could spread to adjacent ferries or combustibles on the pontoon. • Some smoke may be generated including HF, but if fire does not spread to the adjacent ferries the quantity of smoke will be lower

		than Scenarios 1. Natural ventilation is expected to assist with smoke build-up. • The risk to occupant life safety is lower than Scenarios 1 due to the lower production of heat and smoke. • It may take some time for the fire to be extinguished by DFES, but the quantity of water required is expected to be less than for Scenarios 1. Contaminated run-off water expected to discharge to the Swan River. • Fire spread to adjacent combustibles may occur. • Possible impact to Ferry Services
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Fire Safety Recommendations

The fire safety recommendations derived from the considerations outlined in this letter are summarised below:

- General Fire safety measures (all terminals):
 - The Terminal (including the Fixed Jetty, Access Gangway and Floating pontoon) and the wharf building elements shall be constructed of non-combustible materials so far is reasonably practicable. It is noted that slip-resistant matting and buffer protection will be required and that these are likely to be combustible materials (rubber) – these should be kept to a minimum.
 - Hydrant outlet(s) to be considered on the fixed portion of the terminal to reduce the distances and number of hoses required to reach the vessel(s).
 - Review of fire fighting water provisions to meet the minimum street hydrant flow and pressure to allow for effective fire fighting response. For the Matilda Bay site this will require investigation into a possible extension of a fire main from top end of Hackett drive near intersection with Mounts Bay Road or another solution for improving the flow and pressure at the site. It should be noted that the introduction of pumps and tanks will be a difficult planning negotiation.
 - The engagement of environmental specialist to review the treatment options of fire fighting water run off and the impact of an EV Ferry fire releasing contaminants into the river.
 - Emergency Services Information Pack (ESIP) be developed for first responders.
 - Block plans include location of charging points and isolation switch.
- Additional fire safety measures for Matilda Bay Services Building
 - Separate Ground Floor and Level 1 with a 2 hour FRL slab
 - Separate bike store and the toilet area with 2 hour FRL construction.
 - Provide 2hr fire rated stair serving the upper level.
 - Separate the Western Power transformer with 2hr FRL.
 - Provide isolation switch for the HV transformers and switchgear at the FDCIE
 - Install manual call point(s) at plant level of the services building.
 - Provide hydrant coverage.

- Should e-rideables (e-bikes, e-scooters or the like) be permitted to be stored at the bike shelter, there shall be no EV chargers or nearby power points provided at the bike store to mitigate the risk of any EV charging on site.
- High capacity Charging units at Matilda Bay:
 - Remote monitoring and shutdown controls of the EV chargers be provided at the PTA Central Monitoring Room (CMR) and the Matilda Bay Service Building.
 - Master isolation switch be provided at the FDCIE located at the service building.
 - Charging units have the Regulatory Compliance Mark (RCM)
 - Charging units to be installed by a qualified person in accordance with AS/NZS 3000 Appendix P.
 - Limit charging of ferries to a capped State of Charge (%).
 - Install manual call points located near the exit point on the fixed portion of the jetty. Consideration of the potential for vandalism of device in the public area should be given.
- Vessel design considerations based on DFES advice:
 - The location of the batteries on the vessels to be at deck level to assist with fire fighting.
 - Potential for thermal runaway from the battery to be considered, with ferry construction material to be selected accordingly.
 - The suitability of a suppression system in the battery enclosures.
 - Battery compartments on the ferries to be reinforced to protect the batteries from damage.
- Vessel design and operations should be confirmed by the design team through review of specifications and as built information of the ferries. Advice from the ferry manufactures indicate the following safety measures have been employed. The impact of these measures on the overall risk presented for the EV ferries should reviewed and determined by the design team.
 - Structural fire protection in the battery room
 - Fire detection system (including CCTV in battery rooms) monitored in the wheelhouse
 - Aerosol fire suppression in battery room (for non-battery fires)
 - Fixed sprinkler system in battery room, with additional shore side connection to enable Firefighters to continue running sprinklers from shore supply
 - Fire hydrant system
 - Portable fire fighting equipment
 - Emergency Escape Breathing Devices for crew
 - Vessel Management System which monitors all cooling and ventilation systems, alerts, warnings shutdowns etc.
 - Battery Management System which monitors the entire system with emergency shutdowns and fail safe design.
 - Battery off-gas ducting and gas sensors in the battery room
- Management and Signage:
 - PTA to develop a maintenance schedule for EV charging equipment.

- Provide signage at the Floating Pontoon as a minimum to identify each EV charging point.
 - Provide directional signage to the charging points.
 - Develop a pre-incident plan (PIP) / emergency response plan.
 - Review and update of the EMM to detail required staff actions and evacuation procedures.
 - Weekly visual check of charging units and EV Equipment (on the pontoons and in the services building) to be undertaken by nominated staff member to identify any issues.
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