Planning Approval Consistency Assessment Form

SM-17-00000111

Metro Body of Knowledge (MBoK)

Assessment name:	Sydney Metro West - Clyde Stabling and Maintenance Facility – Water Treatment Plant Discharge to Duck River
Prepared by:	GLC
Prepared for:	Sydney Metro
Assessment number:	GLC09
Status:	Final (February 2023)
Version:	D
Planning approval:	SSI 10038
Date required:	February 2023
iCentral number:	SM-22-00416435
© Sydney Metro 2020	

For information – do not alter:

Applicable to:	Sydney Metro
Document Owner:	Director, Environment, Sustainability & Planning
System Owner:	Deputy Chief Executive, Operations, Customer & Place-making
Status:	Final
Version:	3.0
Date of issue:	27 November 2020
© Sydney Metro 2020	

Table of contents

The Planning Approval Consistency Assessment Form should be completed in accordance with SM-17-00000103 Planning Approval Consistency Assessment Procedure.

1. Existing Approved Project

Planning approval reference details (Application/Document No. (including modifications)):

- SSI-10038 Sydney Metro West – Concept and major civil construction work for Sydney Metro West between Westmead and The Bays (Stage 1 of the planning approval process for Sydney Metro West)
- SSI-10038-Mod-1 The Sydney Metro West Westmead to The Bays and Sydney CBD - Modification 1 (Administrative Modification)
- SSI-10038-Mod-2 The Sydney Metro West Westmead to The Bays and Sydney CBD – Modification 2 (Clyde Stabling and Maintenance Facility)
- SSI-10038-Mod-3 The Sydney Metro West Westmead to The Bays and Sydney CBD - Modification 3 (Administrative Modification)
- SSI-10038-Mod-4 The Sydney Metro West Westmead to The Bays and Sydney CBD - Modification 4 (Administrative Modification)

Date of determination:

- SSI 10038: 11 March 2021
- SSI-10038-Mod-1: 28 July 2021
- SSI-10038-Mod-2: 03 June 2022
- SSI-10038-Mod-3: 04 July 2022
- SSI-10038-Mod-4: 22 December 2022

Type of planning approval: Critical SSI (Division 5.2 “State significant infrastructure”, Environmental Planning and Assessment Act 1979)

Approved Project

The approved project includes the Concept and major civil construction works between Westmead and The Bays (Stage 1 of the planning approval process). This Consistency Assessment relates to Stage 1 works, as described below.

Approved Major Civil Construction Work for Sydney Metro West between Westmead and The Bays

Approved major civil construction works for Sydney Metro West between Westmead and The Bays (Stage 1 of the planning approval process) includes the following: (Refer to Section 9 of the Environmental Impact Statement (EIS) for more detail).

© Sydney Metro 2020

- Enabling works, such as demolition, utility supply to construction sites, utility adjustments and modifications to the existing transport network
- Tunnel excavation including tunnel support activities between Westmead and The Bays
- Station excavation for new metro stations at Westmead, Parramatta, Sydney Olympic Park, North Strathfield, Burwood North, Five Dock and The Bays
- Shaft excavation for services facilities
- Civil work for the Clyde stabling and maintenance facility

The location of Stage 1, including the underground tunnel and surface construction sites for the stations and services facilities are shown on Figure 1 below.

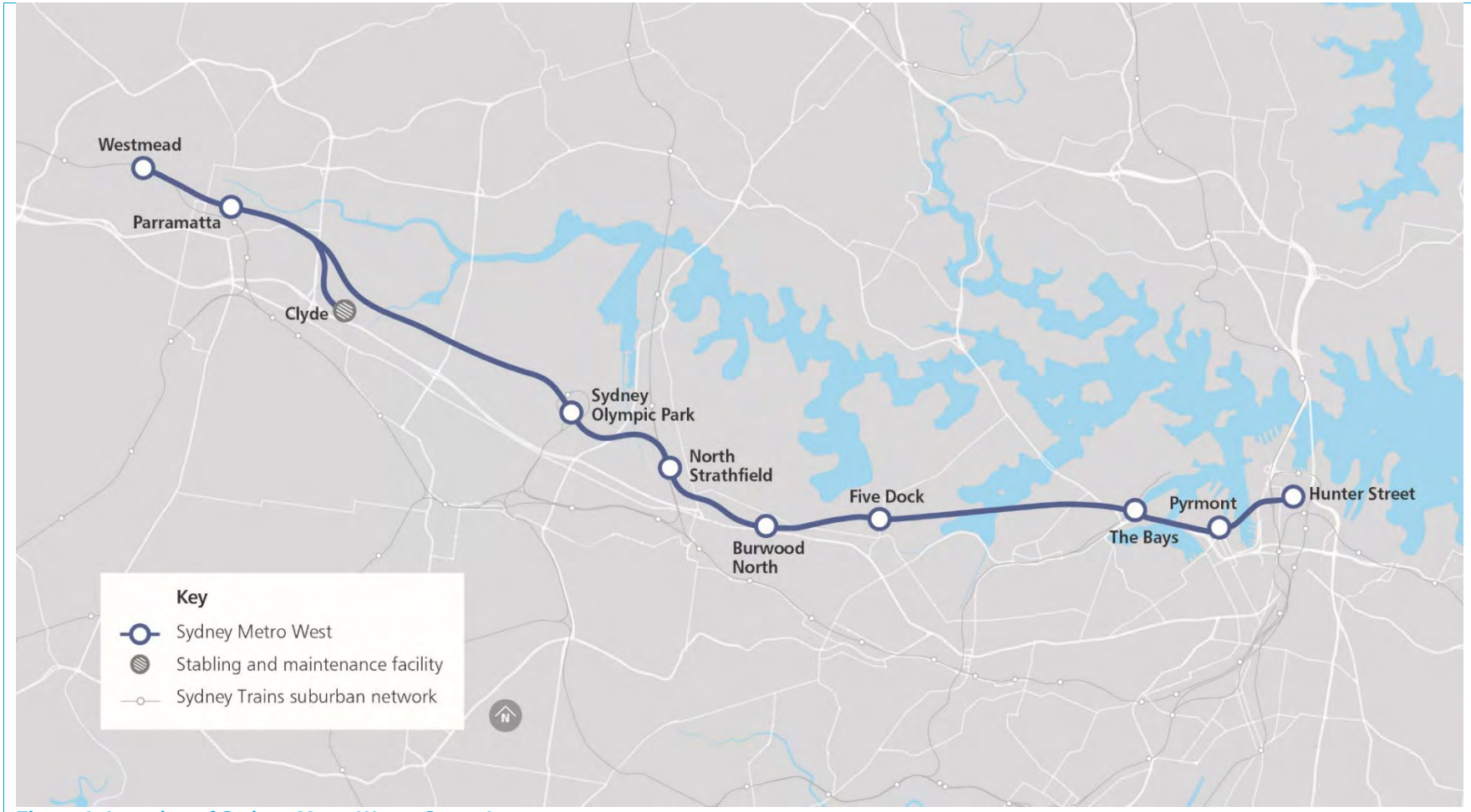


Figure 1: Location of Sydney Metro West - Stage 1

Stage 1 Delivery Phases

The Sydney Metro West - Stage 1 construction works were split into seven delivery phases, including:

- Phase A – Power Enabling Works
- Phase B1 – Central Tunnelling Early Works
- Phase B2 – Central Tunnelling Main Works
- Phase C – Parramatta and Clyde Enabling Works
- Phase D – Greater Sydney Road Works
- Phase E – Existing Rail Corridor Enabling Works
- Phase F – Western Tunnelling Works

© Sydney Metro 2020

The Clyde stabling and maintenance facility indicative construction site and location of water treatment plant is shown on Figure 2 below:

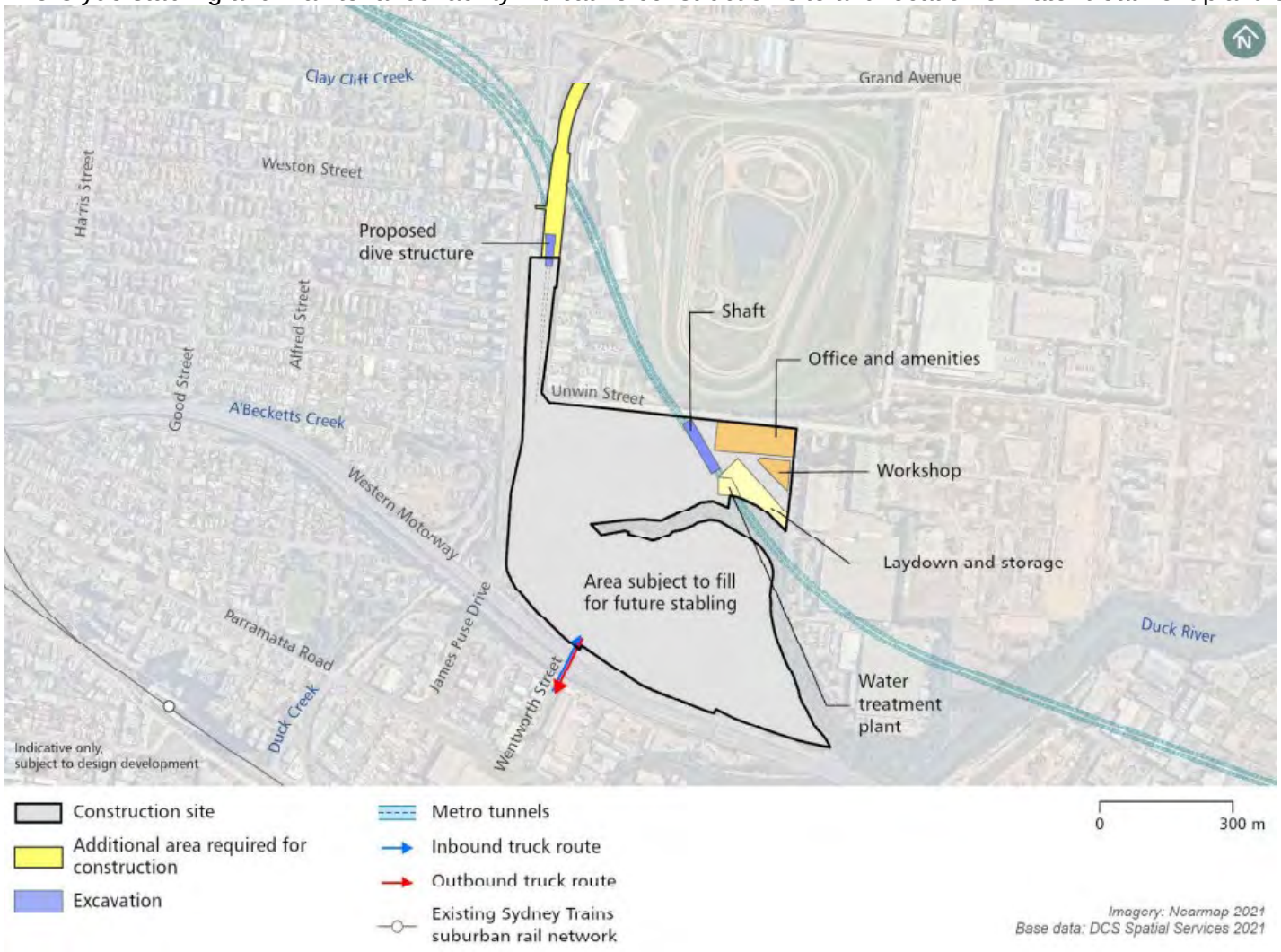


Figure 2: Clyde stabling and maintenance facility indicative construction site (Source, Modification 2 Updated Project Description)

The Project will construct and operate several water treatment plants (WTPs) throughout the duration of tunnel and station excavation works. The WTPs are required to treat:

- groundwater seepage
- Tunnel Boring Machine (TBM) process water
- stormwater runoff, and
- washdown water.

Chapter 9 of the EIS describes water treatment, with an indicative treatment capacity of 30L/s, to service the Clyde stabling and maintenance facility construction site (EIS section 9.5.3). In accordance with REMM SSWQ5, the capacity of the WTP is subject to design confirmation. Discharge of the treated water is described in the EIS as being to either A'Becketts Creek or Duck Creek via existing local stormwater infrastructure (EIS section 19.6.2).

Further design development by GLC has calculated a required treatment capacity of 50L/s for the Clyde stabling and maintenance facility construction site WTP. Preliminary investigations, carried out as part of the water discharge impact assessment, identified significant constraints for discharge to the nominated waterways as neither Ducks Creek or A'Becketts Creek have a base flow large enough to provide appropriate mixing and dispersion of treated water. These locations were not supported by the EPA during initial discharge impact assessment review (discussed further below).

This Consistency Assessment has been prepared to support a change to the discharge location for the Clyde stabling and maintenance facility construction site Primary WTP. It involves the construction of new discharge pipelines to Duck River, where a suitable discharge point has been identified. Sections of the discharge pipeline will be constructed outside the approved construction boundary.

Relevant background information (including EA, REF, Submissions Report, Director General's Report, MCoA):

This Consistency Assessment has been undertaken for the Sydney Metro West Concept and major civil construction work for Sydney Metro West between Westmead and The Bays (Stage 1 of the planning approval process). This includes the following planning approval documentation:

- Sydney Metro West - Westmead to The Bays and Sydney CBD (Concept and Stage 1) Environmental Impact Statement (15 April 2020)
- Sydney Metro West - Westmead to The Bays and Sydney CBD (Concept and Stage 1) Submissions Report (20 November 2020)

© Sydney Metro 2020

- Sydney Metro West - Westmead to The Bays and Sydney CBD (Concept and Stage 1) Amendment Report (20 November 2020)
- Sydney Metro West - Westmead to The Bays and Sydney CBD (Concept and Stage 1) Modification 1 - Administrative Modification (July 2021)
- Sydney Metro West - Westmead to The Bays and Sydney CBD (Concept and Stage 1) Modification 2 - Clyde Stabling and Maintenance Facility Modification Report (November 2021)
- Sydney Metro West - Westmead to The Bays and Sydney CBD (Concept and Stage 1) Modification 2 - Clyde Stabling and Maintenance Facility Submissions Report (March 2022)
- Sydney Metro West - Westmead to The Bays and Sydney CBD (Concept and Stage 1) Modification 3 - Administrative Modification (04 July 2022)
- Sydney Metro West - Westmead to The Bays and Sydney CBD (Concept and Stage 1) Modification 4 – Administrative Modification (22 December 2022)Sydney Metro West - Concept and Stage 1, Modification 2 - Assessment Report (DPE, June 2022)
- Consolidated Instrument of Approval – Sydney Metro West – Concept and Stage 1 – Conditions of Approval (22 December 2022)

All documentation has been published on the DPE Major Projects website located here (Major Project Number: SSI-10038): https://www.planningportal.nsw.gov.au/major-projects/project/25631.

Other relevant documentation prepared as part of design development and construction planning include:

- Rosehill Water Treatment Plants – Water Pollution Impact Assessment SC210108.01 27June 2022 Epic Environmental
- GLC10 Environmental Review – Clyde MSF Temporary discharge pipeline

All proposed works identified in this assessment would be undertaken in accordance with the mitigation measures identified in the Environmental Impact Statement, Submissions Report and Amendment Report and the conditions of approval.

2. Description of Proposed Development/Activity/Works

The proposal includes a change to the location of the treated water discharge and the method for delivery of the treated water. Treated water will be discharged directly to Duck River via a purpose-built pipeline rather than discharge to Duck Creek via stormwater infrastructure as described by the EIS. The majority of the pipework will be installed above ground with only about a 70-meter section along Shirley Street Road Reserve (City of Parramatta Council Land) and the final portion of the pipeline in the area under the M4 to the discharge location between the piers of the M4 crossing of Duck River being installed underground.

© Sydney Metro 2020

Work will include:

- Installation of 2 x 200mm diameter high density polyethylene (HDPE) pipes from the Primary WTP to discharge to Duck River
- Installation of 1 x 160mm diameter HDPE pipe to be used by the follow-on contractor. The discharge pipework for the handover WTP will be installed concurrently with the Primary WTP pipework, to minimise double handling and to provide a single combined package of work to landowners for the purposes of consultation land access agreements. The operation of the Handover WTP will be managed by the follow-on contractor and discharge to Duck River will comply with the relevant EPL.
- Installation of pipework to deliver construction water from Clyde MSF back to the Primary WTP and recycled water from the Primary WTP to Clyde MSF for reuse on site
- Pipework will generally be above-ground supported by precast concrete blocks.
- Support precast concrete blocks will be installed at approximately 1.3m spacings.
- Crossing of Duck Creek will be via an existing Sydney Water aqueduct .
- The pipework will generally be within the construction site except for:
    - Shirley Street - approximately 70m from the southeast corner of the Rosehill site to the Sydney Water aqueduct. Construction along Shirley Street will be within the mulched road verge
    - Transport for NSW (TfNSW) – approximately 200m from the south tip of the Clyde MSF site to Duck River. Construction in this location will require a disturbance width of approximately 3m to provide an access track for pipeline installation and maintenance.
- Minor trench excavation on Shirley Street Road verge and between the edge of the M4 and the Duck River embankment. Pipework will be below ground in this section to reduce infrastructure in public areas.
- Discharge to Duck River via diffuser pipes.

These elements are shown in Appendix D.

Proposed Methodology

As shown in Appendix D, the discharge pipeline will commence from the location of the Primary WTP on the northern boundary of the Rosehill site. The pipework will consist of:

- 2 x 200mm diameter HDPE pipes to carry the discharge effluent from our Primary WTP
- 1 x 160mm diameter HDPE pipe to carry the discharge effluent from the Handover WTP.

The discharge pipeline will then run southwards in a service route around designated areas of site. Once the route reaches the northern boundary of Duck Creek it will travel eastwards along the edge of the site to Shirley Street. At this point the pipeline will exit the site boundary for a short distance and travel along the western verge of Shirley Street to the existing Sydney Water aqueduct.

The existing Sydney Water aqueduct, which carries twin 1200 diameter watermains over Duck Creek, will be used to bring the discharge pipeline over Duck Creek. Once on the southern side of Duck Creek the route will run within the site boundary avoiding the construction work footprint until it reaches the southeast corner of our site.

The route will exit the boundary of the Site and cross over onto TfNSW land. The pipeline route follows the base of the M4 earth embankment and will be outside of the mangrove environment of Duck Creek and above the 20yr flood level (5% AEP).

It will run in a south easterly direction until it has passed the base of the western abutment for the citybound carriageway of the M4 Overbridge. It will divert southwards until it is beneath the overbridge and then turn eastwards and run beneath the outside edge of the structure.

This main length of the pipeline route will be constructed above ground, supported on precast concrete blocks. Blocks will be installed at approximately 1.3m intervals using a frana crane .

The portion of the pipeline along Shirley Street will run underground. A small trench approximately 1.0m wide x 0.8m deep will be excavated to lay the pipework along the road verge.

© Sydney Metro 2020

The final portion of pipeline will run underground in the area under the M4 to the discharge location between the piers of the M4 crossing of Duck River. A small trench approximately 1.0m wide x 0.8m deep will be excavated to lay the pipework to the embankment of Duck River.

The discharge outlet will consist of diffuser heads or similar and will be fully submerged below the low water level, and protrude far enough beyond the bank not to induce eddy currents that might erode the bank below the water level.

Between the WTP (at Rosehill) and the Clyde MSF site additional pipework will be installed on the precast concrete block:

- 1 x 100mm (approx.) diameter HDPE pipe to carry recycled water for reuse from the WTP to a tapping point in the Clyde MSF site near the Sydney Water aqueduct.
- 2 x 150mm (approx.) diameter HDPE pipes to carry construction water back from the Clyde MSF to the Primary WTP for treatment.

Outside the construction site the pipeline route will be constructed to avoid clearance of canopy trees and mangroves. Where minor clearing is required, the route will then be assessed for clearing following our established Project protocols. An Ecologist and Arborist will assess the final route and determine if any adjustments are required. Once approved, a Permit to Clear will be authorised and the clearing can commence. This will largely be undertaken by a small excavator and hand held tools to clear and grub the low level vegetation.

The track to facilitate pipeline construction and maintenance, between the southern end of the Clyde MSF site and the edge of the M4 bridge near Duck River, will be approximately 90m long and 3m in width, and follow the flattest contour between the M4 and Duck Creek embankments. Earthworks will be kept to the minimum required to establish a suitable access track for the installation of the discharge pipeline as well as for future inspection and maintenance purposes. The track will follow the existing ground surface with minor trimming to establish a suitable grade and crossfall on the track. If poor ground is encountered along the route a nominal 300mm will be removed from the surface and replaced with suitable material. The access track will be in place for the duration of GLC's works and for the duration of the follow-on Contractors scope or as long as the diffuser heads are in place.

The HDPE pipes will be procured in the longest stock lengths available. These will generally be 12m lengths with prefabricated bends as required. The pipework will be HDPE pipe with a purple stripe to indicate that it is recycled water. Pipework will be stencilled to indicate that the effluent is “Treated Water Discharge”.

The pipes will be joined via Electrofusion Welding (EF).

© Sydney Metro 2020

Once sections of the pipe have been installed, they will be pressure tested to ensure they have been correctly installed and the integrity of the pipes and EF joints are compliant. The sections of pipe will be tested to a pressure of 6 bar. A final full system test will be undertaken once the complete discharge route has been installed.

Diffuser pipes, or similar, will be used to discharge to Duck River. The pipes will be laid on the stream bed and will not involve excavation into the river. The outlet/s will be designed in accordance with NSW Office of Water Guidelines for Controlled Activities on Waterfront Land and NSW Fisheries fish passage requirements (see Appendix D for indicative drawing of the diffuser pipe).

Discharge to Duck River will be in accordance with conditions applied in the Gamuda Berhad EPL 21676 for Sydney Metro West – Western Tunnelling and Eastern Creek.

Landowners consent will be sought prior to the works commencing and the use of their asset. Landowners includethe City of Parramatta Council, TfNSW and Sydney Water.

At the completion of construction, all the pipework will be removed with the exception of the 1 x 160mm diameter pipe which will remain to be handed over to the Follow-on Contractor at the completion of the Tunnelling Contractors scope (scheduled for Quarter 3 in 2025).

3. Timeframe

Construction of the pipeline will occur within the approved standard working hours. No out-of-hours works are anticipated.

Pipeline installation will commence following the approval of this consistency assessment. Works on the Sydney Water aqueduct will commence following approval from Sydney Water. Works are expected to take approximately 6 weeks to complete.

4. Site Description

Clyde Stabling and Maintenance Facility

As per the approved project (SSI SSI-10038-Mod-2), the Clyde Stabling and Maintenance Facility construction site would cover about 383,000 square metres between the M4 motorway, James Ruse Drive and Rosehill Gardens Racecourse. The site currently contains industrial and commercial buildings, Sydney Speedway (location on NSW Government owned land) and the former T6 Carlingford Line at Rosehill.

© Sydney Metro 2020

Duck River

The Clyde Stabling and Maintenance Facility construction site is located in the lower reaches of the Duck River sub-catchment, which is part of the wider Parramatta River catchment. The Duck River sub-catchment covers an area of around 42km^2 and includes Duck River, Duck Creek and A'Becketts Creek. In its lower reaches Duck River is an estuarine environment. The upper limit of tidal influence is located at the railway culvert near Memorial Drive (approximately 1km upstream of the M4 overpass). Tides in Duck River are semi-diurnal (period of one-half of a day) with two high tides and two low tides each day.

5. Site Environmental Characteristics

A summary of the site environmental characteristics for the Clyde Stabling and Maintenance Facility includes:

Land Use

- Historical aerial photography shows that the Clyde construction site has comprised commercial, industrial and recreational land uses since the 1940s, including a racetrack on the former Sydney Speedway site. A'Becketts Creek and Duck Creek are also visible within the construction site from the 1950s, including areas of riparian vegetation. Reclamation and realignment work appears to have been carried out on some sections of these watercourses in the 1970s, along with increasing development of large industrial and warehousing land uses. There does not appear to have been substantial modification to land uses at the site since this time.
- In the area surrounding the construction site, land uses since the 1940s include low density residential development, commercial and industrial premises, rail infrastructure, Rosehill Gardens racecourse and the former Shell Refinery (Viva Energy). Commercial and industrial premises, rail infrastructure and activities at Rosehill Gardens racecourse may be associated with higher contamination risks. Key developments in the surrounding area since the 1940s include: intensified commercial and industrial development in the 1970s, revegetation along the Parramatta River in the 1980s.
- The Clyde Stabling and Maintenance Facility construction site is currently characterised by industrial uses and major recreational facilities, and is bisected by Duck Creek and A'Becketts Creek. Land uses surrounding the construction site include the following:
    - North of the site is the Rosehill Gardens racecourse
    - East of the site is Duck Creek and Shirley Street, beyond which are large warehouses, and the Viva Energy site that was formerly used as part of Clyde oil refinery
    - South of the site is the M4 Western Motorway, beyond which the Clyde industrial area continues
    - West of the site is a corridor containing James Ruse Drive and the now closed T6 Carlingford Line. Further west are low density residential areas in Rosehill and Granville

© Sydney Metro 2020

- Sydney Speedway (location on NSW Government owned land) is a key land use feature of the site noting the Sydney Speedway has now been made redundant and a new speedway has been constructed and is in operation.
- Duck Creek is also located within the construction site and is heavily vegetated.
- As a result of Stage 1 there would be a change from industrial and recreational land uses to a transport infrastructure construction site. This land use change would be minor considering the scale of surrounding industrial land in Clyde, Camellia, Rosehill and Silverwater. Other developments, once complete, such as the remediation of the western area of the former Viva Energy refinery would also potentially be able to compensate for the loss of industrial zoned land as a result of Stage 1.

Soils and Contamination

- Contamination risk is generally aligned with historical land use. Overall, the soils in the vicinity of the Clyde Stabling and Maintenance Facility construction site have a moderate potential contamination risk associated with current and historical land use activities. There are no sites listed on the NSW Environment Protection Authority Contaminated Sites Register within 500 metres and NSW EPA Protection of the Environment Operations Act public register that have current environment protection licences.
- Contamination risk on the road verge of Shirley Street is considered very low as Endeavour Energy (via subcontractor) recently undertook some utility works (i.e. electricity) at that location at depth of up to 5m and backfilled the area using clean fill.
- No areas of acid sulfate soil risk were identified for the proposed work as these areas are described as ‘disturbed terrain’. Also, no areas of acid sulfate soil risk were identified as the depths of proposed excavation are within fill and wont intersect alluvium soils.

Non-Aboriginal Heritage

- A single historic heritage item was identified within the Project area, consisting of the ‘Wetlands’ (I1 Parramatta LEP 2011). In addition, the ‘RTA Depot’ building and Capral Aluminium building are located in the vicinity, more than 10m west and east respectively from the proposed pipeline along Shirley Street. . Additional detail is contained in the Heritage Due Diligence report included in Appendix A.

Aboriginal Heritage

- Aboriginal heritage for Clyde Stabling and Maintenance Facility, was investigated as part of the Response to Submissions – Artefact November 2020. Extensive landform modification is considered to have limited the archaeological potential of the area. The Duck

River – Duck Creek Junction was however noted as containing some archaeological sensitivity. A Heritage Due Diligence Report has been completed and is included in Appendix A.

Hydrology and Water Quality

- A detailed Water Pollution Impact Assessment (WPIA) has been prepared to address Condition D119 of the Conditions of Approval and to address recommendations made by the EPA in assessing the potential impacts associated with effluent discharges from the Rosehill Primary WTP.
- Duck River receives flows from Duck River, Duck Creek, Little Duck Creek and A'Becketts Creek. The waterways generally flow south to north with the eastern and western sides being moderately sloping. In its lower reaches water levels and flows in the Duck River are influenced by tidal oscillations associated with its location in the upper estuary of the Parramatta River. The upper limit of tidal influence (tidal limit) is located at the railway culvert at Memorial Drive. Upstream of this point there are no tidal oscillations and freshwater flows associated with groundwater baseflow and stormwater runoff are dominant.
- Under dry weather conditions flows in the lower portions of the Duck River will be influenced by baseflow (groundwater) inflows and semi-diurnal tidal oscillations (ebb and flood flows). Baseflow contributions and local catchment morphology creates an asymmetry of flow conditions favouring a net migration of water in the downstream direction over successive tidal cycles, which influences flushing rates and particle migration. The modelled average daily tidal discharge volumes from Duck River, presented in the WPIA, associated with ebb and flood tides between MHW and MLW conditions show approximate discharge volumes of around 300,000 m^3.
- The WPIA presents recent water quality sampling results from Duck River upstream of Duck Creek. The sampling shows water quality is generally good under dry weather conditions. Concentrations of pollutants are typically below the ANZG 95% and 99% species protection criteria for aquatic ecosystems and/ or the laboratory limits of reporting. Contaminants comprising total nitrogen, total oxidised nitrogen, total phosphorous (stressors), zinc and PFOS (toxicants) are elevated at concentrations above the adopted criteria. Turbidity also exceeds the ANZECC 2000 criteria for estuaries.
- The WPIA is included in Appendix B.

Noise and Vibration

The applicable Noise Catchment Areas (NCA) is described as follows:

- NCA07: East of James Ruse Drive, this catchment is mostly commercial and covers Rosehill Gardens racecourse, the Clyde commercial/industrial area, and Silverwater and Newington. Residential receivers and Newington Public School are in the south-east. This catchment is included in both the Clyde and Silverwater precincts.

- The area proposed for the work was inspected in August 2022. Noise was typical for a commercial and industrial landscape. At Duck River noise was dominated by the adjacent industry and traffic from the M4 overpass.

Biodiversity

- The main channel of the Duck River is vegetated to varying extents and in places extensive bank re-vegetation has occurred. In the lower parts of the sub-catchment the banks of the channel are densely vegetated by mangroves and are mapped as coastal wetlands as defined by SEPP Coastal Wetlands.
- Duck River is mapped as Key Fish Habitat and is classified as Type 1 Key Fish Habitat. It is also classified as Class 1 (major key fish habitat) as it is a permanently flowing river. No threatened species listed under the *Fisheries Management Act 1994* have potential habitat within Duck River.
- Estuarine mangrove forests and saltmarshes are the principal vegetative communities present along the shorelines of Duck River. Two mangrove species are typically found in Sydney including grey mangrove (*Avicennia marina*) and river mangrove (*Aegiceras corniculatum*).
- One endangered ecological community (EEC) listed under the BC Act and EPBC Act (Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions) was identified within the study area during the site inspection.
- An additional assessment to address potential biodiversity impacts has been completed and is included in Appendix C.

Traffic, Transport and Access

Detailed traffic, transport and access impacts were not assessed for the work site as construction will only require minor light vehicles for deliveries and a small frana crane and excavator for the installation of precast concrete blocks and pipework. Access to the work areas will generally be via the Clyde stabling and maintenance facility construction site. Works within TfNSW land under the M4 will be managed in accordance with the land access agreement. Traffic and transport issues are anticipated to be minor to negligible with appropriate mitigation measures in place. Light vehicles will park in publicly available spots, either kerbside or in a parking lot.

Land access agreements will be in place for prior to commencement of works.

© Sydney Metro 2020

6. Justification for the Proposed Works

The proposed change seeks discharge of the WTP to Duck River via new pipework and includes access to land outside the approved construction boundary. The changes proposed under this Consistency Assessment would be consistent with the objectives and functions of the approved project. Justification for each aspect of this consistency assessment is as follows:

- Feedback from the EPA on initial early drafts of the Water Pollution Impact Assessment (WPIA) in May 2022 highlighted potential issues with discharge to Duck Creek (identified in the EIS as the receiving waterway). Specifically, the EPA raised concerns around the limited opportunity for mixing to occur if using Duck Creek as a receiving water. To address EPA's concerns GLC agreed that all discharges would be directly to Duck River where there is sufficient capacity for flow to dilute effluent discharges and minimise environmental impacts from both toxicants and stressors.

  This approach has been assessed and modelled as part of the final WPIA and has been accepted by the EPA as the basis for the licence variation issued to Gamuda Berhad on the 25 August 2022 for discharge from the Interim WTP.
- Investigations carried out by the GLC design and flood model team could not identify existing local stormwater infrastructure suitable to discharge a flow volume of 50L/s to Duck River (i.e. stormwater pipe size would not be able to accommodate the flow rate). New pipework is therefore required from the WTP to Duck River.
- The proposed change will be implemented in accordance with Condition D119 of the Conditions of Approval which require a WPIA to be prepared to support the licencing of the Project (EPL 21676)
- The pipeline route has been chosen to minimise potential environmental impacts, specifically
  - avoiding impacts to mangroves (PCT 4091) along Duck Creek by using existing Sydney Water infrastructure to cross the creek line.
  - Locating pipeline outlets under the M4 overpass in a highly disturbed location where impacts to marine vegetation and fish passage will be negligible

7. Environmental Benefit

The key environmental benefit of the proposal is prevention of potential water quality impacts to Duck Creek from discharge of treated effluent from the WTP. While the environmental risk of the discharge has been transferred to Duck River, the WPIA found that effluent discharges from the Rosehill Primary WTP will have a minimal impact on the water quality of Duck River as discharges are minimal compared to the storage volume and tidal flow rates through the channel. Water quality improvements are expected for many water quality parameters in Duck River as effluent water quality is anticipated to be of better quality than the average conditions in Duck River reported through recent surface water monitoring activities.

© Sydney Metro 2020

8. Control Measures

The proposal would also be undertaken in accordance with the mitigation measures and the conditions of approval for the approved project. The proposal would be managed in accordance with the relevant Construction Environmental Management Plans, which have been produced in accordance with the conditions of approval for the approved project.

9. Climate Change Impacts

No change in climate change risk (as identified in the EIS) will occur as a result of this proposed change in construction methodology.

10. Impact Assessment – Construction

Aspect	Nature and extent of impacts (negative and positive) during construction (if control measures implemented) of the proposed/activity, relative to the Approved Project	Proposed Control Measures in addition to project COA and REMMs	Minimal Impact Y/N	Endorsed	
				Y/N	Comments
Flora and fauna	Minor additional clearing of vegetation has been assessed where the pipeline route exits the south of the Clyde MSF site towards the M4. No tree removal is required and minor trimming of branches of any street tree or native canopy species will not involve removal of individual plants. Minor clearing of the ground stratum will be required through exotic grassland south of the site for the access track and pipeline. Due to the proximity of trees near the small trench along Shirley Street, tree roots might be uncovered. NDD will be undertaken prior to trenching and if roots are observed, the installation of the pipeline will be undertaken under the direction of an arborist. No significant impacts to biodiversity of threatened species habitat have been identified as likely to occur as a result of the proposed work. Mangrove removal has been avoided. Impacts to the Swamp Oak Floodplain Forest have also been avoided. As such, no additional impacts to the approved project are anticipated as a result of the updated construction methodology proposed under this Consistency Assessment.	The relevant mitigation measures and recommendations identified in the Biodiversity Briefing note in Appendix C will be discussed during pre-start and implemented on site. Tree species and area of canopy removed will be recorded for any tree trimming required The Sydney Metro West –Western Tunnelling Package –Flora and Fauna Management Plan (SMWSTWTP-GLO-1NL-NL000-EO-PLN-000001)will be implemented where applicable.	Y	Y	
Water and soils	Construction of the pipeline is generally above ground, with minor disturbance of soils for excavation of the 2 underground sections and the access track. The work would be managed in accordance with the Soil and Water Management Plan and the detailed Erosion and Sediment Control Plan (ESCP).		Y	Y	

Aspect	Nature and extent of impacts (negative and positive) during construction (if control measures implemented) of the proposed/activity, relative to the Approved Project	Proposed Control Measures in addition to project COA and REMMs	Minimal Impact Y/N	Endorsed	
				Y/N	Comments
	The outlet structure to Duck River has the potential to cause localised scouring and erosion as well as bank instability. The design and construction of the outlet/s to Duck River would be in accordance with the appropriate Office of Water Guidelines for Controlled Activities on Waterfront Land. The design will be documented as part of the Temporary Works Design process. The WPIA assesses the water quality impacts of the operation of the Primary WTP. It anticipates that (with the exception of chromium) there is likely to be a net improvement in the average water quality in Duck Creek in response to discharge of treated effluent from the Rosehill primary construction water treatment plant. The exceedance of chromium was found to be below the ANZG (I2018) DGV for 95% species protection and thus the impacts from elevated chromium are considered to be negligible. Dilution modelling also found that ANZG criteria for Chromium would be achieved within 6-10m from the discharge point. In addition, tidal flushing by rainfall events is anticipated to periodically refresh water quality conditions in Duck River to represent the catchment condition. The WPIA recommends discharge criteria for the Primary WTP to be included on the Environmental Protection Licence (EPL). Prior to operation of the WTP GLC will seek a variation to the EPL to include appropriate conditions for the operation of the Primary WTP. Soils and surface water quality are anticipated to be consistent to that assessed Project. As such, no additional impacts to the approved project are anticipated as a result of the updated construction	Design for the pipeline outlets to Duck River will be in accordance with relevant Guidelines for Controlled Activities on Waterfront Land. The Sydney Metro West –Western Tunnelling Package –Soil and Water Management Plan (SMWSTWTP-GLO-1NL-EN-PLN-000001) and Sydney Metro West – Western Tunnelling Package – Groundwater Management Plan (SMWSTWTP-GLO-1NL-EN-PLN-000002) will be implemented where applicable			

Aspect	Nature and extent of impacts (negative and positive) during construction (if control measures implemented) of the proposed/activity, relative to the Approved Project	Proposed Control Measures in addition to project COA and REMMs	Minimal Impact Y/N	Endorsed	
				Y/N	Comments
	methodology proposed under this Consistency Assessment.				
Air quality	No additional impacts to the approved project.	No additional measures required. The Sydney Metro West –Western Tunnelling Package –Air Quality Management Plan(SMWSTWTP-GLO-1NL-NL000-AH-PLN-000001) will be implemented where applicable.	Y	Y	
Noise and vibration	A quantitative noise assessment has not been undertaken for this work. Construction is generally within the site or along the boundary of the site, with the exception of the work under and beside the M4. The noise impacts from the construction of the pipeline are considered consistent with the overall impacts already described and assessed in the existing CNVIS. Construction on Shirley Street and in the vicinity of the M4 is considered a minor additional noise source however the impact of this is negligible given the surrounding industrial land use, existing industrial noise environment and lack of sensitive receivers. Public users of the pedestrian path under the M4 may notice additional noise during pipeline construction. However, in the context of moving through this already noisy and industrial area no adverse impact to the public is anticipated.	No additional measures required. Noise impacts would also continue to be managed in accordance with the Sydney Metro West –Western Tunnelling Package –Noise and Vibration Management Plan (SMWSTWTP-GLO-1NL-NL000-NV-PLN-000001) will be implemented where applicable.	Y	Y	
Indigenous heritage	The Heritage Due Diligence report found no registered Aboriginal sites located within the Project area and no new Aboriginal sites were identified during the visual inspection component of this assessment. The proposed location of the WTP pipeline has been subject to significant land	The relevant mitigation measures and recommendations identified in the Heritage Due Diligence Report in Appendix A will be discussed during pre-start and implemented on site.	Y	Y	

© Sydney Metro 2020

Aspect	Nature and extent of impacts (negative and positive) during construction (if control measures implemented) of the proposed/activity, relative to the Approved Project	Proposed Control Measures in addition to project COA and REMMs	Minimal Impact Y/N	Endorsed	
				Y/N	Comments
	modification from construction activities and the proposed work area has been assessed as having no potential to contain Aboriginal objects. As such, no additional impacts to the approved project are anticipated as a result of the work proposed under this Consistency Assessment.	The Sydney Metro West – Western Tunnelling Package – Heritage Management Plan (SMWSTWTP-GLO-1NL-HE-PLN-000001) will be implemented where applicable.			
Non-indigenous heritage	The Heritage Due Diligence report assessed the Project Area as having no potential to contain areas of historical archaeological potential. Additionally, the installation of the pipeline within the heritage item 'Wetlands' would not result in any impacts to the significant vegetation and elements of the heritage item nor would the overall significance of the 'Wetlands' be impacted. As such, no additional impacts to the approved project are anticipated as a result of the work proposed under this Consistency Assessment.	The relevant mitigation measures and recommendations identified in the Heritage Due Diligence Report in Appendix A will be discussed during pre-start and implemented on site. The Sydney Metro West – Western Tunnelling Package – Heritage Management Plan (SMWSTWTP-GLO-1NL-HE-PLN-000001) will be implemented where applicable.	Y	Y	
Community and stakeholder	The pipeline route along Shirley Street is the only location accessible to the general public however this area was observed to be little used and as a mulched road verge is not suitable as a footway. There is very minimal potential for interface with public users. In addition, the low impact nature of the work would have minimal effect on other aspects such as noise and visual impacts. Consultation would continue with stakeholders, and updates would be provided through communication streams already established through the approved project. As such, no additional impacts to the approved project are anticipated as a result of the updated construction methodology proposed under this Consistency Assessment.	No additional measures required. Land access approvals will be sought prior to commencement of works specifically with Sydney Water and TfNSW.	Y	Y	

Aspect	Nature and extent of impacts (negative and positive) during construction (if control measures implemented) of the proposed/activity, relative to the Approved Project	Proposed Control Measures in addition to project COA and REMMs	Minimal Impact Y/N	Endorsed	
				Y/N	Comments
Traffic	The use of small vehicles, frana crane, excavator and delivery vehicles required to complete the proposed pipeline construction will not significantly increase the volume of traffic utilising local roads during the day. Work areas will be generally accessed from inside the wider Clyde MSF site, with the exception of work along Shirley Street. Traffic controls required for this work will be done through existing established procedures. As such, no additional impacts to the approved project,	No additional measures required. The Sydney Metro West – Stage 1 Construction Traffic Management Framework will be implemented where applicable.	Y	Y	
Waste	There may be minor volumes of spoil generated as a result of the pipeline construction. Material will be used for backfill as far as possible. DSI is not considered appropriate for this scope of work and any investigation would be disproportionate to the level of subsurface disturbance/excavation proposed under this CA. Sub-surface disturbance for the underground sections is very discrete, with a very small volume of spoil material generated at each location. Undertaking DSI for this CA would expand the extent of excavation and the work footprint. Stockpiling and classification prior to reuse or disposal is considered the most suitable method for managing the minor volume of spoil generated by these works.	Spoil will be stockpiled within the Clyde MSF site and tested and classified prior to reuse or disposal in accordance with Waste Classification Guidelines (NSW EPA, 2014). Implement Unexpected Contaminated Land and Asbestos Finds Procedure as required The Sydney Metro West – Western Tunnelling Package – Waste Management Plan (SMWSTWTP-GLO-1NL-NL000-WM-PLN-000002) will be implemented where applicable.	Y	Y	
Social	No additional impacts to the approved project.	No additional measures required.	Y	Y	
Economic	No additional impacts to the approved project.	No additional measures required.	Y	Y	

Aspect	Nature and extent of impacts (negative and positive) during construction (if control measures implemented) of the proposed/activity, relative to the Approved Project	Proposed Control Measures in addition to project COA and REMMs	Minimal Impact Y/N	Endorsed	
				Y/N	Comments
Visual	There will be minor changes to the pipeline route area when works are being undertaken and once completed as the pipelines will be above ground. However, in the context of their location against the wider Clyde MSF site the potential visual impacts are considered negligible. The pipelines are not permanent structures and will be removed following completion of the work. As such, no additional impacts to the approved project are anticipated as the pipeline construction will not permanently alter the visual landscape of each site.	No additional measures required.	Y	Y	
Urban design	No additional impacts to the approved project.	No additional measures required.	Y	Y	
Hydrology and flooding	The WPIA addresses flows in Duck River and the potential impact of discharges from the construction water treatment discharge as a change to the daily volumetric flow rates. The results from flow modelling show that discharge from the primary construction water treatment plant would increase daily discharge rates through Duck River by between approximately 0.58% under average conditions and 0.68%at peak discharge from the water treatment plant during ebb flows, and between 1.19% and 1.25% during flood flows. A detailed review of potential risks from discharges against all relevant NSW River Flow objectives was carried out and found that: • Discharges will not reduce available water for pools in dry times.	No additional measures required.	Y	Y	

Aspect	Nature and extent of impacts (negative and positive) during construction (if control measures implemented) of the proposed/activity, relative to the Approved Project	Proposed Control Measures in addition to project COA and REMMs	Minimal Impact Y/N	Endorsed	
				Y/N	Comments
	• Discharges will not significantly alter flow rates under ambient conditions. • Effluent discharge will not result in significant increase or decrease in wetland or floodplain inundation. • Effluent discharge will not result in significant increase or decrease in wetland or floodplain inundation. • Discharges are unlikely to result in significant increases in water levels due to high stormwater discharge capacity of receiving waterways and large storage volumes. • No weirs or instream structures are proposed. • Groundwater drawdown will be minimized through the groundwater management plan and is considered unlikely to result in a significant reduction of baseflow to the receiving waterway As such, no additional impacts to the approved project are anticipated as a result of the updated construction methodology proposed under this Consistency Assessment.				
Land use	No additional impacts to the approved project.	No additional measures required.	Y	Y	
Contamination	Minor volumes of spoil material would be managed in accordance with the waste procedure outlined above. Excavation may also pose a risk to receiving environments, primarily Duck Creek or Duck River, from potentially contaminated material. Erosion and sediment risks would be managed in accordance with the Soil and Water Management Plan and the detailed Erosion and Sediment Control Plan (ESCP).	The Sydney Metro West –Western Tunnelling Package –Soil and Water Management Plan (SMWSTWTP-GLO-1NL-EN-PLN-000001)	Y	Y	

© Sydney Metro 2020

Aspect	Nature and extent of impacts (negative and positive) during construction (if control measures implemented) of the proposed/activity, relative to the Approved Project	Proposed Control Measures in addition to project COA and REMMs	Minimal Impact Y/N	Endorsed	
				Y/N	Comments
Climate change	No additional impacts to the approved project.	No additional measures required.	Y	Y	
Risk	No additional impacts to the approved project.	No additional measures required.	Y	Y	
Other	No additional impacts to the approved project.	No additional measures required.	Y	Y	
Management and mitigation measures	No additional impacts to the approved project.	No additional measures required.	Y	Y	

11. Impact Assessment – Operation

As noted in **Section 3** above, the proposed changes related to the location of the treated water discharge and associated pipeline for the Clyde Water Treatment Plant will not impact any aspects of operation phase of the project. Discharge to Duck River will be in accordance with conditions applied in the Gamuda Berhad EPL 21676 for Sydney Metro West – Western Tunnelling and Eastern Creek.

Furthermore, Stage 1 of the planning application for Sydney Metro West (subject of this Consistency Assessment) is for major civil construction work for Sydney Metro West between Westmead and The Bays. As such, operational impacts of the proposal are not applicable, and therefore there are no changes from the approved project are anticipated.

Aspect	Nature and extent of impacts (negative and positive) during operation (if control measures implemented) of the proposed activity/works, relative to the Approved Project	Proposed Control Measures in addition to project COA and REMMs	Minimal Impact Y/N	Endorsed	
				Y/N	Comments
Flora and fauna	No change from the approved project.	No additional measures required.	Y	Y	
Water	No change from the approved project.	No additional measures required.	Y	Y	
Air quality	No change from the approved project.	No additional measures required.	Y	Y	
Noise vibration	No change from the approved project.	No additional measures required.	Y	Y	
Indigenous heritage	No change from the approved project.	No additional measures required.	Y	Y	
Non-indigenous heritage	No change from the approved project.	No additional measures required.	Y	Y	
Community and stakeholder	No change from the approved project.	No additional measures required.	Y	Y	
Traffic	No change from the approved project.	No additional measures required.	Y	Y	

© Sydney Metro 2020

Aspect	Nature and extent of impacts (negative and positive) during operation (if control measures implemented) of the proposed activity/works, relative to the Approved Project	Proposed Control Measures in addition to project COA and REMMs	Minimal Impact Y/N	Endorsed	
				Y/N	Comments
Waste	No change from the approved project.	No additional measures required.	Y	Y	
Social	No change from the approved project.	No additional measures required.	Y	Y	
Economic	No change from the approved project.	No additional measures required.	Y	Y	
Visual	No change from the approved project.	No additional measures required.	Y	Y	
Urban design	No change from the approved project.	No additional measures required.	Y	Y	
Hydrology and Flooding	No change from the approved project.	No additional measures required.	Y	Y	
Land use	No change from the approved project.	No additional measures required.	Y	Y	
Climate Change	No change from the approved project.	No additional measures required.	Y	Y	
Risk	No change from the approved project.	No additional measures required.	Y	Y	
Other	No change from the approved project.	No additional measures required.	Y	Y	
Management and mitigation measures	No change from the approved project.	No additional measures required.	Y	Y	

© Sydney Metro 2020

12. Consistency with the Approved Project

Based on a review and understanding of the existing Approved Project and the proposed modifications, is there is a transformation of the Project?	No. The proposal would not transform the project. The project would continue to provide major civil works between Westmead and The Bays as part of the approved project.
Is the project as modified consistent with the objectives and functions of the Approved Project as a whole?	Yes. The proposal would be consistent with the objectives and functions of the approved project.
Is the project as modified consistent with the objectives and functions of elements of the Approved Project?	Yes. The proposal would be consistent with the objectives and functions of the approved works for the project. The activities proposed to be undertaken are generally consistent with the activities identified for the approved project.
Are there any new environmental impacts as a result of the proposed works/modifications?	No. There would be no new environmental risks as a result of the proposal. All risks identified for the approved project and the proposal would be adequately addressed through the application of the mitigation measures provided in the Environmental Impact Statement, Submissions Report, Amendment Report, Subsequent Modifications and Consolidated Instrument of Approval.
Is the project as modified consistent with the conditions of approval?	Yes. The proposal would be consistent with the conditions of approval.
Are the impacts of the proposed activity/works known and understood?	Yes. The impacts of the proposal are understood and will be accounted for by implementing the existing mitigation measures provided in the Environmental Impact Statement, Submissions Report, Amendment Report, Subsequent Modifications and Consolidated Instrument of Approval (3 June 2022). These would be implemented through the Sydney Metro Construction Environment Management Framework, Construction Traffic Management Framework and Construction Noise and Vibration Standard.
Are the impacts of the proposed activity/works able to be managed so as not to have an adverse impact?	Yes. The impacts of the proposal can be managed so as to avoid an adverse impact.

© Sydney Metro 2020

13. Other Environmental Approvals

Identify all other approvals required for the project:	EPL no 21676 includes new discharge limits, monitoring points, and other any other conditions as required by the EPA. Sydney Water approval is required prior to installation of the pipeline across the Sydney Water Aqueduct City of Parramatta Council have approved the works to be undertaken on the verge of Shirley Street TfNSW approval is required for easement under the M4 Bridge use

© Sydney Metro 2020

Author certification

To be completed by person preparing checklist.

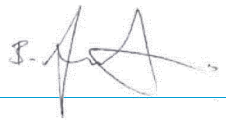
I certify that to the best of my knowledge this Consistency Checklist: • Examines and takes into account the fullest extent possible all matters affecting or likely to affect the environment as a result of activities associated with the Proposed Revision; and • Examines the consistency of the Proposed Revision with the Approved Project; is accurate in all material respects and does not omit any material information.			
Name:	Candice Somerville	Signature:	
Title:	Environmental Approvals Manager		
Company:	GLC	Date:	01 February 2023

This section is for Sydney Metro only.

Application supported and submitted by			
Name:	Yvette Buchli	Date:	07/02/2023
Title:	Associate Director - Planning Approvals	Comments:	
Signature:			

Based on the above assessment, are the impacts and scope of the proposed activity/modification consistent with the existing Approved Project?

Yes	The proposed activity/works are consistent, and no further assessment is required.
No	The proposed works/activity is not consistent with the Approved Project. A modification or a new activity approval/ consent is required. Advise Project Manager of appropriate alternative planning approvals pathway to be undertaken.

Endorsed by			
Name:	Ben Armstrong	Date:	9 February 2023
Title:	Director Environment, Sustainability and Planning	Comments:	
Signature:			

Appendix A – Heritage Assessment

Inspired People.
Dedicated Team.
Quality Outcomes.

Our Ref: 22052_R14_Duck River Discharge_Heritage Due Diligence_Final_V3

20 January 2023

Candice Somerville
Environment Approval Manager
Gamuda Lang O'Rourke Consortium

E|candice.somerville@glcwtp.com.au>

Dear Candice,

1.0 Introduction

Umwelt (Australia) Pty Ltd (Umwelt) was engaged by Gamuda Australia Lang O'Rourke Consortium (GLC) to undertake a combined Aboriginal and Historical (non-Aboriginal) Heritage Due Diligence Assessment for the proposed water treatment pipeline at the Clyde Maintenance and Stabling Facility (Clyde MSF) located in Rosehill, New South Wales (NSW) (hereafter 'the Project').

This Aboriginal and Historical (non-Aboriginal) Heritage Due Diligence Assessment report documents the results of Umwelt's assessment and has been compiled with general reference to the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* 2010 (Department of Environment, Climate Change and Water NSW [former], 2010). This code was developed to assist proponents in exercising due diligence when carrying out activities that may result in harm to Aboriginal objects. Where historical (non-Aboriginal) heritage matters are assessed, Umwelt have referred to *Assessing Heritage Significance* (NSW Heritage Office 2001).

1.1 The Project

The Project received planning approval on 11 March 2021, under *SSI-10038*, as the western portion of the Sydney Metro West, Westmead to The Bays Concept and Stage 1. As part of the planning approval process, an Environmental Impact Statement (EIS) was prepared for the Project by Jacobs/ Arcadis in 2020.

The approved Sydney Metro West construction works between Westmead and The Bays includes the construction of a water treatment plant (WTP) at the Clyde MSF. The approved design for the WTP, as outlined in the EIS, includes the discharge of the treated water as being to either A'Becketts Creek or Duck Creek via existing local stormwater infrastructure (Jacobs/Arcadis 2020).

Umwelt (Australia) Pty Limited

ABN 18 059 519 041

T| 1300 793 267
E| info@umwelt.com.au

www.umwelt.com.au

Further design development by GLC since project approval identified significant constraints for discharge to the nominated waterways; neither Ducks Creek or A'Becketts Creek have a base flow large enough to provide appropriate mixing and dispersion of treated water (GLC 2022). Further, the identified locations were not supported by the NSW Environment Protection Authority (EPA) during initial discharge impact assessment review (GLC 2022).

In order to address the deficiency in the approved WTP design, GLC propose to change the discharge location for the WTP at the Clyde MSF from Duck Creek to the proposed new location at Duck River, where the M4 motorway crosses Duck River at Clyde. The proposed alternate discharge location requires the redesign of the discharge pipeline. Optioneering for the new discharge pipeline has identified two areas where construction activities would be required outside of the approved construction boundary for the Project. These areas, herein referred to as the 'Project area', consist of:

- Shirley Street – approximately 70 metres (m) from the southeast corner of the Rosehill site to the Sydney Water aqueduct. Construction along Shirley Street will be within the mulched road verge. This area is located to the north of Duck Creek, along the road verge of the industrial subdivision, between the former RTA depot site and the former Capral Aluminium site. The area is located on the west side of Shirley Street, in a flat area. The road verge is approximately 1.2 m wide, between the concrete kerb and the chain link wire fence marking the boundary of the former RTA depot. The area adjacent to Duck Creek slopes steeply down the water level, with concrete steps providing access to the creek. Mangroves grow along the length of the creek and extend slightly up the bank. A Sydney Water asset, consisting of two large diameter pipes, crosses Duck Creek in this area, with chain link wire fence to the top and sides of the asset to prevent people climbing over the pipes.

- Transport for NSW (TfNSW) easement – approximately 200 m from the southern tip of the Clyde MSF site to Duck River. Construction in this location will require a disturbance width of approximately 3 m to provide an access track for pipeline installation and maintenance. This area consists of a narrow corridor of overgrown vegetation running east along the north edge of the M4 embankment from the southern corner of the property located at 11 Tennyson Street to Duck River. The corridor crosses under the M4 motorway overpass, where the terrain has been cleared of all vegetation. This area is generally bare of any vegetation, with the ground surface being compressed earth with road base or gravel laid over some areas. Underground service access points are located between the concrete pylons supporting the overpass. The banks of the Duck River slope steeply down to the water from the west. Although other section of Duck River is bordered by mangroves, the area immediately below the M4 motorway is largely devoid of any mangroves.

- These locations where works fall outside the approved construction boundary require assessment to understand the potential impacts to Aboriginal and non-Aboriginal heritage in the vicinity of the proposed works. **Figure 1.1** shows the location of the proposed pipeline.

1.2 Construction Activities

The Project will consist of the following construction activities:

- Installation of two 200 mm diameter and one 160 mm diameter high density polyethylene (HDPE) pipes to deliver construction water from Clyde MSF back to the Primary WTP and recycled water from the Primary WTP to Clyde MSF site for reuse on site. This will require:
    - Duck Creek to be crossed via an existing Sydney Water aqueduct, with the new pipe work fixed to this existing structure.
    - Clearing of an approximately 3 m wide track for installation and maintenance from the south end of the Clyde MFS site to below the M4 motorway overpass. Where the ground level is uneven, minor grading will occur with no more than 300 mm of the existing ground surface removed in providing an even surface falling towards Duck Creek. This will be achieved using a small excavator (approximately 5 tonne). Where excess spoil is produced during any grading works for the pipeline, this will be managed as part of the Sydney Metro West Western Tunnelling Package Spoil Management Plan, including potential storage within the Clyde MSF site for reuse or disposal, depending on the composition of the spoil.
    - Pipework will primarily be installed above ground, supported by pre-cast concrete blocks approximately 600 x 600 x 1200m long and spaced approximately every 1.3 m, except for a 60 m section along the Shirley Street road verge and a small section under the M4 motorway, which will be installed underground. These two sections will include the excavation of a trench approximately 1 m wide and 800 mm deep.
    - The small section of pipework between the north edge of the M4 motorway and the embankment of Duck River will run from the gate to the TfNSW easement below the M4 motorway southeast to the embankment of Duck River. The pipework will extend from approximately 700 mm below the top of the embankment and be laid on the existing ground surface into Duck River, where the discharge outlet (fitted with a diffuser heads or similar) will be fully submerged below the low water level and protrude far enough beyond the bank so as not to induce eddy currents that might erode the bank below the water level.

1.3 The Proponent

The proponent is **Gamuda Australia Lang O'Rourke Consortium (GLC)** (ABN: 27 632 738 768), a joint venture responsible for the delivery of the Western Tunnelling Package of the Sydney Metro West Project on behalf of the NSW Government.

1.4 Project Team

This report was prepared by Alison Fenwick (Umwelt, Archaeologist) and Melissa Moritz (Umwelt, Senior Heritage Consultant). Management assistance and technical review was undertaken by Luke Wolfe (Umwelt, Principal Archaeologist) and Nathan Baker (Umwelt, Principal Environmental Consultant).

1.5 Limitations

This assessment addresses the potential risks to Aboriginal and non-Aboriginal heritage associated with the Project scope indicated in **Section 1.1** and **Section 1.2** of this report. It is noted that the works assessed in this document are located in areas of remnant vegetation, identified as 'Wetlands' in the Parramatta Local Environmental Plan. Consideration of ecological impacts associated with the works have not been included in this assessment. This has been assessed separately in the *Sydney Metro West – Western Tunnelling Package Clyde MSF Discharge Route Biodiversity Assessment* (Umwelt, 2023).

1.6 Disclaimer

This document has been prepared for the sole use of the authorised recipient and this document may not be used, copied or reproduced in whole or part for any purpose other than that for which it was supplied by Umwelt (Australia) Pty Ltd (Umwelt). No other party should rely on this document without the prior written consent of Umwelt.

Umwelt undertakes no duty, nor accepts any responsibility, to any third party who may rely upon or use this document. Umwelt assumes no liability to a third party for any inaccuracies in or omissions to that information. Where this document indicates that information has been provided by third parties, Umwelt has made no independent verification of this information except as expressly stated.

©Umwelt (Australia) Pty Ltd

Legend

- Approved Surface Construction Boundary
- Proposed Discharge Pipeline
- Tunnel Alignment
- Railway Line
- Drainage Line

FIGURE 1.1

Project Components

Image Source: Nearmap (August 2022) Data source: DFSI (2021)

2.0 Statutory Context

2.1 Commonwealth

2.1.1 Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides for the statutory protection of all items of National environmental significance, and includes protection to heritage items of Commonwealth, National and World significance. The EPBC Act and its regulations also set out the processes for undertaking works within (or in the vicinity of) World, National or Commonwealth heritage items, including where approvals under the EPBC Act are required.

The full extent of requirements for environmental approvals are set out in Subdivision A and AA or Part 4 of the Act. The key trigger for requiring approval is whether works – referred to as an 'action' in the Act, will have a significant impact on the item of National environmental significance. If the proposed action is assessed as having, or likely to have, a significant impact, the matter must be referred to the Minister for Environment for approval.

2.2 State

2.3 Environmental Planning and Assessment Act 1979

The NSW *Environmental Planning and Assessment Act 1979* (EP&A) Act enables responsibility for heritage (both Aboriginal and Non-Aboriginal) to be shared by state and local government agencies. The Act provides local government with the power to protect items and places of heritage significance in the local area through local environmental plans (LEPs) and development control plans.

The EP&A Act requires consideration be given to environmental impact – including heritage – as part of the land use planning process, and the provisions of the EP&A Act allow for the implementation of LEPs which provide the statutory framework for heritage conservation within a particular local government area (LGA).

2.3.1 Heritage Act 1977 (NSW)

The NSW *Heritage Act 1977* (the Heritage Act) affords automatic statutory protection to 'relics' which form part of archaeological deposits, except where these provisions are suspended by other prevailing legislation. The Heritage Act defines a 'relic' as any deposit, object or material evidence that:

- Relates to the settlement of the area that comprises NSW, not being Aboriginal settlement.
- Is of State or local heritage significance.
- Sections 139 to 145 of the Heritage Act prevent the excavation of a relic (on non-State Heritage Register listed (SHR) land), except in accordance with a gazetted exception or an excavation permit issued by the Heritage Council of NSW. Section 139 of the Heritage Act requires that:

"A person must not disturb or excavate any land knowing or having reasonable cause to suspect that the disturbance or excavation will or is likely to result in a relic being discovered, exposed, moved, damaged or destroyed unless the disturbance or excavation is carried out in accordance with an excavation permit.

A person must not disturb or excavate any land on which the person has discovered or exposed a relic except in accordance with an excavation permit…".

As all 'relics' are protected under the Heritage Act, an Excavation Permit under Section 140 of the Act needs to be obtained prior to any works that would disturb or destroy them. However, if the proposed works are only minor in nature and will have minimal impact on the heritage significance of the place, they may be excepted from the provisions of Section 139.

The Heritage Council of NSW and delegate offices of Heritage NSW, Community Engagement, Department of Premier and Cabinet (Heritage NSW) are the approval authorities for issuing Excavation Permits and considering exceptions under Sections 139 and 140 of the Heritage Act.

As the Project has been approved as State Significant Infrastructure (SSI) under the EP&A Act, the requirements for approvals under the Heritage Act are generally not required, however the process and procedures required under the Act are followed as best practice in all designated State Significant projects.

2.4 National Parks and Wildlife Act 1974

The NSW *National Parks and Wildlife Act 1974* (NPW Act), administered by the Department of Planning and Environment, is the primary legislation for the protection of Aboriginal cultural heritage in NSW. The NPW Act is accompanied by the National Parks and Wildlife Regulation 2019 (the Regulation). The NPW Act gives the Heritage NSW the responsibility for the proper care, preservation and protection of 'Aboriginal objects' and 'Aboriginal places', defined under the Act as:

An ***Aboriginal object*** is any deposit, object or material evidence (that is not a handicraft made for sale) relating to the Aboriginal habitation of NSW, before or during the occupation of that area by persons of non-Aboriginal extraction (and includes Aboriginal remains).

An ***Aboriginal place*** is a place declared so by the Minister administering the NPW Act because the place is or was of special significance to Aboriginal culture. It may or may not contain Aboriginal objects.

Part 6 of the NPW Act provides specific protection for Aboriginal objects and places by making it an offence to harm them and includes a 'strict liability offence' for such harm. A 'strict liability offence' does not require someone to know that it is an Aboriginal object or place they are causing harm to in order to be prosecuted. Defences against the 'strict liability offence' in the NPW Act include the carrying out of certain 'Low Impact Activities', prescribed in Clause 80B of the *National Parks and Wildlife Amendment Regulation 2010* (NPW Regulation), and the demonstration of due diligence.

In general, an Aboriginal Heritage Impact Permit (AHIP) issued under Section 90 of the NPW Act is required if impacts to Aboriginal objects and/or places cannot be avoided. An AHIP is a defence to a prosecution for harming Aboriginal objects and places if the harm was authorised by the AHIP and the conditions of that AHIP were not contravened. Pursuant to Section 89J of the EP&A Act, AHIPs are not required for projects approved under Division 4.1 of Part 4 of the EP&A Act. As the Project has been approved as State Significant Infrastructure under the EP&A Act however, the requirements for approvals under the NPW Act are not required and are subsequently managed under a Heritage Management Plan.

2.5 Local

The Project area falls within the Parramatta LGA, of which the relevant Environmental Planning Instrument (EPI) is the Parramatta LEP 2011.

Part 5.10 of the Parramatta LEP 2011 provide specific provisions for the protection of heritage items and relics within their respective LGA, in order to:

a. to conserve the environmental heritage,

b. to conserve the heritage significance of heritage items and heritage conservation areas, including associated fabric, settings and views,

c. to conserve archaeological sites,

d. to conserve Aboriginal objects and Aboriginal places of heritage significance.

Under the LEP, development consent is required for any of the following:

e. demolishing or moving any of the following or altering the exterior of any of the following (including, in the case of a building, making changes to its detail, fabric, finish or appearance):

    i. a heritage item,

    ii. an Aboriginal object,

    iii. a building, work, relic or tree within a heritage conservation area,

f. altering a heritage item that is a building by making structural changes to its interior or by making changes to anything inside the item that is specified in Schedule 5 in relation to the item,

g. disturbing or excavating an archaeological site while knowing, or having reasonable cause to suspect, that the disturbance or excavation will or is likely to result in a relic being discovered, exposed, moved, damaged or destroyed,

h. disturbing or excavating an Aboriginal place of heritage significance,

i. erecting a building on land:

    i. on which a heritage item is located or that is within a heritage conservation area, or

    ii. on which an Aboriginal object is located or that is within an Aboriginal place of heritage significance,

j. subdividing land:

    i. on which a heritage item is located or that is within a heritage conservation area, or

    ii. on which an Aboriginal object is located or that is within an Aboriginal place of heritage significance.

Schedule 5 of the Parramatta LEP 2011 provides a list of heritage items within the LGA. The curtilages of items currently listed which fall within the Project area are listed in **Section 4.2**.

2.6 Management Plans

2.6.1 Sydney Metro West Western Tunnelling Package Heritage Management Plan

The Project is currently managed under a Heritage Management Plan that was prepared and subsequently approved in July 2022 (HMP; Umwelt [Australia] Pty Ltd, 2021). Intended to provide robust heritage guidance, the HMP provides outlines the policies and strategies to assist GLC to undertake works associated with the Western Tunnelling Package. Section 7.4.2 of the HMP requires that additional assessment and approval is required for any potential impacts to Aboriginal cultural heritage outside of the approved construction activities for the Project. Similarly, Section 7.6.9 required additional assessment and approval of any additional impacts to historical (non-Aboriginal) heritage items. Both measures in the HMP require the approval of the impacts prior to the commencement of any construction activities, this will occur under the Consistency Assessment approvals pathway.

2.6.2 Parramatta Historical Archaeological Landscape Management Study

The Parramatta Historical Archaeological Landscape Management Study (PHALMS) (GML Heritage, 2000) is a non-statutory framework that was adopted by Parramatta City Council and the Heritage Council of NSW and subsequently integrated into the NSW State Heritage Inventory database to inform urban development in the Parramatta LGA. The PHALMS study area was divided into Archaeological Management Units (AMUs) defined by consideration of the historical development of a particular item/site and the current physical condition. The archaeological resources within each AMU have similar levels of archaeological significance, archaeological research potential and have undergone similar levels of disturbance. Generally, streets are included in PHALMS as either individual AMU's or within the same AMU as the adjacent allotment.

3.0 Aboriginal Heritage

3.1.1 Data Sources

Information regarding the known and potential Aboriginal heritage resource of the Project area was obtained from:

- A review of the landscape context of the Project area and surrounds.
- A review of existing Aboriginal Heritage Information Management System (AHIMS) data for land within and surrounding the Project area, obtained from Heritage NSW on 28 November 2022.
- A search of the National Native Title Register (NNTR) and Register of Native Title Claims (RNTC) administered by the National Native Title Tribunal (NNTT) for land within and surrounding the Project area (14 September 2022).
- A review of the findings of past Aboriginal archaeological investigations within the Project area and surrounds.
- A visual inspection of the Project area by Umwelt Senior Heritage Consultant Melissa Moritz on 25 August 2022.

3.1.2 Landscape Context

Consideration of the landscape context of the Project area is predicated on the proposition that the nature and distribution of Aboriginal sites are connected to the environments in which they occur. Environmental

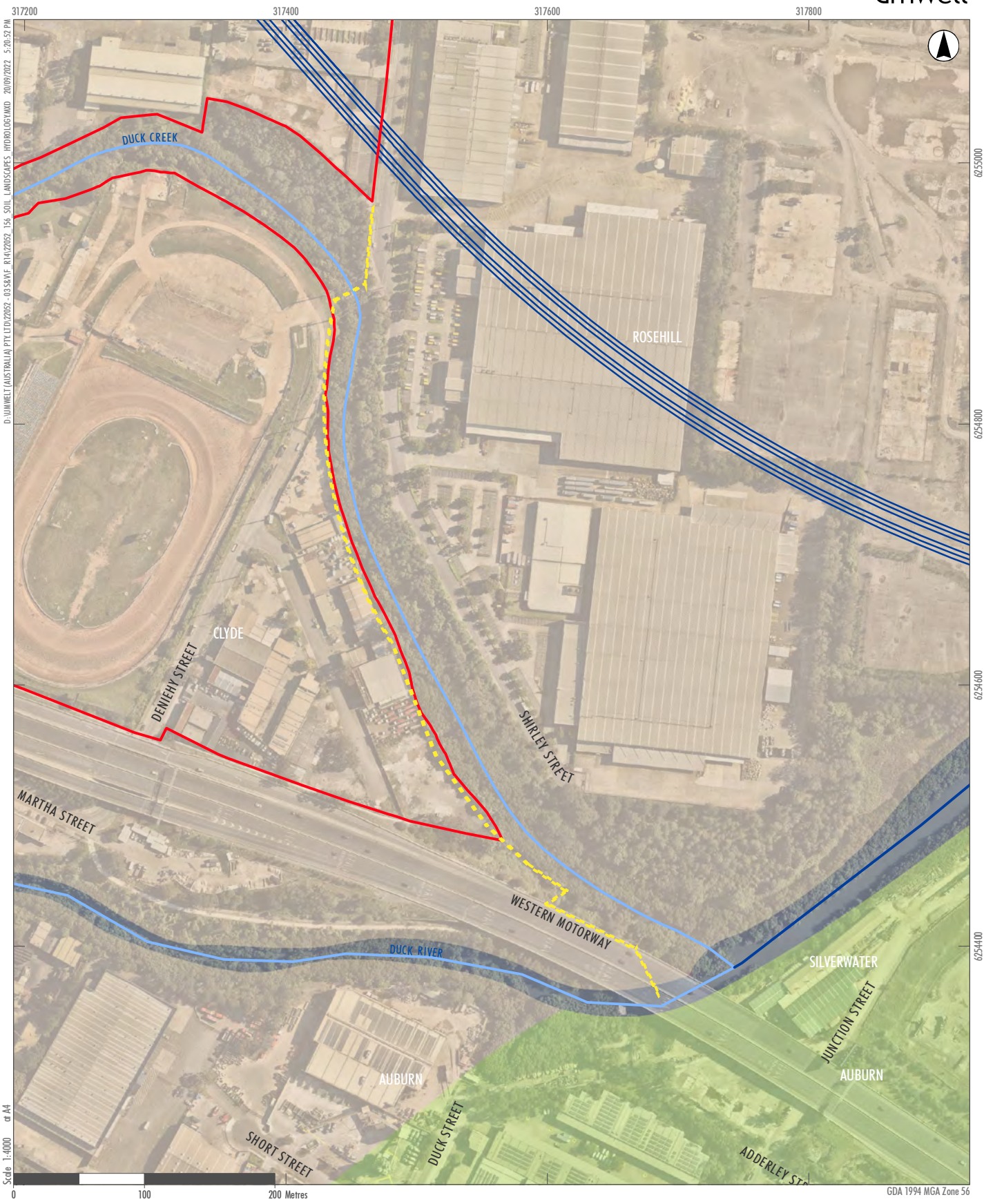
variables such as topography, geology, hydrology and local vegetation and faunal communities are a key consideration to determining how Aboriginal peoples lived and utilised their Country. In practical terms, these variables would have influenced the suitability of campsites, drinking water, plant and animal resources, and raw materials for the manufacture of stone and organic implements. Equally critical is the identification of historical and contemporary land use activities, which contributors to the understanding of the integrity of archaeological deposits.

Key observations from a review of the landscape context of the Project area is presented in **Table 3.1.**

Table 3.1 Review of Landscape Context of the Project Area

Environmental Variable	Key Observations
Topography	The Project area lies within the Cumberland Plain, itself a geographic region characterised by low, gently undulating slopes. The topography of the Project area falls within the Cumberland Lowlands physiographic region. The terrain has been largely levelled as a result of contemporary urban activities and as such has been extensively disturbed. Chapman & Murphy (1989) describe the area as comprising undulating low hills to very steep hills, found in association with prominent Hawkesbury Sandstone outcropping. Local relief varies from 40 to 200 m with slopes ranging from 10 to 70%. The topography of land around the Project area relative to its suitability for Aboriginal occupation, suggests that landscape elements sounding the project area would have been favourable to occupation, being flat, open areas adjacent the estuarine wetlands along the Duck Creek and Duck River. These low, flat plains adjacent to the Duck Creek and River would have likely provided food resources.
Hydrology	The Project area is adjacent to Duck Creek, a minor southern tributary of A'Becketts Creek. A'Becketts Creek is itself, a tributary of Duck River, a major watercourse within the Parramatta River Catchment. Duck Creek is situated within the Duck River Catchment Area which constitutes an area of 41 km^2 from Duck River to its confluence with the Parramatta River. Whilst sections of Duck Creek remain largely natural, the upper reaches of this watercourse have been channelised and/or modified in order to pass under roads, fields and housing developments. The presence of larger perennial watercourses in the immediate vicinity may suggest that these larger watercourses were preferred as a reliable source of drinking water and associated natural resources. Parramatta River represents a significant perennial watercourse in the landscape and is located 1.25 km north and 2 km east of the Project area.
Geology and Soils	Reference to the *1:100,000 Geological Map Sheet for Sydney (9130)* indicates that the surface geology of the Project area is mapped as 'disturbed terrain' associated with construction and development of the metropolitan Sydney environs. Stratigraphy associated with the disturbed terrain geological mapping consists of anthropogenic fill such as redeposited soils, rock, building and waste materials, as well as dredged estuarine sand and mud. Prior to the area being developed, the surface geology would likely have comprised alluvial soils formed on Wianamatta shales and/or estuarine soils associated with the Duck River alluvial environs. Tertiary alluvial units known to contain rocks suitable for flaked artefact manufacture (e.g., the Rickabys Creek Gravel and St Marys formations) are mapped approximately 13 km north-west of the Project area. Both respective geological formations are of demonstrated Aboriginal archaeological significance. Alluvial in origin, the St Marys formation consists of channel remnants cut into shales of the Triassic Wianamatta Group, and contains abundant quantities of silcrete, as well as silicified wood, quartzite and quartz (Corkhill 1999: 56).

Environmental Variable	Key Observations
	Chapman and Murphy (1989) identified the immediate area surrounding the WTP pipeline as 'Disturbed Terrain', which is characterised by black loamy sand to loam - fine-sand soils with loose apedal single grained structure and sandy fabric. This is typically introduced for topsoiling turf however can also include other artificial fill, dredged estuarine sand and mud, demolition rubble, industrial and household waste within the upper layers. Prior to contemporary disturbances however, the extant material in the vicinity of the WTP pipeline likely compromised alluvial silty clay loam sourced from surrounding Wianamatta Shales. Mapped instances of analogous soil materials is demonstrated west of the Project area as the 'Birrong soil landscape' (Chapman and Murphy 1989), itself occurring within the undulating alluvial floodplains which drain Wianamatta Group shales.
Flora and Fauna	Vegetation within the Project area has been extensively cleared to accommodate historical agricultural lands in the late 19th century, and contemporary residential development. Much of the vegetation present today is regrowth grassland and is dominated by invasive weed species. Prior to this extensive land clearance, the Project area and surrounding landscape largely consisted of, where elevated, woodland of Ironbark, Turpentine and Scribbly Gum with low grass and assorted shrubbery. Low lying areas adjacent to the Parramatta River and its associated creek lines were predominately saltmarsh swampland, mudflats and mangrove shrub (Steele 2003). As with vegetation, determining with any certainty the pre-European faunal landscape of the Project area and environs is difficult due to past land use practices. However, consideration of pre-European vegetation and faunal assemblages suggests that a range of terrestrial faunal resources would have likely been present in the area. Locally occurring freshwater resources from Duck Creek, A'Becketts Creek and Duck River, for example, are likely to have consisted of a wide range of fish and shellfish, and other freshwater mammals. A diverse array of terrestrial mammals (for example, macropods, possums and echidna), as well as birds, reptiles and amphibians, would have also been available in proximal woodland areas.
Land Disturbance	Review of historical reference materials and field observations indicate that the Project area has been extensively impacted by anthropogenic activities. By the late 19th century, the area had been cleared to accommodate agricultural practices by early-European settlers, and the natural wetlands had been severely impacted. Review of historic aerial photography suggests that impacts in the early 20th century increased exponentially, with the construction of large warehouse structures, public recreational fields/racecourse and public roadways. By the late 1970s native vegetation was exclusively found in sections along the banks of Duck Creek and Duck River, with the remainder of the area having undergone extensive clearance. Industrial warehouses and carparks dominated the area by the end of the 20th century. The construction of the M4 motorway, including the overpass within the project area, would have resulted in widespread impacts along the construction footbridge, particularly the clearing of the motorway alignment and construction of pylons to support the overpass structure. The archaeological implication of these works is the potential disturbance or destruction of pre-existing Aboriginal sites and archaeological deposits.



Legend

- Approved Surface Construction Boundary
- Proposed Discharge Pipeline
- Tunnel Alignment

Soil Landscapes

- Blacktown
- Disturbed Terrain

Strahler Stream Order

- 2
- 3

FIGURE 3.1

Soil Landscape and Hydrology

Image Source: Nearmap (August 2022) Data source: DFSI (2021)

3.2 Aboriginal Archaeological Context

3.2.1 Aboriginal Heritage Information System (AHIMS)

The AHIMS database, administered by Heritage NSW, contains records of all Aboriginal objects reported to Heritage NSW in accordance with Section 89A of the NPW Act. It also contains information about Aboriginal places, which have been declared to have special significance with respect to Aboriginal culture/s. Previously recorded Aboriginal objects and declared Aboriginal places are defined as 'Aboriginal sites'.

A search of the AHIMS register undertaken on the 28 November 2022 for an approximate five (5) km area for this assessment (i.e., the 'AHIMS search area'; AHIMS ID #736086) identified 187 Aboriginal sites (summarised in **Table 3.2**). The AHIMS search results are presented in **Appendix A** of this report.

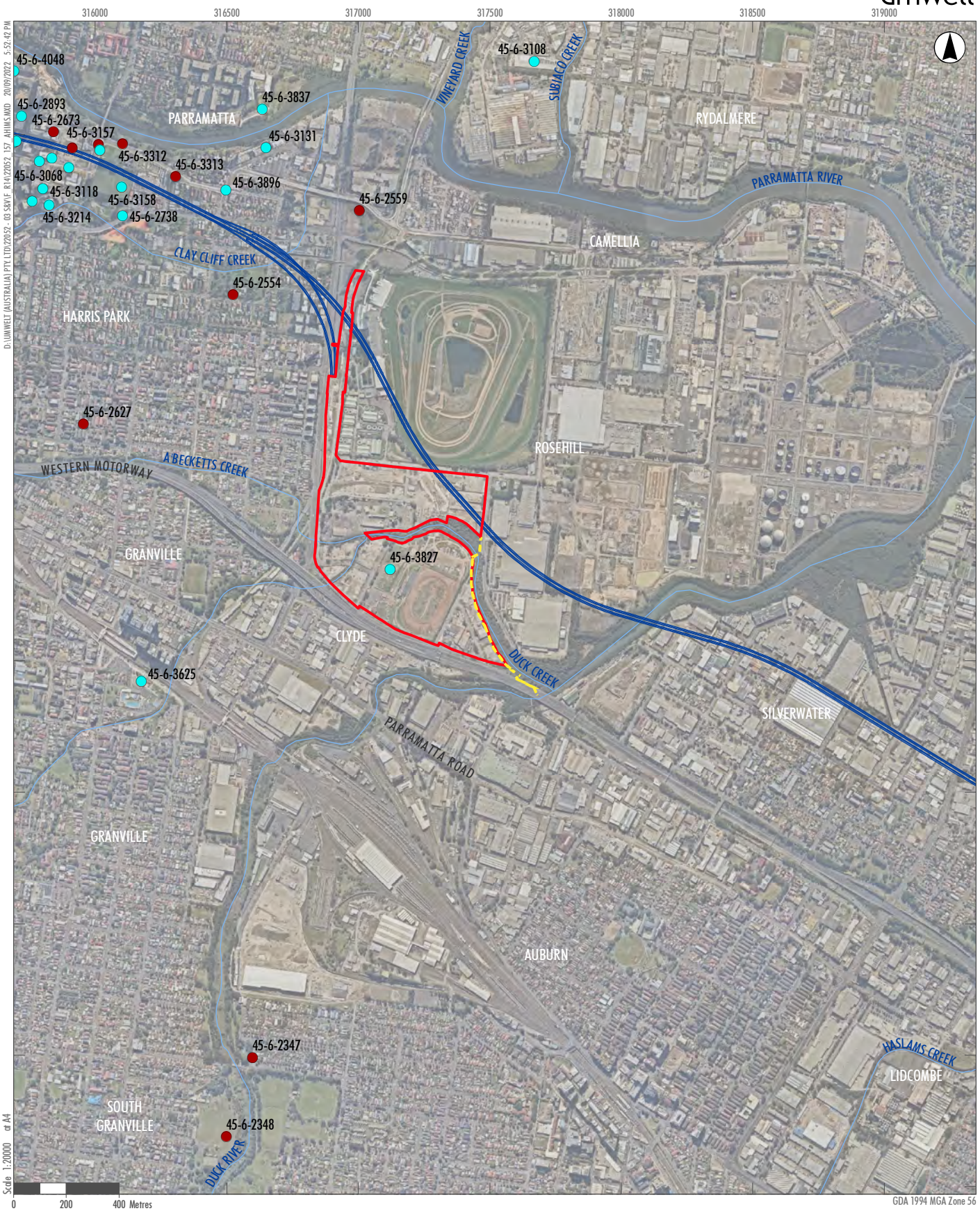
The most common site type represented within the AHIMS search area were areas of potential archaeological deposit (PAD), which accounted for 56.8 % (n = 58) of known sites. As is typical for south-eastern Australia, open artefact sites (comprising one or more artefacts) were also well-represented, accounting for 37.3 % (n=38) of the total search results. The prevalence of both open artefact sites and PAD sites in the AHIMS search area attests to the focussed Aboriginal archaeological investigation of the Parramatta environs associated with compliance-based assessments. Less common site types included culturally modified trees (n=2, 2%), hearths (n = 3, 2.9%) and a single 'resource and gathering site (n=1, 1%).

Of those Aboriginal sites reported in the AHIMS search results, none fall within the footprints of the proposed construction activities for this assessment. The nearest Aboriginal site, 'Clyde PAD 01' (AHIMS # 45-6-3827) is located approximately 100 m from the proposed WTP pipeline alignment, within the former Rosehill speedway. This site was identified during the EIS for the Sydney Metro West WTP works. A small portion of the Sydney Speedway located next to Duck Creek and A'Becketts Creek was identified as containing archaeological potential based on identified lack of historical disturbance across this portion of Clyde. Test excavation of this PAD included the identification of a shallow truncated alluvium soil over part of the PAD area. Two test pits located in different areas of the Sydney Metro West WTP – Clyde study area yielded two artefacts: one quartz bipolar flake and one yellow silcrete flake. The Sydney Metro West WTP – Clyde study area was fully investigated, and archaeological clearance was provided for the commencement of construction works within the Sydney Metro West WTP – Clyde study area (GML, October 2022).

Table 3.2 AHIMS Search Results

Aboriginal Site Type	Frequency (n)	Percentage
Potential Archaeological Deposit	58	56.8%
Open Artefact Site	38	37.3 %
Hearth	3	2.9%
Culturally Modified Tree	2	2.0%
Resource and Gathering	1	1.0%
Total	187	100 %

Source: Department of Planning and Environment, 28/11/2022, AHIMS Search ID 736086.



Legend

- Approved Surface Construction Boundary
- Proposed Discharge Pipeline
- Tunnel Alignment
- Drainage Line

AHIMS Sites

- Open artefact site
- PAD

FIGURE 3.2

Aboriginal Sites

Image Source: Nearmap (August 2022) Data source: DFSI (2021)

3.3 Native Title

A search of the National Native Title Register (NNTR) and Register of Native Title Claims (RNTC) administered by the National Native Title Tribunal was undertaken for the City of Parramatta LGA on 15 September 2022, inclusive of land within and surrounding the Project area. No current Native Title listings or claims were identified within or near the Project area.

3.4 Crown Lands

Under the *Aboriginal Land Rights Act 1983*, NSW Local Aboriginal Land Councils may lodge an Aboriginal Land Claim for ownership of some Crown Lands, where it meets the criteria as set out in Part 36(1) of the Aboriginal Land Rights Act.

An area of Crown land is located within the Clyde MSF site in proximity to the proposed WTP discharge pipeline route. This area of Crown land may be subject to an Aboriginal land claim, which is not yet publicly known. However, this area will be entirely avoided during activities associated the WTP discharge pipe installation.

3.5 Previous Aboriginal Cultural Heritage Assessments

Several archaeological investigations have been carried out within and adjacent to the Project area. In particular, the Parramatta Central Business District (CBD) has been subject to extensive investigation due to its early settlement history and ongoing development. For contextual purposes, the results of a selection of these investigations, including those undertaken near the Project area, are summarised in **Table 3.3.**

Table 3.3 Previous Aboriginal Cultural Heritage Assessments

Assessment	Description	Distance from Project area
Sydney Metro West Stage 1: Technical Paper 4: Aboriginal Cultural Heritage Assessment Report Artefact Heritage Services (April 2021)	An Aboriginal cultural heritage assessment report was prepared as part of the EIS for the Sydney Metro West Western Tunnelling Package. This includes an assessment of the Clyde MSF site located immediately west of the proposed pipeline. This assessment included the assessment of the Aboriginal archaeological potential for the Clyde MSF site. A small portion of the former Rosehill Speedway was identified as being relatively intact, with potential archaeological deposits located within the areas of undisturbed natural soils. This was registered on AHIMS as part of this assessment (AHIMS #45-6-3827). The former natural landform context of the Clyde MSF site was considered to be archaeologically sensitive based mostly on its proximity to high order water courses (being A'Becketts Creek and Duck Creek) however the extensive landform modification undertaken in this area was identified as having resulted in substantially disturbing the area, limiting the potential for archaeological evidence to remain.	Sydney Metro West Western Tunnelling Package – Clyde MSF site Immediately west of the pipeline
Silverwater Correctional Complex, Silverwater, NSW Domonic Steele Consulting Archaeology (2003)	An Aboriginal Heritage Assessment was prepared to inform the Cultural Heritage Management Plan and Master Plan developed for the Silverwater Correctional Complex at Silverwater, NSW. The assessment included background research pertaining to prior land use of the site, Aboriginal Community Consultation and desktop assessment. The assessment found that the Silverwater area was situated in an environment with suitable natural resources capable of supporting Aboriginal people, inclusive of abundant raw materials, food sources and fresh water. Within a contemporary context, the subject site has undergone extensive modification relating to vegetation clearance and successive building, demolition and reconstruction phases associated with the utilisation of the land. During the course of the investigation, no Aboriginal sites were identified within the curtilage of the study area and it was determined that due to long withstanding disturbance of the landscape, that any Aboriginal sites identified would consist of low density artefact assemblages in a disturbed context.	Holker Street, Silverwater Approximately 3 km northeast

Assessment	Description	Distance from Project area
Archaeological Report – 189–191 Macquarie Street, Parramatta Archaeological and Heritage Management Solutions (2013)	An Aboriginal Archaeological Report was prepared to assess Aboriginal heritage impacts associated with a proposed development in Parramatta, NSW. The assessment included background research, surface surveys and test excavations to map the horizontal and vertical extent of the Parramatta Sand Body across the Project area. Seven test pits were excavated, which encompassed a total area of 10 m^2. The excavations recovered 27 Aboriginal objects, which consisted of silcrete, tuff, milky quartz and quartzite. The excavations found that the northeastern portion of the Project area extends into the Parramatta Sand Body, which was identified at a depth of 5.55 m AHD. Artefacts were not retrieved from the Parramatta Sand Body.	189–191 Macquarie Street, Parramatta Approximately 2.2 km northwest
Aboriginal Archaeological Report – 330 Church Street, Parramatta Archaeological and Heritage Management Solutions (2014)	An Aboriginal Archaeological Report was prepared to assess Aboriginal heritage impacts associated with a proposed development in Parramatta, NSW. The assessment included background research and test excavations within the Parramatta Sand Body. 1 m^2 test pits were placed in ten trenches within the Project area, which were excavated by hand in 10 cm spits. The soil was sieved through 5 mm mesh, and all Aboriginal objects and possible Aboriginal objects were retained for analysis. The test excavations identified 43 Aboriginal objects and 32 non-diagnostic fragments of stone suitable for working. Three trenches contained artefacts, which may have been washed into the study area with flood deposits. The test excavations found that the Parramatta Sand Body's depth extends lower than 4 m AHD and contains Aboriginal objects at such depths, which is consistent with the findings from previous assessments for the area.	330 Church Street, Parramatta >3 km northwest

Assessment	Description	Distance from Project area
Archaeological Technical Report: 2-8 River Road West, Parramatta Archaeological and Heritage Management Solutions (2014)	An Aboriginal Technical Report was prepared to identify Aboriginal heritage items within a proposed development in Parramatta, NSW, and identify the potential to harm any Aboriginal objects. The assessment included background research, surface surveys and test excavations to map the horizontal and vertical extent of the Parramatta Sand Body across the Project area. Eight test pits were excavated, each either 2m x 1.5 m or 2 m x 1 m in size, which gave a total area of 20 m². The excavations recovered 14 Aboriginal objects, which were flaked stone artefacts. It was found that the study area is located on a large sand body, approximately 1.2 m in depth, which contains sparsely distributed Aboriginal objects.	2–8 River Road West, Parramatta Approximately 1.5 km northwest
Old Kings School, Parramatta Aboriginal Heritage Impact Assessment Report Archaeological and Heritage Management Solutions (2016)	An Aboriginal Heritage Impact Assessment Report was prepared to assess Aboriginal heritage impacts associated with a proposed development and upgrade of a school in Parramatta, NSW. The assessment included background research and test excavations within the Project area, which is located in the Parramatta Sand Body. Twenty-three (23) mechanical test pits were excavated across the southern portion of the Project area, which were spaced 5–20 cm apart. A thin unit of sand was identified during the excavation works, which was around 1 m thick at a 40–70 cm depth. This unit was found to be characteristic of the Parramatta Sand Body. Sixty-one Aboriginal objects were retrieved from this unit, 57 of which were obtained from a single test pit located along the western extent of the Project area. Further excavations were undertaken for this deposit, which found it to be 25 m² in size and characteristic of a small hunting camp.	Old Kings School, Parramatta >3 km northwest

Assessment	Description	Distance from Project area
Aboriginal Cultural Heritage Assessment Report – 21 Hassall Street, Parramatta LGA Archaeological and Heritage Management Solutions (2016b)	An Aboriginal Cultural Heritage Assessment Report was prepared to assess the potential impacts to Aboriginal heritage items for a proposed development in Parramatta, NSW. The test excavations occurred over two stages. Stage 1 excavations included a 5 m grid of ten 1 m^2 test pits across the site to identify whether Aboriginal objects or cultural materials are present. Stage 2 included an open area excavation for areas identified during Stage 1 as containing significant material. Stage 2 excavation consisted of up to 24 m^2 open area dug at a fine resolution to obtain a high-quality ex-situ conservation record of the deposits. The excavations recovered 1,725 artefacts across the two stages, which were dominated by tuff and fine-grained silcrete materials. These were found within a 60–90 cm sand body on the northern bank of Clay Cliff Creek. The sand body was likely formed through both low energy alluvial flooding and later source-bordering dune formation from nearby Clay Cliff Creek over the last 14,000 years. Ultimately, the study area was considered to contain ~350 m^2 of the archaeological deposit when excluding the archaeological work to date, and existing disturbance, which has the potential to contain 8–17,000 Aboriginal objects.	21 Hassall Street, Parramatta Approximately 2.1 km northwest
Parramatta Light Rail Aboriginal Cultural Heritage Assessment Report Kelleher Nightingale Consulting Pty Ltd (2017)	An Aboriginal Cultural Heritage Assessment Report was prepared to assess Aboriginal heritage impacts associated with the Parramatta Light Rail Project. Along with background research and surface surveys, test excavations were undertaken along the Project area between Westmead and Camellia to identify any areas that contained intact subsurface Aboriginal archaeological deposits associated with the Parramatta Sand Body or other intact soil matrices. Testing was undertaken using a combination of hand-excavated archaeological test squares (50 m by 50 m) and push-tubed core boreholes (using a 50 mm by 1 m soil auger with 1.5 m coarse steel extension). The background research, field surveys and test excavations found intact sands containing artefacts of low to moderate disturbance, as well as four identified Aboriginal archaeological sites exhibiting moderate to high significance. The Parramatta Sand Body was intersected at variable depths along the study area, from 50 cm depth to 1 m depth.	Parramatta Light Rail alignment Approximately 1.2 km north

Assessment	Description	Distance from Project area
Aboriginal Archaeological Test & Salvage Excavation Report – 184-188 George Street, Parramatta, NSW Dominic Steele Consulting Archaeology (2017)	An Aboriginal Archaeological Test and Salvage Excavation Report was prepared for Aboriginal site #45-6-3068 located in Parramatta, NSW. The assessment included background research and test excavations within the study area, which is located in the Parramatta Sand Body. Eight trenches were hand excavated within the study area and one L-shaped trench was machine excavated. These test excavations were completed in accordance with Section 90 of the NPW Act and Section 140 of the Heritage Act. The test excavations completed under Section 90 of the NPW Act recovered an assemblage of 114 Aboriginal objects made primarily from silicified tuff and silcrete. Test excavations completed under Section 140 of the Heritage Act identified archaeological deposits and built elements along a former freshwater lagoon, which comprised the remains of houses and structures dating back to the 1800s.	184–188 George Street, Parramatta Approximately 2.2 km northwest
Aboriginal Archaeological Assessment – 93-95 Phillip Street & 32 Smith Street Parramatta NSW Archaeological Management and Consulting Group and Streat Archaeological Services Pty Ltd (2018)	An Aboriginal Cultural Heritage Assessment and Aboriginal Archaeological Assessment was prepared to identify Aboriginal heritage items within a proposed development in Parramatta, NSW. The assessment included background research and test excavations within the study area. Test excavations were undertaken in 17 1 m^2 trenches, 14 of which were excavated to a depth of at least 2 spits (200 mm). 13 artefacts were uncovered, which have been quantified and undergone preliminary artefact analysis. These artefacts do not appear to represent intact occupation deposits, but instead appear to reflect considerable amounts of archaeological material moving through the bio-mantle. The assemblage is considered to be of low archaeological significance whilst still possessing higher cultural significance based on their intrinsic value within the Aboriginal community.	93–95 Phillip Street & 32 Smith Street, Parramatta Approximately 2.6 km northwest

Assessment	Description	Distance from Project area
Aboriginal Cultural Heritage Assessment Report – 113–117A Wigram Street, Harris Park & 23–29 Hassall Street, Parramatta Archaeological and Heritage Management Solutions and Futurepast (2016)	An Aboriginal Cultural Heritage Assessment Report was prepared to assess the potential impacts to Aboriginal heritage items for a proposed development in Harris Park and Parramatta, NSW. The assessment included background research and test excavations within the study area. Test excavations included 12 1 m^2 test pits in a 5 m–10 m grid across the site. The excavated materials were sieved through 5 mm mesh, and all Aboriginal objects and possible Aboriginal objects were retained for analysis. The excavations found an alluvial sand unit in the western portion of the Project area, in which 93 Aboriginal objects were uncovered. The majority of Aboriginal objects were uncovered from one test pit location at a depth of 30–40 cm, which was considered to represent a discrete occupation event. Due to the truncation and disturbance of the alluvial sand deposit within the study site (due to historical land use activities), the site was ultimately considered of low scientific significance, since the mixed and shallow nature of the deposit limits the potential for further research outcomes.	113–117A Wigram Street, Harris Park & 23–29 Hassall Street, Parramatta Approximately 2 km east
Aboriginal Archaeological Salvage Excavation Report – O'Connell Street Public School (Old King's School), Parramatta Archaeological and Heritage Management Solutions and Futurepast (2018)	An Aboriginal Archaeological Salvage Excavation Report was prepared describe the results of an Aboriginal archaeological salvage excavation undertaken at a school in Parramatta, NSW. The assessment included salvage excavations within the Project area. This included mechanical excavation of the uppermost historic fill layers (at a 40 cm – 70 cm depth) and excavation of a 25 m^2 salvage area. 25 test pits were excavated, which were 1 m^2 squares excavated by hand in 5cm spits. Sediments were wet-sieved through a 3 mm mesh and all Aboriginal objects and other archaeological material were labelled and bagged for subsequent analysis. The salvage excavation found that the Project area contained a low density of artefacts and represented a discrete knapping event. The cultural assemblage identified in the Project area were restricted to a narrow 40 cm band between 7.85 and 7.55m AHD. Despite finding a high concentration of artefacts from the initial testing phase, the subsequent salvage excavation found the assemblage to be relatively sparse beyond this.	Old King's School, Parramatta >3 km

Assessment	Description	Distance from Project area
Clyde, Sydney Metro. Aboriginal Heritage Archaeological Report GML Heritage (2022)	GML Heritage undertook an Aboriginal archaeological investigation of Potential Archaeological Deposit (PAD) site 45-6-3827 located within the proposed Clyde Stabling Yards portion of the Sydney Metro project. Prior to the investigation, the PAD site was assessed as being of low to moderate archaeological potential and so was the subject of intrusive investigations prior to construction activities. Phase 1 test excavation activities comprised the advancement of twenty-two (22) archaeological test pits. All test pits exhibited variable thicknesses of surficial fill material, which was mechanically excavated prior to hand excavation activities. A total of ten (10) test pits retained evidence of *in situ* alluvial materials. Due to inflow of groundwater, test pits were further advanced using a mechanical excavator. A total of two (2) lithic artefacts (quartz and silcrete) were recovered from two separate test pits.	300 m west

3.6 Key Observations

Key observations to be drawn from a review of both the environmental and Aboriginal archaeological context of the Project area and environs are as follows:

- The topography of land within the Project area suggests that although surrounding by primarily flat, open terrain, the swampy and estuarine nature of the land between Duck Creek and Duck River would not provide favourable conditions for occupations.
- Contemporary condition notwithstanding, major watercourses in the vicinity of the Project area; Duck River, Duck Creek, A'Becketts Creek and the Parramatta River, would likely have supported diverse plant and faunal resources, as well as providing an important transport network towards Sydney Harbour and as such, represented favourable environs for Aboriginal occupation. The presence of a recorded Aboriginal site north of Duck Creek, in addition to neighbouring Aboriginal sites identified in proximity to these watercourses, inclusive of Parramatta River and its environs, attests to these watercourses as local focal points for Aboriginal occupation.
- While contemporary vegetation communities within the Project area are generally not indicative of pre-European occupation, indicative mapping suggests that pre-European vegetation regimes would have supported a range of terrestrial faunal and floral resources favoured by Aboriginal peoples occupying the Project area and environs.
- The Project area and the surrounding environment have been heavily impacted by historical and contemporary residential, commercial and industrial development associated with the expansion and growth of the Parramatta/Rosehill area. As a direct result, the landscape has been modified and the environmental context of the region has been dramatically altered. The mapping undertaken by Chapman and Murphy (1989) suggests that soil profile of the Project area is no longer reflective of the natural geological or soil landscape and is best described as 'disturbed land'.

4.0 Historical Heritage

4.1 Data Sources

Information regarding the known and potential historical (non-Aboriginal) heritage resource of the Project area was obtained from:

- Desktop searches of relevant heritage registers.
- Site inspection by Umwelt Senior Heritage Consultant Melissa Moritz on 25 August 2022 in order to assess the existing condition of the Project area and environs.

4.2 Register Searches

Searches of relevant historic heritage registers and lists, both statutory and non-statutory, were undertaken on 16 September 2022 to identify any previously recorded historic heritage items within the Project area. A single (1) historic heritage item was identified within the Project area, consisting of the 'Wetlands' (I1 Parramatta LEP 2011). In addition, the 'RTA Depot' building and Capral Aluminium building are located in the vicinity, less than 10 m west and east respectively from the proposed pipeline along Shirley Street. A natural heritage item was also identified in the vicinity of the Project area, consisting of the 'Lower Duck River Wetlands Area', located approximately 800 m east. Search results are provided in **Table 4.1** and illustrated in **Figure 4.1**.

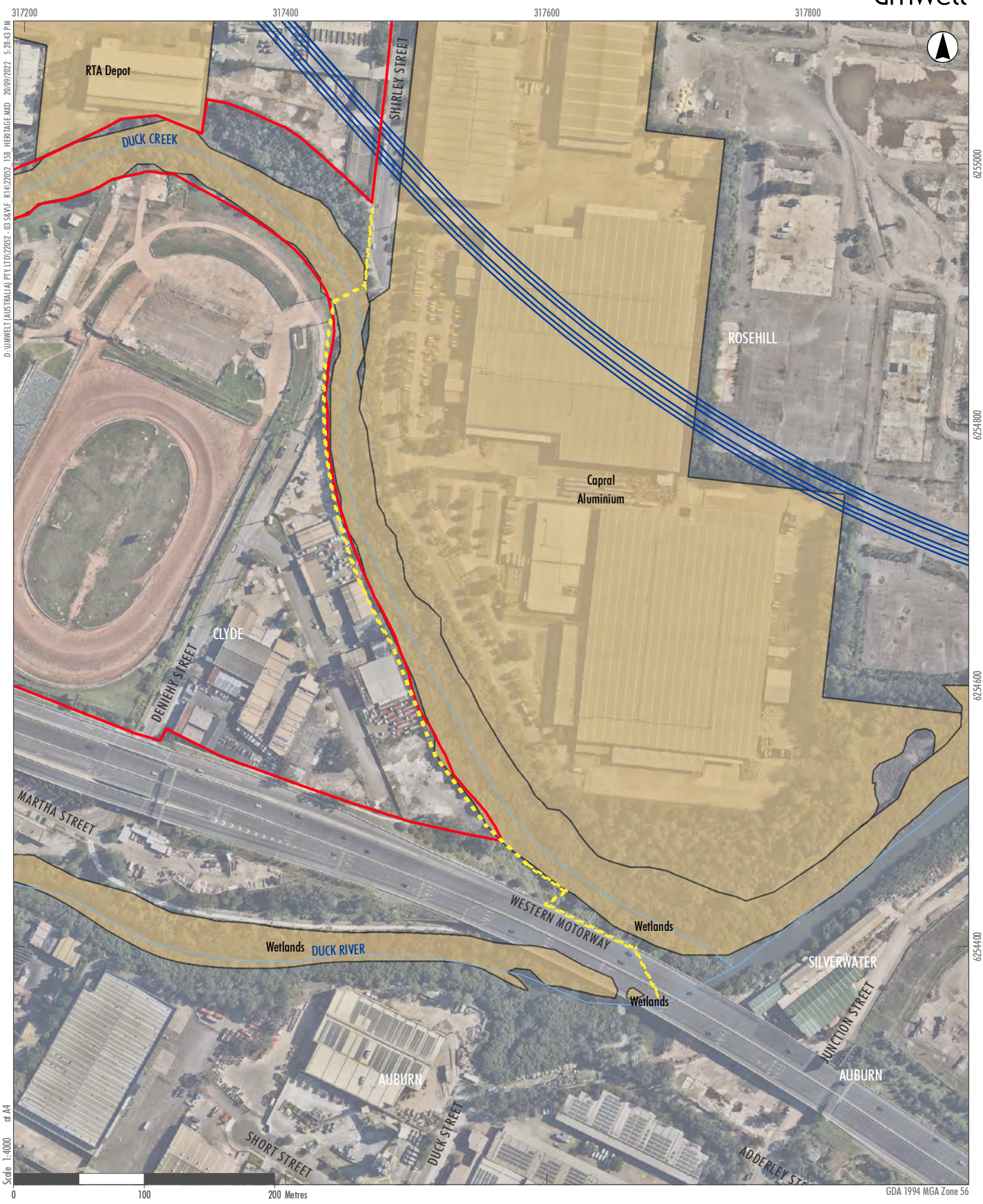
The statement of significance for the Wetlands states:

> *The wetlands along Parramatta River are of significance for Parramatta area as remnant representative areas of mangroves and salt marshes which once extensively lined the foreshores and tidal water flats of the region.*

The Project area is generally located outside of the curtilage of the 'Wetlands' with the exception of where the proposed pipeline will cross Duck Creek. This constitutes a small, isolated section of the wider curtilage for the heritage item.

Table 4.1 Summary of listed heritage items within and adjacent to the Project area

Heritage list	Level of significance	Items adjacent to the Project area	Brief Description	Distance to Project area (m)
City of Parramatta LEP 2011 #1	Local	Wetland	This item consists of remnant wetland vegetation, characterised by mangrove and saltmarsh complex, located along the foreshores of Parramatta and Duck rivers and their tributaries, Vineyard and Subiaco creeks.	Within
City of Parramatta LEP 2011 #I576	Local	RTA Depot (Built Item)	Multi-storey framed industrial workshop, with brick walling and concrete structural frame and corrugated fibro saw-tooth roof. Constructed in 1944 and served as an important wartime facility. Archaeological potential assessed as good in the NSW State heritage inventory citation for this heritage item, and therefore likely to have high archaeological potential.	<10 m west
City of Parramatta LEP 2011 #575	Local	Capral Aluminium	Two-storey art-deco building with three-storey curved section extends over entrance. Light coloured brick building in the *Moderne* style with a flat roof and decorative brickwork. Site includes the plants and shrubs at front and plantings of eucalyptus and canary island palms along street	<10 m east
Australian Heritage Database	National Register of the National Estate #19254	Lower Duck River Wetlands (Natural Item)	One of eight significant remnant wetlands, representing the oldest known stand of mangroves on Duck River/Upper Parramatta River. The wetlands include several areas alternating on the west and east sides of Duck River upstream to its junction with Duck Creek.	<250 m south-east
Local City of Parramatta LEP 2011 #I83		T. C. Barker and Son Pottery (Built Item)	Series of galvanised iron and aluminium clad buildings, with skillion roof, timber posts and rafters. Constructed in 1932 and formerly used as a tannery and for pottery production. The longest surviving clay using industry along A'Becketts Creek in Granville, a representative and rare remnant of industries once common throughout the town of Parramatta in the 19th and early 20th centuries. Archaeological potential assessed as 'fair' in the NSW State heritage inventory citation for this heritage item and is therefore likely to have moderate potential to retain historical archaeological remains.	<250 m west



Legend

- Approved Surface Construction Boundary
- Proposed Discharge Pipeline
- Tunnel Alignment
- Drainage Line

Local Heritage

- Item - General

FIGURE 4.1

Historical Heritage Items

Image Source: Nearmap (August 2022) Data source: DFSI (2021)

4.3 Previous Historical Assessments

Several historical (non-Aboriginal) heritage investigations have been carried out adjacent to the Project area. For contextual purposes, the results of a selection of these investigations are summarised in **Table 4.2**.

Table 4.2 Previous Historical Heritage Assessments

Assessment	Description	Distance from Project area
10 and 10A Prospect Street, Rosehill: An Archaeological Assessment for Luck Development Pty Ltd Archaeological and Heritage Management Solutions	An archaeological assessment was undertaken on lots 26, 27 and 28, DP 1775 (10 and 10a Prospect Street), in Rosehill, NSW. The assessment was requested by Parramatta City Council as the site had been identified in the Parramatta Historical Archaeological Landscape Management Study (PHALMS) as part of Archaeological Management Unit 2975. The assessment included background research and a desktop assessment of the subject site's archaeological potential. As the subject site was originally encompassed by the Elizabeth Farm Estate, albeit in the southern and under-utilised portion of the estate, it is assumed to have been subject to long withstanding disturbance. It was concluded to be highly unlikely that significant deposits associated with the occupation of the site would be present.	<250 m west
Historical and Archaeological Assessment of Proposed Development, 80–100 James Ruse Drive, Rosehill, NSW. Edward Higginbotham & Associates (2003)	A historical archaeological assessment was undertaken for 80–100 James Ruse Drive at Rosehill, NSW, as part of the development consent for a proposed residential development. The subject site is located within Parramatta Archaeological Management Unit 2975. The assessment included background research, a site survey and an assessment of the subject site's archaeological potential. The subject site had been subject to extensive disturbance associated with its location within the Elizabeth Farm Estate. During the site survey, it was assessed that the area did not contain any known sites or buildings of historical archaeological significance. It was concluded to be highly unlikely that significant deposits associated with the occupation of the site would be present.	<250 m west
Historical and Archaeological Assessment of Proposed Development, 102–108 James Ruse Drive, Rosehill, NSW. Edward Higginbotham & Associates (2004)	A historical archaeological assessment was undertaken for 102–108 James Ruse Drive at Rosehill, NSW, as part of the development consent for a proposed residential development. The subject site is located within Parramatta Archaeological Management Unit 2975. The assessment included background research, a site survey and an assessment of the subject site's archaeological potential. The subject site had been subject to extensive disturbance associated with its location within the Elizabeth Farm Estate. During the site survey, it was assessed that the area did not contain any known sites or buildings of historical archaeological significance. It was concluded to be highly unlikely that significant deposits associated with the occupation of the site would be present.	<250 m west

Assessment	Description	Distance from Project area
Statement of Heritage Impact: Former Electricity Substation, 10 Grand Avenue, Rosehill Environmental Resources Management Australia Pty Ltd (2000)	A historical archaeological assessment was undertaken prior to site redevelopment at 10 Grad Avenue, Rosehill, NSW. The subject site was utilised for ceramic tiles manufacture and consisted of an established warehouse building. The assessment included background research, site survey, photographic record and an assessment of the subject site's archaeological potential. The subject site has been subject to disturbance from the late 1880s and the building (now demolished) was assessed as possessing local historic significance, with little archaeological potential of identifying any significance historic deposits.	1 km north-east
Parramatta Light Rail Non-Aboriginal Archaeological Assessment Artefact (2017)	A historical archaeological assessment was undertaken in the Parramatta CBD, in association with the construction of the Parramatta Light Rail. Areas subject to assessment included Smith St, George St, Macquarie St, Charles St, Purchase St, Alfred St and Harris Street. The assessment included background research, site survey and preliminary test excavation. Excavation reached a maximum depth of 1.5m. As a result of disturbance within road corridors from the installation of services and upgrades, modification of the alignment of road corridors and intersections and intensive twentieth century development of the area, it was concluded that there was moderate potential for the truncated remains of post 1814 archaeological deposits and nil to low potential for pre-1814 deposits, such as convict allotments or gardens.	>1.5 km north-west
Sydney Metro West - Major civil construction work between The Bays and Sydney CBD Technical Paper 3: Non-Aboriginal Heritage *Artefact Heritage Services (2021)*	A historical (non-Aboriginal) heritage assessment was undertaken to support the Sydney Metro West EIS for construction works between The Bays and the Sydney CBD. Potential impacts were concluded to have moderate to high risk to existing non-Aboriginal heritage items in the vicinity of the Pyrmont Station and Hunter Street Station (Sydney CBD) construction sites, including heritage items located directly above the tunnel alignment. In general, risks to existing heritage items were considered to be minor and were associated with secondary impacts from machinery operation, including vibration and settlement. Risks to potential archaeological resources within the Pyrmont and Hunter Street environs were assessed as being major, with mitigation measures proposed including comprehensive archaeological investigation.	Within

Assessment	Description	Distance from Project area
Parramatta Light Rail GML (ongoing)	Archaeological assessment is ongoing within the Parramatta CBD in association with the construction of the Parramatta Light Rail. To date the light rail works have exposed numerous archaeological deposits, inclusive of: • A 1790s to 1820s wharf and cottage; including a timber building with a brick chimney (postholes and brick fireplace), garden deposits, rubbish pits and artefacts. • Evidence of the 1825 to 1860s military barracks; including sandstone gatehouse footings and artefactual deposits. • Evidence of the 1860s to 1930s Parramatta Benevolent Asylum; including yards surfaces, outbuildings and artefacts. • Remains of the 1790s to 1810 military barracks; including sandstock brick cesspits, large pits (for storage, sandmining and rubbish), postholes, wall trenches and artefacts. As stated, the archaeological assessment of the Parramatta CBD remains ongoing.	>1.5 km north-west

4.4 Key Observations

Key observations to be drawn from a review of the historical (non-Aboriginal) heritage context of the Project area and environs are as follows:

- One heritage item 'Wetlands' is partially located within the alignment of the proposed pipeline. This listed item is associated with the remnant and regenerated mangrove and wetland ecological system along the banks of the Duck River, Duck Creek and Parramatta River, extending beyond the project area to the east and west.

- The proposed construction footprint of the works is situated in an environment which has been subject to extensive disturbance in relation to the industrial development of the wider Parramatta/Rosehill area. Reference to historical mapping of the St John Parish, within which the Project area is located, indicates that the Project area has been subject to disturbance related to the European colonisation of the Parramatta/Rosehill area since the early 1800s. Historical imaging shows that the area surrounding the proposed pipeline was an established industrial area by the mid-20th century, however limited development appears to have been undertaken along the banks of the Duck River and Duck Creek until the construction of the M4 motorway and Sydney Water pipeline crossing at Duck Creek. Based on the previous land use history, historical archaeological potential is considered to be low to nil.

5.0 Visual Inspection

A visual inspection of the Project area was undertaken by Melissa Moritz on 25 August 2022. The primary aim of the visual inspection was to identify and record any existing surface evidence of past-Aboriginal activity and/or historic heritage relics within the Project area. **Photo 1** to **Photo 8** below were also taken during the visual inspection. The following key observations were made during the visual inspection:

- Ground surface visibility was generally limited due to the extent of introduced gravels, bitumen and other hardstand, and grass growth. Areas of visible ground surface were observed adjacent to Duck Creek, however these areas had been impacted by erosion.

- Native vegetation within the Project area has been extensively modified as a result of industrial and/or urban land use activities. It is unlikely for the Project area to contain mature trees with either cultural significance and/or potential cultural modification and none were identified during the visual inspection.

- Stone suitable for flaked and/or ground stone artefact manufacture is absent from the immediate vicinity of the Project area.

- No new Aboriginal sites were identified during the visual inspection component of this assessment. The proposed location of the WTP pipeline has been heavily disturbed previously, particularly where the M4 motorway has been constructed. Below ground services are also noted to have been installed in the area of the proposed pipeline as evident by the access hatch and signs indicating their presence.

- No Aboriginal objects, historic relics or works (including buildings) were observed during the visual inspection component of this assessment.

- The heritage item 'Wetlands' is located within a small section of the proposed pipeline alignment. This includes at Duck Creek, where an existing Sydney Water asset is located and has introduced a new element previously. This area of the wetlands retains evidence of the mangroves and other significant

natural landscape elements which are contributory to the significance of this heritage item. However, where the 'Wetlands' heritage item has been intersected by the M4 motorway, the significant elements of the heritage item, including mangroves and associated significant vegetation has been significantly modified. No natural ecological community associated with the heritage item 'Wetlands' exists in this discrete section pocket of the wetlands.

Photo 1 Shirley Street, west road verge

Photo is taken looking north and shows location of proposed buried pipeline along Shirley Street.

Source: Umwelt (2022)

Photo 2 Sydney Water Asset, crossing Duck Creek

Photo is taken looking south from Shirley Street.

Source: Umwelt (2022)

Photo 3 Duck Creek and Sydney Water Asset

Photo taken looking north from within the Clyde SMF where the proposed pipeline will cross Duck Creek**.** Source: Umwelt (2022)

Photo 4 Clyde CMSF, south corner

Photo taken looking southeast to the edge of the site. The embankment for the M4 motorway is obscured by the trees on the right of the photo. Source: Umwelt (2022)

Photo 5 Wetlands and Duck River

Photo taken of a part of heritage item 'Wetlands' and the mangroves located along the bank of Duck River near the proposed pipeline. Source: Umwelt (2022)

Photo 6 M4 motorway easement

Photo taken looking northwest showing the location of the proposed pipeline to be installed underground. Source: Umwelt (2022)

Photo 7 M4 motorway easement and Duck River

Photo taken looking southeast showing the extent of modification and disturbance from the construction of the M4 motorway. Note this is where the pipeline is proposed to be installed below ground.
Source: Umwelt (2022)

Photo 8 Duck River at proposed discharge location

Photo taken looing southeast at the embankment to Duck River, where the pipeline is proposed to discharge into the river. Note the extensive disturbance, including removal of wetland vegetation along this section of the river.
Source: Umwelt (2022)

6.0 Key Findings

The key findings of this assessment are as follows:

- No registered Aboriginal sites are located within the Project area and no new Aboriginal sites were identified during the visual inspection component of this assessment. The proposed location of the WTP pipeline has been subject to significant land modification from construction activities associated with the M4 motorway. In particular, construction of the road alignment and development along Shirley Street and the construction of the Sydney Water asset resulted in extensive impacts to the north side of Duck Creek in this area.
- Additional impacts would have occurred through the construction of the M4 motorway where the pipeline is proposed to run from the southern corner of Clyde MSF site to Duck River. Impacts in this

area include the removal of any remaining natural soil profiles within the construction footprint of the M4 motorway.

- The 'Wetlands' consists of a variety of mangrove plants along the banks of Duck Creek and Duck River. Where the proposed pipeline crosses Duck Creek, the 'Wetlands' have been previously impacted through the construction of the Sydney Water pipelines, drainage outlets and retaining walls, likely associated during remediation works to the banks of the creek. The banks to Duck River and Duck Creek included in the 'Wetlands' curtilage are generally steeply sloped with evidence of modification from construction activities, land clearing and also areas of rubbish dumping, particularly behind Tennyson Street where industrial buildings have been uninhabited for some time. However, despite modifications the area can be readily identifiable as a wetland environment.

- The heritage items located in the vicinity of the works, the closest being the RTA depot and Capral Aluminium site, are generally visually separated from the proposed pipeline by the vegetation lining Duck Creek and Duck River. Additionally, the significant elements of these heritage items have a buffer of >100 m from the proposed pipeline.

- No historic relics or works (including buildings) were observed during the visual inspection component of this assessment. Consistent with the findings of Artefact Heritage Services (2021:279-280), the predicted archaeological remains and potential within the Clyde MSF construction site environs was generally assessed as nil. Areas of low to moderate archaeological potential assessed by Artefact Heritage Services (2021:280-281) were identified within the Parramatta Speedway, and RTA depot and their respective industrial development/s. Neither area is located within or immediately adjacent to the current Project area.

7.0 Impact Assessment

7.1 Aboriginal Heritage

The following provides a summary of the key questions asked as part of the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW, 2010:10). Should the answer to Question 4 be 'yes', further investigation and impact assessment would be required.

1. Will the activity disturb the ground surface or any culturally modified trees?

Yes. The proposed works will require ground disturbance through the installation of three sections of pipelines, including the buried pipeline along Shirley Street (approximately 60 m) and the buried section below the M4 motorway overpass. In addition, it is expected that a degree of ground disturbance will occur during the general use of the land via excavator machinery and minimal regrading of the pipeline alignment by up to 300 mm.

No mature vegetation was identified during the course of the visual inspection of the Project area with the potential to contain cultural modifications. No culturally modified trees will be impacted. **Proceed to Question 2a.**

2a. Are there any relevant confirmed site records or other associated landscape feature information on AHIMS?

Searches of the AHIMS database and reference to the relevant site card recordings confirmed that no registered Aboriginal sites are located within the Project area.

The contemporary environmental context discussed in **Section 3.1.2** suggests that the Project area environs are located in a well-resourced landscape, likely capable of supporting sustained occupation. The presence of Duck Creek, A'Becketts Creek and Duck River would have provided adequate sources of drinking water, and likely sustained aquatic and terrestrial food and other resources. However, available environmental data suggests that the immediate environs of the current Project area would likely have been estuarine and/or wetland, which would not have been suitable for occupation. **Proceed to Question 2b.**

2b. Are there any other sources of information of which a person is already aware?

Umwelt has reviewed all available literature and pertinent sources of information pertaining to the known Aboriginal resource of the Project area and surrounds. Although archaeological assessment within the Project area is absent, the available information would suggest that the landscape remained largely undeveloped until the 20th century. Extensive vegetation clearance associated with the agricultural use of the land would have severely modified and impacted the natural soil profiles which was exacerbated further by the later construction of the Rosehill industrial area and modifications to the banks of Duck Creek and Duck River, including within the Project area. **Proceed to Question 2c.**

2c. Are there any landscape features that are likely to indicate presence of Aboriginal objects?

The Project area is located within 200 m of multiple watercourses, including A'Becketts Creek, Duck Creek and Duck River. As discussed above, the Project area has experienced widespread disturbance in relation to the industrial development of the Rosehill area, and as such it is unlikely that any natural soil profiles with the potential to retain Aboriginal objects remain in the Project area. **Proceed to Question 3.**

3. Can harm to Aboriginal objects listed on AHIMS or identified by other sources of information and/or can the carrying out of the activity at the relevant landscape features be avoided?

Yes, the results of the review of environmental context (**Section 3.1.2**) have indicated that significant disturbance has occurred within the Project area that has resulted in the removal of natural soil profiles along the proposed pipeline alignment. No Aboriginal objects or sites were identified during the course of the visual inspection of the Project area and visual inspection confirmed that widespread disturbance within the Project area would have resulted in removal of the natural soil profiles likely to contain Aboriginal objects. No Aboriginal objects are likely to be located within the Project area. **Proceed to Question 4.**

4. Does a desktop assessment and visual inspection confirm that there are Aboriginal objects or that they are likely?

The visual inspection undertaken during the course of this assessment indicates that the Project area has been subject to extensive disturbance which has likely impacted the subsurface context of much of the area. Though the broader landscape has proven potential to contain Aboriginal archaeological material, the potential for such sites to remain intact within the Project area is nil to low.

7.2 Historical (non-Aboriginal) Heritage

One locally listed heritage item on the Parramatta LEP 'Wetlands' is located within the Project area. However, the pipeline is proposed to be fixed to the Sydney Water pipe in this area and will not require interaction with and/or removal of the significant elements of the heritage item, i.e., the wetland vegetation along the banks of Duck Creek.

No vegetation clearance is anticipated and there are no built structures or elements in the vicinity of the proposed pipeline which contribute to the significance of the 'Wetlands' heritage item. No physical impacts to the item are anticipated during the construction and subsequent maintenance of the pipeline. Consistent with the findings of Artefact Heritage Services (2021:279-280), the predicted archaeological remains and potential within the Project area environs was generally assessed as nil and will not result in any anticipated archaeological impacts. Although the proposed pipeline is located in the vicinity of the RTA depot and the Capral Aluminium site, the significant elements of these items are located >100 m from the proposed pipeline. This distance and the surrounding vegetation provide a buffer to these heritage items from the proposed pipeline and will not impede on the views to or from the heritage items in the vicinity of the Project area.

Although the proposed pipeline will constitute a new structural element within the curtilage of the heritage item, the infrastructure will be relatively low profile and within an isolated section of the extensive curtilage of the heritage item, generally not visible from publicly accessible land. It will not obscure or detract from the limited views of the 'Wetlands' that are available from Shirley Street, nor will it change the setting of the 'Wetlands', which is characterised by a dense mangrove canopy at street level, with the mangrove root system and undergrowth visible lower down the banks of Duck Creek. The anticipated visual impacts are assessed as low, and the overall heritage significance of this heritage item will not be adversely impacted by the proposed works.

7.3 Conclusions

The potential impacts of the Project have been assessed in **Section 7.1** and **Section 7.2** of this report. Through a review of environmental and archaeological context for the Project area and environs, the current assessment identified proposed works will not impact any registered Aboriginal objects/sites or listed historical items. The Project area has been assessed as having no potential to contain Aboriginal objects or areas of historical archaeological potential. Additionally, the installation of the pipeline within the heritage item 'Wetlands' would not result in any impacts to the vegetation elements associated with the heritage item nor would the overall significance of the 'Wetlands' be impacted.

The current assessment compared the proposed additions and potential impacts to the heritage values of the Project area to the approved Sydney Metro project (inclusive of Technical Papers 3 and 4 - Artefact Heritage Services 2020; 2021) and determined that the proposed pipeline is generally consistent with the approved built/structural element additions proposed within the broader Sydney Metro project and specifically the Clyde MSF site.

These works may proceed without any further archaeological or heritage assessment, approvals or associated constraint, subject to the recommendations provided in **Section 8.0** of this report.

8.0 Management Recommendations

In light of the above key findings presented in **Section 6.0** and impact assessment presented in **Section 7.0**, this Aboriginal Heritage Due Diligence and Historical (non-Aboriginal) Heritage Impact Assessment provides the following management recommendations:

Recommendation 1. All relevant contractors and GLC personnel should be made aware of the nature and location of previously recorded Aboriginal sites and historical items that lie within and near the Project area. All relevant contractors and GLC personnel should also be made aware of the location of adjacent Aboriginal sites and/or heritage items and avoid impacts. It is also recommended that this information be integrated into the approved project Construction Environmental Management Plan (CEMP) and associated induction material for works within the Clyde MSF construction site.

Recommendation 2. If, in the unlikely event that Aboriginal objects or historical relics are identified during the Project, all works in the area must cease immediately and the *Sydney Metro Unexpected Heritage Finds Procedure* (SM-18-00105232) must be implemented.

Recommendation 3. In the event that location of the proposed pipeline or the construction methodology is altered for any reason, the changes must be reviewed by the Project Heritage Specialist to determine if the location represents a risk to Aboriginal and/or historical heritage.

9.0 Closing

Please do not hesitate to contact the undersigned should you require clarification or further information.

Yours sincerely

Melissa Moritz
Senior Heritage Consultant
E | mmoritz@umwelt.com.au
M| 0477 071 001

Nathan Baker
Project Director
E | nbaker@umwelt.com.au
M | 0477 713 478

10.0 References

Archaeological and Heritage Management Solutions, 2009. Archaeological Assessment: 10 and 10a Prospect Street, Rosehill. Prepared for Luck Development Pty Ltd.

Archaeological and Heritage Management Solutions, 2013. Archaeological Report – 189-191 Macquarie Street, Parramatta.

Archaeological and Heritage Management Solutions, 2014a. Aboriginal Archaeological Report – 330 Church Street, Parramatta.

Archaeological and Heritage Management Solutions, 2014b. Archaeological Technical Report: 2-8 River Road West, Parramatta.

Archaeological and Heritage Management Solutions, 2016a. Old Kings School, Parramatta Aboriginal Heritage Impact Assessment Report.

Archaeological and Heritage Management Solutions, 2016b. Aboriginal Cultural Heritage Assessment Report – 21 Hassall Street, Parramatta LGA.

Archaeological and Heritage Management Solutions, Futurepast, 2016c. Aboriginal Cultural Heritage Assessment Report – 113–117A Wigram Street, Harris Park & 23–29 Hassall Street, Parramatta.

Archaeological Management and Consulting Group, Streat Archaeological Services Pty Ltd, 2018. Aboriginal Archaeological Assessment – 93–95 Phillip Street & 32 Smith Street Parramatta NSW.

Artefact, 2017. Parramatta Light Rail non-Aboriginal Archaeological Assessment Report. Prepared for WSP/Jacobs on behalf of Transport NSW.

Artefact Heritage Services, 2020. Sydney Metro West Stage 1: Technical Paper 4: Aboriginal Cultural Heritage Assessment Report prepared for Sydney Metro.

Artefact Heritage Services, 2021. Sydney Metro West - Major civil construction work between The Bays and Sydney CBD Technical Paper 3: Non-Aboriginal Heritage

Chapman, G.A., Murphy, C.L., 1989. Soil Landscapes of the Sydney 1:100,000 Sheet Report. Soil Conservation Service of NSW, Sydney, New South Wales.

Corkhill, T., 1999. Here and There. Links between Stone Sources and Aboriginal Archaeological Sites in Sydney, Australia. University of Sydney.

Environmental Resource Management Australia Pty Ltd, 2000. Statement of Heritage Impact: Former Electricity Substation: 10 Grand Avenue, Rosehill. Prepared for CSR Monier Wunderlich Pty Ltd.

Department of Environment, Climate Change and Water NSW [former], 2010. Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales.

Dominic Steele Consulting Archaeology, 2017. Aboriginal Archaeological Test & Salvage Excavation Report – 184-188 George Street, Parramatta, NSW.

Gamuda Lang O'Rourke Consortium 2022. Planning Approval Consistency Assessment, Sydney Metro West - Clyde Stabling and Maintenance Facility – Water Treatment Plant Discharge to Duck River, Draft Document.

GML Heritage, 2000, Parramatta Historical Archaeological Landscape Management Study.

Higginbotham & Associates, 2003. Historical and Archaeological Assessment of Proposed Development: 80–100 James Ruse Drive, Rosehill, NSW. Prepared for Order of Architects Pty Ltd.

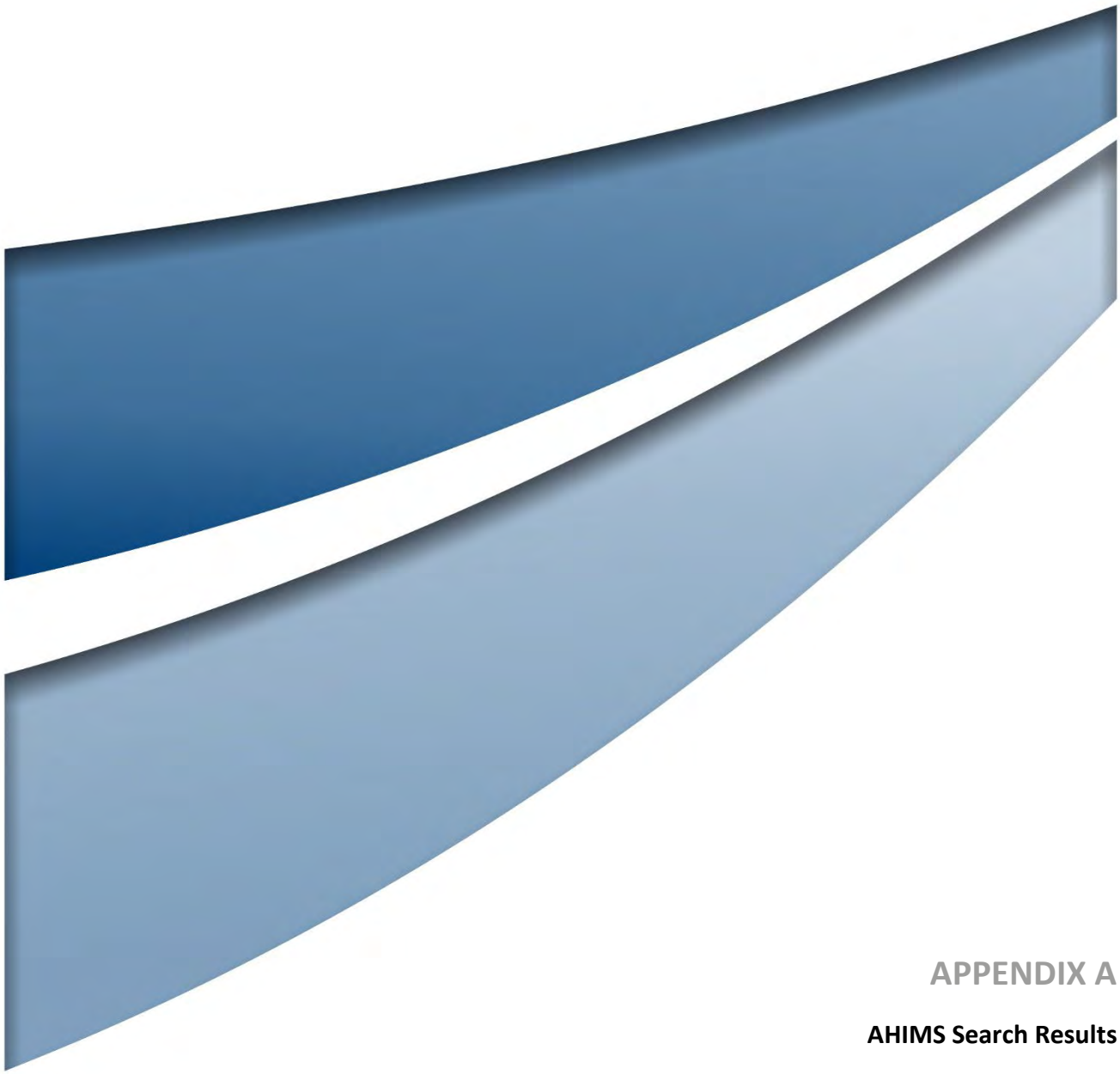
Higginbotham & Associates, 2004. Historical and Archaeological Assessment of Proposed Development: 102–108 James Ruse Drive, Rosehill, NSW. Prepared for Order of Architects Pty Ltd.

Kelleher Nightingale Consulting Pty Ltd, 2017. Parramatta Light Rail Aboriginal Cultural Heritage Assessment Report.

NSW Heritage Office, 2001. Assessing Heritage Significance.

Steele, D,. 2003. Aboriginal Heritage Assessment Report: Silverwater Correctional Complex, Silverwater, NSW. Prepared for NSW Department of Commerce.

Umwelt (Australia) Pty Ltd, 2021. Sydney Metro West Western Tunnelling Package. Heritage Management Plan.



APPENDIX A

AHIMS Search Results

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 4880c

Client Service ID : 736086

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
45-5-2465	Parramatta Regional Park (IF3)	GDA	56	314524	6256879	Open site	Partially Destroyed	Artefact : -	Isolated Find	102142,102196
	Contact	**Recorders**	Doctor.Jillian Comber,J Steel					**Permits**	3822	
45-5-2463	Parramatta Regional Park (IF1)	GDA	56	314462	6257627	Open site	Valid	Artefact : -	Isolated Find	102142,102196
	Contact	**Recorders**	J Steel					**Permits**	3994	
45-5-2464	Parramatta Regional Park (IF2)	GDA	56	314400	6257619	Open site	Valid	Artefact : -	Isolated Find	102196
	Contact	**Recorders**	J Steel					**Permits**		
45-6-2312	Subiaco Ck 1;	AGD	56	319790	6256890	Open site	Valid	Artefact : -	Open Camp Site	102196
	Contact	**Recorders**	Michael Guider					**Permits**		
45-6-2313	Subiaco Ck 2;	AGD	56	319690	6256830	Open site	Valid	Artefact : -	Open Camp Site	102196
	Contact	**Recorders**	Michael Guider					**Permits**		
45-6-1523	George St Parramatta;Family Law Courts;	AGD	56	314950	6256450	Open site	Valid	Artefact : -	Open Camp Site	1809,102196,103782
	Contact	**Recorders**	Val Attenbrow,Doctor.Edward Higginbotham					**Permits**		
45-5-1065	Parra Park 3;PP 3;	AGD	56	314620	6257620	Open site	Valid	Artefact : -	Open Camp Site	102142,102196
	Contact	**Recorders**	Michael Guider					**Permits**		
45-6-2554	Elizabeth Farmhouse	AGD	56	316420	6255700	Open site	Valid	Artefact : -	Open Camp Site	102196,103782
	Contact	**Recorders**	Michael Guider					**Permits**	2928	
45-6-2559	Sydney Turf Club Carpark;STC Carpark;	AGD	56	316900	6256020	Open site	Valid	Artefact : -	Open Camp Site	102142,102196
	Contact	**Recorders**	Michael Guider					**Permits**		
45-6-2573	Turpentines;	AGD	56	319280	6257620	Open site	Valid	Artefact : -	Open Camp Site	102196
	Contact	**Recorders**	Michael Guider					**Permits**		
45-6-2578	Collett Park;	AGD	56	316680	6257140	Open site	Valid	Artefact : -	Open Camp Site	102196
	Contact	**Recorders**	Michael Guider					**Permits**		
45-5-0864	Governors Bathhouse;	AGD	56	314340	6256750	Open site	Partially Destroyed	Artefact : -	Open Camp Site	102142,102196
	Contact	**Recorders**	Michael Guider					**Permits**	3822	
45-5-0277	Cumberland Oval;Parramatta;	AGD	56	314588	6257260	Open site	Destroyed	Modified Tree (Carved or Scarred) : -	Scarred Tree	223,260,1018,102142,102196
	Contact	**Recorders**	Cook					**Permits**		
45-5-0762	Parramatta Park	AGD	56	314320	6256950	Open site	Partially Destroyed	Artefact : -, Modified Tree (Carved or Scarred) : -	Open Camp Site,Scarred Tree	102142,102196
	Contact	**Recorders**	Val Attenbrow					**Permits**	3822	
45-6-2627	HP-1	AGD	56	315850	6255210	Open site	Valid	Artefact : -		102196

Report generated by AHIMS Web Service on 28/11/2022 for Melissa Moritz for the following area at Lat, Long From : -33.8379, 150.9935 - Lat, Long To : -33.8022, 151.0553. Number of Aboriginal sites and Aboriginal objects found is 102

This information is not guaranteed to be free from error omission. Heritage NSW and its employees disclaim liability for any act done or omission made on the information and consequences of such acts or omission.

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 4880c

Client Service ID : 736086

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
	Contact	Recorders	Mick Leon					Permits		
45-6-2648	Charles/George 1	GDA	56	315690	6256470	Open site	Partially Destroyed	Artefact : -, Potential Archaeological Deposit (PAD) : -		99538,102196
	Contact	Recorders	Doctor.Jo McDonald,EMM Consulting - St Leonards - Individual users,Curio Projects					Permits	1433,1682,2176,2240,2353,3049,3509,4662	
45-5-2856	Parramatta Park Macquarie Entrance PAD	AGD	56	314500	6256550	Open site	Partially Destroyed	Potential Archaeological Deposit (PAD) : -		98738,103133
	Contact	Recorders	Dominic Steele Archaeological Consulting					Permits	1647,3822	
45-6-2678	SSP1 (formerly Smith Street PAD)	AGD	56	315330	6256150	Open site	Destroyed	Potential Archaeological Deposit (PAD) : -		99518,102196, 103782
	Contact	Recorders	Doctor.Jo McDonald					Permits	1848,2561	
45-6-2668	Argyle St	AGD	56	315200	6256060	Open site	Valid	Potential Archaeological Deposit (PAD) : -		102196,103782
	Contact	Recorders	Doctor.Jo McDonald					Permits	1764,2155	
45-6-2669	Kendall Street, Harris Park	AGD	56	315525	6256150	Open site	Valid	Potential Archaeological Deposit (PAD) : -		102196,103782
	Contact	Recorders	Jim Wheeler					Permits	1767	
45-6-2673	RTA-G1	GDA	56	315842	6256510	Open site	Valid	Artefact : -		100552,102196,103782
	Contact	Recorders	Doctor.Jo McDonald					Permits	1841,2176,3050,3509	
45-6-2679	Parramatta Children's Court	AGD	56	314900	6256600	Open site	Valid	Potential Archaeological Deposit (PAD) : -		102196,103782
	Contact	Recorders	Ms.Laila Haglund					Permits	1850,1973,2117,3847	
45-6-2738	James Ruse Reserve Open Camp 1	AGD	56	316000	6256000	Open site	Valid	Potential Archaeological Deposit (PAD) : -		102196,103782
	Contact	Recorders	Jim Wheeler					Permits	2018,2187	
45-6-2686	Civic Place PAD	GDA	56	315130	6256450	Open site	Partially Destroyed	Artefact : -, Potential Archaeological Deposit (PAD) : -		99666,99791,103115,103782
	Contact	Recorders	Doctor.Jo McDonald,Niche Environment and Heritage,Niche Environment and Heri					Permits	1960,3749,3890,3897,3983,3988,4044,414	
45-6-2751	Marsden St Carpark	AGD	56	314900	6256350	Open site	Valid	Artefact : -, Potential Archaeological Deposit (PAD) : -		102196,103782
	Contact	Recorders	Ms.Laila Haglund					Permits	2243	

Report generated by AHIMS Web Service on 28/11/2022 for Melissa Moritz for the following area at Lat, Long From : -33.8379, 150.9935 - Lat, Long To : -33.8022, 151.0553. Number of Aboriginal sites and Aboriginal objects found is 102

This information is not guaranteed to be free from error omission. Heritage NSW and its employees disclaim liability for any act done or omission made on the information and consequences of such acts or omission.

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 4880c

Client Service ID : 736086

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
45-6-2739	PADUNknown	AGD	56	314950	6256700	Open site	Valid	Potential Archaeological Deposit (PAD) : -		102196,103782
	Contact	**Recorders**	Haglund and Associates					**Permits**		
45-6-2746	Old Hospital Site Parramatta Health Services Precinct	AGD	56	314950	6256650	Open site	Valid	Artefact : -, Potential Archaeological Deposit (PAD) : -		99798,100551,100558,102196,103782
	Contact	**Recorders**	Ms.Laila Haglund					**Permits**	2160,2507	
45-6-2741	Parramatta Transport Interchange PAD	AGD	56	315450	6256250	Open site	Valid	Potential Archaeological Deposit (PAD) : -		99438,99497,102196,103782
	Contact	**Recorders**	Doctor.Susan (left ahms) Mcintyre-Tamwoy					**Permits**	2121,4767	
45-5-3186	Marsden Street	GDA	56	314800	6256315	Open site	Valid	Artefact : 4		102196,103782
	Contact T Russell	**Recorders**	Doctor.Edward Higginbotham					**Permits**		
45-6-2756	Parramatta Rehabilitation Centre (formerly O'Connell St PAD)	GDA	56	314950	6256850	Open site	Valid	Potential Archaeological Deposit (PAD) : -, Artefact : -		102196,103782
	Contact	**Recorders**	Ms.Laila Haglund,Doctor.Alan Williams,EMM Consulting - St Leonards - Individual u					**Permits**	2317,2414,2511,4797	
45-6-2795	150 Marsden Street Parramatta PAD	AGD	56	314955	6256480	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		102196,103782
	Contact T Russell	**Recorders**	Austral Archaeology					**Permits**	2404	
45-6-2863	Cumberland Press Site	GDA	56	315913	6256448	Open site	Valid	Artefact : 89		103782
	Contact	**Recorders**	Ms.Laila Haglund,Ms.Tory Stening					**Permits**	2865,3307,3509,3816	
45-6-2893	95-101 George St (GSP AD)	GDA	56	315720	6256570	Open site	Valid	Potential Archaeological Deposit (PAD) : -, Artefact : -		101078,103782
	Contact	**Recorders**	Megan Mebberson					**Permits**	3509	
45-5-3630	Macquarie St PAD	AGD	56	314800	6256500	Open site	Destroyed	Potential Archaeological Deposit (PAD) : -		103782
	Contact	**Recorders**	Comber Consultants Pty Limited,Comber Consultants Pty Limited					**Permits**	3107,3302	
45-6-2950	Macquarie St PAD 2	GDA	56	315835	6256410	Open site	Destroyed	Potential Archaeological Deposit (PAD) : -		102144,103782
	Contact	**Recorders**	Doctor.Jillian Comber,Comber Consultants Pty Limited					**Permits**	3238,3366	
45-6-2976	George St PAD 1	GDA	56	315650	6256690	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		

Report generated by AHIMS Web Service on 28/11/2022 for Melissa Moritz for the following area at Lat, Long From : -33.8379, 150.9935 - Lat, Long To : -33.8022, 151.0553. Number of Aboriginal sites and Aboriginal objects found is 102

This information is not guaranteed to be free from error omission. Heritage NSW and its employees disclaim liability for any act done or omission made on the information and consequences of such acts or omission.

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 4880c

Client Service ID : 736086

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
	Contact	**Recorders**	Comber Consultants Pty Limited,Mr.David Nutley					**Permits**	3509,4766,4767	
45-6-2977	Macquarie St PAD 3	GDA	56	315090	6256650	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
	Contact	**Recorders**	Comber Consultants Pty Limited,Mr.David Nutley					**Permits**	3509,4767	
45-5-4097	O'Connell St PAD1	GDA	56	314900	6256695	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
	Contact	**Recorders**	Comber Consultants Pty Limited,Mr.David Nutley					**Permits**	3509	
45-6-2978	41 Hunter Street PAD	GDA	56	315030	6256450	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Mr.Alexander Beben					**Permits**	3419	
45-6-3108	42 Bridge Street Rydalmere PAD	GDA	56	317670	6256778	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
	Contact	**Recorders**	GML Heritage Pty Ltd - Surry Hills,Ms.Sally MacLennan					**Permits**		
45-6-3102	Phillip Street PAD 1	GDA	56	315581	6256801	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
	Contact	**Recorders**	Mr.Dominic Steele					**Permits**	3755	
45-6-2988	7-9 Victoria Road Parramatta	GDA	56	315502	6257233	Open site	Valid	Artefact : 9		
	Contact	**Recorders**	GML Heritage Pty Ltd - Surry Hills,Ms.Anita Yousif					**Permits**	3488	
45-6-3068	GS PAD 1 184-188 George Street	GDA	56	315899	6256375	Open site	Destroyed	Potential Archaeological Deposit (PAD) : 1		103962
	Contact	**Recorders**	Mr.Dominic Steele					**Permits**	3584	
45-6-3065	PHILLIP ST PAD 1	GDA	56	315500	6256675	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
	Contact	**Recorders**	Mr.Dominic Steele					**Permits**		
45-6-3124	330 Church St Artefact Scatter	GDA	56	315330	6256965	Open site	Valid	Artefact : -, Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Doctor.Julie Dibden					**Permits**		
45-6-3151	UWS Rydalmere OS 1	GDA	56	317400	6257004	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Mr.Benjamin Streat					**Permits**	3800	
45-6-3118	Clay Cliff Creek Levee	GDA	56	315801	6256294	Open site	Valid	Artefact : 1, Potential Archaeological Deposit (PAD) : 1		102992,102997,102998
	Contact	**Recorders**	Ms.Fenella Atkinson					**Permits**	3788	

Report generated by AHIMS Web Service on 28/11/2022 for Melissa Moritz for the following area at Lat, Long From : -33.8379, 150.9935 - Lat, Long To : -33.8022, 151.0553. Number of Aboriginal sites and Aboriginal objects found is 102

This information is not guaranteed to be free from error omission. Heritage NSW and its employees disclaim liability for any act done or omission made on the information and consequences of such acts or omission.

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
45-6-3134	Lennox Bridge Car Park PAD	GDA	56	315209	6256970	Open site	Partially Destroyed	Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Miss.Felicity Barry					**Permits**	3797,4094,4537,4767	
45-6-3131	River Road West	GDA	56	316650	6256450	Open site	Partially Destroyed	Potential Archaeological Deposit (PAD) : -, Artefact : -		102338
	Contact	**Recorders**	Extent Heritage Pty Ltd - Pyrmont - Individual users,Ms.Fenella Atkinson,Miss.Cora					**Permits**	3734,4657,4825	
45-5-4630	Parramatta Leagues Club PAD	GDA	56	314974	6257483	Open site	Not a Site	Potential Archaeological Deposit (PAD) : -		103589
	Contact	**Recorders**	GML Heritage Pty Ltd - Surry Hills,Doctor.Tim Owen,Doctor.Tim Owen					**Permits**	3958	
45-5-4530	Parramatta RSL PAD	GDA	56	314810	6256690	Open site	Partially Destroyed	Artefact : -, Potential Archaeological Deposit (PAD) : -, Hearth : -		104179
	Contact	**Recorders**	GML Heritage Pty Ltd - Surry Hills,GML Heritage Pty Ltd - Surry Hills,Doctor.Tim O					**Permits**	3819,3853,3935,4364	
45-6-3159	Catholic Diocese Parramatta PAD	GDA	56	315120	6257259	Open site	Partially Destroyed	Artefact : -, Potential Archaeological Deposit (PAD) : -		104276
	Contact	**Recorders**	Extent Heritage Pty Ltd - Pyrmont - Individual users,Miss.Diana Cowie,Mrs.Laressa					**Permits**	4300	
45-5-4533	Paddocks Playground Parra Park	GDA	56	314323	6257378	Open site	Partially Destroyed	Artefact : -		
	Contact	**Recorders**	Ms.Tory Stening					**Permits**	3822	
45-5-4534	Parramatta Park - Location C	GDA	56	314568	6257473	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Annie Bickford					**Permits**		
45-5-4535	Parramatta Park - Location E	GDA	56	314539	6256846	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Val Attenbrow					**Permits**		
45-5-4536	Parramatta Park - Location G	GDA	56	314504	6256700	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Val Attenbrow					**Permits**		
45-5-4538	Parramatta Park - Location J	GDA	56	314351	6257676	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Val Attenbrow					**Permits**	3994	
45-5-4539	Parramatta Park - Location K	GDA	56	314460	6257823	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Val Attenbrow					**Permits**	3994	
45-5-4542	Parramatta Park - Location L	GDA	56	314542	6257709	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Val Attenbrow					**Permits**	3994	
45-5-4543	Parramatta Park - Location N	GDA	56	314693	6257737	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Val Attenbrow					**Permits**		
45-5-4544	Parramatta Park - Location O	GDA	56	314725	6257680	Open site	Valid	Artefact : -		

Report generated by AHIMS Web Service on 28/11/2022 for Melissa Moritz for the following area at Lat, Long From : -33.8379, 150.9935 - Lat, Long To : -33.8022, 151.0553. Number of Aboriginal sites and Aboriginal objects found is 102

This information is not guaranteed to be free from error omission. Heritage NSW and its employees disclaim liability for any act done or omission made on the information and consequences of such acts or omission.

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
	Contact	**Recorders**	Val Attenbrow					**Permits**		
45-5-4546	Parramatta Park - Location D	GDA	56	314555	6256864	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Val Attenbrow					**Permits**		
45-5-4547	Parramatta Park - Location F	GDA	56	314304	6257230	Open site	Partially Destroyed	Artefact : -		
	Contact	**Recorders**	Val Attenbrow					**Permits**	3994	
45-5-4541	Parramatta Park - Location M	GDA	56	314608	6257586	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Val Attenbrow					**Permits**		
45-6-3158	Robin Thomas Reserve	GDA	56	316100	6256300	Open site	Partially Destroyed	Aboriginal Resource and Gathering : -, Potential Archaeological Deposit (PAD) : -, Artefact : -		
	Contact	**Recorders**	Doctor.Jillian Comber,Extent Heritage Pty Ltd - Pyrmont - Individual users,Extent H					**Permits**	4439	
45-6-3157	Harris St Footpath	GDA	56	316013	6256461	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Ms.Tory Stening					**Permits**	4439,4900	
45-6-3193	Riverbank Square PAD	GDA	56	315405	6256895	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Ms.Ngaire Richards					**Permits**		
45-6-3180	21 Hassall Street	GDA	56	315761	6256247	Open site	Partially Destroyed	Potential Archaeological Deposit (PAD) : 1		103758
	Contact	**Recorders**	Ms.Ngaire Richards					**Permits**	3906,3975	
45-5-4895	Old Kings Oval Artefact Scatter 1	GDA	56	314665	6257231	Open site	Valid	Artefact : -, Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	AECOM Australia Pty Ltd - Sydney,Artefact - Cultural Heritage Management - Pyrm					**Permits**	4307,4461	
45-6-3232	Test recording	GDA	56	315051	6257106	Open site	Deleted	Artefact : -		
	Contact	**Recorders**	DPIE - Armidale,Mr.Stewart Watters					**Permits**		
45-6-3312	PLR AFT 1	GDA	56	316105	6256465	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Kelleher Nightingale Consulting Pty Ltd,Ms.Cristany Milicich					**Permits**		
45-6-3313	PLR AFT 2	GDA	56	316305	6256340	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Kelleher Nightingale Consulting Pty Ltd,Ms.Cristany Milicich					**Permits**		
45-6-3222	Old Kings School AS1	GDA	56	315026	6257139	Open site	Valid	Artefact : -, Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Extent Heritage Pty Ltd - Pyrmont - Individual users,Ms.Ngaire Richards					**Permits**		

This information is not guaranteed to be free from error omission. Heritage NSW and its employees disclaim liability for any act done or omission made on the information and consequences of such acts or omission.

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 4880c

Client Service ID : 736086

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
45-6-3214	Wigram & Hassall St AS	GDA	56	315825	6256231	Open site	Valid	Artefact : 1, Potential Archaeological Deposit (PAD) : 1		
	Contact	**Recorders**	Extent Heritage Pty Ltd - Pyrmont - Individual users,Mr.Alistair Hobbs					**Permits**	4043	
45-6-3503	32 Smith Street	GDA	56	315536	6256745	Open site	Partially Destroyed	Potential Archaeological Deposit (PAD) : 1		103963,103964,103965
	Contact	**Recorders**	AMAC Group P/L,Mr.Benjamin Streat					**Permits**	4268,4347	
45-6-3360	Parramatta Riverside PAD 1	GDA	56	315172	6256924	Open site	Valid	Potential Archaeological Deposit (PAD) : -, Artefact : -		
	Contact	**Recorders**	Biosis Pty Ltd - Sydney,Biosis Pty Ltd - Wollongong,Mr.James Cole,Mrs.Samantha K					**Permits**	4250,4379	
45-6-3625	Granville MPC PAD	GDA	56	316175	6254420	Open site	Not a Site	Potential Archaeological Deposit (PAD) : -		104230
	Contact	**Recorders**	Extent Heritage Pty Ltd - Pyrmont - Individual users,Ms.Fenella Atkinson					**Permits**	4352	
45-6-3692	VOC IF1	GDA	56	315044	6257297	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Artefact - Cultural Heritage Management - Pyrmont,Ms.Jennifer Norfolk					**Permits**	4900	
45-6-3630	Hassall St PAD	GDA	56	315587	6256244	Open site	Destroyed	Potential Archaeological Deposit (PAD) : 1		
	Contact	**Recorders**	Comber Consultants Pty Limited,Ms.Jillian Comber					**Permits**	4412,4527	
45-5-4942	Parramatta RSL Artefact Scatter 1 (PRSL AS-01)	GDA	56	314839	6256683	Open site	Destroyed	Artefact : -, Hearth : -		
	Contact	**Recorders**	Artefact - Cultural Heritage Management - Pyrmont,Artefact - Cultural Heritage Ma					**Permits**	4235,4949	
45-6-3679	Stage One PAD	GDA	56	315454	6256795	Open site	Not a Site	Artefact : -, Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Niche Environment and Heritage,Niche Environment and Heritage,Ms.Clare Anders					**Permits**	4522	
45-6-3582	Macquarie Street PAD	GDA	56	315306	6256602	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Miss.Alandra Tasire,Comber Consultants Pty Limited,Artefact - Cultural Heritage M					**Permits**		
45-5-5126	Cumberland West	GDA	56	314493	6257901	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
	Contact	**Recorders**	Comber Consultants Pty Limited,Ms.Jillian Comber					**Permits**	4363,4468	
45-6-3495	116 Macquarie St Parramatta	GDA	56	315700	6256475	Open site	Valid	Potential Archaeological Deposit (PAD) : 1, Artefact : -		103782
	Contact	**Recorders**	Comber Consultants Pty Limited,Comber Consultants Pty Limited,Ms.Alandra Tasir					**Permits**	4607,4651	

Report generated by AHIMS Web Service on 28/11/2022 for Melissa Moritz for the following area at Lat, Long From : -33.8379, 150.9935 - Lat, Long To : -33.8022, 151.0553. Number of Aboriginal sites and Aboriginal objects found is 102

This information is not guaranteed to be free from error omission. Heritage NSW and its employees disclaim liability for any act done or omission made on the information and consequences of such acts or omission.

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 4880c

Client Service ID : 736086

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
45-5-5010	Parramatta Park PAD_1	GDA	56	314400	6256580	Open site	Valid	Potential Archaeological Deposit (PAD) : -, Artefact : -		
	Contact	**Recorders**	Niche Environment and Heritage,Niche Environment and Heritage,Mr.Samuel Richa					**Permits**	4256,4698,4889	
45-5-5251	Western Sydney Stadium	GDA	56	314884	6257269	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Doctor.Jillian Comber,Comber Consultants Pty Limited					**Permits**		
45-6-3767	85-97 Macquarie St	GDA	56	315235	6256513	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Comber Consultants Pty Limited,Ms.Tory Stening					**Permits**	4627,4681	
45-6-3702	Smith St PAD1	GDA	56	315480	6256713	Open site	Destroyed	Artefact : -, Potential Archaeological Deposit (PAD) : 1		
	Contact	**Recorders**	Comber Consultants Pty Limited,Comber Consultants Pty Limited,Ms.Jillian Combe					**Permits**	4513,4756	
45-6-3837	Baludarri Drive PAD	GDA	56	316635	6256597	Open site	Not a Site	Potential Archaeological Deposit (PAD) : 1		
	Contact	**Recorders**	Extent Heritage Pty Ltd - Pyrmont - Individual users,Extent Heritage Pty Ltd - Pyrm					**Permits**	4657	
45-6-3801	APHS Stone and Glass Artefacts	GDA	56	315650	6256471	Open site	Partially Destroyed	Artefact : -, Hearth : -, Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	GML Heritage Pty Ltd - Surry Hills,GML Heritage Pty Ltd - Surry Hills,Doctor.Tim Ov					**Permits**	4808	
45-6-3827	Clyde PAD 01	GDA	56	317121	6254846	Open site	Valid	Potential Archaeological Deposit (PAD) : -, Artefact : -		
	Contact	**Recorders**	GML Heritage Pty Ltd - Surry Hills,Doctor.Tim Owen,Artefact - Cultural Heritage Ma					**Permits**		
45-6-3818	St Johns Cathedral Background Artefact Scatter	GDA	56	315165	6256458	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Doctor.Alan Williams,EMM Consulting - St Leonards - Individual users					**Permits**	4702	
45-6-3894	PLR Church St PAD and Artefacts	GDA	56	315241	6256871	Open site	Valid	Artefact : -, Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	GML Heritage Pty Ltd - Surry Hills,Doctor.Tim Owen					**Permits**	4900	
45-6-3895	PLR Macquarie St PAD	GDA	56	315787	6256398	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	GML Heritage Pty Ltd - Surry Hills,Doctor.Tim Owen					**Permits**		
45-6-3896	PLR George St PAD	GDA	56	316497	6256288	Open site	Valid	Potential Archaeological Deposit (PAD) : -		

Report generated by AHIMS Web Service on 28/11/2022 for Melissa Moritz for the following area at Lat, Long From : -33.8379, 150.9935 - Lat, Long To : -33.8022, 151.0553. Number of Aboriginal sites and Aboriginal objects found is 102

This information is not guaranteed to be free from error omission. Heritage NSW and its employees disclaim liability for any act done or omission made on the information and consequences of such acts or omission.

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 4880c

Client Service ID : 736086

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
	Contact	**Recorders**	GML Heritage Pty Ltd - Surry Hills,Doctor.Tim Owen					**Permits**	4900	
45-6-3897	PLR RTR Artefacts and PAD	GDA	56	316017	6256441	Open site	Valid	Artefact : -, Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	GML Heritage Pty Ltd - Surry Hills,Doctor.Tim Owen					**Permits**		
45-6-4048	Phillip St East PAD	GDA	56	315691	6256742	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	GML Heritage Pty Ltd - Surry Hills,Doctor.Tim Owen					**Permits**	4981	
45-6-4053	87-91 George St PAD	GDA	56	315633	6256560	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Urbis Pty Ltd - Angel Place L8 123 Pitt Street,Mr.Owen Barrett					**Permits**		
45-6-4015	Church St PAD-1	GDA	56	315118	6256622	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Biosis Pty Ltd - Wollongong,Biosis Pty Ltd - Wollongong,Mrs.Samantha Keats,Mrs.S					**Permits**	4960	
45-6-3992	PPS PAD 1	GDA	56	315168	6256871	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Biosis Pty Ltd - Wollongong,Mrs.Samantha Keats					**Permits**	4906	
45-6-4063	The Albion Hotel	GDA	56	315977	6256462	Open site	Valid	Potential Archaeological Deposit (PAD) : -		105061
	Contact	**Recorders**	Comber Consultants Pty Limited,Ms.Agata Calabrese					**Permits**		
45-6-4068	39-43 Hassall Street, Parramatta	GDA	56	315923	6256253	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Comber Consultants Pty Limited,Ms.Agata Calabrese					**Permits**		

**** Site Status**

Valid - The site has been recorded and accepted onto the system as valid

Destroyed - The site has been completely impacted or harmed usually as consequence of permit activity but sometimes also after natural events. There is nothing left of the site on the ground but proponents should proceed with caution.

Partially Destroyed - The site has been only partially impacted or harmed usually as consequence of permit activity but sometimes also after natural events. There might be parts or sections of the original site still present on the ground

Not a site - The site has been originally entered and accepted onto AHIMS as a valid site but after further investigations it was decided it is NOT an aboriginal site. Impact of this type of site does not require permit but Heritage NSW should be notified

Report generated by AHIMS Web Service on 28/11/2022 for Melissa Moritz for the following area at Lat, Long From : -33.8379, 150.9935 - Lat, Long To : -33.8022, 151.0553. Number of Aboriginal sites and Aboriginal objects found is 102

This information is not guaranteed to be free from error omission. Heritage NSW and its employees disclaim liability for any act done or omission made on the information and consequences of such acts or omission.

Appendix B – Water Pollution Impact Assessment

Rosehill Water Treatment Plants - Water Pollution Impact Assessment

Gamuda Laing O'Rourke Consortium
Sydney Metro West: Westmead to Sydney Olympic Park
Sydney
SC210108.01
27 June 2022

CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF PLATES

No table of contents entries found.

LIST OF APPENDICES

DOCUMENT CONTROL

Revision	Revision date	Revision details	Author	Editorial review	Technical review	Approver
0	16/06/2022	Draft for Client Review	D. Harris			
1	27/06/2022	Final for Issue	D. Harris			

DISTRIBUTION

Revision	Revision date	Issued to
1	27/06/2022	

DOCUMENT INFORMATION

Printed:	27 June 2022
Last saved:	27 June 2022 03:43 PM
File name:	
Author:	David Harris
Project manager:	David Harris
Client:	Gamuda Laing O'Rourke Consortium
Document title:	Rosehill Water Treatment Plants - Water Pollution Impact Assessment
Project number:	SC210108.01

EXECUTIVE SUMMARY

Gamuda Australia Laing O'Rourke Consortium (GALC) has recently been awarded the Western Tunnelling contract to deliver nine kilometres of twin metro rail tunnels between Sydney Olympic Park and Westmead, as part of a 24 km metro line between Westmead and the city. The Western Tunnelling Package (herein referred to as 'The Project'), includes all the construction of all tunnels, stations, and services facilities from Westmead to Sydney Olympic Park (**Figure 1**).

The Project is classified as Critical State Significant Infrastructure (CSSI) under the Environmental Planning & Assessment Act (1979). Conditions of Approval (CoA) for The Project have been specified by the Minister for Planning and Public Spaces for The Project.

To address conditions D117 and D118 of the CoA, The Project will construct and operate several water treatment plants (WTPs) throughout the duration of tunnel and station excavation for the treatment of groundwater seepage, Tunnel Boring Machine (TBM) process water, stormwater runoff, and washdown water. The Project WTPs will be installed and operated for construction stages only at Westmead, Parramatta, Clyde, and Rosehill.

Stormwater, groundwater and process-water from the construction of station boxes, shafts, and services facilities, and from tunnelling operations will be treated using the onsite construction water treatment plants, which will discharge treated effluent through approved discharge points into the storm water system and / or directly into receiving waterways (including the Parramatta River).

The key physical / chemical stressors and toxicants of concern that are likely to be present in feed water (based on available groundwater monitoring data, and construction activities) will vary from site to site but typically include the following parameters at varying concentrations:

- Stressors:
  - Salinity (electrical conductivity)
  - Turbidity
  - Nutrients: total nitrogen, nitrate, nitrite, total phosphorous, reactive phosphorous
- Toxicants
  - Non-metallic inorganics: ammonia
  - Metals: arsenic, cadmium, cobalt, copper, iron, lead, manganese, mercury, nickel, zinc
  - Polycyclic aromatic hydrocarbons: Benzo(alpha)pyrene, anthracene, phenanthrene
  - Fractionated hydrocarbons: Total Recoverable Hydrocarbons

Additional pollutants that may be introduced through water treatment plant processes include free chlorine (monochloramine, dichloramine), and halogenated methane (trihalomethane), which are introduced through the process of chemical oxidation that converts ammonia to oxidised nitrogen.

The following Water Pollution Impact Assessment (WPIA) has been developed to address condition D119 of the CoA and recommendations made by the NSW EPA (EPA) in assessing the potential impacts associated with effluent discharges from the Rosehill primary construction water treatment plant (50 L/s) and interim construction water treatment plant (5 L/s).

The assessment has included a review and summary of the following:

- Groundwater chemistry to assess the range and concentrations of contaminants in groundwater that will form feed water to the Rosehill primary and interim construction water treatment plants.
- Surface water chemistry and flow conditions to assess the condition of waterways that will receive discharges from the Rosehill primary and interim construction water treatment plants.
- Summary of water treatment plant processes to identify and quantify the water quality improvements, and estimate the likely water quality profile of effluents discharged from the Rosehill primary and interim construction water treatment plants.
- Assessment of potential impacts associated with effluent discharge from the Rosehill primary and interim construction water treatment plants considering flow conditions and ambient water chemistry of the receiving waterways.

The impact from effluent discharge has been assessed for the Duck River as this has been identified as the waterway that will receive effluent discharge from the Rosehill primary and interim construction water treatment plants. The discharge point has been relocated from Duck Creek to mitigate the environmental impact of effluent discharges from the construction water treatment plants.

The assessment has found that effluent discharges from the proposed Rosehill primary and interim construction water treatment plants will have a minimal impact on the water quality of Duck River as discharges are minimal compared to storage volume and tidal flow rates through the channel. Water quality improvements are expected for many water quality parameters in Duck River as effluent water quality is anticipated to be of better quality than the average conditions in Duck River reported through recent surface water monitoring activities.

The default ANZG / ANZECC criteria required under the CoA cannot be achieved for a set of pollutants including:

- Primary construction water treatment plant:
  - Total nitrogen, total phosphorous, chromium, zinc
- Interim construction water treatment plant
  - Total nitrogen, total oxidised nitrogen, total phosphorous, cobalt, copper, zinc

Discharge criteria for WTPs have been recommended as part of this DIA report, which may be included on the Environmental Protection Licence (EPL) for the purpose of regulating effluent discharges from the construction WTPs. The proposed discharge criteria account for a range of factors including the practical limitations of construction water treatment plants, flow conditions and attenuation capacity of receiving waterways, ambient chemistry of receiving waterways, and desired outcomes for Duck River under the NSW Water Quality Objectives (WQOs).

Of particular importance is setting practical and achievable targets for total nitrogen, accounting for the limitations of water treatment plants in removing forms of nitrogen from wastewater without biological treatment, which requires long residence times. Setting appropriate criteria for nitrate is also considered essential due to the significant environmental footprint of regenerating and/or replacing ion exchange media to meet the existing stringent ANZECC criteria for total oxidised nitrogen.

1 INTRODUCTION

1.1 Background

Sydney Metro West (SMW) is a new 24-kilometre metro line between Westmead and Sydney CBD providing a turn-up-and-go metro service. The planning approvals and environmental impact assessment for SMW will be broken down into a number of stages recognising the size of SMW. This includes:

- SMW at a Concept level
- Stage 1 – All major civil construction works between Westmead and The Bays including station excavation and tunnelling
- Stage 2 – All stations, depots and rail systems between Westmead and The Bays
- Stage 3 – Major civil construction works including station excavation, tunnels, stations, depots and rail systems between The Bays and the Sydney CBD Station, and operation of the line

Gamuda Australia Laing O'Rourke Consortium (GALC) has recently been awarded the Western Tunnelling contract to deliver nine kilometres of twin metro rail tunnels between Sydney Olympic Park and Westmead (**Figure 1**). The Western Tunnelling Package (herein referred to as 'The Project'), includes:

- Westmead Station box excavation, including temporary support, stub tunnels, partially mined station cavern and crossover cavern including permanent lining and support
- Parramatta Station, including excavation of station box and associated support
- Clyde Maintenance and Stabling Facility (MSF), including permanent dive structure, portal, spur running tunnels, spur tunnel junction cavern, bulk earthworks, civil structures, utilities corridor, road crossing and creek diversion
- Rosehill Services Facility, including shaft excavation, permanent lining and lateral support
- A precast segment manufacturing facility at Eastern Creek (subject to a separate approval and therefore not covered in this WPIA)
- Demolition and site clearance works at the following Construction Sites:
    - Westmead metro station construction site
    - Parramatta metro station construction site
    - Clyde Maintenance and Stabling Facility (MSF)

1.2 CONDITIONS OF APPROVAL

The Sydney Metro West Concept and major civil construction work for Sydney Metro West between Westmead and The Bays (Stage 1 of the planning approval process for Sydney Metro West), application number SSI-10038, were approved on 11 March 2021.

The Project is classified as Critical State Significant Infrastructure (CSSI) under the Environmental Planning & Assessment Act (1979). Conditions of Approval (CoA) for The Project have been specified by the Minister for Planning and Public Spaces for The Project, which include the following specific requirements for Water Quality:

- D117: Stage 1 of the CSSI must be designed and constructed so as to maintain the NSW Water Quality Objectives (NSW WQO) where they are being achieved as at the date of this approval, and contribute towards achievement of the NSW WQO over time where they are not being achieved as at the date of this approval, unless an EPL in force in respect of the CSSI contains different requirements in relation to the NSW WQO, in which case those requirements must be complied with
- D118: Unless an EPL is in force in respect to Stage 1 of the CSSI and that licence specifies alternative criteria, discharges from wastewater treatment plants to surface waters must not exceed:
    - the Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2018 (ANZG (2018)) default guideline values for toxicants at the 95 per cent species protection level
    - for physical and chemical stressors, the guideline values set out in Tables 3.3.2 and 3.3.3 of the Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000 (ANZECC/ARMCANZ)

- for bio-accumulative and persistent toxicants, the ANZG (2018) guidelines values at a minimum of 99 per cent species protection level

Where the ANZG (2018) does not provide a default guideline value for a particular pollutant, the approaches set out in the ANZG (2018) for deriving guideline values, using interim guideline values and/or using other lines of evidence such as international scientific literature or water quality guidelines from other countries, must be used

- D119: If construction stage stormwater discharges are proposed, a Water Pollution Impact Assessment will be required to inform licensing consistent with section 45 of the POEO Act. Any such assessment must be prepared in consultation with the EPA and be consistent with the National Water Quality Guidelines, with a level of detail commensurate with the potential water pollution risk
- D120: Drainage feature crossings (permanent and temporary watercourse crossings and stream diversions) and drainage swales and depressions must be carried out in accordance with relevant guidelines and designed by a suitably qualified and experienced person

To address conditions D117 and D118 of the CoA, The Project will construct and operate a number of treatment plants (water treatment plants) throughout the duration of tunnel and station excavation for the treatment of groundwater seepage, Tunnel Boring Machine (TBM) process water, stormwater runoff from excavations, and washdown water The Project water treatment plants will be installed and operated for construction stages only at Westmead, Parramatta, and Rosehill.

1.3 New South Wales Environment Protection Agency Advice

On 26 June 2020 the New South Wales (NSW) Environment Protection Agency (EPA) issued a letter advice to the Department of Planning, Industry and Environment (DPIE) in response to the Environmental Impact Statement (EIS) for The Project.

The letter issued by the NSW EPA detailed advice and recommendations regarding noise and vibration, water quality, hydrogeology, contamination, and waste. The EPA's recommendations in regarding water quality are summarized in **Table 1** and have been addressed at the current available level of detail as part of this WPIA.

Table 1. NSW EPA Advice Regarding the Preparation of Discharge Impact Assessments

Management Framework	Objectives	Relevant Section of Report
Water Quality Management Framework	A clear statement(s) on the adopted protection levels for each affected waterway	Section 4
	Information on existing water quality characterising each waterway, including categories for pollutants	Section 3.7
	Assessment of whether water quality objectives are currently being met in each waterway	Section 3.7
Construction Stage Wastewater Management Framework	Wastewater Pollution Impact Assessment is provided for wastewater treatment plants	Section 6
	Characterise the groundwater / water quality at each site to inform the selection of appropriate water treatment processes	Section 3.5, 5.3, and 5.4
	Detail proposed wastewater treatment processes including the treatment technology/units and the pollutants being treated	Section 5.3, 5.4
	Detail expected plant discharge water quality under typical and worst-case conditions	Section 5.3, 5.4
	Identify and estimate the quality and quantity of all pollutants that may be introduced into the water cycle at each discharge point	Section 5.3, 5.4
	Assess the potential impact of discharges on the environmental values of the receiving waterway, including typical through to worst-case scenarios, with reference to the relevant guideline values consistent with the National Water Quality Guideline	Section 6
	Where a mixing zone is required, demonstrate how the National Water Quality Guideline criteria for relevant chemical and non-chemical parameters are met at the edge of the initial mixing zone of the discharge	N.A.
	Demonstrate how the proposal will be designed and operated to protect the Water Quality Objectives for receiving waters where they are currently being achieved	Section 5, 6
	Demonstrate how the proposal will be designed and operated to contribute towards achievement of the Water Quality Objectives over time where they are not currently being achieved	Section 5, 6
	Demonstrate that all practical and reasonable measures to avoid or minimise water pollution and protect human health and the environment from harm are investigated and implemented	Section 5.3, 5.4

1.4 Objectives

The following report provides a Water Pollution Impact Assessment (WPIA) for the **Rosehill Temporary Construction Water Treatment Plant** and **Rosehill Primary Construction Water Treatment Plant** to address condition D119 of the CoA and recommendations made by the NSW EPA (EPA) in response to the published Environmental Impact Assessment (EIA) for the Project. Specifically, this WPIA provides the following information:

- A review of existing (baseline) information on groundwater quality along the Tunnel alignments and station excavations
- A review of existing (baseline) information on surface water quality in waterways which may be affected by construction stage discharges
- A summary of the sources, chemistry, and inflow rates of waters that will be managed by each construction water treatment plant
- Identification of pollutants that are present at elevated concentrations in groundwater including pollutants which may present a risk of exceeding the water quality objectives (WQOs) in receiving waterways
- A summary of the proposed treatment processes at each construction water treatment plant, including the proposed treatment technologies and expected outcomes against the desired WQOs under typical and reasonable worst-case conditions
- Demonstration of how the proposed water treatment plants will be designed and operated to:
  - Protect the Water Quality Objectives for receiving waters where they are currently being achieved
  - Contribute towards achievement of the Water Quality Objectives over time where they are not currently being achieved
  - Demonstrate that all practical and reasonable measures to avoid or minimise water pollution and protect human health and the environment from harm are investigated and implemented
- Assessment the potential impact of discharges on the environmental values of the receiving waterway, including typical through to worst-case scenarios, with reference to the relevant guideline values consistent with the National Water Quality Guideline
- Where a mixing zone is required, demonstration of how the National Water Quality Guideline criteria for relevant chemical and non-chemical parameters are met at the edge of the initial mixing zone of the discharge

1.5 Scope of Works

The following scope of works has been completed to address the objectives of the DIA in assessing the water quality impacts resulting from water treatment plant effluent discharges.

- Identification of the regulatory framework and guidelines governing the assessment and management of discharges to water, including:
  - Protection of the Environment Operations Act (1997)
  - Environmental Protection Licence (EPL 21600)
  - New South Wales (NSW) Water Quality Objectives (WQOs)
  - ANZECC (2000) and ANZG (2018) Guidelines
- Review and summary of the catchment environment conditions in waterways that will receive discharge from the project construction water treatment plants, including:
  - Hydrological and hydro-ecological conditions
  - Baseline water quality, including concentrations of toxicants and physical / chemical stressors in groundwater and surface water
- Review of assigned environmental values for the catchment and associated waterways with reference to the NSW Water Quality Objectives
- Identification of the project conceptual model for water treatment, including:
  - Proposed location of the Rosehill construction water treatment plant

  - Sources of influent to the Rosehill construction water treatment plant and anticipated influent water quality
  - Proposed water treatment plant design and water quality treatment processes
  - Anticipated effects of water treatment plant processes on water quality
  - Expected compliance against NSW Water Quality Objectives under typical and worst-case conditions
  - Proposed discharge regime from construction water treatment plants to receiving waterways
- Proposed water treatment plant discharge criteria for all relevant analytes including a justification for proposed discharge criteria submitted with the tender
- Proposed adaptive management measures and contingency options for water treatment and discharge

1.6 Supporting Documents

The following background and supporting documents have been used to guide and support this DIA:

- Department of Planning, Industry and Environment (2021): Conditions of Approval for Sydney Metro West – Concept and Stage 1 Construction (SSI 10038), NSW Government.
- GALC (2022): Soil and Water Management Plan, Sydney Metro West – Western Tunnelling Package, Gamuda Australia Laing O'Rourke Consortium (GALC).
- GALC (2022): Groundwater Management Plan, Sydney Metro West – Western Tunnelling Package, Gamuda Australia Laing O'Rourke Consortium (GALC).
- GALC (2022): Hydrogeological Interpretive Report, Sydney Metro West – Western Tunnelling Package, Gamuda Australia Laing O'Rourke Consortium (GALC).
- Jacobs (2020a): Sydney Metro West, Technical Paper 7: Hydrogeology, Document reference report prepared for Sydney Metro Authority.
- Jacobs (2020b): Sydney Metro West, Technical Paper 8: Contamination, Document reference report prepared for Sydney Metro Authority.
- Jacobs (2020c): Sydney Metro West, Technical Paper 9: Hydrology and Flooding, Document reference report prepared for Sydney Metro Authority.
- NSW EPA (2020): Sydney Metro West (SSI 10038): Advice on the Environmental Impact Statement. June 2020.

Jacobs (2020d), Sydney Metro West, Environmental Impact Statement Chapter 19: Soils and Surface Water Quality – Stage 1, Document reference report prepared for Sydney Metro Authority.

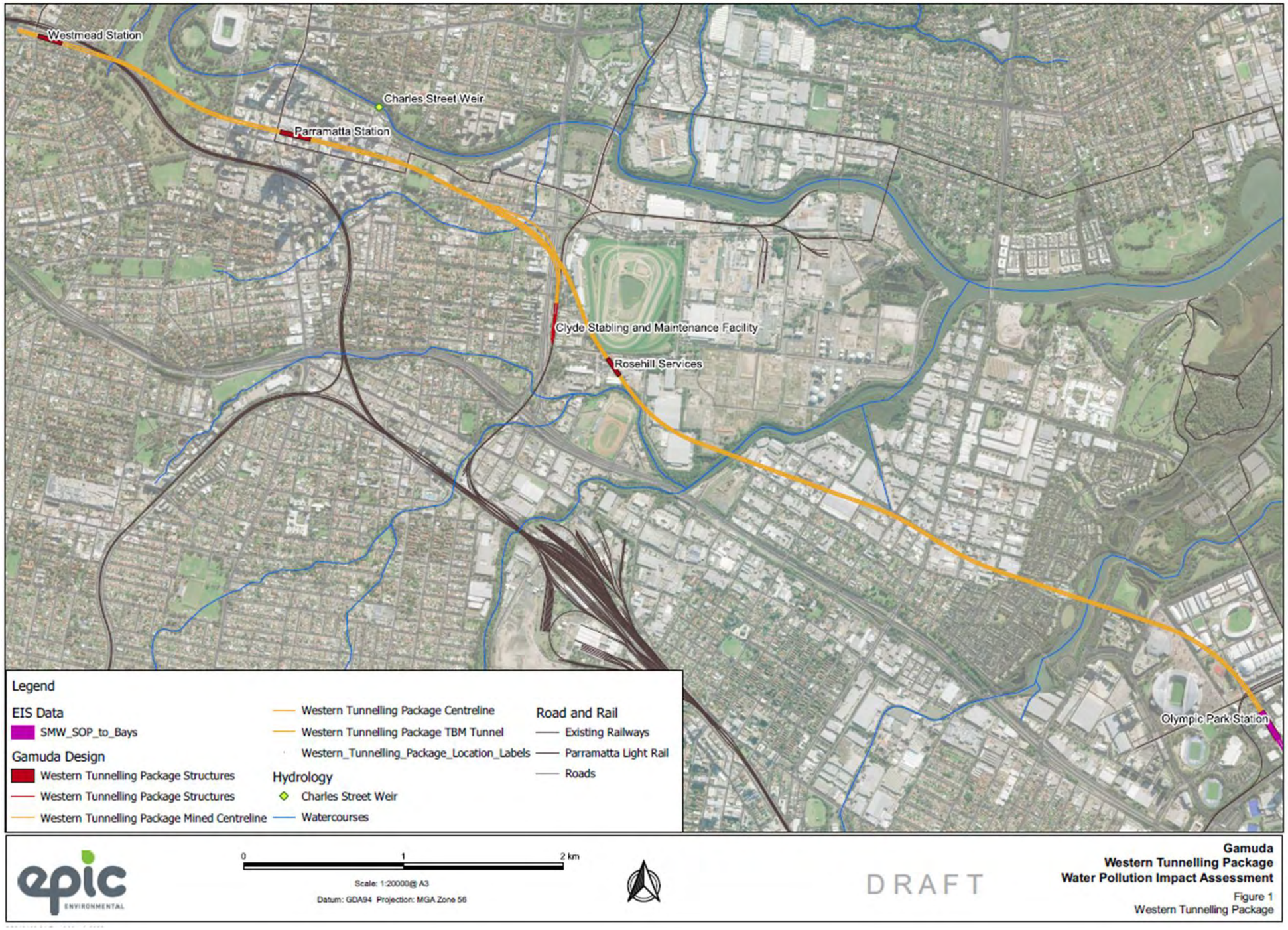


Figure 1. Western Tunnelling Package

2 REGULATORY FRAMEWORK AND GUIDELINES

Table 2. Regulatory Framework and Guidelines for Wastewater Discharges in NSW

Document	Description
Protection of the Environment Operations Act 1997 (POEO Act)	The Protection of the Environment Operations Act 1997 (POEO Act) is the key piece of environment protection legislation administered by the EPA. The EPA is the appropriate regulatory authority and licencing body for the activities specified in Schedule 1 of the POEO Act (scheduled activities), which includes road construction (part 35). Under Section 120 of the POEO Act "A person who pollutes any waters is guilty of an offence". The definition of waters includes: 1. Any river, stream, lake, lagoon, swamp, wetlands, unconfined surface water, natural or artificial watercourse, dam or tidal waters (including the sea), or 2. Any water stored in artificial works, any water in water mains, water pipes or water channels, or any underground or artesian water. The EPA can issue a licence to regulate water pollution from a non-scheduled activity. If it does, the EPA becomes the regulator for all environmental impacts from the activity under the POEO Act instead of the local council.
Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018 and ANZECC, 2000)	The Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Water Quality Guidelines provide authoritative guidance on the management of water quality for natural and semi-natural water resources in Australia and New Zealand. The ANZG (2018) guidelines include default guideline values (DGVs) that are used as a generic starting point for assessing water quality. The DGVs are not mandatory and have no legal status, however, are commonly incorporated into water quality protection policy and regulatory tools for state, territory and local jurisdictions (including the NSW Water Quality Objectives). DGVs have been developed for guidance with aquatic ecosystems, primary industries, drinking water, recreation, and aesthetics. The NWQMS advocates use of weight-of-evidence process above rigid application of guideline values to determine if water quality represents a risk to a particular community value. The Water Quality Management Framework can be used to assess compliance or any current or potential impacts of a waste discharge on water/sediment quality. Assessing a waste discharge in this way aims to ensure that it complies with the conditions of approval and is not causing environmental harm. Consideration of whether water/ sediment quality objectives are achievable is a key step in the management framework for assessing waste discharges.
New South Wales Water Quality and River Flow Objectives	Water quality represents the physical, chemical, and biological characteristics of water and measures the ability of a waterbody to support beneficial uses including uses for people and the environment. The NSW Water Quality Objectives are the agreed environmental values and long-term goals for water quality in surface waters of New South Wales. They set out: 1. The community's agreed values and uses for our rivers, creeks, estuaries and lakes (i.e., healthy aquatic life, water suitable for recreational activities like swimming and boating, and drinking water) 2. A range of water quality indicators to help us assess whether the current condition of our waterways supports those values and uses The River Flow Objectives are the agreed high-level goals for surface water flow management. They identify the key elements of the flow regime that protect river health and water quality for ecosystems and human uses.

3 BASELINE ENVIRONMENTAL CONDITIONS

3.1 Catchment Context

The Project (Western Tunnelling Package) is located within the Parramatta River catchment (**Figure 2**). The catchment covers an area of approximately 252 km^2 (Roper et al., 2011) and can be broadly subdivided into two key sections comprising: i) The Upper Parramatta River and ii) The Lower Parramatta River, which are separated by the Charles Street Weir.

The Parramatta River is the main tributary of Sydney Harbour and extends from Blacktown Creek in the west to where it meets the Lane Cove River in the east. There are 34 tributary creeks to the Parramatta River, including:

- Domain Creek
- Hunts Creek
- Darling Mills Creek
- Bellamys Creek
- Blue Gum Creek
- Bell Bird Creek
- Hawthorne Creek
- Iron Cove Creek
- Powells Creek
- Tarban Creek
- A'Becketts Creek
- Vineyard Creek
- Excelsior Creek
- Saw Mill Creek
- Christmas Bush Creek
- Stevenson Creek
- Rifle Range Creek
- Northmead Gully Creek
- Charity Creek
- Archer Creek
- Haslams Creek
- Duck River
- Glades Creek
- Finlaysons Creek
- Coopers Creek
- Pendle Creek
- Girraween Creek
- Blacktown Creek
- Toongabbie Creek
- Clay Cliff Creek
- Subiaco Creek
- The Ponds Creek
- Duck Creek
- Grove Creek

The Rosehill Services Facility, Clyde Dive and Clyde Maintenance and Stabling Facility are located in the lower reaches of the Duck River sub-catchment (identified in **Figure 2**), which resides in the Lower Parramatta River Catchment.

The Duck River sub-catchment covers an area of approximately 42 km^2 and includes Duck River, Duck Creek and A'Becketts Creek.

Detailed mapping of the Duck River sub-catchment has been undertaken as part of investigations commissioned by Parramatta City Council (Applied Ecology, 2012; Molino Stewart, 2012).

A Further discussion of the baseline environmental conditions including geology, hydrogeology, hydrology, and water quality is provided in the following sections.

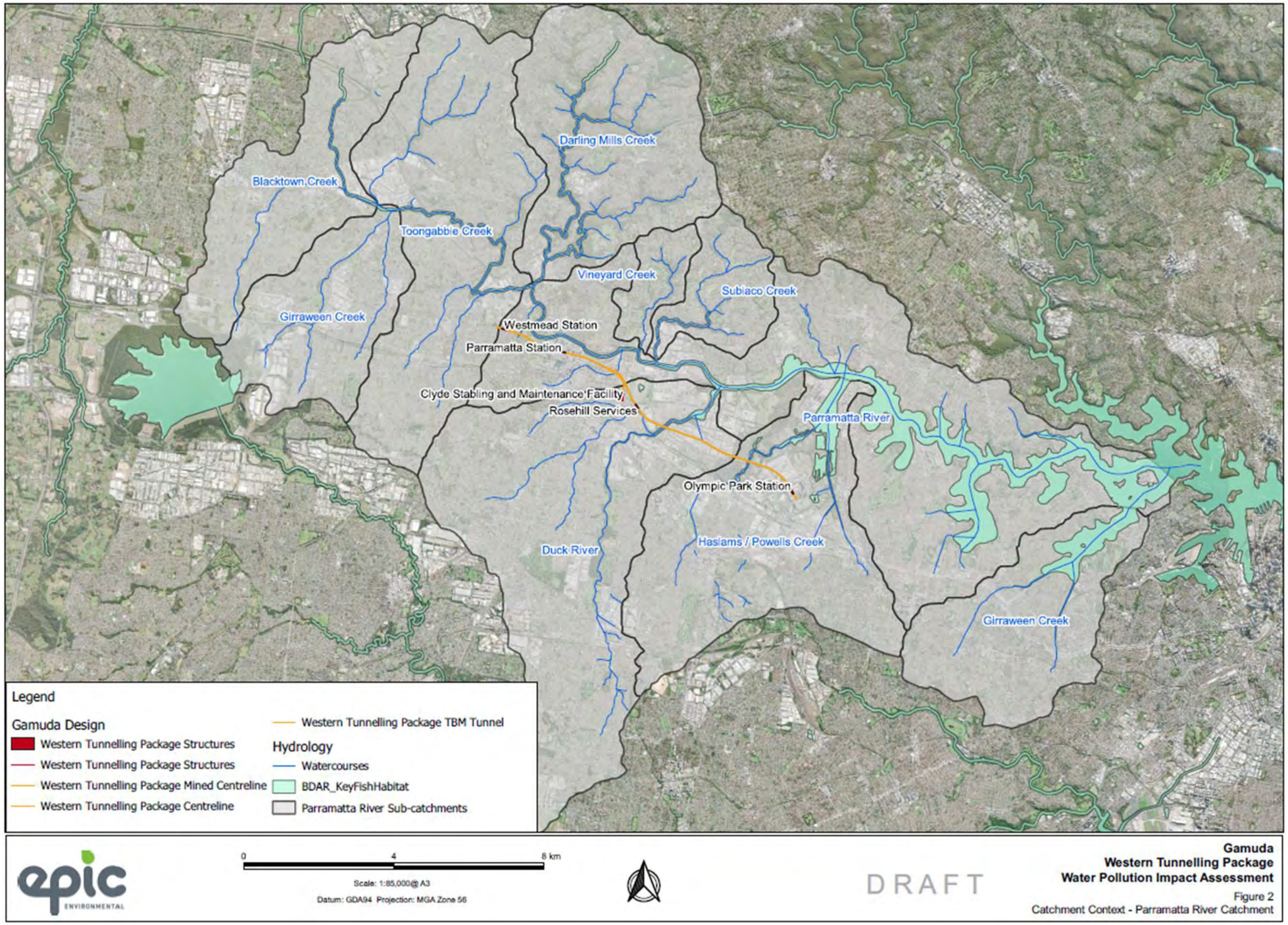


Figure 2. Catchment Context

3.2 Geology and Hydrogeology

3.2.1 Geology

The geology across the area of The Project and the Parramatta River Catchment is described in the Department of Mineral Resources the 1:100,000 Geological Sheet 9130 for Sydney (Herbet, 1983). The mapped geological units are presented in **Figure 3.**

Information derived through the geological mapping indicates that geological units can be broadly sub-divided into: i) unconsolidated / semi-consolidated deposits belonging to Cainozoic Era (66 Ma to current) sediments, and ii) older consolidated Mesozoic Era (252 to 66 Ma) sediments.

Cainozoic geological units typically comprise unconsolidated to semi-consolidated sediments present within and adjacent to existing waterways in response to geomorphic processes. These sediments include:

- Anthropogenic System Deposits
  - Qmx – Modern disturbed land
  - Qmxe – Modern reclaimed estuarine areas
  - Qmxf – Modern fill on Quaternary deposits
  - Qmw – Modern stored water, pondage, reservoirs, canals

- Estuarine Plain System Sediments
  - Qhes – Holocene saline swamp: organic mud, peat, clay, silt marine sand, fluvial sand

- Subaqueous System Sediments
  - Qhac – Holocene alluvial channel: alluvial sand, gravel, silt, clay
  - Qhec – Holocene estuarine channel: marine sand, silt, clay, shell, gravel

- Alluvial Plain System Sediment
  - Qpat – Pleistocene terrace: silt, clay, fluvial sand, gravel
  - Qav – Quaternary valley fill: silt, clay, fluvial sand, gravel

Mesozoic geological units typically comprise consolidated sediments that have been variably weathered, fractured, rotated, and faulted from tectonic and deformation and uplift. The Mesozoic units present along the project area include:

- Twia – Middle Triassic Ashfield Shale: Dark grey to black sideritic siltstone, slightly carbonaceous near the base, faint siltstone laminae near the top
  - Kellyville Laminite: dark grey to black sideritic claystone to siltstone laminae, interbedded with light grey siltstone to fine-grained, quartz-lithic sandstone laminae
  - Mulgoa Laminite: dark grey to black sideritic siltstone, interbedded with fine-grained, light grey, quartz-lithic sandstone to form a aminate in beds less than 10 mm thick. Sandstone beds sporadically micro-cross bedded with silt-infilled burrows
  - Regentville Siltstone: black to dark grey sideritic siltstone, with sporadic thin zones of very fine-grained, light grey sandstone laminae throughout
  - Rouse Hill Siltstone: dark grey to black sideritic siltstone, slightly carbonaceous near the base, faint siltstone laminae near the top

- Tuth – Hawkesbury Sandstone: medium- to coarse-grained quartz sandstone with minor shale and laminite lenses.

At Rosehill and Clyde the geological units that will be encountered will include both Cainozoic (clays, silts, sands, and gravels) and Mesozoic sediments (shale, siltstone, and sandstone).

3.2.2 Hydrogeology

Several hydrogeological investigations (Jacobs, 2020; GALC, 2021) and a number of groundwater monitoring events (Golder | Douglas: 2021a; 2021b; 2022; 2020a; 2020b; 2019a; 2019b; 2019c; 2019d; 2018a; 2018b; 2018c) have been undertaken as part of EIS and detailed design stage investigations for the Project.

Three principal hydrostratigraphic units within the Rosehill and Clyde construction areas, including an alluvial aquifer (associated with Quaternary sediments), a shale aquifer (associated with the Ashfield Shale) and a sandstone aquifer (associated with the Hawkesbury Sandstone) (identified in **Figure 3**).

The Quaternary alluvial aquifer occurs locally around watercourses and typically exhibits brackish water quality in the Lower Parramatta River catchment. The permeability and hydraulic conductivity of Quaternary alluvium is highly variable in response to varying proportions of sand and clay that make up the geological matrix.

The aquifer associated with the Ashfield Shale is a fractured rock aquifer, possessing a low hydraulic conductivity and low yield. The shale aquifer has little groundwater flowing into it and also acts as a partial barrier to groundwater recharge into the underlying Hawkesbury Sandstone.

The Hawkesbury Sandstone is a formation of horizontally bedded sandstone, with variable hydraulic conductivity, which hosts a generally confined fractured rock aquifer. Most of the groundwater within the Hawkesbury Sandstone migrates through features such as fractures, joints, shears and bedding planes, however some intra-granular flow (groundwater flow between grains in rock) also occurs.

A summary of the hydrogeological properties of the key geological units associated with conditions at Rosehill are presented in

Table 3. Key Hydrogeological Properties for Geological Units at Rosehill

Material	Groundwater Levels (m AHD)	Hydraulic Conductivity (m/day)	Specific Yield	Hydrogeological Condition
Fill / Alluvium	1.95 to 5.30	0.01 to 0.2 (0.08 expected)	0.1 to 0.3 (0.2 expected)	Unconfined Aquifer
Dyke	No Data	0.05 to 0.2 (0.1 expected)	No Data	Confined Aquifer
Siltstone	3.2	0.01 to 0.02 (0.016 expected)	No Data	Unconfined / Semi-Confined Aquifer
Shale / Siltstone	3.2	0.00086 to 0.05 (0.01 expected)	0.01 to 0.1 (0.03 expected)	Aquitard
Sandstone	No data	No data	0.01 to 0.1 (0.03 expected)	Unconfined / Semi-Confined Aquifer

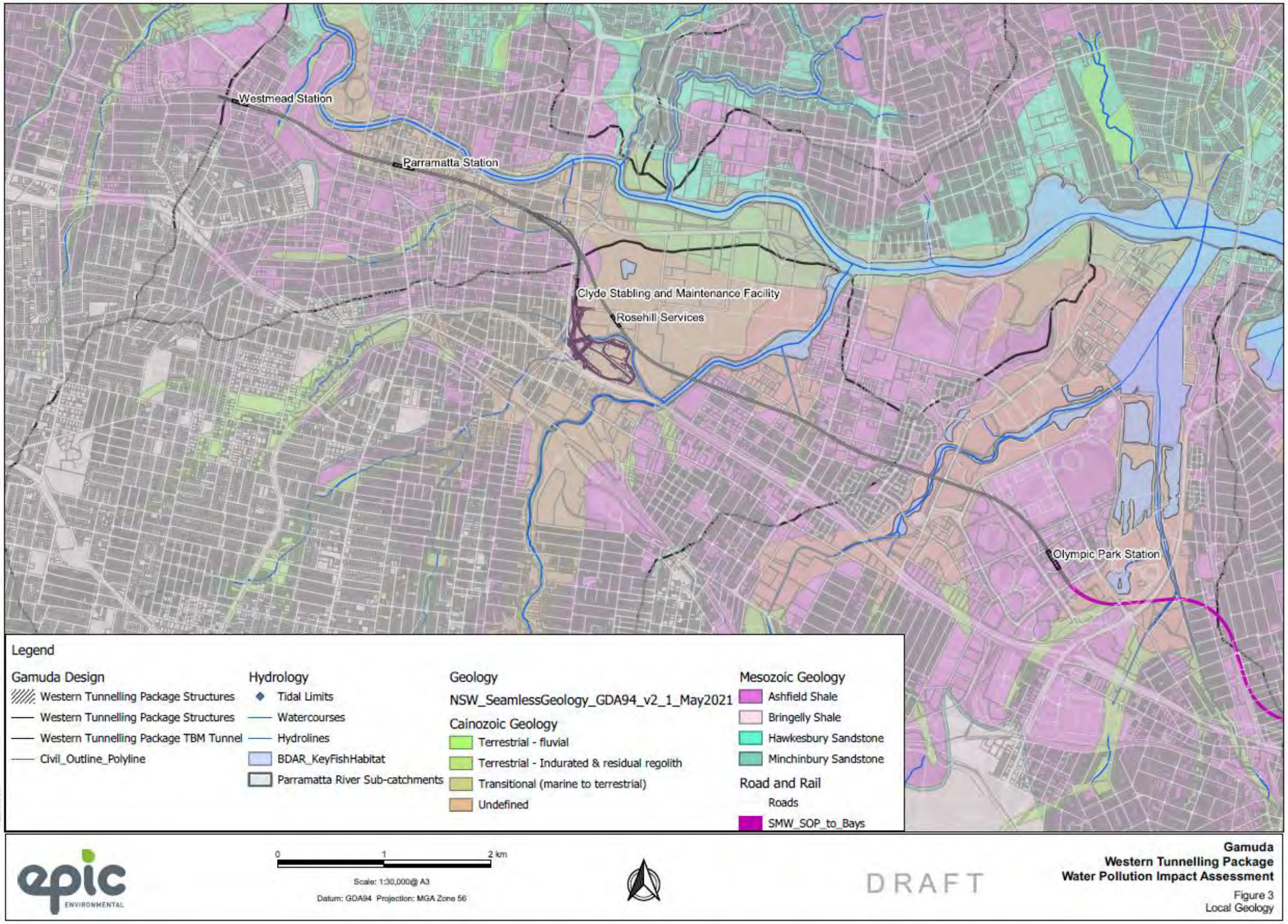


Figure 3. Local Geology

3.3 Land Use

The land use along the Western Tunnelling Package between Westmead and Sydney Olympic Park is reflective of a highly urbanised metropolitan catchment. The tunnelling package will include surface works at Westmead, Parramatta, Rosehill and Clyde, along with twin tunnels from Westmead to Sydney Olympic Park. Both surface and tunnelled sections of the project intersect a range of land use categories, including:

- Childcare
- Educational
- Medium Density Residential
- Community Use
- Commercial
- Industrial
- Residential
- Low Density Residential
- Commercial (Medical)
- Industrial/ Urban Services
- Recreational
- Transport and Infrastructure

Contamination impacts for soil and groundwater are typically closely aligned with land use categories. Contaminated lands are typically encountered in areas that have been (or are currently) used for industrial or agricultural activities, as individual sites that store chemicals, or as other potentially contaminating sites such as service stations and dry cleaners.

Land use mapping for the Western Tunnelling Package is presented in **Figure 4**.

The following sections explore land use categories present along the project alignment for running tunnels between Westmead and Sydney Olympic Park, and at the project areas comprising Clyde Dive, Clyde MSF, and Rosehill Services Facility.

3.3.1 Clyde Dive

The Clyde Dive structure construction site includes an elongate parcel of land along James Ruse Drive between Unwin Street and Grand Avenue. Land use along the Clyde Dive construction site comprises transport and infrastructure corridor. Adjacent land use includes recreational land associated with Rosehill Racecourse to the east and residential / commercial lots on the western side of James Ruse Drive.

3.3.2 Clyde Maintenance and Stabling Facility

The Clyde Maintenance and Stabling Facility (MSF) construction site includes land along James Ruse Drive, and the land between Duck Creek and Duck River north of the Western Motorway. Land uses within and around the Clyde MSF includes:

- Recreational land use associated with the former Sydney Speedway
- Transport and infrastructure corridor
- Industrial land use associated with former industrial activities, including metal merchants, fertiliser supplies, foundry, automotive paints, heavy haulage, steel fabrication, oil and fuel heating products, lubricant distribution and manufacturing, and electroplating services.

3.3.3 Rosehill Services Facility

The Rosehill Services Facility construction site includes land between Duck Creek and Unwin Street, east of James Ruse Drive, and west of Shirley Street. Land uses within and around the Rosehill Services Facility comprises industrial land use associated with former industrial activities, including:

- Bitumen spraying
- Fertiliser supplies
- Aluminium smelting
- Petroleum and coal product manufacturing
- Non-metallic mineral mining and quarrying
- Manufacturing - cement, concrete or lime
- Substations and switching stations
- Chemical manufacturing

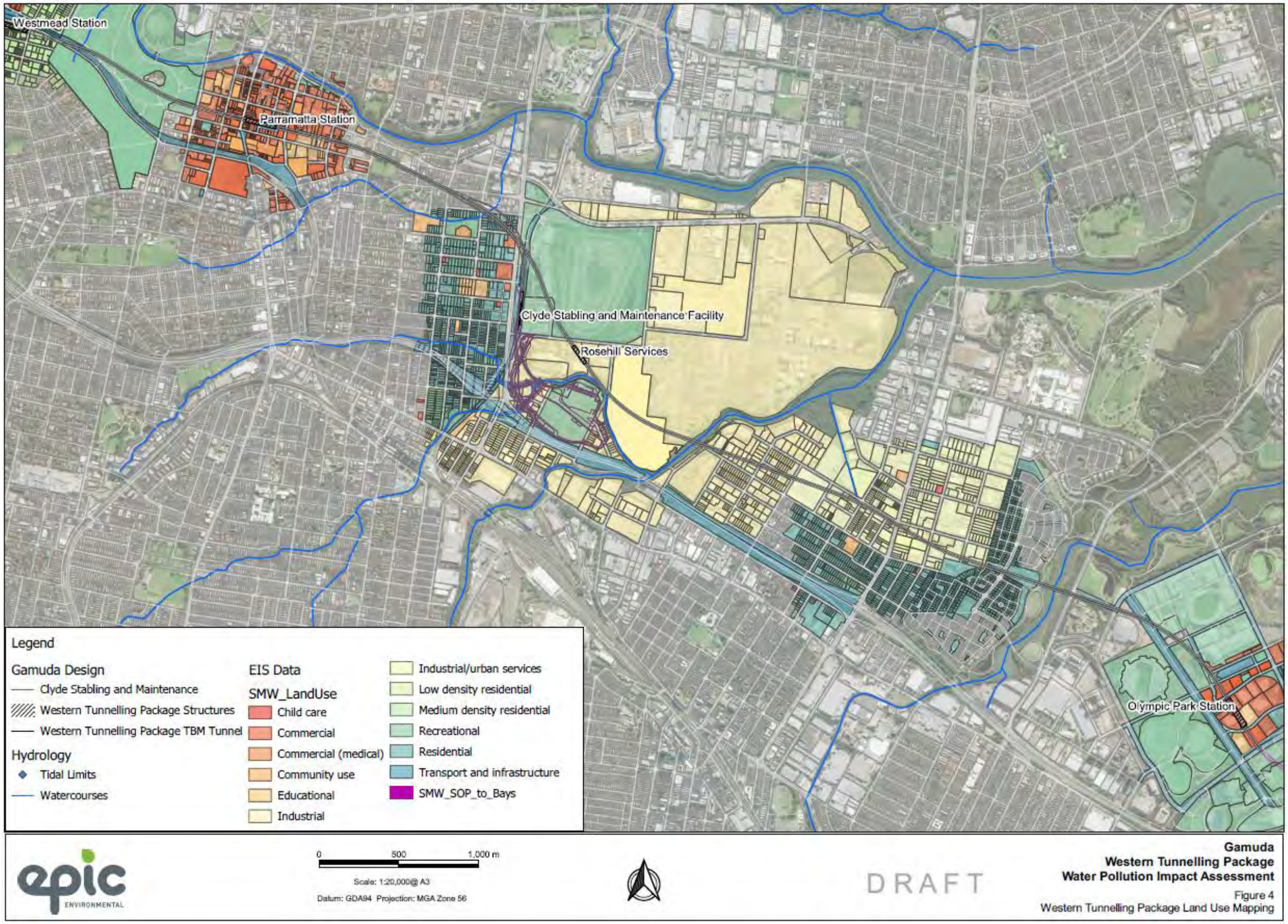


Figure 4. Land Use Mapping

3.3.4 Running Tunnels

The running tunnels will be advanced below ground between Westmead and Sydney Olympic Park as part of project delivery. Tunnels will be shallowest at stations and at the tunnel portal with depth typically increasing between stations and facilities.

The land use along the alignment varies significantly, with the tunnels passing beneath a range of land uses, including all of the categories identified in Section 3.3, along with known landfills (e.g., Sydney Olympic Park).

3.4 Contamination

3.4.1 Clyde Dive

Limited information is available on the contamination status of lands within and around the Clyde Dive construction site. Land use mapping indicates that the site is located within an infrastructure corridor and adjacent to recreational lands associated with Rosehill Racecourse. Information made available through EIS stage investigations indicates elevated contaminants in soil typical of urban pollution and comprising:

- Heavy metals (Cu, Ni, Zn)
- Benzo(a)pyrene

3.4.2 Clyde Stabling and Maintenance Facility and Rosehill Services Facility

Clyde stabling and maintenance facility construction site, Rosehill Services Facility and sections of the mainline tunnel through Rosehill have been classified as having a moderate potential for impacted by soil, groundwater and vapour contamination associated with the current and historical activities carried out on and/or adjacent to the site (as discussed in Section 3.3), including:

- Industrial land use
- Industrial land use on adjoining sites
- Vehicle maintenance at Sydney Speedway (location on NSW Government owned land)
- Historical land reclamation around on-site waterways
- Heliport operations
- Known groundwater contamination on adjoining or nearby sites (James Hardie and Clyde Refinery)
- Landfilling of asbestos and PFAS containing wastes
- Possible inappropriate management (during demolition) and/or degradation of hazardous building materials within current and former on-site structures.

Contaminants of concern include:

- Nutrients (nitrogen, ammonia, nitrate, nitrite)
- Heavy metals (Al, As, Cd, Cr, Co, Cu, Pb, Ni, Mn, Hg, Ni, Zn)
- Hydrocarbons (TRH, BTEXN, PAH)
- Pesticides (OCPs, OPPs)
- Polychlorinated Biphenyls
- Asbestos
- Volatile Organic Compounds

3.4.3 Running Tunnels

The running tunnels will be advanced below ground between Westmead and Sydney Olympic Park as part of project delivery. Tunnels will be shallowest at stations and at the tunnel portal with depth typically increasing between stations and facilities.

At and between stations and facilities, sections of the tunnel may be impacted by both soil/ rock and groundwater contamination associated with the historic land use activities overlying the tunnel sections. Key risks include sites of former industrial land use, and sites of former or current landfilling activities (e.g., Sydney Olympic Park).

Contaminants of concern include:

- Nutrients (nitrogen, ammonia, nitrate, nitrite)
- Heavy metals (Al, As, Cd, Cr, Co, Cu, Pb, Ni, Mn, Hg, Ni, Zn)
- Hydrocarbons (TRH, BTEXN, PAH)
- Pesticides (OCPs, OPPs)
- Polychlorinated Biphenyls
- Volatile Organic Compounds

3.5 Groundwater Quality

3.5.1 EIS Investigations

Groundwater monitoring has been completed between 2018 and 2021 as part of geotechnical and environmental baseline investigations overseen by Sydney Metro.

Groundwater samples collected as part of the baseline monitoring activities were submitted for laboratory testing for screening of contaminants of concern against water quality standards.

The laboratory testing results from the groundwater monitoring are summarized in **Table 4** for all pollutants and stressors that have been recorded at non-trivial levels (i.e., concentrations exceeding ANZECC / ANZG Default Guideline Values (DGVs)).

For the purpose of this assessment the ANZECC 2000 default guideline values (DGVs) for stressors and ANZG 2018 DGVs at 95% and 99% species protection have been used as benchmark and screening criteria. Where marine guideline values are not available, equivalent freshwater guideline values have been adopted as screening criteria. **Appendix A** presents the laboratory testing results for all parameters screened against the EIS criteria.

Table 4. Western Tunnelling Package - Groundwater Sampling Summary Results (2021)

Parameter	ANZG / ANZECC DGV (Marine /Estuarine)	Westmead Mesozoic	Parramatta Cainozoic	Parramatta Mesozoic	Clyde MSF Cainozoic	Clyde MSF Mesozoic	Rosehill Cainozoic	Rosehill Mesozoic	Sydney Olympic Park Mesozoic
Electrical Conductivity (µs/cm)	-	5780-17400	490-754	339 - 7680	588-33200	2550 - 11600	21200 - 25400	25100	16400 - 48700
pH (units)	6.5-8.5	7.3 - 8.2	6.9 - 7.2	6.7 - 7.8	6.46 - 7.43	6.17 - 7.55	6.27 - 7.58	7.45	6.96 - 7.22
T. Nitrogen	300	500 - 3300	100 - 5700	160 - 3450	200 – 16,900	200 - 2400	730 - 1800	6100	1700 - 7000
T. Ammonia	910	370 - 3380	120 - 280	400 - 3500	10 – 15,300	30 - 2300	1100 - 1800	5660	1640 - 6890
R. Phosphorus	5	10 - 60	10	10 - 40	10 - 100	10	10	10	10 - 50
T. Phosphorus	30	20 - 50	10 - 240	10 - 140	30 - 640	20 - 40	20 – 2100	20	20 - 160
Arsenic	2.3	1 - 6	1 - 5	1	1 - 49	1 - 17	1 - 2	1	2 - 10
Cadmium	0.7	0.1	0.1	0.1	0.1 - 1	0.1 - 0.6	0.1	0.1	0.1 - 1
Chromium	4.4	1	1	1	1 - 20	1	1 - 2	1	1 - 10
Cobalt	1.0	1 – 3	1 - 5	1 – 13	1 - 28	1 - 70	4 - 62	1	8 - 10
Copper	1.3	1	1	1 - 6	1 - 10	1	2 - 3	1	1 - 10
Iron	300	50 - 1,240	4.2 - 3880	50 - 2150	440 - 42700	50 - 14100	3000 - 50300	1270	1120 - 12000
Lead	4.4	1	1	1	1 - 10	1	1	1	1 - 10
Manganese	1,900	72 - 176	54 - 171	29 - 478	143 - 1460	376 - 1230	151 - 889	384	441 - 3100
Mercury	0.1	0. 1 – 1	0.05 - 0.1	0.1	0.1 - 0.3	0.1	0.1	0.1	0.1
Nickel	70	2 – 3	1 - 3	1 - 182	1 - 10	1 - 49	1 - 37	2	2 - 67
Zinc	8	5 – 11	5 - 16	5 - 26	5 - 50	5 - 278	5 - 697	5	5 - 73
Toluene	180	<1	<1	<1	<1 - 333	<1	<1	<1	<1
Anthracene	0.01	<1	<1	<1	<1– 4.1	<1	<1	<1	<1
Fluoranthene	1	<1	<1	<1	<1– 1.3	<1	<1	<1	<1
Naphthalene	16	<1	<1	<1	<1 – 414	<1	<1	<1	<1
Phenanthrene	0.6	<1	<1	<1	<1 – 12.5	<1	<1	<1	<1

Parameter	ANZG / ANZECC DGV (Marine /Estuarine)	Westmead Mesozoic	Parramatta Cainozoic	Parramatta Mesozoic	Clyde MSF Cainozoic	Clyde MSF Mesozoic	Rosehill Cainozoic	Rosehill Mesozoic	Sydney Olympic Park Mesozoic
Total Recoverable Hydrocarbons	100	<100	<100	<100	<100	<100	<100 – 1,200	<100	<100

Note: Cainozoic alluvium is not present around Westmead Station
All values in µg/L unless otherwise specified
Value exceeds ANZG / ANZECC DGV

A review of the monitoring data shows that groundwater quality is highly variable along the length of the Western Tunnelling Package from Westmead to Sydney Olympic Park with a range of contaminants variably exceeding the ANZECC 2000 / ANZG 2018 DGVs in both Cainozoic and Mesozoic geological units.

The following sections provide a further discussion of the variability in groundwater quality for Cainozoic (Quaternary) sediments and Mesozoic sediments.

3.5.1.1 Cainozoic (Quaternary) Sediments

Groundwater salinity in Cainozoic (Quaternary) sediments is typically fresh to brackish in the western portions of the Western Tunnelling Package (around Parramatta and upstream of the Charles Street Weir) and increases downstream in response to the transition from freshwater to estuarine conditions in connected surface waters. Salinity also increases with increasing proximity to the Parramatta River.

Concentrations of nutrient type pollutants including nitrogen, ammonia, and phosphorous show significant range in baseline concentrations along the length of the alignment and are frequently elevated above the relevant ANZECC 2000 / ANZG 2018 DGVs. The Elevated nutrient concentrations may be attributable to a range of factors associated with diffuse urban pollution, including leaking sewerage infrastructure, historic land use (e.g., fertilizer storage), and former landfilling.

The concentrations of heavy metals also show significant variability along the length of the Western Tunnelling Package. The highest concentrations of heavy metals are typically observed around Rosehill, which has been subjected to significant historic industrial and commercial activity. Cobalt, copper, iron, manganese, nickel and zinc all show frequently elevated concentrations, which may be attributable to a number of factors, principally associated with both industrial land use and diffuse urban pollution.

Hydrocarbons within the C10-C16 range has been recorded in laboratory testing results from boreholes around the Rosehill Services Facility as part of recent groundwater sampling investigations.

Further investigations are currently underway and/or planned for all station excavations, including Rosehill to collect further information on groundwater quality and address data gaps.

3.5.1.2 Mesozoic Sediments (Ashfield Shale and Hawkesbury Sandstone)

Groundwater salinity in Mesozoic sediments is typically fresh to brackish in the western portions of the Western Tunnelling Package (around Parramatta and upstream of the Charles Street Weir) and increases downstream in response to the transition from freshwater to estuarine conditions in connected surface waters. Salinity also increases with increasing proximity to the Parramatta River. Salinity around Westmead is notably elevated despite being in the western (upstream) portion of the project area. This elevated salinity is likely attributable to greater prevalence of the Ashfield Shale in that area which has a naturally high salt content in groundwater.

Concentrations of nutrients, including nitrogen, ammonia, and phosphorous are highly variable and frequently elevated above the adopted ANZECC 2000 and ANZG 2018 DGVs in Mesozoic sediments along the length of the Western Tunnelling Package, and most notably at and around Rosehill. Elevated nutrient concentrations may

be attributable to a range of factors including leaky sewerage infrastructure, historic land use, and former landfilling.

The concentrations of heavy metals also show significant variability along the length of the Western Tunnelling Package. Elevated concentrations of heavy metals occur frequently, with the highest concentrations typically observed around Clyde and Parramatta (note: limited data is available for Rosehill). Iron, manganese, nickel, and zinc all show frequently elevated concentrations, which may be attributable to a number of factors, principally associated industrial land uses and diffuse urban pollution. Hydrocarbons within the C10-C16 range has been recorded in laboratory testing results from boreholes around the Rosehill Services Facility as part of recent groundwater sampling investigations.

Further investigations are currently underway and/or planned for all station excavations, including Rosehill to collect further information on groundwater quality and address data gaps

3.5.2 Recent Investigations – Clyde and Rosehill

Recent investigations completed by Golder-Douglas partners have investigated groundwater quality within shallow sediments around Clyde MSF and Rosehill.

The laboratory testing results from the groundwater monitoring are summarized in **Table 5** for all pollutants and stressors that have been recorded at non-trivial levels (i.e., concentrations exceeding ANZECC / ANZG Default Guideline Values).

For the purpose of this assessment the ANZECC 2000 default guideline values (DGVs) for stressors and ANZG 2018 DGVs at 95% and 99% species protection have been used as benchmark and screening criteria. Where marine guideline values are not available, equivalent freshwater guideline values have been adopted as screening criteria. **Appendix A** presents the laboratory testing results for all parameters screened against the adopted trigger values.

Table 5. Western Tunnelling Package - Groundwater Sampling Summary Results Rosehill and Clyde (2022)

Parameter	ANZG / ANZECC DGV (Marine /Estuarine)	Rosehill Median	Rosehill 80%ile	Clyde Dive, Clyde MSF, Rosehill Median	Clyde Dive, Clyde MSF, Rosehill 80%ile
Electrical Conductivity (µs/cm)	-	25,300	30,880	18,100	30,450
pH (units)	6.5-8.5	6.57	6.78	6.55	7.6
Total Nitrogen	300	700	1,200	700	4,650
Total Ammonia	910	290	490	315	1,315
Nitrate	2,400	10	44	15	100
Total Oxidised Nitrogen	15	10	52	15	100
Reactive Phosphorus	5	10	10	10	50
Total Phosphorus	30	50	470	50	205
Arsenic	2.3	1	8.2	1	5
Cadmium	0.7	0.1	0.5	0.1	0.3
Chromium	4.4	1	4.6	1	1.5
Cobalt	1.0	31	50	35	100
Copper	1.3	1	4.6	1	10.5
Iron	300	4,140	8,566	4,070	88,200
Lead	4.4	1	4.6	1	10
Manganese	1,900	366	600	385	1,355
Mercury	0.1	0.1	0.1	0.1	0.1
Nickel	70	14	22.4	14	55
Zinc	8	64	76.4	42	331
Anthracene	0.01	1*	1.3	0.01	0.01
Fluoranthene	1	1	1	1	1
Naphthalene	16	1	1	1	1
Phenanthrene	0.6	1*	3.6	1*	1*

Parameter	ANZG / ANZECC DGV (Marine /Estuarine)	Rosehill Median	Rosehill 80%ile	Clyde Dive, Clyde MSF, Rosehill Median	Clyde Dive, Clyde MSF, Rosehill 80%ile
Total Recoverable Hydrocarbons	100	100	120	100	140
Benzo(a)pyrene	0.1	0.5*	0.5*	0.5*	0.5*
Benzene	1	1	1	2*	2*
Ethylbenzene	1	2*	2*	2*	2*
Toluene	180	2	3.6	2	2
Xylene	2	2	2	2	2
PFOS	0.00023	0.01*	0.01*	0.01*	0.155
PFOA	19	0.01	0.01	0.01	0.075

All values in µg/L unless otherwise specified
*Limit of Reporting exceeds default guideline value
Value exceeds ANZG / ANZECC DGV

The results from recent groundwater monitoring show elevated concentrations of a range of pollutants in groundwater across the Clyde MSF, Clyde Dive, and Rosehill construction areas, at concentrations exceeding the adopted ANZECC 2000, and ANZG 2018 DGVs. Key contaminants observed at elevated concentrations include **nitrogen, ammonia, phosphorous, arsenic, chromium, cobalt, copper, iron, lead, and zinc**. Minor exceedances of **anthracene, phenanthrene**, and **TRH** are also recorded.

The contaminants and concentrations of contaminants identified from historic and recent investigations have been considered in the design specifications for the Rosehill construction water treatment plant, and the target of achieving water quality outcomes that are protective of watercourses receiving construction stage discharges.

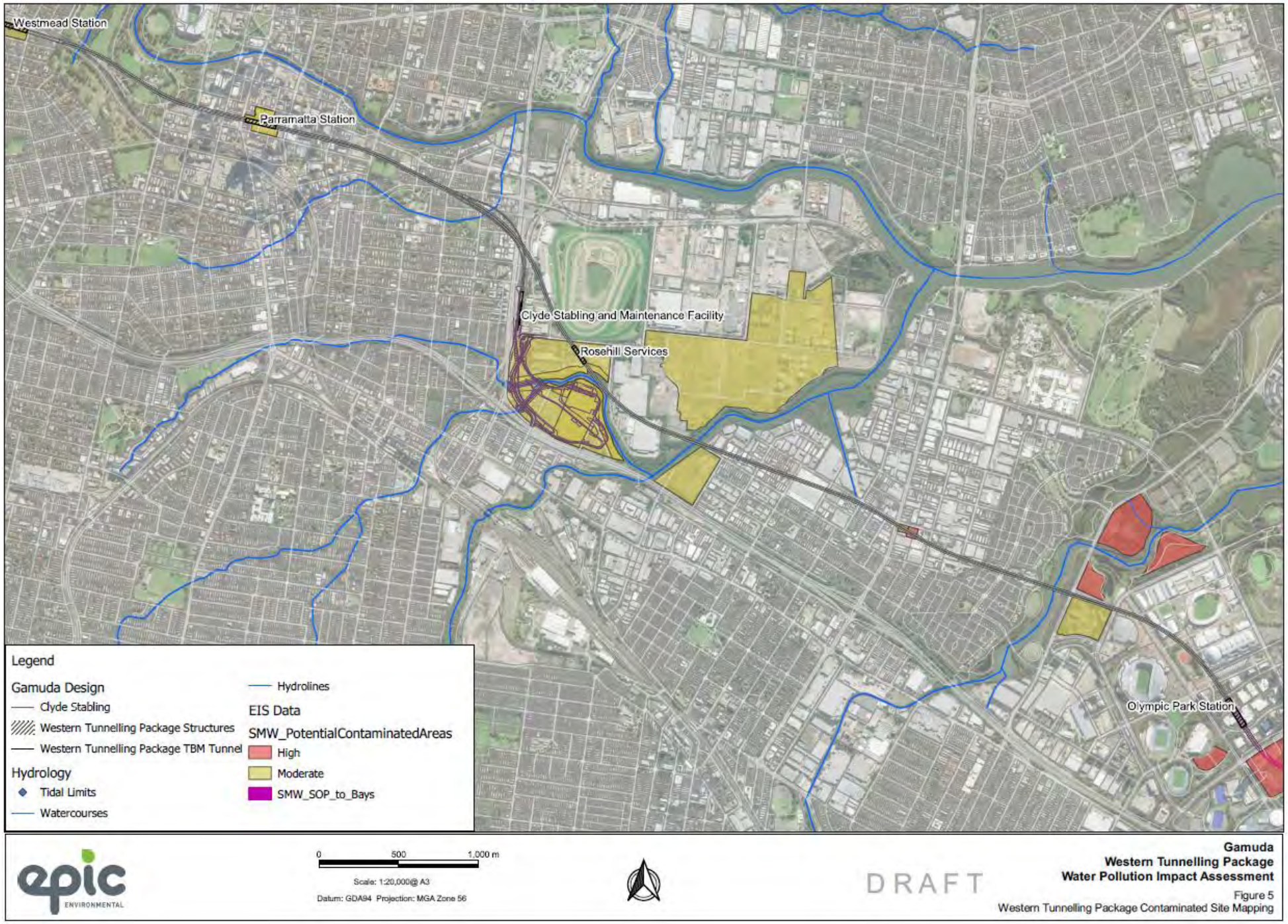


Figure 5. Potentially Contaminated Sites

3.6 Drainage and Hydrology

3.6.1 Parramatta River Catchment

The hydrology of the Parramatta River catchment can be broadly sub-divided into two categories of flow condition based on location within the catchment, including:

- Riverine (upper – middle catchment)
- Estuarine (middle – lower catchment)

The transition between riverine and estuarine conditions has been artificially fixed by emplacement of the Charles Street Weir (shown on **Figure 1**), which forms a physical barrier preventing migration of tidal water to upstream sections of the Parramatta River while allowing freshwater flows to discharge into the estuary.

Hydrological conditions upstream of the Charles Street weir are dominated by freshwater flows, while conditions downstream of the Charles Street weir are a combination of freshwater flows and oscillations of the tide.

Three additional weirs are present upstream of the Charles Street weir that influence flow conditions, including Kiosk Weir and Upstream Weir in Parramatta Park, and Marsden Street Weir in Parramatta CBD.

The major waterways flowing into the Parramatta River along the length of the project include (from west to east):

- Domain Creek
- Clay Cliff Creek
- A'Becketts Creek
- Duck Creek
- Duck River
- Haslams Creek.

Many of the minor drainage lines entering the watercourses have largely been straightened, narrowed and lined to increase outflow of excess water and reclaim adjacent lands for development (Cardno 2008).

Most streams within the catchment maintain a flow of water throughout the year. However, this base flow is low compared to flood discharges, being generally only a trickle in first order non-tidal channels.

Runoff pattern is directly related to the rainfall pattern for the whole region, and most of the total water resource is derived from storm rainfall. The runoff that continues in the minor (tidal and non-tidal) streams beyond the rainfall periods is supplied by interflow in the short term and groundwater in the longer term.

Despite the significant urbanisation, the creek systems that drain the various sub catchments of the Parramatta River are still very evident. In many of the mid-reaches of the creeks, the flows have been piped which has allowed development to encroach onto the floodplain.

Limited is available on ambient (dry weather) baseflow or stormwater flow rates through the affected sub-catchments of the Project. Stormwater modelling reported in 2009 indicated an average annual discharge to Sydney Harbour of 215 gigalitres (GL) (Birch & Rochford, 2010), much of which is delivered to the lower reaches of the estuary via the Parramatta River.

Downstream of tidal limits, water levels and flows in the Parramatta River catchment are subject to tidal influences. The estuary has a volume of approximately 69,700 megalitres and an average depth of approximately 5m (Roper et al., 2011).

Tidal flushing for complete water exchange within estuarine sections of the Parramatta River is typically in the range of 17 days (Roper et al., 2011) but may take significantly longer in the upper reaches (up to 130 days under dry conditions). Seasonal and non-seasonal variations in rainfall and runoff, and variations in tidal range over lunar and seasonal cycles exert a significant control on tidal flushing rates.

Tides in the Parramatta River and associated sub-catchments including Duck River are semi-diurnal (period cycle of one-half of a day) with two high tides and two low tides each day.

The data the amplitudes of the semidiurnal tides vary over a daily time period (the two high and two low waters on a given day are typically of different heights, known as the higher high water and the lower high water for the high tides) from solar gravitational forces, monthly (spring and neap tides) in response to lunar gravitational forces, and annually in response to the elliptical orbit of the earth around the sun.

As a result of these varying gravitational forces water levels and flow rates in estuaries can vary significantly. Combined effects of gravitational forces result in tidal maxima (High High Water Solstices Springs) and tidal minima (Indian Spring Low Water). **Figure 6** provides a conceptual schematic of typical variations observed at Fort Denison (NSW).

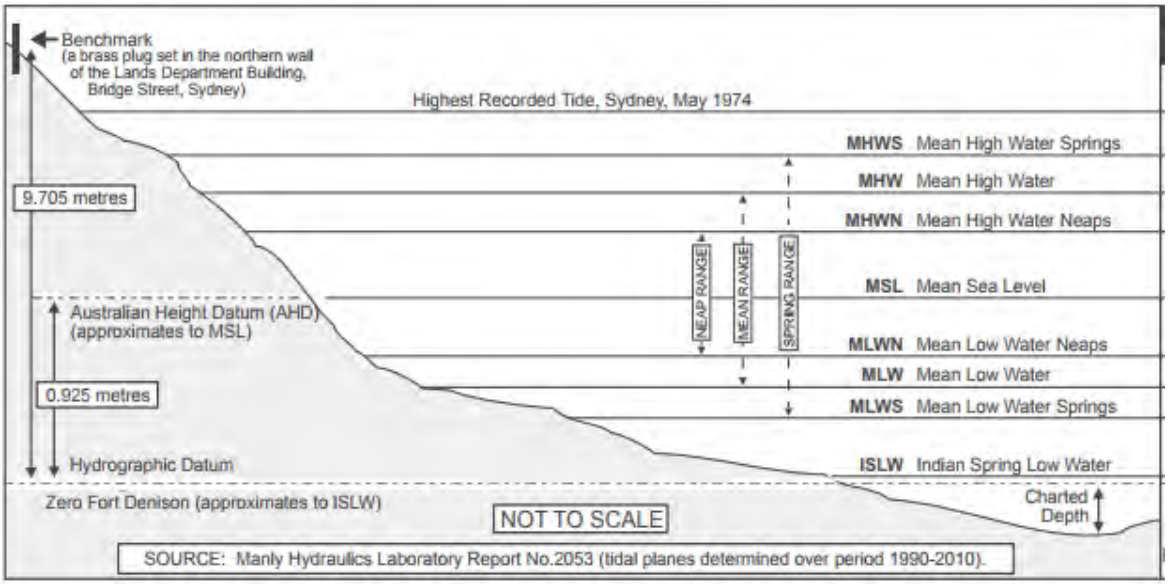


Figure 6. Manly Hydraulics Laboratory – Tidal Planes Conceptual Schematic

Tidal monitoring data from Silverwater Bridge has been obtained through the Department of Planning and Environment for Silverwater Bridge (Station 213435), which is located near the confluence of Duck River and Parramatta River. An extract of the tidal data for the month of January 2021 is shown in **Figure 7**.

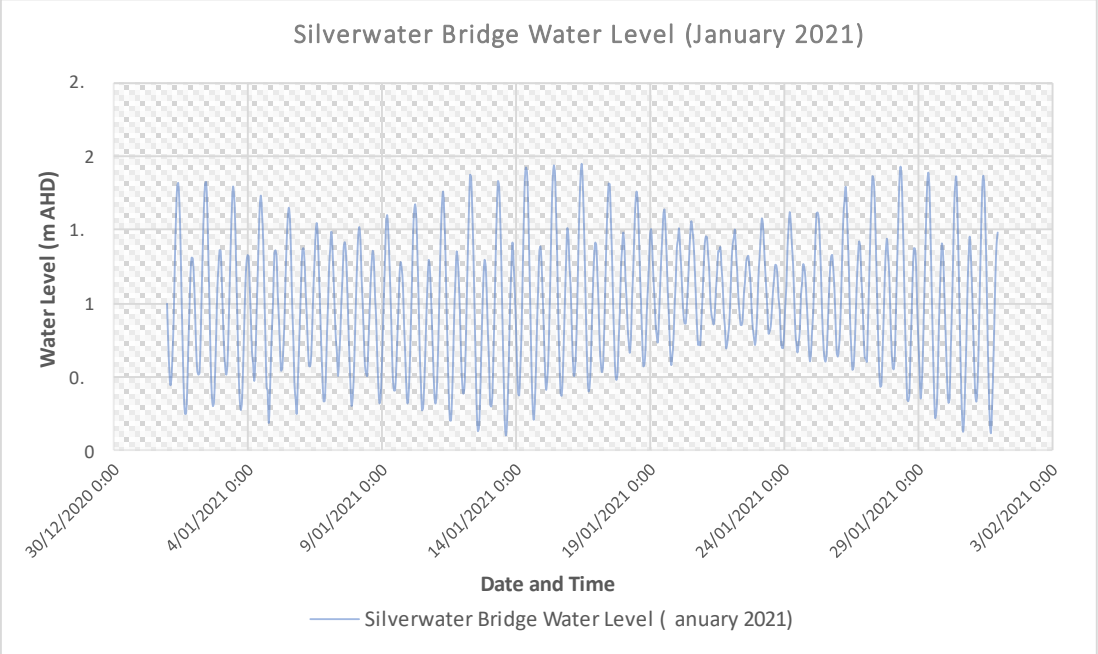


Figure 7. Silverwater Bridge Water Level Data

Simple harmonic analysis of the tidal data was undertaken to extract the value for MHW (1.627 m AHD) and MLW (0.536 m AHD).

3.6.2 Duck River Sub-Catchment (Rosehill)

The Rosehill, Clyde Dive and Clyde MSF construction areas are located in the lower reaches of the Duck River sub-catchment (**Figure 6**), downstream of the Charles Street Weir (identified in **Figure 1**). Conceptual cross sections from of Duck River and Duck Creek from field investigations undertaken by Applied Ecology in 2012 for the Duck River sub-catchment (Applied Ecology, 2012) are presented in Figure 5, Figure 6, and Figure 7.

There are approximately five kilometres of open channel system within the Duck River sub-catchment with the channel / creek becoming wider as the upstream catchment increases. At road crossings and the railway crossing the creek is constrained by culverts. The heavily urbanised nature of the catchment has resulted in highly altered rainfall-runoff response and increased loads of pollutants associated with urbanized landscapes.

Gradients and channel bank slopes become flatter towards the downstream reaches from Parramatta Road to its confluence with Parramatta River near Silverwater Bridge. The headwaters of the Duck River catchment drain by overland flow and a pit and pipe network. With increasing distance downstream and as the catchment area increases, the pipes discharge to either concrete lined drainage channels or the natural creek of the Duck River.

Duck River receives flows from Duck River, Duck Creek, Little Duck Creek and A'Becketts Creek (Molino Stewart, 2012). The waterways generally flow south to north with the eastern and western sides being moderately sloping.

In its lower reaches water levels and flows in the Duck River are influenced by tidal oscillations associated with its location in the upper estuary of the Parramatta River. The upper limit of tidal influence (tidal limit) is located at the railway culvert at Memorial Drive. Upstream of this point there are no tidal oscillations and freshwater flows associated with groundwater baseflow and stormwater runoff are dominant.

TUFLOW modelling has been undertaken for the middle reaches of Duck River to provide information on the tidal variations. Modelling predictions for flow velocity and volumetric discharge rates are presented alongside a typical water level oscillation in **Figure 8** and **Figure 9**.

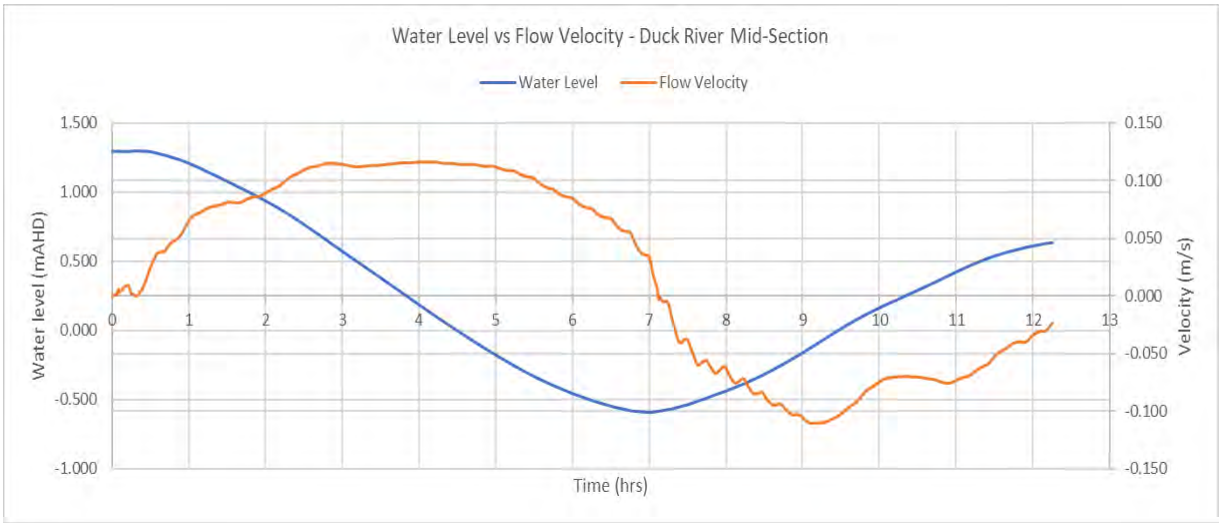


Figure 8. Model Predicted Water Levels and Flow Velocities in Duck River Mid-Section

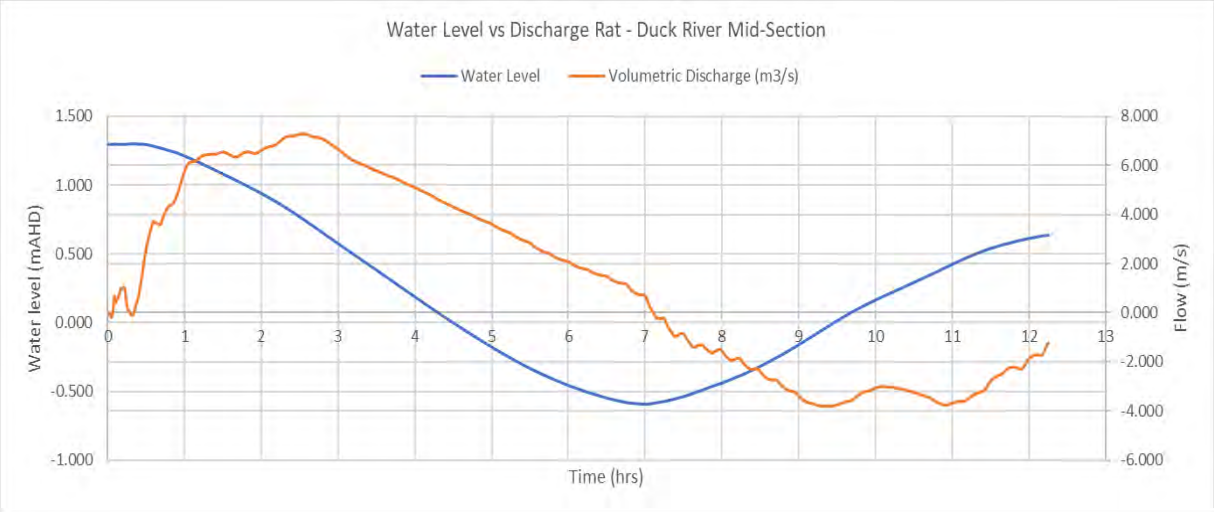


Figure 9. Model Predicted Water Levels and Volumetric Discharge Rates in Duck River Mid-Section

The modelling results show flow velocities of up to 0.125 m/s during ebb and flood tides, and volumetric discharge rates of up to approximately 7 m^3/s during ebb tides, and up to approximately 4 m^3/s during flood tides.

Under dry weather conditions flows in the lower portions of the Duck River will be influenced by baseflow (groundwater) inflows and semi-diurnal tidal oscillations (ebb and flood flows). Baseflow contributions and local catchment morphology creates an asymmetry of flow conditions favouring a net migration of water in the downstream direction over successive tidal cycles, which influences flushing rates and particle migration.

The modelled average daily tidal discharge volumes from Duck River associated with ebb and flood tides between MHW and MLW conditions are presented in Table 6Error! Reference source not found. and show approximate discharge volumes of around 300,000 m^3.

Table 6. Duck River Average Daily Tidal Discharge Volumes

Flow Parameter	Discharge (m^3/d)	Comment
Duck River Ebb: MHW-MLW	305,151	Volumetric discharge between mean high water and mean low water
Duck River Flood: MHW-MLW	305,151	Volumetric discharge between mean high water and mean low water

On average there are approximately 140 rainfall days in the Sydney basin annually. As such, dry conditions are common for catchments through the Sydney Basin. The highly urbanized nature of the catchment has resulted in a large impervious fraction that has increased runoff volumes and discharge rates. The anticipated runoff volumes from the Duck River catchment in response to varying magnitude rainfall events up to the 0.5 ARI are presented in **Table 34**.

Table 7. Anticipated Catchment Runoff Volumes

Impervious Fraction	5mm Rainfall Event Runoff (m^3/d)	15mm Rainfall Event Runoff (m^3/d)	30mm Rainfall Event Runoff (m^3/d)	60mm Rainfall Event Runoff (m^3/d)
40%	84,000	252,000	504,000	1,008,000
50%	105,000	315,000	630,000	1,260,000
60%	126,000	378,000	756,000	1,512,000

Review of the rainfall-runoff predictions show that discharge from rainfall at 15mm would be roughly equivalent to the tidal discharge (ebb / flow) under one tidal cycle. Higher magnitude rainfall events that frequently occur in the Duck River catchment would result in flushing volumes greater than the tidal exchange rate that would effectively act to refresh the tidal prism.

Peak flows for 1% to 20% annual exceedance probability (AEP) and probable maximum flood (PMF) events for Duck River and Duck Creek have been calculated as part of historic flood modelling undertaken on behalf of Parramatta City Council (WMA Water, 2012). Peak flows in Duck Creek upstream of the Sydney Water Pipeline (SWP) off Shirley Street were found to range between approximately 90 and 130 m^3/s for 20% and 1% AEP

events respectively. Peak flows in Duck River upstream of the M4 motorway were found to range between approximately 100 and 156 m^3/s for 20% and 1% AEP events respectively.

3.7 Surface Water Quality

3.7.1 Parramatta River Catchment

Freshwater conditions persist in the Parramatta River from its headwaters up to the Charles Street weir in the Parramatta River. The Charles Street Weir forms a physical barrier between the lower estuarine sections of the river, and upper freshwater sections, limiting migration of saline water upstream but allowing freshwater flows into downstream sections.

Water quality s in a constant state of flux downstream of the Charles Street Weir in response to the interactions between tidal movements and freshwater flows from the river's tributaries changing the chemical composition of the water on a daily basis (Parramatta River Catchment Group, 2016). The estuary has a calculated dilution factor of approximately 14:1, which is calculated as the ratio of the estuary volume to the volume of runoff from a large rainfall event, assumed at 10 per cent of the total annual inflow. As such, the estuary volume is approximately 14 times larger than the runoff from a large rainfall event.

A range of studies of estuarine salinity have been conducted for the Parramatta River Estuary. Salt-water intrusion associated with oceanic influences is the key driver of salinity within the Parramatta River Estuary, particularly within the lower to middle regions. Stormwater discharges also play a significant role in estuarine salinity, particularly in the upper reaches of the estuary around stormwater outlets. At stormwater outlets, freshwater flows can significantly reduce estuarine salinity.

Historically, the Parramatta River catchment has been heavily impacted by industry, resulting in widespread contamination of sediments on land and within / adjacent to waterways.
Industrial activities throughout the 20th century, along the shores and within the catchment of the river (Birch et al., 2015), have resulted in a large store of legacy chemicals in sediments (Birch & Taylor, 1999; Birch & Taylor, 2000). Additionally, large areas of the estuary have been subject to land reclamation, and in many cases, these reclaimed lands have been filled with municipal or other waste materials (Birch et al., 2009). This reclamation has been shown to have detrimentally impacted water quality in the Parramatta River and its tributaries in a number of circumstances (Suh et al., 2003; Suh et al., 2004).

The key contaminants of concern associated with historic industrial activities and land reclamation are described in several studies (Birch & Taylor, 2000; McCready et al., 2006; Ying et al., 2009) and include the following contaminants as described in Jacobs | UNSW (2016):

- **Metals and metalloids**
  - antimony, arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, silver, and zinc
- **Halogenated organics**
  - Organochlorine pesticides (chlordane, DDT/DDD/DDE, Aldrin, dieldrin, endrin, heptachlor, heptachlor epoxide and hexachlorbenzene)
- **Polychlorinated biphenyls (PCBs)**
  - Chlordane, dieldrin, DDT, hexachlorobenzene
- **Petroleum Hydrocarbons**
  - C6-C10, C10-C16, C16-C34, C34-C40
- **Aromatic Hydrocarbons**
  - Benzene, toluene, ethylbenzene, xylene, naphthalene
- **Polycyclic aromatic hydrocarbons (PAHs)**
  - acenaphthene, acenaphthylene, anthracene, benz(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(ghi)perylene, benzo(a)pyrene, benzo€pyrene, coronene, chrysene,

dibenz(ah)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, 2-methylnaphthalene, naphthalene, perylene, phenanthrene, and pyrene

- **Perfluoroalkyl substances (PFAS)**
  - Perfluorooctane sulphonate (PFOS)
  - Perfluorooctanoate (PFOA)

Currently, there are a range of land uses across the Parramatta catchment, including residential, commercial, environmental protection, education, industrial, open space and recreation services, transport and communications (Cardno 2008). As a result of modern development and urbanisation the water quality in the Parramatta River catchment is dominated by catchment inputs including stormwater and wastewater overflows. Evidence for this includes a strong spatial relationship between major stormwater outlets and distribution of metals in Sydney Harbour sediment (Birch & McCready, 2009; Birch & Rochford, 2010).

Stormwater is widely recognised as a significant source of water pollution globally and across the Sydney Metropolitan Region. It contributes to a range of pollutants found in waterways from sedimentation, heavy metals, debris and eutrophication.

Stormwater discharges result in a range of pollutants entering the waterways of the Parramatta River catchment. The contaminants present in stormwater are generally reflective of the land use and contamination status of soils and sediments that are present at surface. In highly urbanised areas large pollutant loads of faecal material, dissolved nutrients, hydrocarbons and heavy metals are common. In areas with less urbanisation/industrial land use, water quality is better as catchment activities do not generate the same types or loads of pollutants.

Typically, stormwater in urbanized catchments (such as the Parramatta River Catchment) is likely to contain elevated concentrations of the following contaminants:

- **Metals and metalloids**
  - Cadmium, chromium, copper, lead, nickel, zinc
- **Petroleum Hydrocarbons**
  - C6-C10, C10-C16, C16-C34, C34-C40
- **Aromatic Hydrocarbons**
  - Benzene, toluene, ethylbenzene, xylene, naphthalene
- **Nutrients**
  - Nitrogen, ammonia, phosphorous
- **Suspended solids**

Urban stormwater also often conveys high loads of pathogens (disease-causing microorganisms) such as viruses, bacteria and protozoa (Jiang et al., 2015; Lim et al., 2015; Page et al., 2015), which commonly originate from municipal sewage and sewage systems to stormwater systems by leakage or wet weather overflows (Passerat et al., 2011; Khan et al., 2014). Consequently, increased rainfall, runoff and stormwater overflow lead to more events carrying peak concentrations of waterborne pathogens in surface water (Schijven & de Roda Husman, 2005; Schijven et al., 2013).

Microbial contaminants are generally regarded as posing greater risks to human health than to aquatic ecosystems. Important microbial contaminants which may present health risks to recreational water users include bacteria, viruses, protozoa and cyanobacteria.

A review of water quality data collected for the upper Parramatta River between 1990 and 2007 was commissioned by Parramatta Council (Laxton et al., 2008). This review reported a number of indicators of generally poor water quality including elevated nutrient concentrations, turbidity, and –following wet weather – faecal coliforms.

Several sites on the lower Parramatta River are currently monitored for recreational water quality, including Cabarita Beach (Cabarita), Chiswick Baths (Five Dock Bay) and the Dawn Fraser Pool (Balmain). These sites have been assessed as having water quality that is safe for swimming most of the time but could be

susceptible to pollution after heavy rainfall (10 mm or more) (OEH NSW 2015) as a result of sediment mobilisation and inflows from sewer overflows or potentially contaminated sites. The Parramatta River west of Cabarita is not currently considered to be swimmable due to poor water quality, including the assumed presence of pathogenic microorganisms.

Under dry conditions the accumulation of sediments, organic materials, and contaminants can occur resulting in degraded water quality conditions in upper estuaries. Periodic rainfall events promote flushing and remobilization of sediments downstream and towards the mouth of the estuary and out to the ocean, thereby improving water quality conditions overall within the estuary despite short term spikes in contaminants during rainfall events.

Overall, previous investigations completed to date have identified that the Parramatta River is impacted by elevated concentrations of nutrients and heavy metals with significant ranges in turbidity in response to rainfall events.

Gamuda has recently undertaken water quality sampling in the Parramatta River catchment to address gaps from the EIS on baseline water quality of receiving watercourses. The sampling program includes locations within the Parramatta River, and Duck River sub-catchment to assess discharge impacts from construction phase activities. The surface water sampling locations are shown in **Figure 10.**

Recent results from sampling undertaken by Gamuda between 17th May 2022 and 05th June 2022 within the Parramatta River upstream of the confluence with Duck River around Parramatta downstream of the Charles Street Weir are summarized in **Table 8** with raw data presented in **Appendix B.** It should be noted that surface water sampling has been undertaken under dry conditions and thus catchment stormwater impacts from rainfall events are not represented.

Table 8. Gamuda Water Quality Monitoring Results – Parramatta River SW06

Parameter	Units	Default Guideline Value	Round 1 (17.05.22)	Round 2 (27.05.22)	Round 3 (03.06.22)
Elec. Conduct.	µS/cm	N.A.	15000	23000	25000
Turbidity	NTU	10	5.4	4.9	2.2
pH	Units	7.0-8.5	7.3	7.4	7.5
Total Nitrogen	µg/L	300	800	700	1200
Total Oxidised Nitrogen	µg/L	15	393	230	215
Total Kjeldahl Nitrogen	µg/L	-	400	500	1000
Ammonia	µg/L	910	290	270	250
Nitrate	µg/L	2,400	370	210	190
Nitrite	µg/L	-	23	20	25
Total Phosphorus	µg/L	30	90	70	80
Arsenic	µg/L	13	1	1	<1
Cadmium	µg/L	0.7	<0.1	<0.1	<0.1
Chromium	µg/L	4.4	<1	<1	<1
Copper	µg/L	1.3	1	<1	1
Iron	µg/L	300	110	70	40
Lead	µg/L	4.4	<1	<1	<1
Manganese	µg/L	1,900	81	56	45
Mercury	µg/L	0.1	<0.05	<0.05	<0.05
Nickel	µg/L	70	<1	1	<1
Zinc	µg/L	8	8	7	9
TPH	µg/L	<100	<100	<100	<100
TRH	µg/L	<100	<100	<100	<100
Sum of BTEX	µg/L	<1	<1	<1	<1
PFOS	µg/L	0.00023	0.02	0.02	0.01
PFOA	µg/L	19	<0.01	<0.01	<0.01

Default Guideline Values (DGVs) based on ANZG 2018 / ANZECC 2000 95% and 99% species protection and PFAS NEMP
Value exceeds DGV

The results from recent water quality sampling show water quality in the Parramatta River near Parramatta is generally good under dry weather conditions. Concentrations of pollutants are generally below the ANZG 95% and 99% species protection criteria for aquatic ecosystems and/ or the laboratory limits of reporting.

Contaminants comprising total nitrogen, total oxidised nitrogen, and total phosphorous (stressors) and PFOS (toxicant) are elevated at concentrations above the adopted criteria.

3.7.2 Duck River Sub-Catchment (Rosehill)

Gamuda has recently undertaken water quality sampling in the Duck River sub-catchment to address gaps from the EIS on baseline water quality of receiving watercourses. Sampling of the Duck River has included locations upstream and downstream of the proposed discharge point from the Rosehill Water Treatment Plant (identified in **Section 5**), including:

- SW08 - Duck River upstream of Duck Creek
- SW03 - Duck River downstream of Duck Creek
- SW02 – Duck Creek upstream of Duck River and downstream of Rosehill / Clyde

Sampling was undertaken by Gamuda on three sampling events between 17th May 2022 and 05th June 2022 to inform this impact assessment. The results from sampling are summarized in **Table 9** (SW08), **Table 10** (SW03) **Table 11** (SW02), with raw data presented in **Appendix B.**

It should be noted that surface water sampling has been undertaken under dry conditions and thus catchment stormwater impacts from rainfall events are not represented.

Table 9. Gamuda Water Quality Monitoring Results – Duck River Upstream of Duck Creek (SW08)

Parameter	Units	Default Guideline Value	Round 1 (17.05.22)	Round 2 (27.05.22)	Round 3 (03.06.22)
Elec. Conduct.	µS/cm	N.A.	9800	12000	25000
Turbidity	NTU	10	7.4	19	3
pH	Units	7.0-8.5	7.2	7.4	7.2
Total Nitrogen	µg/L	300	900	1000	800
Total Oxidised Nitrogen	µg/L	15	483	411	254
Total Kjeldahl Nitrogen	µg/L	-	500	600	600
Ammonia	µg/L	910	250	170	220
Nitrate	µg/L	2,400	450	390	230
Nitrite	µg/L	-	33	21	24
Total Phosphorus	µg/L	30	90	90	90
Arsenic	µg/L	13	2	2	1
Cadmium	µg/L	0.7	<0.1	<0.1	<0.1
Chromium	µg/L	4.4	<1	<1	<1
Copper	µg/L	1.3	2	2	1
Iron	µg/L	300	180	260	20
Lead	µg/L	4.4	1	2	<1
Manganese	µg/L	1,900	110	64	74
Mercury	µg/L	0.1	<0.05	<0.05	<0.05
Nickel	µg/L	70	1	1	1
Zinc	µg/L	8	26	28	26
TPH	µg/L	<100	<100	<100	<100
TRH	µg/L	<100	<100	<100	<100
Sum of BTEX	µg/L	<1	<1	<1	<1
PFOS	µg/L	0.00023	0.07	0.04	0.04
PFOA	µg/L	19	0.02	<0.01	0.01

Default Guideline Values (DGVs) based on ANZG 2018 / ANZECC 2000 95% and 99% species protection and PFAS NEMP
Value exceeds DGV

The results from recent water quality sampling of Duck River upstream of Duck Creek (**Table 9**) show water quality is generally good under dry weather conditions. Concentrations of pollutants are typically below the ANZG 95% and 99% species protection criteria for aquatic ecosystems and/ or the laboratory limits of reporting. Contaminants comprising total nitrogen, total oxidised nitrogen, and total phosphorous (stressors), and zinc and PFOS (toxicants) are elevated at concentrations above the adopted criteria. Turbidity also exceeds the ANZECC 2000 criteria for estuaries.

The results from water quality sampling in Duck River downstream of Duck Creek are presented in **Table 10.**

Table 10. Gamuda Water Quality Monitoring Results – Duck River Downstream of Duck Creek (SW03)

Parameter	Units	Default Guideline Value	Round 1 (17.05.22)	Round 2 (27.05.22)	Round 3 (03.06.22)
Elec. Conduct.	µS/cm	N.A.	----	12000	26000
Turbidity	NTU	10	----	15	2.4
pH	Units	7.0-8.5	----	7.5	7.3
Total Nitrogen	µg/L	300	----	1000	700
Total Oxidised Nitrogen	µg/L	15		415	216
Total Kjeldahl Nitrogen	µg/L	-	----	500	500
Ammonia	µg/L	910	----	130	240
Nitrate	µg/L	2,400	----	390	190
Nitrite	µg/L	-	----	25	26
Total Phosphorus	µg/L	30	----	90	70
Arsenic	µg/L	13	----	2	1
Cadmium	µg/L	0.7	----	<0.1	<0.1
Chromium	µg/L	4.4	----	<1	<1
Copper	µg/L	1.3	----	2	<1
Iron	µg/L	300	----	80	30
Lead	µg/L	4.4	----	<1	<1
Manganese	µg/L	1,900	----	61	82
Mercury	µg/L	0.1	----	<0.05	<0.05
Nickel	µg/L	70	----	1	1
Zinc	µg/L	8	----	24	30
TPH	µg/L	<100	----	<100	<100
TRH	µg/L	<100	----	<100	<100
Sum of BTEX	µg/L	<1	----	<1	<1
PFOS	µg/L	0.00023	----	0.05	0.03
PFOA	µg/L	19	----	0.02	<0.01

Default Guideline Values (DGVs) based on ANZG 2018 / ANZECC 2000 95% and 99% species protection and PFAS NEMP
Value exceeds DGV

The results from recent water quality sampling of Duck River downstream of Duck Creek (**Table 10**) are consistent with results from samples upstream of Duck Creek and show water quality is generally good under dry weather conditions. Concentrations of pollutants are typically below the ANZG 95% and 99% species protection criteria for aquatic ecosystems and/ or the laboratory limits of reporting. Contaminants comprising total nitrogen and total phosphorous (stressors), and copper, zinc and PFOS (toxicants) are elevated at concentrations above the adopted criteria. Turbidity also exceeds the ANZECC 2000 criteria for estuaries on one occasion.

The results from water quality sampling in Duck Creek downstream of Clyde are presented in Table 11

Table 11. Gamuda Water Quality Monitoring Results – Duck Creek (SW02)

Parameter	Units	Default Guideline Value	Round 1 (17.05.22)	Round 2 (27.05.22)	Round 3 (03.06.22)
Elec. Conduct.	µS/cm	N.A.	12000	5500	21000
Turbidity	NTU	10	3	3.3	1.6
pH	Units	7.0-8.5	7.2	7.6	7.3
Total Nitrogen	µg/L	300	1000	1300	1000
Total Kjeldahl Nitrogen	µg/L	-	600	700	800
Ammonia	µg/L	910	380	90	370
Nitrate	µg/L	2,400	400	500	160
Nitrite	µg/L	-	55	47	41
Total Phosphorus	µg/L	30	100	80	100
Arsenic	µg/L	13	2	1	<1
Cadmium	µg/L	0.7	<0.1	<0.1	<0.1
Chromium	µg/L	4.4	<1	<1	<1
Copper	µg/L	1.3	1	2	<1
Iron	µg/L	300	70	100	90
Lead	µg/L	4.4	<1	<1	<1
Manganese	µg/L	1,900	140	47	230
Mercury	µg/L	0.1	<0.05	<0.05	<0.05
Nickel	µg/L	70	<1	2	1
Zinc	µg/L	8	18	20	28
TPH	µg/L	<100	<100	<100	<100

Parameter	Units	Default Guideline Value	Round 1 (17.05.22)	Round 2 (27.05.22)	Round 3 (03.06.22)
TRH	µg/L	<100	<100	<100	<100
Sum of BTEX	µg/L	<1	<1	<1	<1
PFOS	µg/L	0.00023	0.07	0.08	0.04
PFOA	µg/L	19	0.02	0.01	0.01

Default Guideline Values (DGVs) based on ANZG 2018 / ANZECC 2000 95% and 99% species protection and PFAS NEMP
Value exceeds DGV

The results from recent sampling of Duck Creek downstream of Clyde (**Table 11**) are consistent with results from samples collected in Duck River and show water quality is generally good under dry weather conditions. Concentrations of pollutants are typically below the ANZG 95% and 99% species protection criteria for aquatic ecosystems and/ or the laboratory limits of reporting. Contaminants comprising total nitrogen and total phosphorous (stressors), and copper, zinc and PFOS (toxicants) are elevated at concentrations above the adopted criteria.

Figure 10. Gamuda Surface Water Monitoring Locations

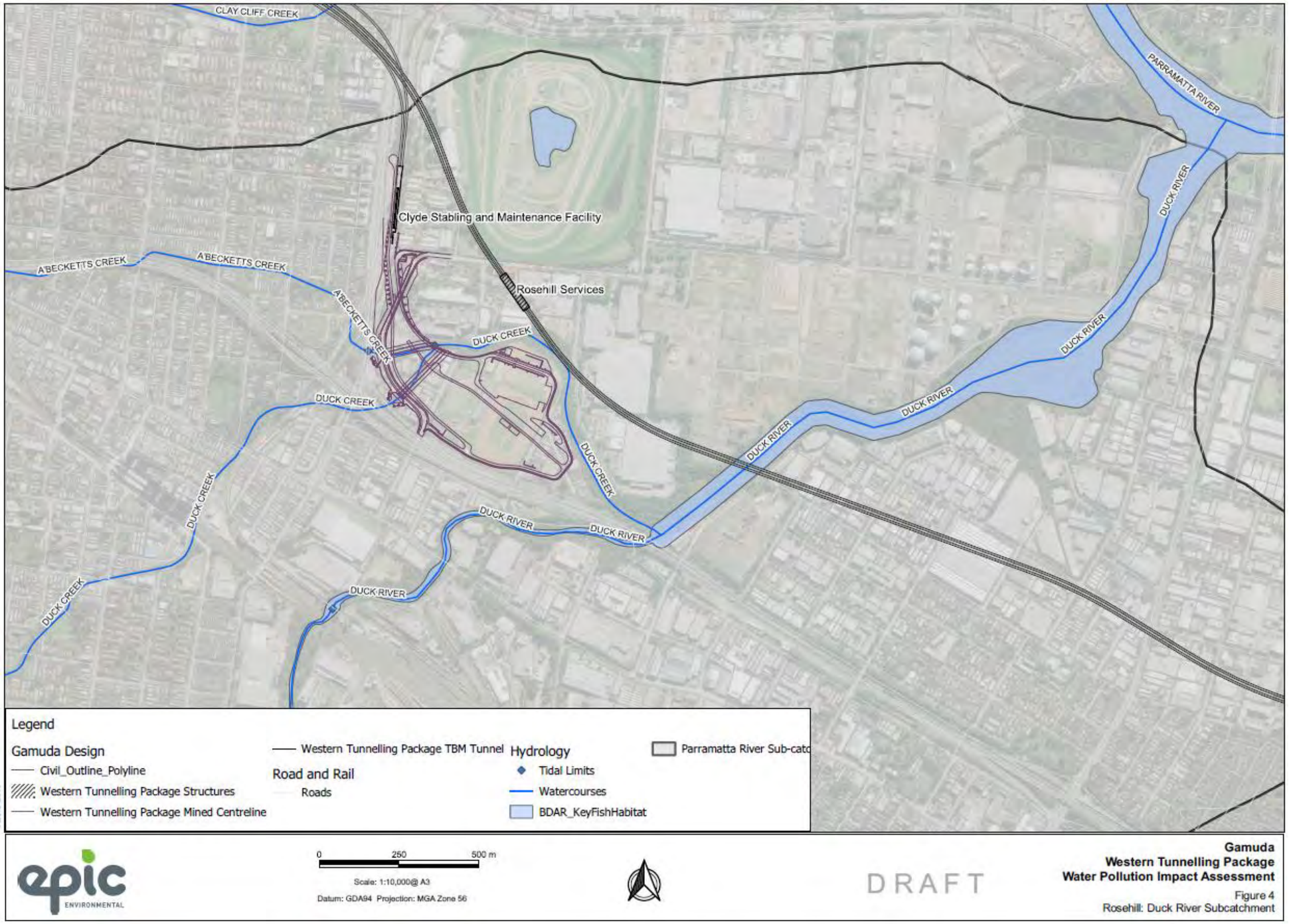


Figure 11. Duck River Sub-catchment at Rosehill

3.8 Aquatic Ecology

3.8.1.1 Parramatta River Catchment

The Parramatta River is mapped as Key Fish Habitat (Type 1 – Highly sensitive Key Fish Habitat) and is classified as Class 1 (major key fish habitat) as it is a permanently flowing river. Coastal wetlands which are listed under the Coastal Management SEPP occur along large sections of the Parramatta River estuary (Jacobs 2020 – Technical Paper 10: Biodiversity Development Assessment Report).

Estuarine mangrove forests and saltmarshes are the principal vegetative communities present along the shorelines of the Parramatta River adjacent to the Project. Two mangrove species are typically found in Sydney including Grey mangrove (Avicennia marina) and river mangrove (Aegiceras corniculatum).

3.8.1.2 Duck River Sub-Catchment

The Duck River catchment covers an area of approximately 42 square kilometres and is heavily urbanised. Development within the catchment is predominately detached residential developments with higher density villa and unit developments in parts. There is considerable industrial development in the lower parts and scattered commercial development throughout. The main industrial areas that contribute to the catchments are Regents Park industrial park, Clyde marshalling yard and Silverwater (Molino Stewart, 2012).

The residential areas encroach on the fringes of the floodplain with industrial developments fronting the channel from upstream of the Main Western Railway to its junction with the Parramatta River upstream of Silverwater Road (Molino Stewart, 2012). Downstream of the Sydney Water Pipeline the channel is in a semi natural state (unlined) and it is crossed by several bridges and pipelines.

The main channel of the Duck River is vegetated to varying extents and in places extensive bank re-vegetation has occurred. In the lower parts of the sub-catchment the banks of the channel are densely vegetated by mangroves and are mapped as coastal wetlands as defined by SEPP Coastal Wetlands, and high likelihood groundwater dependent ecosystems. Vegetation mapping for the lower Duck River is presented in **Figure 12**.

Like the Parramatta River, estuarine mangrove forests are saltmarshes are the principal vegetative communities present along the shorelines of Duck River. Two mangrove species are typically found in Sydney including grey mangrove (Avicennia marina) and river mangrove (Aegiceras corniculatum).

Duck River is mapped as Key Fish Habitat and is classified as Type 1 Key Fish Habitat. It is also classified as Class 1 (major key fish habitat) as it is a permanently flowing river. No threatened species listed under the Fisheries Management Act 1994 have potential habitat within Duck River.

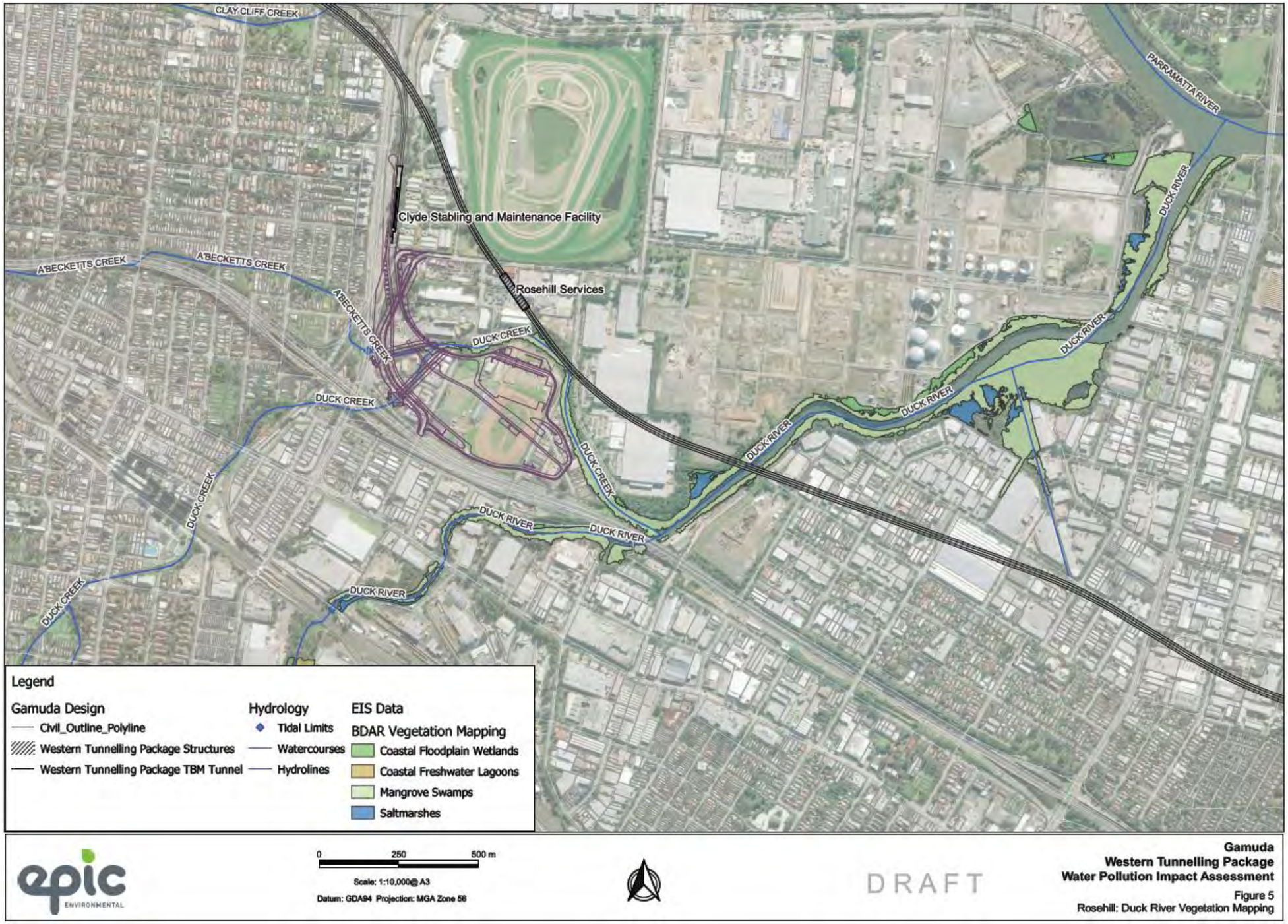


Figure 12. Rosehill Duck River Riparian Vegetation Mapping

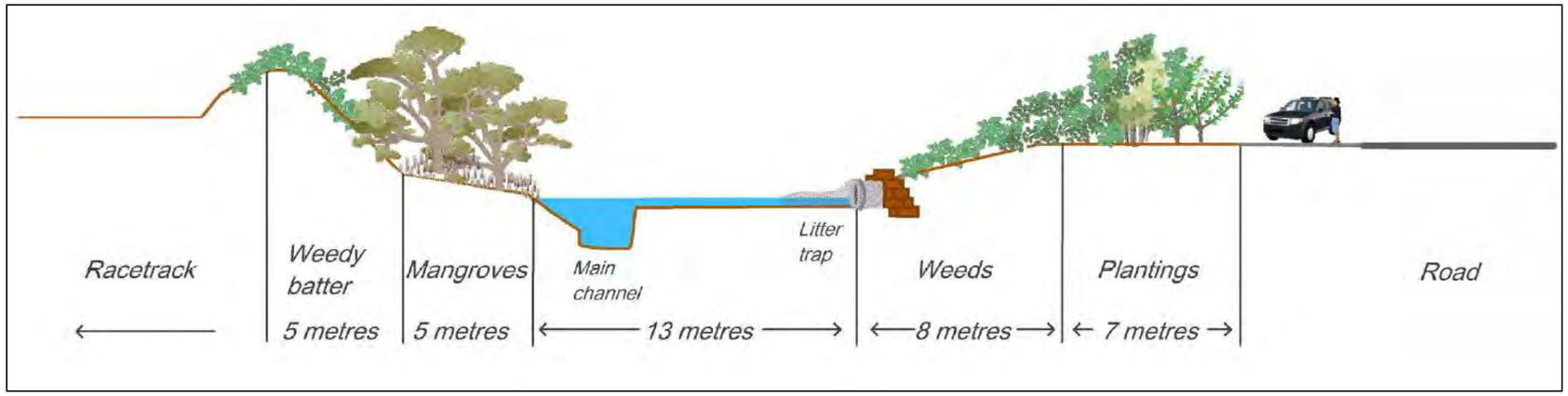
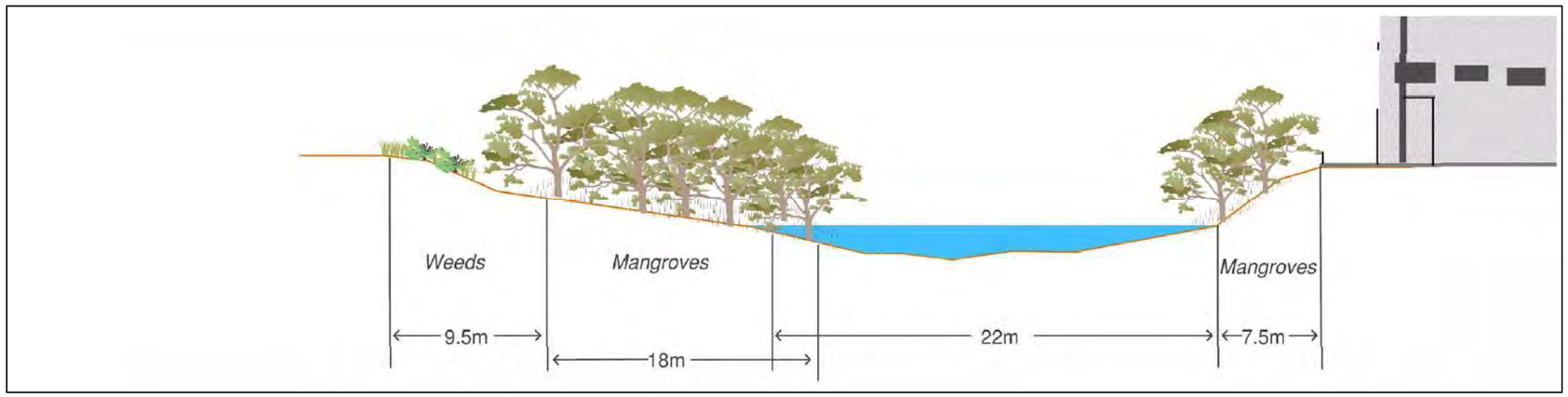


Figure 13. Duck Creek Conceptual Cross Section (Applied Ecology, 2012)



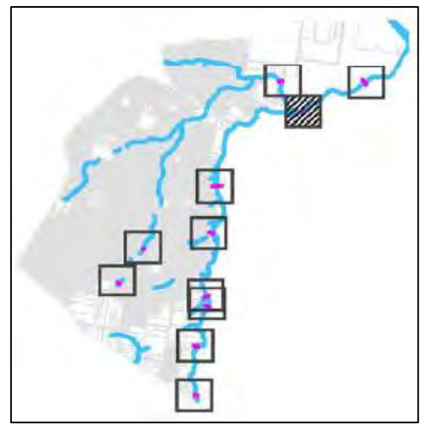


Figure 14. Duck River / Duck Creek Confluence Conceptual Cross Section (Applied Ecology, 2012)

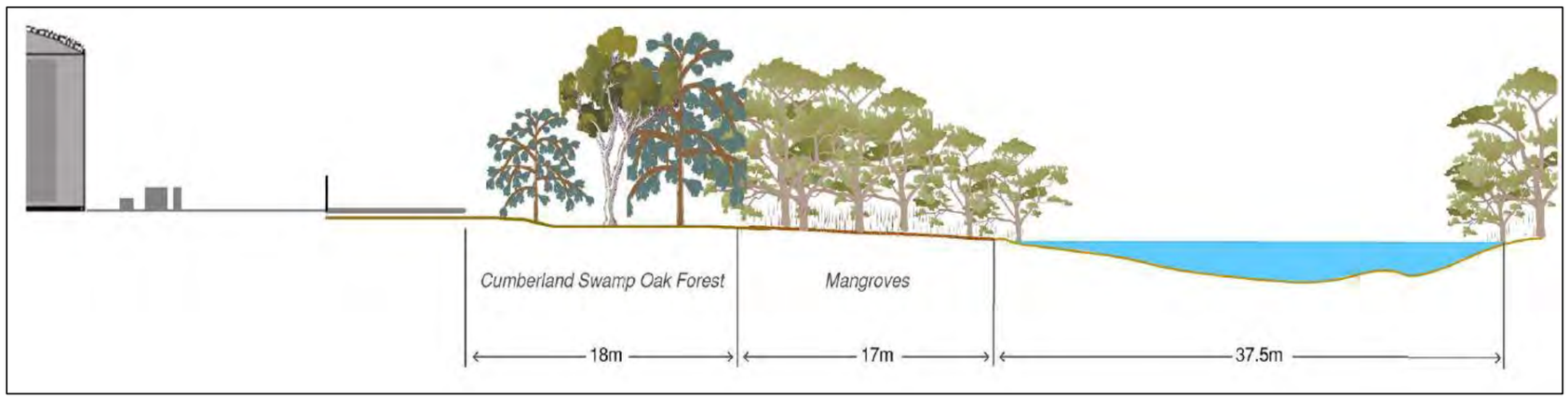


Figure 15. Duck River Conceptual Cross Section (Applied Ecology, 2012)

4 ENVIRONMENTAL VALUES, WATER QUALITY OBJECTIVES AND RIVER FLOW OBJECTIVES

4.1 Water Quality Objectives

The NSW Water Quality Objectives are the agreed environmental values and long-term goals for NSW's surface waters. They set out:

- the community's values and uses for our rivers, creeks, estuaries and lakes (i.e. healthy aquatic life, water suitable for recreational activities like swimming and boating, and drinking water)
- a range of water quality indicators to help us assess whether the current condition of our waterways supports those values and uses

Table 6 outlines the water quality objectives for the Parramatta River and associated tributaries affected by the Project.

Table 12. Assigned Environmental Values for Watercourses and Receiving Waters Relevant to Western Tunnelling Package

Watercourse / Receiving Water	Strahler Order	Relevant Watercourse Classification	Aquatic Ecosystems	Visual Amenity	Primary Contact Recreation	Secondary Contact Recreation	Aquatic Foods (Cooked)
Domain Creek	First Order	Lowland River	X	X	X	X	-
Parramatta River	Fourth Order	Lowland River	X	X	X	X	-
Parramatta River	Fourth Order	Upper Estuary	X	X	X	X	X
Clay Cliff Creek	Second Order	Upper Estuary	X	X	X	X	-
Duck River	Third Order	Upper Estuary	X	X	X	X	-
Duck Creek	Second Order	Upper Estuary	X	X	X	X	-
A'Becketts Creek	First Order	Upper Estuary	X	X	X	X	-
Haslams Creek	Third Order	Upper Estuary	X	X	X	X	-
Homebush Bay	Fourth Order	Upper Estuary	X	X	X	X	X

Water treatment plants at Rosehill will discharge treated effluent to Duck River upstream of the confluence with Duck Creek via pipeline(s) from the nominated construction water treatment plants.

The water quality objectives relevant to Duck Creek, Duck River, and Parramatta River are discussed further in the following sections to provide a clear framework for assessing potential water quality impacts resulting from discharges associated with the proposed Rosehill construction water treatment plants.

A discussion of potential water quality impacts as a result of discharge from the water treatment plant at Rosehill is provided in Section 6.

4.1.1 Aquatic Ecosystems

The specific WQO's for protection of aquatic ecosystems in the in the fresh and estuarine waters affected by the project include trigger values for both "water quality indicators" and for chemical contaminants or "toxicants".

Water quality indicators are addressed in the ANZECC 2000 Guidelines include direct effect non-toxic physical / chemical stressors (total phosphorous, total nitrogen, turbidity), indirect stressors (dissolved oxygen, pH), and effect indicators (Chlorophyll-a). Chemical contaminants of concern are addressed in the ANZG 2018 guidelines and include a wide range of parameters under the following parameter groups:

- Chloroethanes
- Chlorinated Alkenes
- Chloropopanes
- Chlorobenzenes & Chloronaphthalenes
- Nitrobenzenes
- Phenols and Xylenols
- Phenoxyacetic Acid Herbicides
- Polychlorinated Biphenyls (PCBs) & Dioxins
- Triazine Herbicides
- Organophosphorus Pesticides
- Aromatic Hydrocarbons
- Organic Sulfur Compounds
- Oil Spill Dispersants
- Carbamate & other Pesticides

- Nitrophenols
- Nitrotoluenes
- Anilines
- Miscellaneous Herbicides
- Surfactants
- Organochlorine Pesticides
- Metals and Metalloids
- Non-metallic Inorganics
- Polycyclic Aromatic Hydrocarbons
- Chloromethanes
- Pyrethroids
- Phthalates
- Miscellaneous Industrial Chemicals
- Bypyridilium Herbicides
- Urea Herbicides
- Organic Alcohols
- Sulfonylurea herbicides
- Thiocarbamate Herbicides

Trigger values are the numeric criteria that if exceeded indicate potential for harmful environmental effects to occur. The default trigger values provided in ANZECC 2000, and AZNG 2018 Guidelines are essentially conservative and precautionary. If they are not exceeded, a very low risk of environmental damage can be assumed. If they are exceeded, further investigation is "triggered" for the pollutant concerned. Assessing whether the exceedance means a risk of impact to the Water Quality Objective requires site-specific investigation, using decision trees provided in the Guidelines.

The water quality indicators and specific trigger values for the watercourses affected by discharges from the Rosehill water treatment plants are outlined in Table 13 and are consistent with the default guideline values as identified in Tables 3.3.2 and 3.3.3 of the ANZECC (2000) guidelines.

Table 13. Water Quality Indicators - Estuaries

Category	Indicator	Tigger Value
Direct Effect Non-Toxic Physical / Chemical Stressors	Total Phosphorous	30 µg/L
	Total Nitrogen	300 µg/L
	Turbidity	0.5 – 10 NTU
Indirect Stressors	Dissolved Oxygen	80 – 110%
	pH	7.0 – 8.5 pH units
	Temperature	See ANZECC 2000 Guidelines
Effect Indicator	Chlorophyll-a	4 µg/L
Chemical contaminants or toxicants	-	See ANZG 2018 Guidelines

Trigger values for physical / chemical stressors and chemical toxicants that are directly toxic to biota are defined by the relevant environment and species protection trigger values specified in the ANZG, (2018) guidelines. For slightly to moderately disturbed ecosystems (including those affected by urban development) The 95% species protection, and 99% species protection for (bioaccumulating contaminants) are typically applied for permanent discharges, whilst lower levels of protection may be applied for temporary discharges.

The water quality criteria for chemical contaminants and toxicants that have been adopted for discharges from the Project are presented in **Section 7** and are consistent with 95% species protection for chemical toxicants, and 99% species protection for (bioaccumulating chemical toxicants) in marine environments.

The marine water quality default guideline values have been adopted for the upper estuary as there are no available default guideline values for water quality in estuaries. This approach is consistent with advice under the ANZG (2018) and ANZECC (2000) guidelines.

4.1.2 Visual Amenity

This objective applies to all waters, particularly those used for aquatic recreation and where scenic qualities are important. Indicators used to assess and monitor visual amenity in the Parramatta River and associated tributaries affected by the Project are summarised in Table 8.

Table 14. Parramatta River Catchment Visual Amenity Indicators

Indicator	Criteria
Visual Clarity and Colour	Natural visual clarity should not be reduced by more than 20%.
	Natural hue of the water should not be changed by more than 10 points on the Munsell Scale.
	The natural reflectance of the water should not be changed by more than 50%.

Indicator	Criteria
Indirect Stressors	Oils and petrochemicals should not be noticeable as a visible film on the water, nor should they be detectable by odour.
	Waters should be free from floating debris and litter.
Effect Indicator	Macrophytes, phytoplankton scums, filamentous algal mats, blue-green algae, sewage fungus and leeches should not be present in unsightly amounts.

4.1.3 Secondary Contact Recreation

This objective applies to all waters but may not be achievable for some time in some areas. Secondary contact recreation applies in waterways where communities do not require water quality of a level suited to primary contact recreation, or where primary contact recreation will be possible only in the future.

Indicators used to assess and monitor water for secondary contact recreation in the Parramatta River Catchment are summarised in Table 9.

Table 15. Parramatta River Catchment Secondary Contact Recreation Indicators

Indicator	Criteria
Faecal Coliforms	Median bacterial content in fresh and marine waters of < 1000 faecal coliforms per 100 mL, with 4 out of 5 samples < 4000/100 mL (minimum of 5 samples taken at regular intervals not exceeding one month).
Enterococci	Median bacterial content in fresh and marine waters of < 230 enterococci per 100 mL (maximum number in any one sample: 450-700 organisms/100 mL).
Algae & Blue-Green Algae	< 15 000 cells/mL
Nuisance Organisms	Use visual amenity guidelines.
	Large numbers of midges and aquatic worms are undesirable.
Chemical Contaminants	Waters containing chemicals that are either toxic or irritating to the skin or mucous membranes are unsuitable for recreation.
	Toxic substances should not exceed values in tables 5.2.3 and 5.2.4 of the ANZECC 2000 Guidelines.
Visual Clarity and Colour	Use visual amenity guidelines.
Surface Films	Use visual amenity guidelines.

4.1.4 Primary Contact Recreation

This objective applies in the immediate future to waters within and immediately upstream of recognised recreation sites. For many other waters, this is a long-term objective. Secondary contact recreation levels should apply in areas where primary contact recreation, such as swimming, is unlikely to be achieved in the immediate future, owing to pollution.

Indicators used to assess and monitor water for primary contact recreation in the Parramatta River Catchment are summarised in Table 10.

Table 16. Parramatta River Catchment Primary Water Quality Indicators

Indicator	Criteria
Turbidity	A 200 mm diameter black disc should be able to be sighted horizontally from a distance of more than 1.6 m (approximately 6 NTU).
Faecal coliforms	Beachwatch considers waters are unsuitable for swimming if: The median faecal coliform density exceeds 150 colony forming units per 100 millilitres (cfu/100mL) for five samples taken at regular intervals not exceeding one month, or
	Beachwatch considers waters are unsuitable for swimming if: The second highest sample contains equal to or greater than 600 cfu/100mL (faecal coliforms) for five samples taken at regular intervals not exceeding one month.
	ANZECC 2000 Guidelines recommend: Median over bathing season of < 150 faecal coliforms per 100 mL, with 4 out of 5 samples < 600/100 mL (minimum of 5 samples taken at regular intervals not exceeding one month).
Enterococci	Beachwatch considers waters are unsuitable for swimming if: the median enterococci density exceeds 35 cfu/100mL for five samples taken at regular intervals not exceeding one month, or; the second highest sample contains equal to or greater than 100 cfu/100mL (enterococci) for five samples taken at regular intervals not exceeding one month.
	ANZECC 2000 Guidelines recommend: Median over bathing season of < 35 enterococci per 100 mL (maximum number in any one sample: 60-100 organisms/100 mL).

Indicator	Criteria
Protozoans	Pathogenic free-living protozoans should be absent from bodies of fresh water. (Note, it is not necessary to analyse water for these pathogens unless temperature is greater than 24 degrees Celsius).
Algae & blue-green algae	< 15 000 cells/mL
Nuisance organisms	Use visual amenity guidelines.
	Large numbers of midges and aquatic worms are undesirable.
pH	5.0-9.0
Temperature	15°-35°C for prolonged exposure.
Chemical contaminants	Waters containing chemicals that are either toxic or irritating to the skin or mucus membranes are unsuitable for recreation.
	Toxic substances should not exceed the concentrations provided in tables 5.2.3 and 5.2.4 of the ANZECC 2000 Guidelines 2000.
Visual Clarity and Colour	Use visual amenity guidelines.
Surface Films	Use visual amenity guidelines.

4.1.5 Aquatic Foods

Refers to protecting water quality so that it is suitable to produce aquatic foods for human consumption and aquaculture activities. The ANZECC 2000 Guidelines lists this environmental value as Aquaculture and human consumption of aquatic foods (Table 11).

Table 17. Parramatta River Catchment Aquatic Foods Indicators

Indicator	Criteria
Algae & blue-green algae	No guideline is directly applicable, but toxins present in blue-green algae may accumulate in other aquatic organisms
Faecal coliforms	Guideline in water for shellfish: The median faecal coliform concentration should not exceed 14 MPN/100mL; with no more than 10% of the samples exceeding 43 MPN/100 mL
	Standard in edible tissue: Fish destined for human consumption should not exceed a limit of 2.3 MPN E Coli /g of flesh with a standard plate count of 100,000 organisms /g
Toxicants (as applied to aquaculture activities)	Metals: Copper: less than 5 µgm/L
	Metals: Mercury: less than 1 µgm/L
	Metals: Zinc: less than 5 µgm/L
	Organochlorines: Chlordane: less than 0.004 µgm/L (saltwater production)
	Organochlorines: PCBs: less than 2 µgm/L
Physio-chemical indicators (as applied to aquaculture activities)	Suspended solids: less than 40 micrograms per litre (freshwater)
	Temperature: less than 2 degrees Celsius change over one hour

4.2 River Flow Objectives

The River Flow Objectives are the agreed high-level goals for surface water flow management. They identify the key elements of the flow regime that protect river health and water quality for ecosystems and human uses. Table 18 outlines the River Flow Objectives for the Parramatta River and associated tributaries bisected by the Project.

Table 18. Parramatta River Catchment Visual Amenity Indicators

Watercourse / Receiving Water	Strahler Order	Relevant Watercourse Classification	1	2	3	4	5	6	7	8	9
Domain Creek	First Order	Lowland River	X	X	X	X	X	X	X	-	-
Parramatta River	Fourth Order	Lowland River	X	X	X	X	X	X	X	-	-
Parramatta River	Fourth Order	Upper Estuary	-	-	X	-	-	-	X	X	X
Clay Cliff Creek	Second Order	Upper Estuary	X	X	X	X	X	X	X	-	-
Duck River	Third Order	Upper Estuary	X	X	X	X	X	X	X	-	-
Duck Creek	Second Order	Upper Estuary	X	X	X	X	X	X	X	-	-
A'Becketts Creek	First Order	Upper Estuary	X	X	X	X	X	X	X	-	-
Haslams Creek	Third Order	Upper Estuary	X	X	X	X	X	X	X	-	-
Homebush Bay	Fourth Order	Upper Estuary	X	X	X	X	X	X	X	-	-

Watercourse / Receiving Water	Strahler Order	Relevant Watercourse Classification	1	2	3	4	5	6	7	8	9

1- Protect Pools in Dry Times, 2 - Protect Natural Low Flows, 3 - Maintain Wetland and Floodplain Inundation, 4 - Mimic Natural Drying in Temporary Waterways, 5 - Maintain Natural Flow Variability, 6 - Maintain Natural Rates of Change in Water Levels, 7 - Minimise Effects of Weirs and Other Structures, 8 - Manage Groundwater for Ecosystems, 9 - Maintain or rehabilitate estuarine processes and habitats.

Water treatment plants at Rosehill will discharge treated effluent to Duck River upstream of the confluence with Duck Creek via pipeline(s) from the nominated construction water treatment plants (Figure 16). Duck River subsequently discharges into the Parramatta River approximately 2.5 km downstream of the proposed discharge point.

The river flow objectives relevant to Duck River and the Parramatta River are discussed further in the following Table 13 to provide a clear framework for assessing potential flow impacts resulting from discharges associated with the proposed Rosehill construction water treatment plants.

A discussion of potential water flow impacts as a result of discharge from the water treatment plant at Rosehill is provided in **Section 6.2**Error! Reference source not found..

Table 19. Parramatta River Catchment River Flow Objectives

Objective	Measures to Achieve Objective
Protect natural low flows	• Share low flows between the environment and water users and fully protect all natural very low flows • In streams with little water use or important conservation values, minimise risks to ecosystems in low-flow periods.
Maintain or restore the natural inundation patterns and distribution of floodwaters supporting natural wetland and floodplain ecosystems	• Management plans and actions for waterways need to include strategies to maintain, restore or mimic natural patterns of inundation, water movement and drying in natural and semi-natural wetlands, and remaining native floodplain ecosystems. • Ensure adequate access for native fish to and from floodplain wetlands. • Flooding patterns should not be altered without proper environmental assessment.
Mimic the natural frequency, duration and seasonal nature of drying periods in naturally temporary waterways	• Identify any streams where unnatural flows have greatly reduced drying periods. Assess potential short- and long-term environmental, economic and social effects of this change and of possible management alternatives. • Decisions on what (if any) action is appropriate to implement this objective in streams should be worked out on a case-by-case basis after giving due consideration to local views.
Maintain or mimic natural flow variability in all streams	• Identify streams with unnatural flow variability and develop appropriate actions to mimic natural variability. • Identify streams with potential for flow variability problems and take early action.
Maintain Natural Rates of Change in Water Levels (Maintain rates of rise and fall of river heights within natural bounds)	• Identify locations where water levels often rise or fall faster than they would naturally. Identify the reasons (in urban areas, usually the result of increased hard-surfacing) and impacts. Remedial action requires case-by-case assessment. • Identify potential problems and take early action.
Minimise the impact of instream structures	• Implement the NSW Weirs Policy (DLWC 1997b). • Identify, and take action to minimise, the impact on native fauna of other structures that impede movement of water-e.g. floodgates, tidal barriers, culverts.
Maintain groundwater within natural levels and variability, critical to surface flows and ecosystems	• Implement the State Groundwater Policy (DLWC 1997a, 1998b). • Identify any streams or ecosystems that may depend on high groundwater levels, and assess impacts of reduced recharge or excessive pumping or drainage. • Identify areas where rising groundwater may threaten ecosystems or surface-water quality. • Determine appropriate action to keep ground-water level changes within acceptable bounds.
Maintain or rehabilitate estuarine processes and habitats	• Dredging beyond minimal maintenance dredging for navigation requires environmental assessment. • Draining or disturbance of areas of potential acid sulfate soils must be minimised. • Water-based activities should be controlled to minimise impact on fish habitat. • Other processes affecting or potentially affecting estuary health need to be addressed-e.g. the impact of increasing urbanisation.

1- Freshes are short-duration flow events that submerge the lower parts of the river channel. They are important for plants that grow low on the banks and provide opportunities for fish and other animals to move more easily along the river.

5 CONSTRUCTION WATER MANAGEMENT

5.1 Construction Activities

5.1.1 Rosehill Service Facility

Rosehill Service Facility will include a temporary station box to enable TBM launch, spoil stockpile area, tunnel boring machines (TBM) laydown / assembly area, parking, site offices and the primary construction water treatment plant. At the end of construction, the Rosehill Service Facility will be converted into a permanent fully lined (tanked) structure. During construction the Rosehill excavation will be drained feature requiring dewatering to maintain dry conditions.

The Rosehill Station Box within the Rosehill Service Facility will act as the launch site for the project TBM. The TBMs will be launched from Rosehill Station Box and migrate eastward to Sydney Olympic Park (SOP) station, with TBM breakthrough at SOP expected to be completed around month 30. The TBMs will then be taken back to Rosehill service facility and re-launched westward toward Westmead station, where they are expected to breakthrough at Westmead Station around month 42.

Dewatering will be undertaken in the Station Box Excavation to enable construction and tunnelling from the Station Box to Sydney Olympic Park and Westmead.

5.1.2 Clyde Dive

As Part of the WTP project, a permanent dive structure, a vertical access shaft, spur running tunnels and junction cavern will be constructed at the Clyde Dive Site, located adjacent to James Ruse Drive.

Dive structure and tunnel portal construction would generally involve:

- Cast in-situ concrete piling along the edge of the dive structure to form the walls
- Excavating below track level
- Placing of precast and cast in-situ concrete for the cut-and-cover section and to form the tunnel portal.

5.1.3 Clyde Maintenance and Stabling Facility

Clyde Maintenance and Stabling Facility includes a number of earthworks activities including shallow excavations for utilities, retaining walls, and culverts, along with cut and fill excavations for final landform design.

The Clyde Maintenance and Stabling Facility construction site covers an area of approximately 380,000 m^2 with an anticipated total cut volume of approximately 160,000m^3 and fill volume of approximately 400,000m^3. Excavations intercepting shallow groundwater will require dewatering to facilitate the site establishment and construction activities.

5.2 Water Treatment Plants

5.2.1 Overview

To address conditions D117 and D118 of the CoA, The Project will construct and operate a number of water treatment plants (water treatment plants) throughout the duration of tunnel and station excavation for the treatment of groundwater seepage, TBM process water, stormwater runoff from excavations, and washdown water.

The Project Water Treatment Plants will be installed and operated for construction stages only at Westmead, Parramatta and Rosehill (including Clyde Stabling and Maintenance Facility). Water treatment plants at Westmead and Parramatta are being assessed as a separate package of works.

The proposed construction water treatment plant at Rosehill has been re-designed from earlier design stages to achieve better environmental and sustainability outcomes. Under the new approach, the primary

construction water treatment plant at Rosehill will treat groundwater inflows and construction water from three separate sources including:

- Rosehill Service Facility
- Clyde Dive
- Clyde Stabling and Maintenance Facility.

To enable construction activities within the required timeframes and meet requirements under contract conditions, Gamuda will commission and operate two (2) construction water treatment plants and provide one (1) operational water treatment plant for handover to Sydney Metro at the completion of the required construction activities, including.

- I-WTP: Rosehill interim construction water treatment plant
- WTP-1: Rosehill primary construction water treatment plant
- WTP-6: Rosehill operational water treatment plant

The locations of the Rosehill primary construction water treatment plant (WTP-1), operational water treatment plant (WTP-6) and proposed interim construction water treatment plant (I-WTP) are shown in **Figure 8**.

The interim construction water treatment plant (I-WTP) is required for an initial 6-month period while the primary construction water treatment plant (WTP-1) is being installed and commissioned for the principal stages of construction. The interim water treatment plant will be used to manage groundwater inflows into the TBM launch excavation at Rosehill.

The sources of inflow and anticipated influent water quality to the Rosehill **primary construction water treatment plant** and proposed **interim construction water treatment plant** are discussed further in the Sections **5.2 and 5.3**.

5.3 Rosehill Primary Construction Water Treatment Plant

5.3.1 Sources and Inflow Rates

Over the course of the construction period, inflows to the Rosehill construction water treatment plants will comprise a mixture of groundwater inflows to excavations, recycled TBM process water, incident rainfall into excavations, and washdown water. Sources of inflow will include:

- Rosehill Service Facility (excavation)
- Clyde Dive (excavation and mined tunnel)
- Clyde Stabling and Maintenance Facility (excavations)
- Running Tunnels between Westmead and Sydney Olympic Park (tunnels)

Groundwater inflows at the TBM face are a key input to the Rosehill primary construction water treatment plant. Summary assessment of the estimated inflows at the tunnel boring machine face are as follows:

- Average inflow rates approximate 8m3/day.
- The maximum and minimum rates are 29m3/day and 2m3/day respectively.
- Locations of higher estimated inflows include:
    - 500 m west of Parramatta Station, (where deep tunnel excavation intersects inferred faulting) where flows are estimated to approximate 29m3/day
    - At the western exit from Parramatta Station Box which may be affected by subvertical connection to overlying alluvial sediments and crowning in low cover rock with sub-horizontal shearing)
    - At the eastern exit from Parramatta Station where faulting and dyke intrusion are anticipated an there is a risk of elevated inflows
    - Either side of the former Silverwater Service Facility where the combination of inferred faulting and elevated water levels has indicated potential high inflows
    - At the Spur Tunnel junction, with cavern construction occurs below the interface with the Mittagong Formation.

- The estimated inflows to the 35 cross passages (XP) are as follows:
- Average inflow rates approximate 3m3/day
- The maximum and minimum rates are 10m3/day and 1m3/day respectively
- Location of higher inflows is:
  - Chainage19.570 km to 19.650 km were flows are estimated to approximate 10m3/day.
- The estimated inflows to the Clyde Dive site are as follows:
- 8m diameter spur junction flows are estimated at 27m3/day
- 10m diameter spur junction flows are estimated at 21m3/day
- 14m diameter spur junction flows are estimated at 39m3/day.
- Additional inflows will also occur from the following sources:
- Groundwater inflow into drained excavations (e.g., Rosehill, Clyde MSF)
- Rainfall events into excavations
- TBM process water

During dry conditions the inflow volumes from Rosehill Services Facility are predicted to range between approximately 336 m^3/day and 435 m^3/day. This range includes approximately 209 m^3/day of recycled TBM process water at peak, which will commence after the Rosehill service facility is built and the TBM is launched within the excavation. When it rains there will be additional water to treat. The reasonable worst-case 24-hour rainfall event (a 50% AEP) will result in the generation of an additional 315 m^3/day (the peak flow rate is 0.061 m3/sec from a 15-minute storm event).

During dry conditions the treatment volumes from Clyde Dive are predicted to range between 69.8 m^3/day and 111 m^3/day. There may be additional construction process water that is not currently accounted for. When it rains there will be additional water to treat. The reasonable worst-case 24-hour rainfall event (a 50% AEP) will result in the generation of an additional 706 m^3/day (the peak flow rate is 0.081 m^3/sec from a 30-minute storm event).

During dry conditions the treatment volumes from Clyde Maintenance and Stabling Facility will range between 46 m^3/day and 467 m^3/day in response to open trenching. Any rainfall within the Clyde Stabling and Maintenance Facility area would infiltrate to underlying groundwater or subsequently be managed as part of the by the primary Rosehill construction water treatment plant.

In terms of relative water volumes, combined groundwater seepage into excavations at Rosehill, Clyde Dive, and Clyde Stabling and Maintenance Facility will be significantly greater than the seepage volumes generated by the TBM and will therefore dominate the influent flows to the Rosehill water treatment plant. At peak capacity the water treatment plant will manage over 1,000 m^3 /day under dry conditions, and significantly greater volumes in response to storm events.

The water treatment plant will treat and discharge water at a treatment capacity of up to 50L/s to ensure that dewatering of excavations and tunnels can be suitably managed.

5.3.2 Influent Water Quality

The chemical composition of waters treated by each of the construction water treatment plants will vary during the construction period in response to varying relative loads of groundwater, process water, washdown water and excess rainfall runoff. Of these sources, groundwater is anticipated to have a varying chemical profile as tunnelling progresses in response to changing hydrogeological conditions and potential localized sources of contamination.

The water quality of each source of influent to the construction water treatment plant at Rosehill is discussed in the following sections.

5.3.2.1 Groundwater

Groundwater monitoring has been completed as part of geotechnical and environmental investigations by Sydney Metro between 2018 and 2021.

Groundwater samples collected during monitoring events were submitted for laboratory testing for screening of contaminants of concern against water quality standards. This information has been used to undertake a predictive assessment of potential water quality to the Rosehill water treatment plant during construction.

Table 20 presents estimates on the expected lower, middle, and upper ranges of for key contaminants of concern that are likely to be present in groundwater inflows pumped to the primary Rosehill water treatment plant, including water treatment plants managing flows between Rosehill and Sydney Olympic Park (SOP) (WTP-1 and WTP-6).

Table 20. Anticipated Groundwater Contaminant Concentrations – Rosehill WTP

Parameter	DGV	Rosehill to SOP (Lower Range)	Rosehill to SOP (Mid-Range)	Rosehill to SOP (Upper Range)	Rosehill to Clyde (Lower Range)	Rosehill to Clyde (Mid-Range)	Rosehill to Clyde (Upper Range)
Electrical Conductivity (µs/cm)	-	19,000 - 21,800	24,100 - 29,200	25,100 – 44,100	3,800 – 21,800	9,200 – 24,100	21,100 - 25,100
pH (Units)	7.0-8.5	6.4 - 6.9	6.9 - 7.1	7.38 - 7.45	6.4 - 6.5	6.96 - 7.35	7.45 - 7.52
Ammonia (Total)	910	800 -2,200	1,100 - 4,500	1,200- 15,300	70 - 800	1,100 – 1,200	1,300-15,300
Nitrogen (Total)	300	1,200 - 2,200	1,500 - 4,750	1,750–16,900	380-1,180	1,500 - 1,600	1,750-16,900
Reactive Phosphorus	5	10*	10*	10 - 40	10*	10*	10*
Total Phosphorus	30	20	20 - 35	20 - 130	20	20	20 - 34
Arsenic (III & V)	2.3	1 - 1.3	1 - 3	2 - 8	1	1	2 - 12
Cadmium	0.7	0.1	0.1	0.1 - 0.7	0.1	0.1	0.1 - 0.45
Chromium (III & VI)	4.4	1	1	2 - 7.5	1	1	1 - 1.8
Cobalt	1	3.1 - 4.4	6 - 9	10 - 12.5	1 - 4.4	2.5 - 6	12 - 50
Copper	1.3	1 - 2	2 - 3.5	3 - 9	1 - 2	1 - 2	1 - 3
Iron	300	1,150 - 4,200	5,900 – 9,000	11,600 - 88,400	400 – 4,200	2,650 - 9,000	11,100-88,400
Lead	4.4	1	1	1 - 7	1	1	1
Manganese	80	210 - 400	440 - 480	580 – 2,300	210 - 380	440 - 520	580 - 1,100
Mercury	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Nickel	70	2 - 2.2	6 - 7	11 - 50	1.3 - 2.2	2 - 7	11 - 35
Zinc	8	5 - 8	18 - 28	40 - 66	5 - 8	8 - 18	40 - 200
Petroleum Hydrocarbons C6-C40	-	<100	<100	<100	<100	<100	<100

All values in µg/L unless otherwise specified
Concentration exceeds default guideline value
* Exceedance related to elevated laboratory limit of reporting

Based on the results from groundwater monitoring it is considered likely that groundwater inflows to the water treatment plants at Rosehill will commonly contain the following toxicants and stressors at concentrations above the default 95% and 99% species protection criteria for receiving waterways:

- Toxicants: including ammonia, cobalt, copper iron, manganese, and zinc
- Stressors: including total nitrogen and other nitrogen species

Contaminants that may exceed default guideline values in groundwater less frequently include arsenic, chromium, lead (toxicants), and phosphorous (stressor).

Groundwater salinity is typically brackish to saline, however this is not considered to reflect a water quality limitation as the Rosehill water treatment plant will discharge into an estuarine environment that experiences salinity variations consistent with the ranges observed in groundwater.

5.3.2.2 Process Water

During the tunnelling process TBMs will generate substantial volumes of sediment laden water derived from the mixing of potable water (used for pressurised stabilisation of the rock face and lubrication of cutting heads) and waste rock fines generated from the boring process.

The resulting wastewater stream from the TBMs will be pumped back to the Rosehill WTP for treatment prior to discharge into receiving waterways. The chemistry of the wastewater stream from TBM will reflect the composition of the rock / groundwater unit being intercepted, and the original process water profile. As such

the composition may vary significantly along the length of the alignment in response to heterogeneity in geological conditions and localized sources of soil / rock contamination.

To achieve enhanced sustainability targets the TBM will aim to use water recycled through the water treatment plant during tunnelling. The water quality criteria for the TBM cooling circuit and TBM industrial water circuit are summarized in **Table 21** and

Table 22.

Table 21. TBM Cooling Water Circuit – Water Quality Criteria

Parameter	Units	Default Guideline Value
Total Hardness	°dH	< 11
Carbonate Hardness	°dH	< 8
Non – carbonate Hardness	°dH	< 3
pH value	Units	6 - 8
Electrical conductivity	µS/cm	< 2,500
pKs 8.2	mmol/l	< 3
pKs 4.3	mmol/l	< 25
Iron contents (Fe)	mg/l	< 0.2
Manganese content (Mn)	mg/l	< 0.05
Calcium content (Ca)	mg/l	< 400
Magnesium content (Mg)	mg/l	< 50
Sodium content (Na)	mg/l	< 200
Chloride content (Cl)	mg/l	< 250
Sulphate content (SO4)	mg/l	< 240
Nitrate content (NO4)	mg/l	< 50
Free carbon dioxide (CO2)	mg/l	< 10
Dissolved organic carbon	mg/l	< 1.7
Depositing substances after 0.5 hours	mg/l	< 0.1

Table 22. TBM Industrial Water Circuit – Water Quality Criteria

Parameter	Units	Default Guideline Value
Total hardness	°dH	< 15
pH value	Units	6 - 9
Electrical conductivity	µS/cm	< 5,000
Chloride content (Cl)	mg/l	< 300
Depositing substances after 0.5 hour	mg/l	< 0.5

Based on the criteria it is anticipated that up to 50% of the process water generated during tunnelling (approximately 170 m^3/day at peak) will be recoverable by processing through the water treatment plant. 100% of approximately 39 m^3 day used for miscellaneous processes (surface plant cooling, horizontal conveyor, sprinkler, dust suppression, general washdown) it anticipated to be recoverable following water treatment. The TBM cooling water circuit is not anticipated to include any recoverable water due to the stringent water quality requirements.

5.3.2.3 Excess Rainfall into Rosehill Excavation

Excess rainfall into the Rosehill excavation will managed through WTP1 during construction, and WTP6 during operation.

The constituents and relative concentrations of contaminants in present in excess rainfall affecting the Rosehill excavation are expected to vary in response the intensity, duration, and frequency of rainfall-runoff events. Specifically high contaminant concentrations would be expected in low volume events, and during the initial runoff (first flush) period, with lower concentrations in response to significant storms.

The key contaminants of concern in excess rainfall ponding in the Rosehill excavation are likely to include any toxicants and stressors present in exposed soils or rock that can dissolve or come into suspension in response to rainfall events. Typically, this may include a range of heavy metals and nutrients.

5.3.3 Design Specifications and Treatment Processes

The new Rosehill construction water treatment plant will be designed with a flow capacity of up to 50 L/s. The water treatment plant will include a multi-stage treatment process with the objective of achieving the required WQOs for the receiving waterways (consistent with condition D118), including ANZECC (2000) and ANZG (2018) criteria. The proposed treatment processes that will be adopted at the Rosehill WTP are summarized in Table 23.

Table 23. Water Treatment Plant Design Treatment Processes – Primary Water Treatment Plant

Process	Description	Water Quality Outcome
Step 1: Coarse grit removal	Coarse grit removal (pre-screening) in tunnel fish tanks will be implemented as primary treatment measures for water quality upstream of the proposed water treatment plants. Coarse grit removal has also been included in the water treatment plants as a contingency measure for coarse materials that are not intercepted through tunnel fish tanks.	Reduced turbidity and removal of coarse suspended solids.
Step 2: Balancing of incoming flows (inflow balance tank)	Water from excavation/tunnelling is directly pumped to a balance tank. The purpose of the balance tank is: • To buffer the expected highly variable flowrates and accommodate any surges in flow • Enable settling of heavy solids/sludge in the stream which are removed via an automated slurry pump and transferred to a sludge tank for dewatering Any off-spec filtrate and backwash return streams from the downstream processes are also directed here for re-processing.	Reduced turbidity; coarse / heavy suspended solids; recirculate non-compliant water from downstream processes.
Step 3a: In-line pH correction	Acid / caustic dosing will also be used upstream of the clarifier if necessary to assist in the clarification process, optimizing removal of oils and settling of sediment.	Enhance removal of contaminants through settling of solids.
Step 3b: Coagulant / polymer flocculant dosing	Coagulant and polymer are also dosed to the wastewater to aid in the settling of solids in the lamella clarifier. Coagulants and polymers used will include: HP1420 polyaluminium chloride liquid (PACL); ferrous sulfate / ferric chloride; HB4302 anionic emulsion polymer.	Enhance removal of contaminants through settling of solids.
Step 4: Clarification (lamella plate clarifier)	Lamella plate clarification will be used to promote sedimentation of suspended solids, reducing turbidity and suspended solids loads of processed effluent. The lamella clarifier will be fitted with an underflow weir that will retain oil and any other floating matter. The settled sludge at the bottom of the clarifier will be pumped to the dewatering plant, whereas the clarified water shall be sent to the pH correction system.	Reduce turbidity; suspended solids; oil and grease; heavy metals (Cr III, Cr VI, Cu, Fe, Pb, Mn, Ni, Zn); VOCs/ SVOCs; C6 – C36 petroleum hydrocarbons.
Step 5: Solids removal	Settled sediment (sludge) will be pumped to a sludge tank via slurry pump for storage prior to dewatering via screw press / filter press and removal of press cake to offsite disposal facility.	Removal of settled sediment.
Step 6: pH correction	Treated water from the Lamella system will flow into a pH correction tank for acid / caustic dosing to meet discharge criteria enhance and optimise metal removal in the downstream greensand media filters. An automated divert system returns any off-spec water back to the head of works (balance tank) for re-processing	pH correction for discharge and downstream treatment processes.
Step 7: Media filtration (e.g., Greensand)	Suitably clarified water will be processed through the appropriately sized filter banks for the removal of contaminants. Greensand filtration is proposed to assist in reducing concentrations of heavy metals, particularly iron, manganese, and arsenic from effluent.	Reduce turbidity; residual solids; and concentrations of heavy metals (As, Cd, Cu, Fe, Pb, Ni, Mn, Hg); oil and grease.
Step 8: Breakpoint chlorination	Breakpoint chlorination will be used to reduce concentrations of ammonia through conversion of ammonia to free nitrogen, nitrate, and chloramines. Sodium hypochlorite is added into the pump well as part of the existing process to encourage further removal of metals.	Reduce concentrations of ammonia; range of heavy metals. Biproducts include chloramines, nitrate, nitrite.
Step 9: Dechlorination	Overflow from the BPC tank will gravity flow to a dechlorination tank to polish any excess free chlorine, including chlorine reaction products (chloramines) prior to being pumped to the Granular Activated Carbon (GAC) filters. Sodium metabisulphite (SMBS) will be dosed to the treated water to convert the excess free chlorine to sodium chloride and sodium sulphate prior to discharge to GAC filters.	Reduce concentrations of free chlorine (including chloramines).
Step 10: Carbon filtration	GAC filtration will be used to reduce concentrations of nitrate, chloramines and residual contaminants from treated effluent, including metals, and hydrocarbons. Optional catalytic carbon may be used instead of conventional carbon media to improve removal rate of chloramines and organic compounds if needed, however optimal dosing rates at the breakpoint chlorination stage will mitigate potential risks from bi-products associated with the breakpoint chlorination process.	Reduce residual concentrations of free chlorine (including chloramines); C6 – C36 petroleum hydrocarbons; BTEX; chlorinated solvents; VOCs / SVOCs; PAH; residual

Process	Description	Water Quality Outcome
		metals (Zn, Pb, Cu, Cd, Ni; Cr VI); PFAS; oil and grease.
Step 11: Ion Exchange	Ion exchange media will be used to reduce concentrations of nitrate, heavy metals, phosphorous and PFAS prior to discharge. A nitrate specific ion exchange resin will be included to manage excess nitrate associated with removal (transformation) of ammonia from breakpoint chlorination.	Reduce concentrations of nitrate, heavy metals, phosphorous, and PFAS.
Step 12: Balancing of outgoing flows (Outflow balance tank)	Processed water will be balanced in an outgoing balance tank, fitted with an outlet valve for discharge from the Water Treatment Plant or recycling through the Water Treatment Plant if needed.	Flow balancing and discharge from water treatment plant / recirculation to inflow balance tank.

Following the treatment process, effluent will be stored in outgoing balance tanks for discharge to stormwater / receiving waterways and/ or onsite beneficial reuse. Discharge rates from the construction Water Treatment Plants will depend on the volume of water stored in the outgoing balance tank prior to discharge, however, is likely to range between 5 and 50 L/s during active discharge, discounting any reuse of water for TBM process water.

Estuarine conditions persist Parramatta River downstream of the Charles Street Weir. The receiving waterways are generally brackish to saline, with ambient salinities typically exceeding the salinities observed in groundwater. As a result, groundwater may be discharged directly to receiving waterways downstream of the Charles Street Weir without RO treatment.

5.3.3.1 Anticipated Effluent Water Quality

The design specifications and treatment processes for the Rosehill primary construction water treatment plant utilise the best available treatment technology for the management of water quality associated with major infrastructure projects. The anticipated effluent water quality profile for the primary construction water treatment plant is outlined in **Table 24**.

Overall, it is anticipated that the majority of pollutants can be treated to levels that are consistent with the ANZECC / ANZG default guideline values for 95% and 99% species protection of marine / estuarine ecosystems. Despite this, there are several limitations in treatment technology that should be outlined in deriving discharge criteria that are reflective of the treatment technology and practical limitations.

Treatment processes that can result in significant variability include a) breakpoint chlorination and b) nitrate ion exchange.

The basic process of breakpoint chlorination is that chlorine reacts with ammonia in four different stages to ultimately produce nitrogen gas (N), hydrogen ions (H+), chloride ions (Cl-), and lesser amounts of nitrous oxide (N2O) and nitrate (NO3). Stage one of the breakpoint chlorination process involves the introduction of chlorine and reaction with oxidisable pollutants to produce chlorides and oxides. During the second stage of the process chlorides are consumed by reactions with organic matter, if NH3 is present then chloramines (i.e. Mono- and dichloramines) are formed. Trichloramines are also formed in gaseous state, which evaporate away. During stage 3 chloramines are broken down and converted to nitrogen gas, which is vented from the system (this is the breakpoint of the process). During the last stage of the process destruction of chloramines is complete and residual chlorine concentrations increase. Trihalomethanes (CH4) can form at low concentrations during stage 4 of the breakpoint process.

As a result of the breakpoint chlorination process it is necessary to consider the potential introduction of reactive species of chlorine (e.g., chloramines) and halogenated methanes (e.g., trihalomethanes) in water. There are no current Australian aquatic or marine protection guidelines for concentrations of reactive species of chlorine (e.g., chloramines) or halogenated methanes (e.g., trihalomethanes) in water. The Canadian Council of Minsters of the Environment (CCME) specify that long term limits for reactive species of chlorine should not exceed 0.5 µg/L in marine water. There is no marine guideline for halogenated methanes, however a freshwater limit of 1.8 µg/L is adopted for trichloromethane in freshwater ecosystems. As such, these have been included in **Table 24,** but are unlikely to be generated at any significant quantity with appropriate control of dosing rates.

Ion exchange has been proposed as an additional treatment process to remove nitrates (NO3) that are generated through conversion of ammonia (NH3) via breakpoint chlorination.

Ion exchange resins typically comprise small porous plastic beads that contain a polymer resin. The structure of the resin includes a fixed (permanent) ion and a mobile counterion. The mobile counterions are selected to enable a ready exchange with ions of pollutants that are present in feed water to ion exchange vessels.

The efficiency of nitrate ion exchange vessels decreases over time in response to cumulative replacement of counterions in the nitrate selective resins with nitrate in feed water. To maintain performance, ion exchange resins must be flushed periodically with an acidic saline (brine) solution to replace counterions and remove accumulated pollutants (e.g., nitrate). The frequency of brine regeneration increases as a function of the required discharge criteria. Recent performance outcomes from existing construction projects indicate regeneration timescales of less than 1 week with 30KL of brine to achieve ANZECC criteria of 15 µg/L. The cost and environmental impact of regeneration and brine disposal is significant and thus the criteria of 15 µg/L is not considered to be a practical or reasonable target for water quality outcomes.

Table 24. Rosehill Primary Construction Water Treatment Plant – Anticipated Effluent Water Quality

Parameter	Units	Default Guideline Value	Anticipated Influent	Anticipated Effluent	Treatment Method
Elec. Conduct.	µS/cm	N.A.	600 – 33,000	600 – 33,000	No suitable treatment
Turbidity	NTU	10	50 – 250	10	Clarification
pH	Units	7.0-8.5	6.1 – 7.6	7.0-8.5	pH Correction
Total Nitrogen	µg/L	300	200 – 8,000	200 – 800	Breakpoint Chlorination, Nitrate Ion Exchange, GAC
Total Ammonia	µg/L	910	10 – 7,000	50 - 200	Breakpoint Chlorination
Nitrate	µg/L	2,400	15 – 100	**15+	Nitrate Ion Exchange
Total Oxidised Nitrogen	µg/L	15	15 - 100	**15+	Nitrate Ion Exchange
Total Phosphorus	µg/L	30	20 – 2,100	10 - 90	Clarification, GAC
Arsenic	µg/L	13	1 – 50	1 - 2	Media Filtration, Ion Exchange
Cadmium **(B)**	µg/L	0.7	0.1 – 1.0	0.1 – 0.5	Media Filtration, Ion Exchange
Chromium	µg/L	4.4	1 – 20	1 - 10	Media Filtration, Ion Exchange
Cobalt	µg/L	1.0	1 – 70	<1	Media Filtration, Ion Exchange
Copper	µg/L	1.3	1 – 10	<1	Media Filtration, Ion Exchange
Iron	µg/L	300	400 – 50,000	50 – 250	Media Filtration, Ion Exchange
Lead	µg/L	4.4	1 – 10	1 - 2	Media Filtration, Ion Exchange
Manganese	µg/L	1,900	100 – 3,100	1 - 50	Media Filtration, Ion Exchange
Mercury (inorganic) **(B)**	µg/L	0.1	0.1 – 0.3	0.1	Media Filtration, Ion Exchange
Nickel	µg/L	70	1 – 70	1 – 2	Media Filtration, Ion Exchange
Zinc	µg/L	8	5 – 700	5 - 15	Media Filtration, Ion Exchange
Anthracene **(B)**	µg/L	0.01	1* - 1.3	<1	Media Filtration, GAC
Fluoranthene	µg/L	1	1	1	Media Filtration, GAC
Naphthalene	µg/L	1	1	1	Media Filtration, GAC
Phenanthrene **(B)**	µg/L	0.6	1* - 3.6	<1	Media Filtration, GAC
Benzo(a)pyrene	µg/L	0.1	0.5*	0.1	Media Filtration, Coagulation, GAC
Benzene	µg/L	1	2*	1	Media Filtration, Coagulation, GAC
Ethylbenzene	µg/L	1	2*	1	Media Filtration, Coagulation, GAC
Toluene	µg/L	180	2	1	Media Filtration, Coagulation, GAC
Xylene	µg/L	2	2	1	Media Filtration, Coagulation, GAC
TRH (C6-C40)	µg/L	<100	100 – 1,200	<100	Clarification, GAC
PFOS	µg/L	0.00023	No Data	0.01	GAC, Ion Exchange
PFOA	µg/L	19	No Data	0.01	GAC, Ion Exchange
Monochloramine **(1)**	µg/L	0.5	No Data	<0.5	Breakpoint Chlorination, GAC
Dichloramine **(1)**	µg/L	0.5	No Data	<0.5	Breakpoint Chlorination, GAC
Trihalomethane **(1)**	µg/L	1.8	No Data	<1	Breakpoint Chlorination, GAC

** Target criteria for oxides of nitrogen may be achieved initially, however rapid breakthrough will occur requiring intensive regeneration using saline brines

(B) – DGV value of 99% adopted for bioaccumulation risk, **(1)** – potential bi-product of water treatment process.,

Concentration exceeds default guideline value

* Exceedance related to elevated laboratory limit of reporting

The anticipated impact from discharge of elevated concentrations of the above listed contaminants is provided in Section 6.

5.3.3.2 Discharge Rates

Discharge rates from the Rosehill primary water treatment plant are anticipated to increase with progression of tunnelling from Rosehill. Discharge rates are anticipated to vary from between 5 L/s during early stages of operation for the primary WTP, up to 50 L/s during the peak of construction activities.

5.4 Rosehill Interim Construction Water Treatment Plant

5.4.1 Sources and Inflow Rates

The Rosehill interim construction water treatment plant will be installed as a temporary water treatment plant for up to a maximum of six months to treat groundwater inflows to the Rosehill Box excavation. Sources of inflow will be limited to groundwater ingress and incident rainfall into the Rosehill Box excavation. Inflow rates are anticipated at between 3 L/s and a maximum of 5L/s during excavation.

5.4.2 Influent Water Quality

Groundwater monitoring has been undertaken for monitoring wells local to the Rosehill Box excavation. The results from monitoring have been summarized in **Table 25**.

Table 25. Summary Groundwater Monitoring – Contaminants of Potential Concern at Rosehill Box

Parameter	Units	ANZG / ANZECC DGV (Marine /Estuarine)	Lower Range (20 %ile)	Upper Range (80 %ile)
Electrical Conductivity (µs/cm)	µS/cm	-	17,260	30,880
Turbidity	NTU	10	No Data	No Data
pH (units)	Units	6.5-8.5	6.1	6.8
Total Nitrogen	µg/L	300	500	1,200
Total Ammonia	µg/L	910	170	490
Nitrate	µg/L	2,400	10	44
Total Oxidised Nitrogen	µg/L	15	10	52
Reactive Phosphorus	µg/L	5	10*	10*
Total Phosphorus	µg/L	30	20	470
Arsenic	µg/L	2.3	1	8.2
Cadmium **(B)**	µg/L	0.7	0.1	0.5
Chromium	µg/L	4.4	1	4.6
Cobalt	µg/L	1.0	23	50
Copper	µg/L	1.3	1	4.6
Iron	µg/L	300	458	8,566
Lead	µg/L	4.4	1	4.6
Manganese	µg/L	1,900	135	600
Mercury (inorganic) **(B)**	µg/L	0.1	0.1	0.1
Nickel	µg/L	70	8.6	22.4
Zinc	µg/L	8	26.2	76.4
Anthracene **(B)**	µg/L	0.01	1	1.3
Fluoranthene	µg/L	1	1	1
Naphthalene	µg/L	1	1	1
Phenanthrene **(B)**	µg/L	0.6	1*	3.6
Benzo(a)pyrene	µg/L	0.1	0.5*	0.5*
Benzene	µg/L	1	1	1
Ethylbenzene	µg/L	1	2*	2*
Toluene	µg/L	180	2	3.6
Xylene	µg/L	2	2	2
Total Recoverable Hydrocarbons	µg/L	100	100	120
PFOS	µg/L	0.00023	0.01*	0.01*
PFOA	µg/L	19	0.01	0.01

(B) – DGV value of 99% adopted for bioaccumulation risk, **(1)** – potential bi-product of water treatment process.,
Concentration exceeds default guideline value
* Exceedance related to elevated laboratory limit of reporting

Based on the monitoring results it is anticipated that groundwater inflows to the Rosehill Box excavation will contain elevated concentrations of a range of contaminants, including:

- Toxicants: Arsenic, chromium, cobalt, copper, iron, lead, zinc, anthracene, phenanthrene and TRH

- Stressors: Total nitrogen, total oxidised nitrogen, total phosphorous, reactive phosphorous

Groundwater salinity is typically brackish to saline, however this is not considered to reflect a water quality limitation as the Rosehill water treatment plant will discharge into an estuarine environment that experiences salinity variations consistent with the ranges observed in groundwater.

5.4.3 Design Specifications and Treatment Processes

Table 26. Water Treatment Plant Design Treatment Processes – Interim Water Treatment Plant

Process	Description	Water Quality Outcome
pH correction	Acid / caustic dosing will also be used if necessary to assist in the clarification process, and to ensure pH meets the necessary discharge criteria.	Enhance removal of contaminants through settling of solids. pH correction for discharge and downstream treatment processes.
Coagulant / polymer flocculant dosing	Coagulant and polymer are also dosed to the wastewater to aid in the settling of solids in the lamella clarifier. Coagulants and polymers used will include: HP1420 polyaluminium chloride liquid (PACL); ferrous sulfate / ferric chloride; HB4302 anionic emulsion polymer.	Enhance removal of contaminants through settling of solids.
Clarification	Clarification will be used to promote sedimentation of suspended solids, reducing turbidity and suspended solids loads of processed effluent. The lamella clarifier will be fitted with an underflow weir that will retain oil and any other floating matter. The settled sludge at the bottom of the clarifier will be pumped to the dewatering plant, whereas the clarified water shall be sent to the pH correction system.	Reduce turbidity; suspended solids; oil and grease; heavy metals (Cr III, Cr VI, Cu, Fe, Pb, Mn, Ni, Zn); VOCs/ SVOCs; C6 – C36 petroleum hydrocarbons.
Media filtration	Suitably clarified water will be processed through the appropriately sized filter banks for the removal of contaminants. Greensand filtration is proposed to assist in reducing concentrations of heavy metals, particularly iron, manganese, and arsenic from effluent.	Reduce turbidity; residual solids; and concentrations of heavy metals (As, Cd, Cu, Fe, Pb, Ni, Mn, Hg); oil and grease.
Carbon filtration	GAC filtration will be used to reduce concentrations of nitrate, chloramines and residual contaminants from treated effluent, including metals, and hydrocarbons. Optional catalytic carbon may be used instead of conventional carbon media to improve removal rate of chloramines and organic compounds if needed, however optimal dosing rates at the breakpoint chlorination stage will mitigate potential risks from bi-products associated with the breakpoint chlorination process.	Reduce residual concentrations of free chlorine (including chloramines); C6 – C36 petroleum hydrocarbons; BTEX; chlorinated solvents; VOCs / SVOCs; PAH; residual metals (Zn, Pb, Cu, Cd, Ni; Cr VI); PFAS; oil and grease.

5.4.3.1 Anticipated Effluent Water Quality

The design specifications and treatment processes for the Rosehill interim construction water treatment plant utilise the best available treatment technology for temporary water treatment plants in managing water quality associated construction dewatering works.

The anticipated effluent water quality profile for the interim construction water treatment plant is outlined in **Table 27.** The anticipated water quality is based on the results from recent bench testing undertaken on groundwater samples recovered from around the proposed Rosehill Box excavation.

Table 27. Interim Construction Water Treatment Plant – Anticipated Effluent Water Quality

Parameter	Units	Default Guideline Value	Anticipated Influent	Anticipated Effluent	Treatment Method
Elec. Conduct.	µS/cm	N.A.	17,260-30,880	17,260-30,880	No suitable treatment
Turbidity	NTU	10	50 - 250	10	Clarification
pH	Units	7.0-8.5	6.1 - 6.8	7.0-8.5	pH Correction
Total Nitrogen	µg/L	300	500 – 1,300	500 – 1,300	No suitable treatment
Total Ammonia	µg/L	910	200 – 300	170 - 490	No suitable treatment
Nitrate	µg/L	2,400	10 – 200	500 – 900	No suitable treatment
Total Oxidised Nitrogen	µg/L	15	10 - 200	500 – 900	No suitable treatment
Total Phosphorus	µg/L	30	20 - 470	10 - 200	GAC
Arsenic	µg/L	13	1 - 8.2	1 - 2	Media Filtration, GAC
Cadmium **(B)**	µg/L	0.7	0.1 - 0.5	0.1 – 0.5	Media Filtration, GAC
Chromium	µg/L	4.4	1 - 4.6	0.1 - 0.5	Media Filtration, GAC
Cobalt	µg/L	1.0	23 - 50	1 - 2	Media Filtration, GAC
Copper	µg/L	1.3	1 - 4.6	1 - 2	Media Filtration, GAC

Parameter	Units	Default Guideline Value	Anticipated Influent	Anticipated Effluent	Treatment Method
Iron	µg/L	300	458 – 8,566	50 – 250	Media Filtration, GAC
Lead	µg/L	4.4	1 - 4.6	1 - 2	Media Filtration, GAC
Manganese	µg/L	1,900	135 - 600	1 - 50	Media Filtration, GAC
Mercury (inorganic) **(B)**	µg/L	0.1	0.1	0.1	Media Filtration, GAC
Nickel	µg/L	70	8.6 - 22.4	1 – 2	Media Filtration, GAC
Zinc	µg/L	8	26.2 - 76.4	5 - 15	Media Filtration, GAC
Anthracene **(B)**	µg/L	0.01	1* - 1.3	<1	Media Filtration, GAC
Fluoranthene	µg/L	1	1	1	Media Filtration, GAC
Naphthalene	µg/L	1	1	1	Media Filtration, GAC
Phenanthrene **(B)**	µg/L	0.6	1* - 3.6	<1	Media Filtration, GAC
Benzo(a)pyrene	µg/L	0.1	0.5*	0.1	Media Filtration, Coagulation, GAC
Benzene	µg/L	1	2*	1	Media Filtration, Coagulation, GAC
Ethylbenzene	µg/L	1	2*	1	Media Filtration, Coagulation, GAC
Toluene	µg/L	180	2	1	Media Filtration, Coagulation, GAC
Xylene	µg/L	2	2	1	Media Filtration, Coagulation, GAC
TRH (C6-C40)	µg/L	<100	100 - 120	<100	GAC
PFOS	µg/L	0.00023	<0.01*	<0.01*	GAC
PFOA	µg/L	19	No Data	No Data	GAC

* Limit of reporting above DGV

The adopted treatment processes for the interim water treatment plant have been specified with the objective of achieving the required ANZECC / ANZG default guideline values for 95% and 99% species protection of marine / estuarine ecosystems. Due to the limited scalability of a temporary water treatment plant, removal of several contaminants to the required discharge criteria may not be practical, including:

- Total nitrogen / total oxidised nitrogen: There is no available treatment technology to remove total nitrogen outside of ion exchange, as such the interim water treatment plant will not have the capacity to remove total nitrogen.
- Cobalt, copper, zinc: Bench testing undertaken indicates improvement in concentrations of cobalt, copper, and zinc, however compliance with DGVs could not be achieved.

A second bench test is currently underway to verify the results from initial bench testing and identify whether any further improvements in water quality outcomes can be achieved.

The anticipated impact from discharge of elevated concentrations of the above listed contaminants is provided in Section 6.

5.4.3.2 Discharge Rates

Discharge rates from the Rosehill interim water treatment plant are anticipated to increase with progression of excavation works at Rosehill. Discharge rates are anticipated to vary from between 0.5 L/s during early stages of construction, and up to 5 L/s once the excavation reaches target depth.

Figure 16. Rosehill Water Treatment Plant Proposed Discharge Point

6 DISCHARGE IMPACT ASSESSMENT

6.1 Overview

The proposed construction water treatment plants at Rosehill include measures to protect the water quality and river flow objectives of receiving waterways to which they discharge treated effluent.

The following sections provide a detailed review of the potential impacts to water quality and river flow objectives for the waterways receiving discharge from the Rosehill water treatment plants in consideration of the environmental characteristics of receiving environments and proposed water treatment / management measures.

6.2 Flows

6.2.1 Tidal Flows

There is limited information on ambient flow rates in Duck River. The sections of the Duck River that will be impacted by discharges from the construction water treatment plants (interim and primary) are limited to the portions that are influenced by tidal flows (ebb and flood) as the water treatment plants will discharge to the main channel downstream of the tidal limit.

Under dry weather conditions flows in the lower portions of the Duck River will be influenced by baseflow (groundwater) inflows and semi-diurnal tidal oscillations (ebb and flood flows). Baseflow contributions and local catchment morphology creates an asymmetry of flow conditions favouring a net migration of water in the downstream direction over successive tidal cycles, which influences flushing rates and particle migration.

The modelled average daily tidal discharge volumes from Duck River associated with ebb and flood tides between MHW and MLW conditions are presented in Table 28 and show approximate discharge volumes of around 300,000 m^3.

Table 28. Duck River Average Daily Tidal Discharge Volumes

Flow Parameter	Discharge (m^3/d)	Average Flow Rate (m3/s)	Peak Flow Rate (m3/s)
Duck River Ebb: MHW-MLW	305,151	4.3	7.3
Duck River Flood: MHW-MLW	305,151	2.1	4.0

The assessment of flow impacts from the project are based on discharge under dry conditions, where tidal discharge is the dominant mechanism affecting discharge through Duck River. Despite this, rainfall runoff events (discussed in the following section) are an important factor in refreshing water quality in Duck River.

6.2.2 Rainfall - Runoff

On average there are approximately 140 rainfall days in the Sydney basin annually. As such, dry conditions are common for catchments through the Sydney Basin. The highly urbanized nature of the catchment has resulted in a large impervious fraction that has increased runoff volumes and discharge rates. The anticipated runoff volumes from the Duck River catchment in response to varying magnitude rainfall events up to the 0.5 ARI are presented in **Table 34**.

Table 29. Anticipated Catchment Runoff Volumes

Impervious Fraction	5mm Rainfall Event Runoff (m^3/d)	15mm Rainfall Event Runoff (m^3/d)	30mm Rainfall Event Runoff (m^3/d)	60mm Rainfall Event Runoff (m^3/d)
40%	84,000	252,000	504,000	1,008,000
50%	105,000	315,000	630,000	1,260,000
60%	126,000	378,000	756,000	1,512,000

Review of the rainfall-runoff predictions show that discharge from rainfall at 15mm would be roughly equivalent to the tidal discharge (ebb / flow) under one tidal cycle. Higher magnitude rainfall events that frequently occur in the Duck River catchment would result in flushing volumes greater than the tidal exchange rate that would effectively act to refresh the tidal prism.

6.2.3 Primary Construction Water Treatment Plant

The proposed Primary Construction Water Treatment Plant at Rosehill will discharge treated effluent at a peak rate of up to 50 L/s (0.05 m^3/s) to Duck River at intermittent periods over 24-hour cycles during the construction stages of the project.

Due to the unavailability of information on flow rates through Duck River, discharge impacts relating to changes of flow rates are limited to an assessment of daily volumetric flow changes.

The anticipated daily volumetric discharge rates from the primary construction water treatment plant (WTP-1) have been compared against the daily volumetric discharge through Duck River associated with ebb and flood flows associated with a typical tidal oscillation (mean high water (MHW) to mean low water (MLW) transition) (**Table 35**). A % change of flow based on addition of flow from WTP-1 to ebb and flood flows has been calculated in **Table 35** to assess the impact of discharge on flow rates through Duck River.

Table 30. Anticipated Flow Impacts

Flow Parameter	WTP-1	Duck River Ebb: MHW-MLW	% Change	Duck River Flood: MHW-MLW	% Change
Average Flow Rate (m3/s)	0.025	4.3	0.58%	2.1	1.19%
Peak Flow Rate (m3/s)	0.05	7.3	0.68%	4.0	1.25%
Average Discharge (m3/d)	2,160	185,000	1.16%	90,720	1.19%
Peak Discharge (m3/d)	4,320	315,360	0.68%	172,800	1.25%

The results from flow modelling show that discharge from the primary construction water treatment plant would increase daily discharge rates through Duck River by between approximately 0.58% under average conditions and 0.68% at peak discharge from the water treatment plant during ebb flows, and between 1.19% and 1.25% during flood flows.

Based on these findings a detailed review of potential risks from discharges against all relevant NSW River Flow objectives is presented in **Table 31**.

Table 31. Rosehill Primary Construction Water Treatment Plant Discharges Flow Risk Summary

River Flow Objective	Risk Assessment	Risk Rating
Protect Pools in Dry Times	Discharges will not reduce available water for pools in dry times.	Very Low
Protect Natural Low Flows	Discharges will not significantly alter flow rates under ambient conditions.	Very Low
Maintain Wetland and Floodplain Inundation	Effluent discharge will not result significant increase or decrease in wetland or floodplain inundation.	Very Low
Mimic Natural Drying in Temporary Waterways	Natural waterways are perennial. Effluent discharges will not result in a significant increase or decrease in flow rates.	Very Low
Maintain Natural Flow Variability	Discharges will not significantly alter natural flow variability due to perennial nature of flows.	Very Low
Maintain Natural Rates of Change in Water Levels	Discharges are unlikely to result in significant increases in water levels due to high stormwater discharge capacity of receiving waterways and large storage volumes.	Very Low
Minimise Effects of Weirs and Other Structures	No weirs or instream structures are proposed.	Very Low
Manage Groundwater for Ecosystems	Groundwater drawdown will be minimized through the groundwater management plan and is considered unlikely to result in a significant reduction of baseflow to receiving waterways.	Very Low

6.2.4 Interim Construction Water Treatment Plant

The proposed Interim Construction Water Treatment Plant at Rosehill will discharge treated effluent at a peak rate of up to 5 L/s (0.005 m^3/s) to Duck River at intermittent periods over 24-hour cycles during the construction stages of the project.

The anticipated daily volumetric discharge rates from the interim construction water treatment plant (I-WTP) have been compared against the daily volumetric discharge through Duck River associated with ebb and flood flows associated with a typical tidal oscillation (mean high water (MHW) to mean low water (MLW) transition) (**Table 35**). A % change of flow based on addition of flow from I-WTP to ebb and flood flows has been calculated in Table 35 to assess the impact of discharge on flow rates through Duck River.

Table 32. Anticipated Flow Impacts

Flow Parameter	WTP-1	Duck River Ebb: MHW-MLW	% Change	Duck River Flood: MHW-MLW	% Change
Average Flow Rate (m3/s)	0.0025	4.3	0.058%	2.1	0.119%
Peak Flow Rate (m3/s)	0.005	7.3	0.068%	4.0	0.125%
Average Discharge (m3/d)	216	185,000	0.058%	90,720	0.119%
Peak Discharge (m3/d)	432	315,360	0.068%	172,800	0.125%

The results from flow modelling show that discharge from the primary construction water treatment plant would increase daily discharge rates through Duck River by between approximately 0.058% under average conditions and 0.068% at peak discharge from the water treatment plant during ebb flows, and between 0.119% and 0.125% during flood flows.

Based on these findings a detailed review of potential risks from discharges against all relevant NSW River Flow objectives is presented in **Table 31**.

Table 33. Rosehill Interim Construction Water Treatment Plant Discharges Flow Risk Summary

River Flow Objective	Risk Assessment	Risk Rating
Protect Pools in Dry Times	Discharges will not reduce available water for pools in dry times.	Very Low
Protect Natural Low Flows	Discharges will not significantly alter flow rates under ambient conditions.	Very Low
Maintain Wetland and Floodplain Inundation	Effluent discharge will not result significant increase or decrease in wetland or floodplain inundation.	Very Low
Mimic Natural Drying in Temporary Waterways	Natural waterways are perennial. Effluent discharges will not result in a significant increase or decrease in flow rates.	Very Low
Maintain Natural Flow Variability	Discharges will not significantly alter natural flow variability due to perennial nature of flows.	Very Low
Maintain Natural Rates of Change in Water Levels	Discharges are unlikely to result in significant increases in water levels due to high stormwater discharge capacity of receiving waterways and large storage volumes.	Very Low
Minimise Effects of Weirs and Other Structures	No weirs or instream structures are proposed.	Very Low
Manage Groundwater for Ecosystems	Groundwater drawdown will be minimized through the groundwater management plan and is considered unlikely to result in a significant reduction of baseflow to receiving waterways.	Very Low

6.3 Water Quality

Under dry conditions the dominant factors influencing water quality in estuarine sections of the Duck River are baseflow (groundwater inflows) and tidal exchange. During rainfall events freshwater inflows can occur at significant volumes resulting in a flushing effect through the estuary.

Under dry conditions the accumulation of sediments, organic materials, and contaminants can occur resulting in degraded water quality conditions in upper estuaries. Periodic rainfall events promote flushing and remobilization of sediments downstream and towards the mouth of the estuary and out to the ocean, thereby improving water quality conditions overall within the estuary despite short term spikes in contaminants during rainfall events.

Typical flushing times range from days in small estuaries to months in large estuaries during low flow conditions. Tidal flushing for complete water exchange within estuarine sections of the Parramatta River is typically in the range of 17 days (Roper et al., 2011) but may take significantly longer in the upper reaches (up to 130 days under dry conditions).

Due to the prevalence of dry conditions in the Sydney Basin, it is important to assess the impact of the proposed construction stage discharges under dry conditions, where limited flushing is available to 'reset' the baseline concentrations of contaminants.

A box model has been developed to simulate potential changes in water quality over multiple tidal cycles in response to discharges from both the primary Rosehill construction water treatment plant (WTP-1) and interim Rosehill construction water treatment plant (I-WTP). The box model consists of three cells representing sections of Duck River upstream, mid-stream, and downstream of the proposed discharge point.

As the main exchange of mixing is tidal exchange, the tidal prism (Vft) is calculated using mean high tide (MHW) and mean low tide (MLW) values with (V0) representing the volume of the box at mean low water. Flood tide volumes and ebb tide volumes were calculated as follows:

$$Vft = VMHW - VMLW$$

Tidal heights were obtained through the Department of Planning and Environment for Silverwater Bridge (Station 213435). Simple harmonic analysis of the tidal data was undertaken to extract the value for MHW (1.627 m AHD), and MLW (0.536 m AHD).

As water propagates upstream due to the tidal process, there is an exchange of residual concentration based on the previous box providing model continuity. A return flow factor has been included in the mass balance model based on average flushing rates (c. 130 days) for the upper estuary. The return flow factor accounts for the proportion of discharge impacted water that returns back up the Duck River channel during the flood tide.

A schematic of the analytical model is shown in Figure 17 and is based on the following assumptions:

- the pollutant is conservative,
- complete internal mixing of the contaminant each tidal cycle,
- no vertical stratification due to thermal or density effects,
- the initial pollutant distribution is uniform within the basin, and
- the freshwater/groundwater inflow from the surrounding land is constant with time and is negligible.

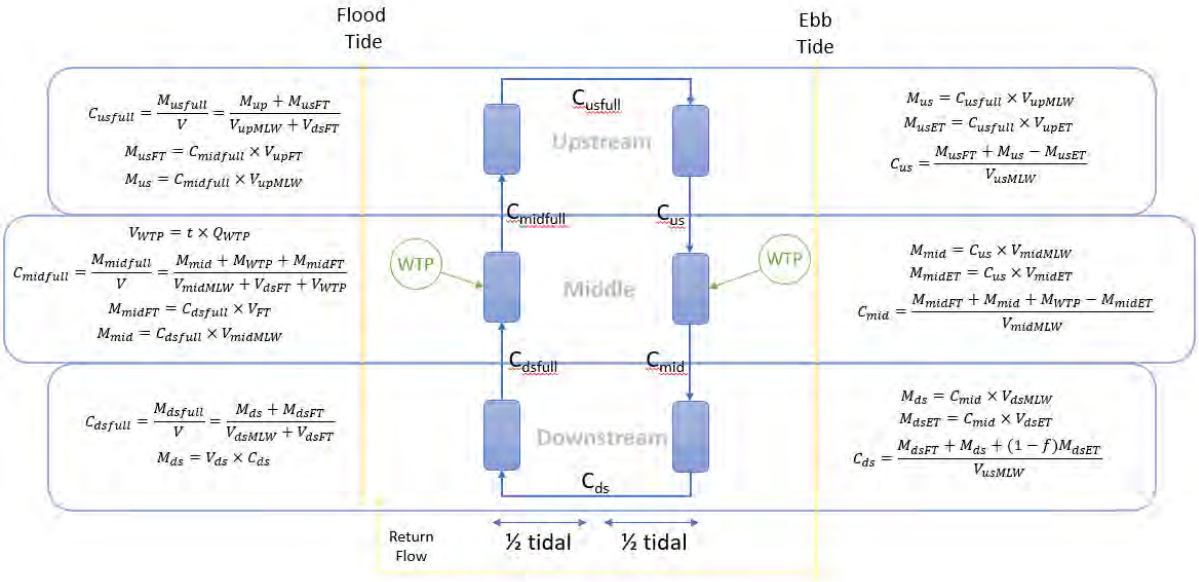


Figure 17. Water Quality Predictive Impact Box Model Schematic

An advection-dispersion equation using predicted ambient average flood and ebb tide discharge rates vs average and peak discharge rates from the primary and interim construction water treatment plants has been applied to estimate the approximate mixing zone to return to near ambient conditions for any pollutants that are likely to be present in effluent at concentrations exceeding ANZG and average ambient conditions in Duck River.

$$\frac{\partial \phi}{\partial t} + v\frac{\partial \phi}{\partial x} = K_d \frac{\partial^2 \phi}{\partial x^2}$$

1 Dimensional advection-dispersion equation (Julien, 2002).

The 1D dispersion area accounts for mixing across approximately one third of the channel width (13m) and the full channel depth (approximately 2.0 – 2.5m).

As the model accounts for negligible freshwater inflows ambient concentrations of pollutants will increase over each iteration of the model in response to the return flow factor. Flushing from rainfall events is expected to occur on average every 8 – 10 days (16-20 ebb or flow cycles). As such it is anticipated that water quality will reset to ambient conditions periodically in response to rainfall flushing.

6.3.1 Rosehill Primary Construction Water Treatment Plant

Predictive modelling of potential effluent impacts from the Rosehill primary construction water treatment plant on ambient water quality has been undertaken for the range of parameters identified in groundwater at typically elevated concentrations and concentrations exceeding the ANZECC / ANZG default guideline values for 95% and 99% species protection of marine / estuarine ecosystems.

The upper range of pollutant concentrations anticipated in effluent water discharged from the Rosehill primary construction water treatment plant have been used as the inputs to the predictive model, with ambient concentrations reflective of average concentrations of pollutants present in Duck River from baseline monitoring.

The results from predictive modelling of effluent discharges from the Rosehill primary construction water treatment plant are presented in **Table 34** and show the following:

- The following pollutants are anticipated in effluent at concentrations below ambient average concentrations in Duck River, and / or below ANZG / ANZECC default guideline values:
  - Electrical conductivity, turbidity, pH, ammonia, total oxidised nitrogen, nitrate, arsenic, cadmium, cobalt, copper, iron, lead, manganese, mercury, nickel, anthracene, phenanthrene, TRH, PFOA, monochloramine, dichloramine, and trihalomethane, naphthalene, fluoranthene benzo(a)pyrene, benzene, ethylbenzene, toluene, xylene.
- The following pollutants are anticipated in effluent at concentrations above the ANZG / ANZECC default guideline values but below the ambient concentrations in Duck River:
  - Total nitrogen, total phosphorous, and zinc.
- The following pollutants are anticipated in effluent at concentrations above the ANZG / ANZECC default guideline values and above the ambient water quality in Duck River:
  - Chromium.

As a result, it is anticipated that (with the exception of chromium) there is likely to be a net improvement in the average water quality in Duck Creek in response to discharge of treated effluent from the Rosehill primary construction water treatment plant. The worst-case scenario for total chromium (10 µg/L) anticipated effluent would result in net changes between approximately 14% and 27% in Duck River, from 1 µg/L to 1.14 and 1.27 µg/L respectively under average and peak tidal flow conditions. These values are below the ANZG (I2018) DGV for 95% species protection and thus the impacts from elevated chromium are considered to be negligible. Dilution modelling based on storage volume and flow rates for Duck River indicate that ANZG criteria would be achieved within 6-10m from the discharge point as excess concentration of chromium reduces to zero (**Figure 18**).

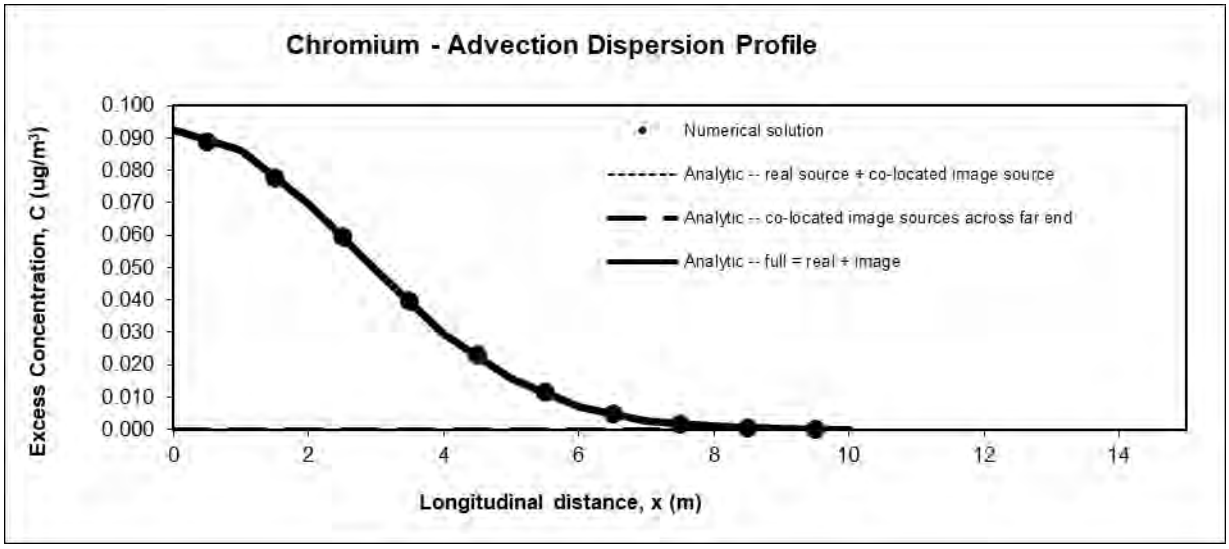


Figure 18. Chromium Advection Dispersion Profile and Excess Concentrations – Primary water treatment plant

While anticipated effluent concentrations of total nitrogen, total phosphorous, and zinc are above the ANZG / ANZECC default guideline values, the concentrations are lower than ambient levels in Duck River. Thus, although discharge will likely exceed the default guideline values in treated effluent there is expected to be a net improvement in water quality for these parameters in Duck River as a result.

Water quality improvements from ambient conditions are expected for the following pollutants:

- Total nitrogen, total ammonia, nitrate, total oxidised nitrogen, copper, manganese, and zinc.

Table 34. Primary Construction Water Treatment Plant – Anticipated Water Quality Impacts

Parameter	Units	DGV	Anticipated Effluent	Duck River Ambient Average	Duck River Anticipated Water Quality – Average Flow (25 L/s)	Impact of the Average Flow (%)	Duck River Anticipated Water Quality – Peak Flow (50 L/s)	Impact of the Peak Flow (%)
Elec. Conduct.	µS/cm	N.A.	600 – 33,000	15600	15865	1.70	15677	0.49
Turbidity	NTU	10	10	10	10	0	10	0.07
pH	Units	7.0-8.5	7.0-8.5	7.27	7.29	0.26	7.3	0.51
Total Nitrogen	µg/L	300	200 – 800	900	899	-0.17	897	-0.33
Total Ammonia	µg/L	910	50 – 200	213	213	-0.09	213	-0.18
Nitrate	µg/L	2,400	**15+	357	351	-1.45	346	-2.86
Total Oxidised Nitrogen	µg/L	15	**15+	383	377	-1.46	372	-2.87
Total Phosphorus	µg/L	30	10 – 90	90	90	0	90	0.01
Arsenic	µg/L	13	1 – 2	1.67	1.67	0.31	1.68	0.60
Cadmium **(B)**	µg/L	0.7	0.1 – 0.5	0.1	0.11	6.08	0.11	11.98
Chromium	µg/L	4.4	1 – 10	1	1.14	13.69	1.27	26.96
Cobalt	µg/L	1.0	<1	N.D.	N.D.	N.D.	N.D.	N.D.
Copper	µg/L	1.3	<1	1.67	1.67	-0.61	1.65	-1.19
Iron	µg/L	300	50 – 250	153	155	0.96	156	1.89
Lead	µg/L	4.4	1 – 2	1.33	1.34	0.76	1.35	1.50
Manganese	µg/L	1,900	1 – 50	82.7	82.2	-0.60	81.7	-1.18
Mercury (inorganic) **(B)**	µg/L	0.1	0.1	0.05	0.05	1.52	0.05	3.00
Nickel	µg/L	70	1 – 2	1	1.02	1.52	1.03	3.00
Zinc	µg/L	8	5 – 15	26.7	26.5	-0.66	26.3	-1.30
Anthracene **(B)**	µg/L	0.01	<1	N.D.	N.D.	N.D.	N.D.	N.D.
Fluoranthene	µg/L	1	<1	<1	<1	0	<1	0
Naphthalene	µg/L	1	<1	<1	<1	0	<1	0
Phenanthrene **(B)**	µg/L	0.6	<1	N.D.	N.D.	N.D.	N.D.	N.D.
Benzo(a)pyrene	µg/L	0.1	<0.1	N.D.	N.D.	N.D.	N.D.	N.D.

Parameter	Units	DGV	Anticipated Effluent	Duck River Ambient Average	Duck River Anticipated Water Quality – Average Flow (25 L/s)	Impact of the Average Flow (%)	Duck River Anticipated Water Quality – Peak Flow (50 L/s)	Impact of the Peak Flow (%)
Benzene	µg/L	1	<1	<1	<1	0	<1	0
Ethylbenzene	µg/L	1	<1	<1	<1	0	<1	0
Toluene	µg/L	180	<1	<1	<1	0	<1	0
Xylene	µg/L	2	<2	<2	<2	0	<2	0
TRH (C6-C40)	µg/L	<100	<100	100	100	0	100	1.50
PFOS	µg/L	0.00023	<0.01	<0.05	<0.05	N.D.	<0.05	N.D.
PFOA	µg/L	19	0.01	0.013	0.013	-0.38	0.013	-0.74
Monochloramine **(1)**	µg/L	0.5	<0.5	N.D.	N.D.	N.D.	N.D.	N.D.
Dichloramine **(1)**	µg/L	0.5	<0.5	N.D.	N.D.	N.D.	N.D.	N.D.
Trihalomethane **(1)**	µg/L	1.8	<0.5	N.D.	N.D.	N.D.	N.D.	N.D.

(1) Anticipated bi-product of breakpoint chlorination

**value of 15 µg/L may be achieved initially, however concentrations will increase in response to saturation of ion exchange media.

It is important to note that the efficiency of nitrate ion exchange vessels decreases over time in response to cumulative replacement of counterions in the nitrate selective resins with nitrate in feed water. To maintain performance, ion exchange resins must be flushed periodically with an acidic saline (brine) solution to replace counterions and remove accumulated pollutants (e.g., nitrate). The frequency of brine regeneration increases as a function of the required discharge criteria. Recent performance outcomes from existing construction projects indicate regeneration timescales of less than 1 week with 30KL of brine to achieve ANZECC criteria of 15 µg/L.

The cost and environmental impact of regeneration and brine disposal of 30,000 KL per week is significant and thus the criteria of 15 µg/L is not considered to be a practical or reasonable target for water quality outcomes. It should also be noted that efficiency of brine regeneration is generally less than 80% for each cycle of regeneration. Outcomes from existing projects within the Sydney metropolitan area have found that replacement of ion exchange media is required approximately every two weeks at flow rates >10L/s to maintain performance against the existing criteria of 15 µg/L (without significantly reducing flow rates through the water treatment plant and diverting flows to trade waste). Replacement of ion exchange media requires import of media from overseas at up to 1.8 tonnes of media for each replacement cycle, resulting in significant environmental and project sustainability impacts.

The following alternative methods (in order of preference for balance between project sustainability and protection of water quality) for deriving pollutant limits for total oxidised nitrogen are proposed:

- Adopt the nitrate toxicant default guideline value for 95% species protection (2.4 mg/L) for the management of nitrate associated toxicity risks:
  - this would protect key species for toxicity risks associated with nitrate, which is the principal form of oxidised nitrogen.
  - this scenario would increase ambient concentrations of nitrate in Duck River by between 1.9% and 3.7%, representing an increase of <12 µg/L under dry weather conditions.
- Adopt the proposed 90 percentile EPL limit for total nitrogen identified in Section 7 (800 µg/L):
  - this acknowledges that nitrate will be the principal form of nitrogen after treatment but will limit concentrations of nitrate in effluent such that impacts to ambient water quality are minimized and nitrate toxicity is mitigated.
  - this scenario would increase ambient concentrations of nitrate in Duck River by between 0.6% and 1.2%, representing an increase of <4 µg/L under dry weather conditions
- Adopt limit equivalent to ambient concentrations of total oxidised nitrogen in Duck River (350 µg/L):
  - this would result in maintaining or improving average water quality, and thus achieving desired outcomes of NSW Water Quality Objectives.

Tidal flushing by rainfall events is anticipated to periodically refresh water quality conditions in Duck River to represent the catchment condition.

6.3.2 Interim Construction Water Treatment Plant

Predictive modelling of potential effluent impacts from the Rosehill interim construction water treatment plant on ambient water quality has been undertaken for the range of parameters identified in groundwater around the Rosehill Box that which have been identified at typically elevated concentrations and concentrations exceeding the ANZECC / ANZG default guideline values for 95% and 99% species protection of marine / estuarine ecosystems.

The upper range of pollutant concentrations anticipated in effluent water discharged from the Rosehill interim construction water treatment plant have been used as the inputs to the predictive model, with ambient concentrations reflective of average concentrations of pollutants present in Duck River from baseline monitoring.

The results from predictive modelling of effluent discharges from the Rosehill interim construction water treatment plant are presented in **Table 35** and show the following:

- The following pollutants are anticipated in effluent at concentrations below ambient average concentrations in Duck River, and / or below ANZG / ANZECC default guideline values:
  - Turbidity, pH, nitrate, arsenic, cadmium, chromium, iron, lead, manganese, mercury, nickel, anthracene, phenanthrene, TRH, naphthalene, fluoranthene benzo(a)pyrene, benzene, ethylbenzene, toluene, xylene and PFOA.
- The following pollutants are anticipated in effluent at concentrations above the ANZG / ANZECC default guideline values but below the ambient concentrations in Duck River:
  - Zinc.
- The following pollutants are anticipated in effluent at concentrations above the ANZG / ANZECC default guideline values and above the ambient water quality in Duck River:
  - Total nitrogen, total oxidised nitrogen, total phosphorous, cobalt, and copper.

As a result, it is anticipated that (except for total nitrogen total oxidised nitrogen, total phosphorous, cobalt, and copper) there is likely to be a net improvement in the average water quality in Duck Creek in response to discharge of treated effluent from the Rosehill primary construction water treatment plant.

Table 35. Interim Construction Water Treatment Plant – Anticipated Water Quality Impacts

Parameter	Units	DGV	Anticipated Effluent	Duck River Average	Duck River Anticipated Water Quality – Median Flow (5L/s)	Impact of the Average Flow (%)	Duck River Anticipated Water Quality – Peak Flow (10 L/s)	Impact of the Peak Flow (%)
Elec. Conduct.	µS/cm	N.A.	17,260-30,880	15600	15647	0.30	15693	0.60
Turbidity	NTU	10	10	10	10	0	10	0
pH	Units	7.0-8.5	7.0 – 8.5	7.27	7.27	0.05	7.27	0.11
Total Nitrogen	µg/L	300	500 – 1,300	900	901	0.14	902	0.27
Ammonia	µg/L	910	170 – 490	213	214	0.40	215	0.80
Nitrate	µg/L	2,400	500 – 900	357	358	0.47	360	0.94
Total Oxidised Nitrogen	µg/L	15	500 – 900	383	384	0.42	384	0.83
Total Phosphorus	µg/L	30	10 – 200	90	90	0.38	91	0.75
Arsenic	µg/L	13	1 – 2	1.67	1.67	0.06	1.67	0.12
Cadmium **(B)**	µg/L	0.7	0.1 – 0.5	0.1	0.1	1.23	0.1	2.46
Chromium	µg/L	4.4	0.1 – 0.5	1	1	-0.15	1	-0.31
Cobalt	µg/L	1.0	1 – 2	N.D.	N.D.	N.D.	N.D.	0.00
Copper	µg/L	1.3	1 – 2	1.67	1.67	0.06	1.67	0.12
Iron	µg/L	300	50 – 250	153	154	0.19	154	0.39
Lead	µg/L	4.4	1 – 2	1.33	1.34	0.15	1.34	0.31
Manganese	µg/L	1,900	1 – 50	82.7	82.6	-0.12	82.5	-0.24
Mercury (inorganic) **(B)**	µg/L	0.1	0.1	0.05	0.05	0.31	0.05	0.61
Nickel	µg/L	70	1 – 2	1	1.00	0.31	1	0.61

Parameter	Units	DGV	Anticipated Effluent	Duck River Average	Duck River Anticipated Water Quality – Median Flow (5L/s)	Impact of the Average Flow (%)	Duck River Anticipated Water Quality – Peak Flow (10 L/s)	Impact of the Peak Flow (%)
Zinc	µg/L	8	5 – 15	26.7	26.6	-0.13	26.6	-0.27
Anthracene **(B)**	µg/L	0.01	<1	N.D.	N.D.	N.D.	N.D.	N.D.
Fluoranthene	µg/L	1	<1	<1	<1	0	<1	0
Naphthalene	µg/L	1	<1	<1	<1	0	<1	0
Phenanthrene **(B)**	µg/L	0.6	<1	N.D.	N.D.	N.D.	N.D.	N.D.
Benzo(a)pyrene	µg/L	0.1	<0.1	N.D.	N.D.	N.D.	N.D.	N.D.
Benzene	µg/L	1	<1	<1	<1	0	<1	0
Ethylbenzene	µg/L	1	<1	<1	<1	0	<1	0
Toluene	µg/L	180	<1	<1	<1	0	<1	0
Xylene	µg/L	2	<2	<2	<2	0	<2	0
TRH (C6-C40)	µg/L	<100	<100	100	100	0	100	0
PFOS	µg/L	0.00023	<0.01	<0.05	<0.05	N.D.	<0.05	N.D.
PFOA	µg/L	19	<0.01	0.013	0.013	-0.08	0.013	-0.15

Predicted increases in ambient water quality for parameters exceeding ANZG and baseline in Duck River are as follows:

- Total nitrogen: 0.14% to 0.27% increase, representing an increase of approximately 1-2 µg/L.
- Total oxidised nitrogen: 0.42% to 0.83% increase, representing an increase of approximately 1-2 µg/L.
- Total phosphorous: 0.38% to 0.75% increase, representing an increase of approximately 0.5 – 1.0 µg/L
- Cobalt: No data is available for concentrations of cobalt in ambient water, however anticipated impacts are considered to be minimal with respect to departure from the ANZG DGVs. Assuming concentrations are equivalent to 1 µg/L added cobalt would represent an approximate 0.15% increase, which would be attenuated to near ambient within 2 - 6m of the discharge point based on advection-dispersion modelling.
- Copper: 0.06% to 0.12% increase, representing an increase of less than 0.01 µg/L. Advection dispersion modelling indicates that background concentrations are typically achieved within approximately 2 - 8m of the discharge point.

The increases in concentrations of pollutants in Duck River in response to predicted effluent quality are noted to be minimal and it is considered that they are unlikely to result in any significant water quality impacts beyond ambient conditions. Tidal flushing by rainfall events is anticipated to periodically refresh water quality conditions in Duck River to represent the catchment condition, thus attenuating any potential water quality impacts in the long term.

7 RECOMMENDED DISCHARGE CRITERIA

7.1 Primary Construction Water Treatment Plant

Predicted effluent water quality and associated predicted impacts on ambient water quality in Duck River have been assessed as part of this water pollution impact assessment. Generally, it has been found that water treatment processes associated with the Rosehill primary water treatment plant are effective in reducing contaminants from influent to concentrations below the ANZG / ANZECC default guideline values for 95% and 99% species protection. A few exceptions to this are total nitrogen, total phosphorous, chromium and zinc, which cannot be consistently reduced to the required ANZG / ANZECC criteria due to the limitations in treatment technology.

The impacts of discharging effluent at concentrations exceeding the default guideline values and / or ambient concentrations in Duck River have been assessed in Section 6. The results have found minimal impacts are likely to result from pollutants in effluent, and typically a water quality improvement is expected for many parameters.

Table 36 provides the proposed EPL pollutant limits for pollutants associated with discharges from the Rosehill primary water treatment plant based. The list of contaminants provided is commensurate with the anticipated range of pollutants expected in groundwater inflows to the primary construction water treatment plant at non-trivial levels based on groundwater monitoring for the project.

Table 36. Primary Water Treatment Plant – Proposed EPL Pollutant Limits

Parameter	Category	Units of Measure	90th Percentile Limit	100th Percentile Limit	Source / Comment
pH	Stressor	Units		7.0-8.5	ANZECC 2000 Estuary DGV
Turbidity	Stressor	NTU		25	ANZECC 2000 Estuary DGV
Total Nitrogen	Stressor	µg/L	800	1,200	Site Specific Recommendation
Total Phosphorous	Stressor	µg/L	30	90	Site Specific Recommendation
Nitrate [1]	Toxicant	µg/L		2,400	ANZG 2018 95% SPC
Ammonia	Toxicant	µg/L		910	ANZG 2018 90% & 95% SPC
Arsenic (As III)	Toxicant	µg/L		2.3	ANZG 2018 95% SPC
Arsenic (As V)	Toxicant	µg/L		4.5	ANZG 2018 95% SPC
Cadmium **(B)**	Toxicant	µg/L		0.7	ANZG 2018 99% SPC
Chromium (Cr VI)	Toxicant	µg/L	4.4	20.0	ANZG 2018 90% & 95% SPC
Chromium (Cr III)	Toxicant	µg/L		27	ANZG 2018 95% SPC
Cobalt	Toxicant	µg/L		1	ANZG 2018 95% SPC
Copper	Toxicant	µg/L		1.3	ANZG 2018 95% SPC
Iron	Toxicant	µg/L		300	CCME Aquatic Life
Lead	Toxicant	µg/L		4.4	ANZG 2018 95% SPC
Manganese	Toxicant	µg/L		1,900	ANZG 2018 95% SPC
Mercury (inorganic) **(B)**	Toxicant	µg/L		0.1	ANZG 2018 99% SPC
Nickel	Toxicant	µg/L		70	ANZG 2018 95% SPC
Zinc	Toxicant	µg/L		12	ANZG 2018 90% SPC
Anthracene **(B)**	Toxicant	µg/L		0.01	ANZG 2018 99% SPC
Phenanthrene **(B)**	Toxicant	µg/L		0.6	ANZG 2018 99% SPC
Benzo(a)pyrene	Toxicant	µg/L		0.1	ANZG 2018 95% SPC
Total Recoverable Hydrocarbons	Toxicant	µg/L		100	Limit of Reporting
PFOS	Toxicant	µg/L		0.13	NEMP 2.0 95% SPC
PFOA	Toxicant	µg/L		19	NEMP 2.0 99% SPC
Monochloramine **(1)**	Toxicant	µg/L		0.5	CCME Aquatic Life
Dichloramine **(1)**	Toxicant	µg/L		0.5	CCME Aquatic Life
Trihalomethane **(1)**	Toxicant	µg/L		1.8	CCME Aquatic Life

(B) – Bioaccumulation Risk; SPC – Species Protection Criteria; DGV – Default Guideline Value; LoR – Limit of Reporting, **(1)** Anticipated bi-product of breakpoint chlorination

7.2 Temporary Construction Water Treatment Plant

Predicted effluent water quality and associated predicted impacts on ambient water quality in Duck River have been assessed as part of this water pollution impact assessment. Generally, it has been found that water

treatment processes associated with the Rosehill interim water treatment plant are generally effective in reducing contaminants from influent to concentrations below the ANZG / ANZECC default guideline values for 95% and 99% species protection. A few exceptions to this are Total nitrogen total oxidised nitrogen, total phosphorous, cobalt, copper, and zinc which cannot be consistently reduced to the required ANZG / ANZECC criteria due to the limitations in treatment technology of the interim water treatment plant.

The impacts of discharging effluent at concentrations exceeding the default guideline values and / or ambient concentrations in Duck River have been assessed in Section 6. The results have found minimal impacts are likely to result from pollutants in effluent, and typically a water quality improvement is expected for many parameters.

Table 37 provides the proposed EPL pollutant limits for pollutants associated with discharges from the Rosehill primary water treatment plant based. The list of contaminants provided is commensurate with the anticipated range of pollutants expected in groundwater inflows to the primary construction water treatment plant at non-trivial levels based on groundwater monitoring for the project. It is anticipated at this stage that the interim water treatment plant will be operational for a period of approximately six (6) months before the Primary construction water treatment plant is operational.

Table 37. Interim Water Treatment Plant – Proposed EPL Pollutant Limits

Parameter	Category	Units of Measure	90th Percentile Limit	100th Percentile Limit	Source / Comment
pH	Stressor	Units		7.0-8.5	ANZECC 2000 Estuary DGV
Turbidity	Stressor	NTU		25	ANZECC 2000 Estuary DGV
Total Nitrogen	Stressor	µg/L	1,300	1,500	Site Specific Recommendation
Total Phosphorous	Stressor	µg/L		90	Site Specific Recommendation
Nitrate	Toxicant	µg/L		2,400	ANZG 2018 95% SPC
Ammonia	Toxicant	µg/L		910	ANZG 2018 95% SPC
Arsenic (As III) [2]	Toxicant	µg/L		2.3	ANZG 2018 95% SPC
Arsenic (As V) [2]	Toxicant	µg/L		4.5	ANZG 2018 95% SPC
Cadmium **(B)** [2]	Toxicant	µg/L		0.7	ANZG 2018 99% SPC
Chromium (Cr VI) [2]	Toxicant	µg/L		4.4	ANZG 2018 95% SPC
Chromium (Cr III) [2]	Toxicant	µg/L		27	ANZG 2018 95% SPC
Cobalt [2]	Toxicant	µg/L		14	ANZG 2018 90% SPC
Copper [2]	Toxicant	µg/L		3	ANZG 2018 90% SPC
Iron [2]	Toxicant	µg/L		300	Canadian Guideline Level
Lead [2]	Toxicant	µg/L		4.4	ANZG 2018 95% SPC
Manganese [2]	Toxicant	µg/L		1,900	ANZG 2018 95% SPC
Mercury (inorganic) **(B)**	Toxicant	µg/L		0.1	ANZG 2018 99% SPC
Nickel [2]	Toxicant	µg/L		70	ANZG 2018 95% SPC
Zinc [2]	Toxicant	µg/L		12	ANZG 2018 90% SPC
Anthracene **(B)**	Toxicant	µg/L		0.01	ANZG 2018 99% SPC
Phenanthrene **(B)**	Toxicant	µg/L		0.6	ANZG 2018 99% SPC
Benzo(a)pyrene	Toxicant	µg/L		0.1	ANZG 2018 95% SPC
Total Recoverable Hydrocarbons	Toxicant	µg/L		100	Limit of Reporting
PFOS	Toxicant	µg/L		0.13	NEMP 2.0 95% SPC
PFOA	Toxicant	µg/L		19	NEMP 2.0 99% SPC

(B) – Bioaccumulation Risk; SPC – Species Protection Criteria; DGV – Default Guideline Value; LoR – Limit of Reporting, 2 – values may require variation following second round of bench testing for interim construction water treatment plant.

It should be noted that a second round of bench testing is currently underway to verify the results from initial bench testing and determine whether any further water quality improvements can be made. Gamuda will seek to inform the NSW EPA of the results from updated bench testing to further inform proposed EPL pollutant limits if necessary. Specific pollutants that may require review include heavy metals (As, Cd, Cr, Co, Cu, Pb, Ni, Zn) and total recoverable hydrocarbons (TRH).

8 REFERENCES

ANZECC (1992): Water quality guidelines for fresh and marine waters. Australian and New Zealand Environment and Conservation Council, Australian Government Publishing Service, Canberra.

ANZECC & ARMCANZ (2000): Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra.

ANZG (2018): Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines.

Applied Ecology (2012): Duck River Catchment Waterways Maintenance and Rehabilitation Master Plan - Preliminary Assessment of the Duck River Catchment Waterways. Prepared for Parramatta City Council. 19th October 2012.

Birch, G. F. and Rochford, L. (2010): Stormwater metal loading to a well-mixed/stratified estuary (Sydney Estuary, Australia) and management implications. Environmental Monitoring and Assessment, 169(1-4), 531-551.

Birch, G. and Taylor, S. (1999): Source of heavy metals in sediments of the Port Jackson estuary, Australia. Sci. Total Environ., 227(2-3), 123-138.

Birch, G. F. and Taylor, S. E. (2000): Distribution and possible sources of organochlorine residues in sediments of a large urban estuary, Port Jackson, Sydney. Australian Journal of Earth Sciences, 47(4), 749-756.

Birch, G. F. and McCready, S. (2009): Catchment condition as a major control on the quality of receiving basin sediments (Sydney Harbour, Australia). Sci. Total Environ., 407(8), 2820-2835.

Birch, G. F., Lean, J. and Gunns, T. (2015): Historic change in catchment land use and metal loading to Sydney estuary, Australia (1788-2010). Environ Monit Assess, 187(9), 594.

Cardno (2008): Parramatta River Estuary Data Compilation and Review Study. Prepared for Parramatta City Council, Department of Environment and Climate Change, & Sydney Metropolitan Catchment Management Authority. July, 2008.

Department of Planning, Industry and Environment (2021): Conditions of Approval for Sydney Metro West – Concept and Stage 1 Construction (SSI 10038), NSW Government.

Golding, L.A., Angel, B.M., Batley, G., Apte, S.C., Krassol, R., Doyle, C.J., (2014): Derivation of a water quality guideline for aluminium in marine waters: Derivation of a marine water quality guideline for aluminium. Environmental Toxicology and Chemistry · January 2015.

Herbet, C. (1983): Geology of the Sydney 1:100,000 Sheet 9130, Department of Mineral Resources, Sydney.

Jacobs (2020a): Sydney Metro West, Technical Paper 7: Hydrogeology, Document reference report prepared for Sydney Metro Authority.

Jacobs (2020b): Sydney Metro West, Technical Paper 8: Contamination, Document reference report prepared for Sydney Metro Authority.

Jacobs (2020c): Sydney Metro West, Technical Paper 9: Hydrology and Flooding, Document reference report prepared for Sydney Metro Authority.

Julien, P.Y., (2002): River Mechanics, Cambridge University Press, Cambridge, UK, 434 pp.

McCready, S., Birch, G. F. and Long, E. R. (2006): Metallic and organic contaminants in sediments of Sydney Harbour, Australia and vicinity - A chemical dataset for evaluating sediment quality guidelines. Environ. Int., 32(4), 455-465.

NSW EPA (2020): Sydney Metro West (SSI 10038): Advice on the Environmental Impact Statement. June 2020.

Jacobs | UNSW (2016): Strategic Analysis of Water Quality in the Parramatta River, Technical Analysis Report, prepared for Parramatta City Council. 5 December 2016.

Jacobs (2020d): Sydney Metro West, Environmental Impact Statement Chapter 19: Soils and Surface Water Quality – Stage 1, Document reference report prepared for Sydney Metro Authority.

Jiang, S. C., Lim, K. Y., Huang, X., McCarthy, D. and Hamilton, A. J. (2015): Human and environmental health risks and benefits associated with use of urban stormwater. Wiley Interdisciplinary Reviews-Water, 2(6), 683-699.

Khan, S. J., Wang, L. L., Hashim, N. H. and McDonald, J. A. (2014): Distinct Enantiomeric Signals of Ibuprofen and Naproxen in Treated Wastewater and Sewer Overflow. Chirality, 26(11), 739-746.

Laxton, J. H., Laxton, E. and Gittins, R. (2008): Water Quality of Upper Parramatta River: Analysis of Data Collected between 1990 and 2007. Parramatta Council.

Lim, K. Y., Hamilton, A. J. and Jiang, S. C. (2015): Assessment of public health risk associated with viral contamination in harvested urban stormwater for domestic applications. Sci. Total Environ., 523, 95- 108.

Molino Stewart (2012): Duck River Catchment Floodplain Risk Management Plan. Prepared for Parramatta City Council, Auburn City Council, Bankstown City Council. November 2012.

Page, D., Gonzalez, D., Torkzaban, S., Toze, S., Sidhu, J., Miotlinski, K., Barry, K. and Dillon, P. (2015): Microbiological risks of recycling urban stormwater via aquifers for various uses in Adelaide, Australia. Environmental Earth Sciences, 73(12), 7733-7737.

Passerat, J., Ouattara, N. K., Mouchel, J.-M., Vincent, R. and Servais, P. (2011): Impact of an intense combined sewer overflow event on the microbiological water quality of the Seine River. Water Res., 45(2), 893- 903.

Roper, T., Creese, B., Scanes, P., Stephens, K., Williams, R., Dela-Curz, J., Coade, G., Coates, B., & Fraser, M., (2011): Assessing the condition of estuaries and coastal lake ecosystems in NSW, Monitoring, evaluation and reporting program, Technical report series, Office of Environment and Heritage, Sydney

Schijven, J., Bouwknegt, M., Husman, A. M. D., Rutjes, S., Sudre, B., Suk, J. E. and Semenza, J. C. (2013): A Decision Support Tool to Compare Waterborne and Foodborne Infection and/or Illness Risks Associated with Climate Change. Risk Anal., 33(12), 2154-2167.

Schijven, J. F. and de Roda Husman, A. M. (2005): Effect of climate changes on waterborne disease in The Netherlands. Water Sci Technol, 51(5), 79-87.

Suh, J. Y., Brown, P. L. and Virch, G. F. (2003): Hydrogeochemical characteristics and importance of natural and anthropogenic influences on soil and groundwater in reclaimed land adjacent to Port Jackson, Sydney, Australia. Mar. Freshw. Res., 54(6), 767-779.

Suh, J. Y., Birch, G. F. and Hughes, K. (2004): Hydrochemistry in reclaimed lands of the 2000 Olympic games site, Sydney, Australia. Journal of Coastal Research, 20(3), 709-721.

WMA Water (2012): Duck River and Duck Creek Flood Study Review. Prepared for Parramatta City Council. 20th December 2012.

Ying, G.-G., Rawson, C. A., Kookana, R. S., Warne, M. S. J., Peng, P.-A., Li, X.-M., Laginestra, E., Tremblay, L. A., Chapman, J. C. and Lim, R. P. (2009): Distribution of inorganic and organic contaminants in sediments from Sydney Olympic Park and the surrounding Sydney metropolitan area. J. Environ. Monitoring, 11(9), 1687-1696.

APPENDIX A GROUNDWATER MONITORING DATA

Well ID	SMW_BH001	SMW_BH008	SMW_BH048_S	FD11	FT11	SMW_BH048_W	SMW_BH004_w	SMW_BH004_s	SMW_BH003
Sample ID	SMW_BH001	SMW_BH008	SMW_BH048_S	SMW_BH048_S	SMW_BH048_S	SMW_BH048_W	SMW_BH004_w	SMW_BH004_s	SMW_BH003
Easting	313798.5	314037	315344	315344	315344	315343	315398.7	315398.5	315256.5
Northing	6257312	6257152	6256836	6256836	6256836	6256836	6256778.1	6256776.9	6256613.6
Location	Westmead Station	Westmead Station	Parramatta Station	Parramatta Station	Parramatta Station	Parramatta Station	Parramatta Station	Parramatta Station	Parramatta Station
Target Unit	Ashfield Shale	Ashfield Shale	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Ashfield Shale	Ashfield Shale	Ashfield Shale	Ashfield Shale
Lithology	Siltstone	Siltstone	Sand	Sand	Sand	Sandstone	Sandstone	Sand	Siltstone
Depth	12.5	24.2	7.5	7.5	7.5	23.6	24.6	11.5	19
Sample Date	9/09/2018	25/06/2020	11/03/2020	11/03/2020	11/03/2020	11/03/2020	11/03/2020	11/03/2020	18/09/2018
Receiving Environment	Freshwater	Freshwater	Freshwater	Freshwater	Freshwater	Freshwater	Freshwater	Freshwater	Freshwater

Analyte	Units	EQL	ANZG Freshwater DGV	Freshwater Species Protection	ANZG Marine DGV	Marine Species Protection Level								
General Parameters														
Electrical Conductivity @ 25°C	µS/cm	1	2200	-	-	-	5780	17400	494	502	490	1590	3960	339	7440
pH (Lab)	pH units	0.01	6.5-8.5	-	7.0-8.5	-	8.19	7.3	7.25	7.19	6.9	7.67	7.83	6.79	7.44
Total Dissolved Solids @180°C	mg/L	5	-	-	-	-	3140	12900	-	-	51	-	2180	202	3880
Hydrocarbon utilising bacteria	CFU/mL	1	-	-	-	-		-	-	-	-	-	-	-	
Pseudomonas aeruginosa	CFU/100mL	1	-	-	-	-		-	-	-	-	-	-	-	
Major Ions								-	-	-	-	-	-	-	
Sodium (Filtered)	mg/L	0.5	-	-	-	-	928	3540	66	66	3.7	271	592	56	1260
Potassium (Filtered)	mg/L	0.5	-	-	-	-	27	54	3	4	10	11	21	2	19
Calcium (Filtered)	mg/L	0.5	-	-	-	-	50	294	12	12	12	59	108	6	129
Magnesium (Filtered)	mg/L	0.5	-	-	-	-	107	515	13	13	47	20	56	8	67
Chloride	mg/L	1	-	-	-	-	1510	6680	50	50	51	362	1040	26	2350
Fluoride	mg/L	0.1	-	-	-	-	0.6	0.5	0.1	0.1	-	0.3	0.2	0.2	0.1
Sulphate (as SO4)	mg/L	1	-	-	-	-	230	369	49	49	-	24	11	31	307
Bicarbonate Alkalinity (as CaCO3)	mg/L	1	-	-	-	-	439	1080	122	121	110	407	408	92	331
Carbonate Alkalinity (as CaCO3)	mg/L	1	-	-	-	-	<1	<1	<1	<1	<5	<1	<1	<1	<1
Hydroxide Alkalinity (as CaCO3)	mg/L	1	-	-	-	-	<1	<1	<1	<1	<5	<1	<1	<1	<1
Total Alkalinity (as CaCO3)	mg/L	1	-	-	-	-	439	1080	122	121	110	407	408	92	351
Total Anions	meq/L	0.01	-	-	-	-	5.2	218	4.87	4.85	-	18.8	37.7	3.22	79.3
Total Cations	meq/L	0.01	-	-	-	-	52.4	212	4.62	4.64	-	16.6	36.3	3.44	67.2
Ionic Balance (Lab)	%	0.01	-	-	-	-	3.5	1.23	2.66	2.17	-	6.15	1.94	3.42	8.22
Nutrients	-						-	-	-	-	-	-	-	-	-
Nitrate (as N)	ug/L	10	-	-	-	-	70	<10	-	-	<5	-	160	1420	<10
Nitrite (as N)	ug/L	10	-	-	-	-	<10	20	-	-	<5	-	<10	20	<10
Nitrogen (Total Oxidised)	ug/L	10	40	-	15		70	20	<10	<10	-	<10	160	1420	<10
Ammonia (as N)	ug/L	10	900	95	910	95	370	3380	120	120	140	610	160	<10	710
Total Kjeldahl Nitrogen (as N)	ug/L	200	-	-	-	-	400	3300	200	100	-	700	200	400	800
Nitrogen (Total)	ug/L	200	350	-	300	-	500	3300	200	100	100	700	400	1800	800
Reactive Phosphorus (as P)	ug/L	10	20	-	5	-	60	<10	<10	<10	-	<10	10	<10	<10
Total Phosphorus (as P)	ug/L	10	25	-	30	-	50	<20	200	<10	<50	30	90	140	10
Metals								-	-	-	-	-	-	-	-
Arsenic (Filtered)	µg/L	1	13	95	2.3	95	<1	6	5	5	5	<1	<1	<1	<1
Cadmium (Filtered)	µg/L	0.1	0.2	95	0.7	99	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium (Filtered)	µg/L	1	1	95	4.4	95	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chromium (hexavalent) (Filtered)	µg/L	10	1	95	4.4	95	-	-	-	-	-	-	-	-	-
Cobalt (Filtered)	µg/L	1	1.4	Unknown	1	95	3	<1	5	5	5	<1	<1	13	<1
Copper (Filtered)	µg/L	1	1.4	95	1.3	95	<1	<1	<1	<1	<1	<1	1	1	6
Iron (ferrous)	µg/L	50	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron (Filtered)	µg/L	50	300	Unknown	300	Unknown	<50	1240	3780	3880	4.2	630	<50	2150	1470
Lead (Filtered)	µg/L	1	3.4	95	4.4	95	<1	<1	<1	<1	<1	<1	<1	<1	<1
Manganese (Filtered)	µg/L	1	1900	95	80	Unknown	176	72	165	171	150	173	29	73	154
Mercury (Filtered)	µg/L	0.1	0.06	99	0.1	99	<1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1
Nickel (Filtered)	µg/L	1	11	95	70	95	3	2	3	3	3	<1	182	7	<1
Zinc (Filtered)	µg/L	1	8	95	8	95	11	<5	16	15	14	<5	13	26	<5
Heavy Metals (Organo)							-	-	-	-	-	-	-	-	-
Tributyltin	ngSn/L	2	0.006	95	0.006	95	-	-	-	-	-	-	-	-	-
Dissolved Gases							-	-	-	-	-	-	-	-	-
Methane	µg/L	10	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Recoverable Hydrocarbons (TRHs)							-	-	-	-	-	-	-	-	-
TRH C10 - C14 Fraction	µg/L	50	100	-	100	-	<50	-	<50	<50	<0.05	<50	<50	<50	<50
TRH C15 - C28 Fraction	µg/L	100	100	-	100	-	<100	-	<100	<100	<100	<100	<100	<100	<100
TRH C29 - C36 Fraction	µg/L	50	100	-	100	-	<50	-	<50	<50	<100	<50	<50	<50	<50
TRH+C10 - C36 (Sum of total) (Lab Reported)	µg/L	50	100	-	100	-	<50	-	<50	<50	-	<50	<50	<50	<50
TRH >C10 - C16 Fraction F2	µg/L	100	100	-	100	-	<100	-	<100	<100	<50	<100	<100	<100	<100
TRH >C10 - C16 Fraction Less Naphthalene (F2)	µg/L	50	100	-	100	-	<100	-	<100	<100	<50	<100	<100	<100	<100
TRH >C16 - C34 Fraction F3	µg/L	100	100	-	100	-	<100	-	<100	<100	<100	<100	<100	<100	<100
TRH >C34 - C40 Fraction F4	µg/L	100	100	-	100	-	<100	-	<100	<100	<100	<100	<100	<100	<100
TRH+C10 - C40 (Sum of total) (Lab Reported)	µg/L	100					<100	-	<100	<100	<100	<100	<100	<100	<100
Volatile Petroleum Hydrocarbons (PHCs)							-	-	-	-	-	-	-	-	-
TRH C6 - C9 Fraction	µg/L	20	100	-	100	-	<20	-	<20	<20	<10	<20	<20	<20	<20
TRH C6 - C10 Fraction F1	µg/L	20	100	-	100	-	<20	-	<20	<20	<10	<20	<20	<20	<20
TRH C6 - C10 Fraction Less BTEX F1	µg/L	20	-	-	-	-	<20	-	<20	<20	<10	<20	<20	<20	<20
BTEX							-	-	-	-	-	-	-	-	-
Benzene	µg/L	1	950	95	700	95	<1	-	<1	<1	<1	<1	<1	<1	<1
Toluene	µg/L	2	180	95	180	95	<2	-	<2	<2	<1	<2	<2	<2	<2
Ethylbenzene	µg/L	2	80	95	80	95	<2	-	<2	<2	<1	<2	<2	<2	<2
Xylenes (m & p)	µg/L	2	75	95	75	95	<2	-	<2	<2	<2	<2	<2	<2	<2
Xylene (o)	µg/L	2	350	95	470	Unknown	<2	-	<2	<2	<1	<2	<2	<2	<2
Xylenes (Sum of total) (Lab Reported)	µg/L	2	-	-	-	-	<2	-	<2	<2	-	<2	<2	<2	<2
Naphthalene	ug/L	1-5*	16	95	70	95	-	-	-	-	-	-	-	-	-
Total BTEX	µg/L	1	-	-	-	-	-	-	-	-	-	-	<1	<1	-
Organochlorine Pesticides							-	-	-	-	-	-	-	-	-
p,p-DDE	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
a-BHC	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Aldrin	µg/L	2	0.001	Unknown	0.003	Unknown	-	-	-	-	-	-	-	-	-
Dieldrin	µg/L	2	0.01	Unknown	0.01	Unknown	-	-	-	-	-	-	-	-	-
Aldrin & Dieldrin (Sum of total) (Lab Reported)	µg/L	4	-	-	-	-	-	-	-	-	-	-	-	-	-
b-BHC	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
cis-Chlordane	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-
trans-Chlordane	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlordane (Sum of total)	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-
d-BHC	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
DDD	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
DDE	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-
DDT	µg/L	4	0.006	99	0.0004	Unknown	-	-	-	-	-	-	-	-	-
DDT+DDE+DDD (Sum of total) (Lab Reported)	µg/L	4	-	-	-	-	-	-	-	-	-	-	-	-	-
Endosulfan I	µg/L	2	0.03	99	0.005	99	-	-	-	-	-	-	-	-	-
Endosulfan II	µg/L	2	0.03	99	0.005	99	-	-	-	-	-	-	-	-	-
Endosulfan (as sum of Endosulfan I and Endosulfan II)	µg/L	-	0.03	99	0.005	99	-	-	-	-	-	-	-	-	-
Endosulfan sulphate	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Endrin	µg/L	2	0.01	99	0.004	99	-	-	-	-	-	-	-	-	-
Endrin aldehyde	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-
Endrin ketone	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-
g-BHC	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Heptachlor	µg/L	2	0.01	99	0.0004	Unknown	-	-	-	-	-	-	-	-	-

Well ID	SMW_BH001	SMW_BH008	SMW_BH048_S	FD11	FT11	SMW_BH048_W	SMW_BH004_w	SMW_BH004_s	SMW_BH003
Sample ID	SMW_BH001	SMW_BH008	SMW_BH048_S	SMW_BH048_S	SMW_BH048_S	SMW_BH048_W	SMW_BH004_w	SMW_BH004_s	SMW_BH003
Easting	313798.5	314037	315344	315344	315344	315343	315398.7	315398.5	315256.5
Northing	6257312	6257152	6256836	6256836	6256836	6256836	6256778.1	6256776.9	6256613.6
Location	Westmead Station	Westmead Station	Parramatta Station	Parramatta Station	Parramatta Station	Parramatta Station	Parramatta Station	Parramatta Station	Parramatta Station
Target Unit	Ashfield Shale	Ashfield Shale	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Ashfield Shale	Ashfield Shale	Ashfield Shale	Ashfield Shale
Lithology	Siltstone	Siltstone	Sand	Sand	Sand	Sandstone	Sandstone	Sand	Siltstone
Depth	12.5	24.2	7.5	7.5	7.5	23.6	24.6	11.5	19
Sample Date	9/09/2018	25/06/2020	11/03/2020	11/03/2020	11/03/2020	11/03/2020	11/03/2020	11/03/2020	18/09/2018
Receiving Environment	Freshwater	Freshwater	Freshwater	Freshwater	Freshwater	Freshwater	Freshwater	Freshwater	Freshwater

Analyte	Units	EQL	ANZG Freshwater DGV	Freshwater Species Protection	ANZG Marine DGV	Marine Species Protection Level									
Heptachlor epoxide	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Hexachlorobenzene	µg/L	4	0.05	99	0.05	99	-	-	-	-	-	-	-	-	-
Methoxychlor	µg/L	2	0.005	Unknown	0.004	Unknown	-	-	-	-	-	-	-	-	-
Organophosphorous Pesticides							-	-	-	-	-	-	-	-	-
Azinphos-methyl	µg/L	0.5	0.02	95	0.01	Unknown	-	-	-	-	-	-	-	-	-
Bromophos-ethyl	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbophenothion	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlorfenvinphos	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlorpyriphos	µg/L	0.5	0.01	95	0.009	95	-	-	-	-	-	-	-	-	-
Chlorpyriphos-methyl	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-
Demeton-s-methyl	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-
Diazinon	µg/L	0.5	0.01	95	0.01	Unknown	-	-	-	-	-	-	-	-	-
Dichlorvos	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-
Dimethoate	µg/L	0.5	0.15	95	0.15	Unknown	-	-	-	-	-	-	-	-	-
Ethion	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-
Fenitrothion	µg/L	0.5	0.2	95	0.001	Unknown	-	-	-	-	-	-	-	-	-
Fenamiphos	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-
Fenthion	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-
Malathion	µg/L	0.5	0.05	95	0.05	Unknown	-	-	-	-	-	-	-	-	-
Parathion-methyl	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Monocrotophos	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Parathion	µg/L	2	0.004	95	0.004	Unknown	-	-	-	-	-	-	-	-	-
Pirimphos-ethyl	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-
Prothiofos	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-
Ronnel	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-
PAHs							-	-	-	-	-	-	-	-	-
Benzo(a)pyrene (TEQs)	µg/L	5	0.1	99	0.1	99	-	-	-	-	-	-	-	-	-
Benzo(b+j) & Benzo(k)fluoranthene	µg/L	4	-	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthene	µg/L	1	-	-	-	-	<1	-	<1	<1	-	<1	<1	<1	<1
Acenaphthylene	µg/L	1	-	-	-	-	<1	-	<1	<1	-	<1	<1	<1	<1
Anthracene	µg/L	1	0.01	99	0.01	99	<1	-	<1	<1	-	<1	<1	<1	<1
Benz(a)anthracene	µg/L	1	-	-	-	-	<1	-	<1	<1	-	<1	<1	<1	<1
Benzo(a)pyrene	µg/L	0.5	0.1	99	0.1	99	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ (lower bound)*	µg/L	0.5	0.1	99	0.1	99	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5
Benzo(b)&(j)fluoranthene	µg/L	1	-	-	-	-	<1	-	<1	<1	-	<1	<1	<1	<1
Benzo(g,h,i)perylene	µg/L	1	-	-	-	-	<1	-	<1	<1	-	<1	<1	<1	<1
Benzo(k)fluoranthene	µg/L	1	-	-	-	-	<1	-	<1	<1	-	<1	<1	<1	<1
Chrysene	µg/L	1	-	-	-	-	<1	-	<1	<1	-	<1	<1	<1	<1
Dibenz(a,h)anthracene	µg/L	1	-	-	-	-	<1	-	<1	<1	-	<1	<1	<1	<1
Fluoranthene	µg/L	1	1	99	1	99	<1	-	<1	<1	-	<1	<1	<1	<1
Fluorene	µg/L	1	-	-	-	-	<1	-	<1	<1	-	<1	<1	<1	<1
Indeno(1,2,3-c,d)pyrene	µg/L	1	-	-	-	-	<1	-	<1	<1	-	<1	<1	<1	<1
Naphthalene	µg/L	1	16	95	70	95	<1	-	<1	<1	-	<1	<1	<1	<1
Phenanthrene	µg/L	1	0.6	99	0.6	99	<1	-	<1	<1	-	<1	<1	<1	<1
Pyrene	µg/L	1	-	-	-	-	<1	-	<1	<1	-	<1	<1	<1	<1
PAH (Sum of Common 16 PAHs - Lab Reported)	µg/L	0.5	-	-	-	-	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5
Total PAH (NEPM/WHO 16)	µg/L	1	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenols							-	-	-	-	-	-	-	-	-
Phenolics (Sum of total)	µg/L	50	-	-	-	-	-	-	-	-	-	-	-	-	-
4,6-Dinitro-2-methylphenol	µg/L	10	-	-	-	-	-	-	-	-	-	-	-	-	-
2,3,4,6-Tetrachlorophenol	µg/L	1	10	99	20	Unknown	-	-	-	-	-	-	-	-	-
2,4,5-Trichlorophenol	µg/L	1	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4,6-Trichlorophenol	µg/L	1	3	99	3	Unknown	-	-	-	-	-	-	-	-	-
2,4-Dichlorophenol	µg/L	1	160	95	160	Unknown	-	-	-	-	-	-	-	-	-
2,6-Dichlorophenol	µg/L	1	34	Unknown	34	Unknown	-	-	-	-	-	-	-	-	-
2-Chlorophenol	µg/L	1	490	95	490	Unknown	-	-	-	-	-	-	-	-	-
4-Chloro-3-methylphenol	µg/L	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Pentachlorophenol	µg/L	2	3.6	99	11	99	-	-	-	-	-	-	-	-	-
2,4-Dimethylphenol	µg/L	1	2	Unknown	2	Unknown	-	-	-	-	-	-	-	-	-
2-Methylphenol	µg/L	1	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Nitrophenol	µg/L	1	-	-	-	-	-	-	-	-	-	-	-	-	-
3- & 4- Methylphenol	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenol	µg/L	1	320	95	400	95	-	-	-	-	-	-	-	-	-
Polychlorinated Biphenyls							-	-	-	-	-	-	-	-	-
PCB (Sum of Total-Lab Reported)	µg/L	1	-	-	-	-	-	-	-	-	-	-	-	-	-
SVOCs							-	-	-	-	-	-	-	-	-
Cyclohexane	µg/L	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds							-	-	-	-	-	-	-	-	-
1,3-Dichloropropene (Calculated)	µg/L		-	-	-	-	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	µg/L	2, 5	60	95	75	Unknown	-	-	-	-	-	-	-	-	-
4-Chlorotoluene	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	µg/L	5	3	99	10	Unknown	-	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	µg/L	2	85	99	20	99	-	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	µg/L	2	160	95	160	95	-	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	µg/L	2	260	95	350	Unknown	-	-	-	-	-	-	-	-	-
2-Chlorotoluene	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromobenzene	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlorobenzene	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2,4-trimethylbenzene	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-
Isopropylbenzene	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-
n-Butylbenzene	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-
n-Propylbenzene	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-
p-Isopropyltoluene	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-
sec-Butylbenzene	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-
Styrene	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-
tert-Butylbenzene	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-
Methyl Ethyl Ketone	µg/L	50	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Hexanone	µg/L	50	-	-	-	-	-	-	-	-	-	-	-	-	-
Methyl iso-butyl ketone	µg/L	50	-	-	-	-	-	-	-	-	-	-	-	-	-
Isophorone	µg/L	2	N.D.	Unknown	130	Unknown	-	-	-	-	-	-	-	-	-
Vinyl acetate	µg/L	50	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/L	5	400	95	400	95	-	-	-	-	-	-	-	-	-

Well ID	SMW_BH001	SMW_BH008	SMW_BH048_S	FD11	FT11	SMW_BH048_W	SMW_BH004_w	SMW_BH004_s	SMW_BH003
Sample ID	SMW_BH001	SMW_BH008	SMW_BH048_S	SMW_BH048_S	SMW_BH048_S	SMW_BH048_W	SMW_BH004_w	SMW_BH004_s	SMW_BH003
Easting	313798.5	314037	315344	315344	315344	315343	315398.7	315398.5	315256.5
Northing	6257312	6257152	6256836	6256836	6256836	6256836	6256778.1	6256776.9	6256613.6
Location	Westmead Station	Westmead Station	Parramatta Station	Parramatta Station	Parramatta Station	Parramatta Station	Parramatta Station	Parramatta Station	Parramatta Station
Target Unit	Ashfield Shale	Ashfield Shale	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Ashfield Shale	Ashfield Shale	Ashfield Shale	Ashfield Shale
Lithology	Siltstone	Siltstone	Sand	Sand	Sand	Sandstone	Sandstone	Sand	Siltstone
Depth	12.5	24.2	7.5	7.5	7.5	23.6	24.6	11.5	19
Sample Date	9/09/2018	25/06/2020	11/03/2020	11/03/2020	11/03/2020	11/03/2020	11/03/2020	11/03/2020	18/09/2018
Receiving Environment	Freshwater	Freshwater	Freshwater	Freshwater	Freshwater	Freshwater	Freshwater	Freshwater	Freshwater

Analyte	Units	EQL	ANZG Freshwater DGV	Freshwater Species Protection	ANZG Marine DGV	Marine Species Protection Level									
1,1,1-Trichloroethane	µg/L	5	270	95	270	95	-	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	µg/L	5	6500	95	1900	95	-	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dibromoethane	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethane	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloroethane	µg/L	5	1900	95	1900	95	-	-	-	-	-	-	-	-	-
1,1-Dichloroethene	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-
cis-1,2-Dichloroethene	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-
trans-1,2-dichloroethene	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2 - Dichloroethene (as sum of cis-1,2-Dichloroethene and trans-1,2-dichloroethene)	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloropropane	µg/L	5	900	95	900	95	-	-	-	-	-	-	-	-	-
1,3-Dichloropropane	µg/L	5	1100	95	1100	95	-	-	-	-	-	-	-	-	-
2,2-Dichloropropane	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloropropene	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-
cis-1,3-Dichloropropene	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-
trans-1,3-dichloropropene	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3-dichloropropene (as sum of cis-1,3-Dichloropropene	µg/L	10	-	-	-	-	-	-	-	-	-	-	-	-	-
cis-1,4-Dichloro-2-butene	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-
trans-1,4-Dichloro-2-butene	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromochloromethane	µg/L	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromodichloromethane	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromoform	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromomethane	µg/L	50	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbon disulfide	µg/L	5	20	Unknown	20	Unknown	-	-	-	-	-	-	-	-	-
Carbon tetrachloride	µg/L	5	240	95	240	95	-	-	-	-	-	-	-	-	-
Chlorodibromomethane	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloroethane	µg/L	50	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloroform	µg/L	5	770	95	770	95	-	-	-	-	-	-	-	-	-
Chloromethane	µg/L	50	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibromomethane	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichlorodifluoromethane	µg/L	50	-	-	-	-	-	-	-	-	-	-	-	-	-
Hexachlorobutadiene	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Hexachloroethane	µg/L	2	290	99	360	Unknown	-	-	-	-	-	-	-	-	-
Iodomethane	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-
Pentachloroethane	µg/L	5	80	95	80	95	-	-	-	-	-	-	-	-	-
Trichloroethene	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-
Tetrachloroethene	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-
Trichlorofluoromethane	µg/L	50	-	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl chloride	µg/L	50	-	-	-	-	-	-	-	-	-	-	-	-	-
SVOCs							-	-	-	-	-	-	-	-	-
n-Nitrosomethylethylamine	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
n-Nitrosodiethylamine	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
N-Nitrosodi-n-butylamine	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
N-Nitrosodi-n-propylamine	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
1-Naphthylamine	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
n-Nitrosodiphenylamine & Diphenylamine	µg/L	4	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Nitroaniline	µg/L	4	-	-	-	-	-	-	-	-	-	-	-	-	-
3-Nitroaniline	µg/L	4	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Chloroaniline	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
2-methyl-5-nitroaniline	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Nitroaniline	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Aniline	µg/L	2	250	95	250	Unknown	-	-	-	-	-	-	-	-	-
Nitrobenzene	µg/L	2	550	95	550	Unknown	-	-	-	-	-	-	-	-	-
Pentachloronitrobenzene	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3,5-Trinitrobenzene	µg/L	2	4	Unknown	4	Unknown	-	-	-	-	-	-	-	-	-
2,4-Dinitrotoluene	µg/L	4	65	95	65	Unknown	-	-	-	-	-	-	-	-	-
2,6-Dinitrotoluene	µg/L	4	-	-	-	-	-	-	-	-	-	-	-	-	-
Pentachlorobenzene	µg/L	2	1.5	99	1.5	99	-	-	-	-	-	-	-	-	-
Pronamide	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Chloronaphthalene	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
3-Methylcholanthrene	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
7,12-Dimethylbenz(a)anthracene	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbazole	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlorobenzilate	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl) phthalate	µg/L	10	-	-	-	-	-	-	-	-	-	-	-	-	-
Butylbenzyl phthalate	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Diethyl phthalate	µg/L	2	1000	95	1000	Unknown	-	-	-	-	-	-	-	-	-
Dimethyl phthalate	µg/L	2	3700	95	3700	Unknown	-	-	-	-	-	-	-	-	-
Di-n-butyl phthalate	µg/L	2	10	99	10	Unknown	-	-	-	-	-	-	-	-	-
Di-n-octyl phthalate	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
2-(Acetylamino) fluorene	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Picoline	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
3,3-Dichlorobenzidine	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
4-(Dimethylamino) azobenzene	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Aminobiphenyl	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Bromophenyl phenyl ether	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Chlorophenyl phenyl ether	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Nitroquinoline-n-oxide	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Acetophenone	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Azobenzene	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-chloroethoxy) methane	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-chloroethyl) ether	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Hexachlorocyclopentadiene	µg/L	10	-	-	-	-	-	-	-	-	-	-	-	-	-
Hexachloropropene	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Methapyrilene	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
n-Nitrosomorpholine	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
N-Nitrosopiperidine	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
n-Nitrosopyrrolidine	µg/L	4	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenacetin	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Per- and polyfluoroalkyl substances (PFAS)							-	-	-	-	-	-	-	-	-
10:2 Fluorotelomer sulfonic acid	µg/L	0.05	-	-	-	-	-	-	<0.05	<0.05	-	<0.05	<0.05	<0.05	-
4:2 Fluorotelomer sulfonic acid	µg/L	0.05	-	-	-	-	-	-	<0.05	<0.05	-	<0.05	<0.05	<0.05	-
8:2 Fluorotelomer sulfonate	µg/L	0.05	-	-	-	-	-	-	<0.05	<0.05	<0.01	<0.05	<0.05	<0.05	-

Well ID	SMW_BH001	SMW_BH008	SMW_BH048_S	FD11	FT11	SMW_BH048_W	SMW_BH004_w	SMW_BH004_s	SMW_BH003
Sample ID	SMW_BH001	SMW_BH008	SMW_BH048_S	SMW_BH048_S	SMW_BH048_S	SMW_BH048_W	SMW_BH004_w	SMW_BH004_s	SMW_BH003
Easting	313798.5	314037	315344	315344	315344	315343	315398.7	315398.5	315256.5
Northing	6257312	6257152	6256836	6256836	6256836	6256836	6256778.1	6256776.9	6256613.6
Location	Westmead Station	Westmead Station	Parramatta Station	Parramatta Station	Parramatta Station	Parramatta Station	Parramatta Station	Parramatta Station	Parramatta Station
Target Unit	Ashfield Shale	Ashfield Shale	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Ashfield Shale	Ashfield Shale	Ashfield Shale	Ashfield Shale
Lithology	Siltstone	Siltstone	Sand	Sand	Sand	Sandstone	Sandstone	Sand	Siltstone
Depth	12.5	24.2	7.5	7.5	7.5	23.6	24.6	11.5	19
Sample Date	9/09/2018	25/06/2020	11/03/2020	11/03/2020	11/03/2020	11/03/2020	11/03/2020	11/03/2020	18/09/2018
Receiving Environment	Freshwater	Freshwater	Freshwater	Freshwater	Freshwater	Freshwater	Freshwater	Freshwater	Freshwater

Analyte	Units	EQL	ANZG Freshwater DGV	Freshwater Species Protection	ANZG Marine DGV	Marine Species Protection Level									
N-Et-FOSA	µg/L	0.05	-	-	-	-	-	-	<0.05	<0.05	-	<0.05	<0.05	<0.05	-
N-Et-FOSE	µg/L	0.05	-	-	-	-	-	-	<0.05	<0.05	-	<0.05	<0.05	<0.05	-
N-Me-FOSA	µg/L	0.05	-	-	-	-	-	-	<0.05	<0.05	-	<0.05	<0.05	<0.05	-
N-Me-FOSE	µg/L	0.05	-	-	-	-	-	-	<0.05	<0.05	-	<0.05	<0.05	<0.05	-
Perfluorobutanoic acid (PFBA)	µg/L	0.1	-	-	-	-	-	-	<0.1	<0.1	-	<0.1	<0.1	<0.1	-
Perfluoroheptane sulfonic acid	µg/L	0.02	-	-	-	-	-	-	<0.02	<0.02	-	<0.02	<0.02	<0.02	-
Perfluoro-n-pentanoic acid (PFPeA)	µg/L	0.02	-	-	-	-	-	-	<0.02	<0.02	-	0.04	<0.02	<0.02	-
Perfluoropentane sulfonic acid	µg/L	0.02	-	-	-	-	-	-	<0.02	<0.02	-	<0.02	<0.02	<0.02	-
PFDcS	µg/L	0.02	-	-	-	-	-	-	-	-	-	-	<0.02	<0.02	-
N-methyl-perfluorooctanesulfonamidoacetic acid	µg/L	0.02	-	-	-	-	-	-	<0.02	<0.02	-	<0.02	<0.02	<0.02	-
Sum of PFHxS and PFOS (lab reported)	µg/L	0.01	-	-	-	-	-	-	0.01	0.01	0.02	0.01	<0.01	0.03	-
Sum of WA DER PFAS (n=10)	µg/L	0.01	-	-	-	-	-	-	0.02	0.02	-	0.12	<0.01	0.05	-
Sum of PFASs (n=28)	µg/L	0.01	-	-	-	-	-	-	0.02	0.02	0.03	0.36	<0.01	0.05	-
Perfluorobutanesulfonic acid (PFBS)	µg/L	0.02	-	-	-	-	-	-	<0.02	<0.02	-	<0.02	<0.02	<0.02	-
Perfluorodecanoic acid (PFDA)	µg/L	0.02	-	-	-	-	-	-	<0.02	<0.02	-	<0.02	<0.02	<0.02	-
Perfluorododecanoic acid (PFDoA)	µg/L	0.02	-	-	-	-	-	-	<0.02	<0.02	-	<0.02	<0.02	<0.02	-
Perfluoroheptanoic acid (PFHpA)	µg/L	0.02	-	-	-	-	-	-	<0.02	<0.02	0.01	<0.02	<0.02	<0.02	-
Perfluorooctanesulfonic acid (PFOS)	µg/L	0.01	0.13	-	0.13	-	-	-	0.01	0.01	0.02	0.01	<0.01	0.03	-
Perfluorooctanoate (PFOA)	µg/L	0.01	220	-	220	-	-	-	0.01	0.01	-	0.03	<0.01	0.02	-
Perfluorohexanesulfonic acid (PFHxS)	µg/L	0.02	-	-	-	-	-	-	<0.02	<0.02	<0.01	<0.02	<0.02	<0.02	-
Perfluorononanoic acid (PFNA)	µg/L	0.02	-	-	-	-	-	-	<0.02	<0.02	-	<0.02	<0.02	<0.02	-
Perfluorohexanoic acid (PFHxA)	µg/L	0.02	-	-	-	-	-	-	<0.02	<0.02	-	0.04	<0.02	<0.02	-
6:2 Fluorotelomer Sulfonate (6:2 FtS)	µg/L	0.05	-	-	-	-	-	-	<0.05	<0.05	<0.01	<0.05	<0.05	<0.05	-
N-ethyl-perfluorooctanesulfonamidoacetic acid	µg/L	0.02	-	-	-	-	-	-	<0.02	<0.02	-	<0.02	<0.02	<0.02	-
Perfluorooctanesulfonamide (PFOSA)	µg/L	0.02	-	-	-	-	-	-	<0.02	<0.02	-	<0.02	<0.02	<0.02	-
Perfluorotetradecanoic acid (PFTeDA)	µg/L	0.05	-	-	-	-	-	-	<0.05	<0.05	-	<0.05	<0.05	<0.05	-
Perfluorotridecanoic acid (PFTrDA)	µg/L	0.02	-	-	-	-	-	-	<0.02	<0.02	-	<0.02	<0.02	<0.02	-
Perfluoroundecanoic acid (PFUnA)	µg/L	0.02	-	-	-	-	-	-	<0.02	<0.02	-	<0.02	<0.02	<0.02	-

EIS Baseline Groundwater Monitoring Data - Western Tunnelling Package

Analyte	Units	EQL	ANZG Freshwater DGV	Freshwater Species Protection	ANZG Marine DGV	Marine Species Protection Level	SMW_BH003s	SMW_BH002	SMW_BH057	SMW_BH057_S	SMW_ENV009_W	SMW_ENV011_W	SMW_ENV010	SMW_BH043	SMW_BH064	SMW_ENV078	QA131119 9
Well ID							SMW_BH003s	SMW_BH002	SMW_BH057	SMW_BH057_S	SMW_ENV009_W	SMW_ENV011_W	SMW_ENV010	SMW_BH043	SMW_BH064	SMW_ENV078	SMW_ENV078
Sample ID							SMW_BH003s	SMW_BH002	SMW_BH057	SMW_BH057_S	SMW_ENV009_W	SMW_ENV011_W	SMW_ENV010	SMW_BH043	SMW_BH064	SMW_ENV078	SMW_ENV078
Easting							315256	315413.7	316956	316958	316988	316959	316987	316907	316900	316893	316893
Northing							6256614	6256576	6256071	6256067	6256042	6256039	6256022	6255572	6255473	6255363	6255363
Location							Parramatta Station	Parramatta Station	Clyde	Clyde	Clyde	Clyde	Clyde	Clyde	Clyde	Clyde	Clyde
Target Unit							Alluvial Terrace	Ashfield Shale	Ashfield Shale	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Ashfield Shale	Ashfield Shale	Alluvial Terrace	Alluvial Terrace
Lithology							Sand	Sandstone	Sandstone	Sand	Clayey Sand	Clayey Sand	Sandy Clay	Siltstone	Siltstone	Clay	Clay
Depth							11	33.5	27.3	5.3	7.3	7	6.6	13.5	9.9	14.5	14.5
Sample Date							4/09/2018	4/09/2018	12/11/2019	12/11/2019	21/11/2019	21/11/2019	12/11/2019	20/08/2020	13/11/2019	13/11/2019	13/11/2019
Receiving Environment							Freshwater	Freshwater	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary
General Parameters																	
Electrical Conductivity @ 25°C	µS/cm	1	2200	-	-	-	754	7680	11600	588	1210	1340	1020	2550	6810	21300	21200
pH (Lab)	pH units	0.01	6.5-8.5	-	7.0-8.5	-	7.24	6.74	7.25	6.98	7.43	6.46	7.12	7.55	6.17	7.3	7.36
Total Dissolved Solids @180°C	mg/L	5	-	-	-	-	1690	5310	6490	366	620	673	540	1440	3410	13900	13900
Hydrocarbon utilising bacteria	CFU/mL	1	-	-	-	-			-	-	-	-	-	-	-	-	-
Pseudomonas aeruginosa	CFU/100mL	1	-	-	-	-			-	-	-	-	-	-	-	-	-
Major Ions									-	-	-	-	-	-	-	-	-
Sodium (Filtered)	mg/L	0.5	-	-	-	-	132	1030	1880	75	94	192	86	463	1170	3540	3600
Potassium (Filtered)	mg/L	0.5	-	-	-	-	4	40	45	12	14	26	13	11	3	50	51
Calcium (Filtered)	mg/L	0.5	-	-	-	-	17	386	366	21	100	13	103	56	16	258	260
Magnesium (Filtered)	mg/L	0.5	-	-	-	-	5	102	297	20	37	30	24	32	81	596	603
Chloride	mg/L	1	-	-	-	-	43	2480	3510	43	171	171	62	57	1760	7040	6940
Fluoride	mg/L	0.1	-	-	-	-	-	-	0.6	0.1	1	0.2	0.5	0.9	0.9	0.8	0.8
Sulphate (as SO4)	mg/L	1	-	-	-	-	154	8	4	70	<5	279	<1	852	418	794	781
Bicarbonate Alkalinity (as CaCO3)	mg/L	1	-	-	-	-	160	631	1000	162	400	179	444	374	50	683	634
Carbonate Alkalinity (as CaCO3)	mg/L	1	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Hydroxide Alkalinity (as CaCO3)	mg/L	1	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Alkalinity (as CaCO3)	mg/L	1	-	-	-	-	160	631	1000	162	400	179	444	374	50	683	634
Total Anions	meq/L	0.01	-	-	-	-	7.62	82.7	119	5.91	12.8	14.2	10.6	26.8	59.3	229	225
Total Cations	meq/L	0.01	-	-	-	-	7.1	73.5	126	6.26	12.5	12.1	11.2	25.8	58.4	217	220
Ionic Balance (Lab)	%	0.01	-	-	-	-	3.48	5.92	2.68	2.92	1.32	7.88	2.6	1.84	0.78	2.6	0.94
Nutrients							-	-	-	-	-	-	-	-	-	-	-
Nitrate (as N)	ug/L	10	-	-	-	-	3350	100	<10	100	10	10	<10	520	<10	20	10
Nitrite (as N)	ug/L	10	-	-	-	-	60	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Nitrogen (Total Oxidised)	ug/L	10	40	-	15		3590	100	<10	100	10	10	<10	520	<10	20	10
Ammonia (as N)	ug/L	10	900	95	910	95	280	3450	2300	<10	6350	3320	5800	30	160	1130	1140
Total Kjeldahl Nitrogen (as N)	ug/L	200	-	-	-	-	2100	3400	2400	200	7900	5100	6600	200	200	1800	1700
Nitrogen (Total)	ug/L	200	350	-	300	-	5700	3500	2400	300	7900	5100	6600	800	200	1800	1700
Reactive Phosphorus (as P)	ug/L	10	20	-	5	-	<10	40	<10	<10	<50	<50	<100	<10	<10	<10	<10
Total Phosphorus (as P)	ug/L	10	25	-	30	-	240	10	40	90	640	30	140	20	20	90	50
Metals							-	-	-	-	-	-	-	-	-	-	-
Arsenic (Filtered)	µg/L	1	13	95	2.3	95	<1	<1	17	<1	2	13	49	<1	<1	<1	2
Cadmium (Filtered)	µg/L	0.1	0.2	95	0.7	99	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.6	<0.1	<0.1	<0.1
Chromium (Filtered)	µg/L	1	1	95	4.4	95	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1
Chromium (hexavalent) (Filtered)	µg/L	10	1	95	4.4	95	-	-	<50	<10	<10	<10	<100	<10	<10	<10	<10
Cobalt (Filtered)	µg/L	1	1.4	Unknown	1	95	<1	<1	4	3	<1	14	1	1	70	12	13
Copper (Filtered)	µg/L	1	1.4	95	1.3	95	<1	<1	<1	<1	<1	<1	<1	1	<1	<1	<1
Iron (ferrous)	µg/L	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron (Filtered)	µg/L	50	300	Unknown	300	Unknown	100	1280	4000	440	20900	40300	42700	<50	14100	1560	1530
Lead (Filtered)	µg/L	1	3.4	95	4.4	95	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Manganese (Filtered)	µg/L	1	1900	95	80	Unknown	54	478	658	495	830	1190	359	1230	376	849	848
Mercury (Filtered)	µg/L	0.1	0.06	99	0.1	99	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	<0.1	0.1	<0.1	<0.1
Nickel (Filtered)	µg/L	1	11	95	70	95	<1	<1	2	1	<1	7	<1	1	49	6	7
Zinc (Filtered)	µg/L	1	8	95	8	95	<5	<5	<5	<5	<5	15	<5	10	278	15	16
Heavy Metals (Organo)							-	-	-	-	-	-	-	-	-	-	-
Tributyltin	ngSn/L	2	0.006	95	0.006	95	-	-	-	-	-	-	-	-	-	-	-
Dissolved Gases							-	-	-	-	-	-	-	-	-	-	-
Methane	µg/L	10	-	-	-	-	-	-	-	-	5290	1960	-	-	-	<10	<10
Total Recoverable Hydrocarbons (TRHs)							-	-	-	-	-	-	-	-	-	-	-
TRH C10 - C14 Fraction	µg/L	50	100	-	100	-	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
TRH C15 - C28 Fraction	µg/L	100	100	-	100	-	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
TRH C29 - C36 Fraction	µg/L	50	100	-	100	-	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
TRH+C10 - C36 (Sum of total) (Lab Reported)	µg/L	50	100	-	100	-	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
TRH >C10 - C16 Fraction F2	µg/L	100	100	-	100	-	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
TRH >C10 - C16 Fraction Less Naphthalene (F2)	µg/L	50	100	-	100	-	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
TRH >C16 - C34 Fraction F3	µg/L	100	100	-	100	-	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
TRH >C34 - C40 Fraction F4	µg/L	100	100	-	100	-	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
TRH+C10 - C40 (Sum of total) (Lab Reported)	µg/L	100					<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Volatile Petroleum Hydrocarbons (PHCs)							-	-	-	-	-	-	-	-	-	-	-
TRH C6 - C9 Fraction	µg/L	20	100	-	100	-	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
TRH C6 - C10 Fraction F1	µg/L	20	100	-	100	-	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
TRH C6 - C10 Fraction Less BTEX F1	µg/L	20	-	-	-	-	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
BTEX							-	-	-	-	-	-	-	-	-	-	-
Benzene	µg/L	1	950	95	700	95	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Toluene	µg/L	2	180	95	180	95	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Ethylbenzene	µg/L	2	80	95	80	95	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Xylenes (m & p)	µg/L	2	75	95	75	95	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Xylene (o)	µg/L	2	350	95	470	Unknown	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Xylenes (Sum of total) (Lab Reported)	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Naphthalene	ug/L	1-5*	16	95	70	95	-	-	<5	<5	<5	<5	<5	-	<5	<5	<5
Total BTEX	µg/L	1	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1
Organochlorine Pesticides							-	-	-	-	-	-	-	-	-	-	-
p,p-DDE	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
a-BHC	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	<2
Aldrin	µg/L	2	0.001	Unknown	0.003	Unknown	-	-	<2	<2	<2	<2	<2	-	-	<2	<2
Dieldrin	µg/L	2	0.01	Unknown	0.01	Unknown	-	-	<2	<2	<2	<2	<2	-	-	<2	<2
Aldrin & Dieldrin (Sum of total) (Lab Reported)	µg/L	4	-	-	-	-	-	-	<4	<4	<4	<4	<4	-	-	<4	<4
b-BHC	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	<2
cis-Chlordane	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
trans-Chlordane	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlordane (Sum of total)	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
d-BHC	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	<2
DDD	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	<2
DDE	µg/L	0.5	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	<2
DDT	µg/L	4	0.006	99	0.0004	Unknown	-	-	<4	<4	<4	<4	<4	-	-	<4	<4
DDT+DDE+DDD (Sum of total) (Lab Reported)	µg/L	4	-	-	-	-	-	-	<4	<4	<4	<4	<4	-	-	<4	<4
Endosulfan I	µg/L	2	0.03	99	0.005	99	-	-	<2	<2	<2	<2	<2	-	-	<2	<2
Endosulfan II	µg/L	2	0.03	99	0.005	99	-	-	<2	<2	<2	<2	<2	-	-	<2	<2
Endosulfan (as sum of Endosulfan I and Endosulfan II)	µg/L	-	0.03	99	0.005	99	-	-	-	-	-	-	-	-	-	-	-
Endosulfan sulphate	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	<2
Endrin	µg/L	2	0.01	99	0.004	99	-	-	<2	<2	<2	<2	<2	-	-	<2	<2
Endrin aldehyde	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Endrin ketone	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
g-BHC	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	<2
Heptachlor	µg/L	2	0.01	99	0.0004	Unknown	-	-	<2	<2	<2	<2	<2	-	-	<2	<2

Analyte	Units	EQL	ANZG Freshwater DGV	Freshwater Species Protection	ANZG Marine DGV	Marine Species Protection Level											
Well ID							SMW_BH003s	SMW_BH002	SMW_BH057	SMW_BH057_S	SMW_ENV009_W	SMW_ENV011_W	SMW_ENV010	SMW_BH043	SMW_BH064	SMW_ENV078	QA131119 9
Sample ID							SMW_BH003s	SMW_BH002	SMW_BH057	SMW_BH057_S	SMW_ENV009_W	SMW_ENV011_W	SMW_ENV010	SMW_BH043	SMW_BH064	SMW_ENV078	SMW_ENV078
Easting							315256	315413.7	316956	316958	316988	316959	316987	316907	316900	316893	316893
Northing							6256614	6256576	6256071	6256067	6256042	6256039	6256022	6255572	6255473	6255363	6255363
Location							Parramatta Station	Parramatta Station	Clyde	Clyde	Clyde	Clyde	Clyde	Clyde	Clyde	Clyde	Clyde
Target Unit							Alluvial Terrace	Ashfield Shale	Ashfield Shale	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Ashfield Shale	Ashfield Shale	Alluvial Terrace	Alluvial Terrace
Lithology							Sand	Sandstone	Sandstone	Sand	Clayey Sand	Clayey Sand	Sandy Clay	Siltstone	Siltstone	Clay	Clay
Depth							11	33.5	27.3	5.3	7.3	7	6.6	13.5	9.9	14.5	14.5
Sample Date							4/09/2018	4/09/2018	12/11/2019	12/11/2019	21/11/2019	21/11/2019	12/11/2019	20/08/2020	13/11/2019	13/11/2019	13/11/2019
Receiving Environment							Freshwater	Freshwater	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary
Heptachlor epoxide	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	<2
Hexachlorobenzene	µg/L	4	0.05	99	0.05	99	-	-	<4	<4	<4	<4	<4	-	-	<4	<4
Methoxychlor	µg/L	2	0.005	Unknown	0.004	Unknown	-	-	-	-	-	-	-	-	-	-	-
Organophosphorous Pesticides							-	-	-	-	-	-	-	-	-	-	-
Azinphos-methyl	µg/L	0.5	0.02	95	0.01	Unknown	-	-	-	-	-	-	-	-	-	-	-
Bromophos-ethyl	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbophenothion	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlorfenvinphos	µg/L	0.5	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	<2
Chlorpyriphos	µg/L	0.5	0.01	95	0.009	95	-	-	<2	<2	<2	<2	<2	-	-	<2	<2
Chlorpyriphos-methyl	µg/L	0.5	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	<2
Demeton-s-methyl	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diazinon	µg/L	0.5	0.01	95	0.01	Unknown	-	-	<2	<2	<2	<2	<2	-	-	<2	<2
Dichlorvos	µg/L	0.5	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	<2
Dimethoate	µg/L	0.5	0.15	95	0.15	Unknown	-	-	<2	<2	<2	<2	<2	-	-	<2	<2
Ethion	µg/L	0.5	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	<2
Fenitrothion	µg/L	0.5	0.2	95	0.001	Unknown	-	-	-	-	-	-	-	-	-	-	-
Fenamiphos	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fenthion	µg/L	0.5	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	<2
Malathion	µg/L	0.5	0.05	95	0.05	Unknown	-	-	<2	<2	<2	<2	<2	-	-	<2	<2
Parathion-methyl	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Monocrotophos	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	-	-
Parathion	µg/L	2	0.004	95	0.004	Unknown	-	-	-	-	-	-	-	-	-	-	-
Pirimphos-ethyl	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	<2	<2
Prothiofos	µg/L	0.5	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	<2
Ronnel	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PAHs							-	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene (TEQs)	µg/L	5	0.1	99	0.1	99	-	-	-	-	-	-	-	-	-	-	-
Benzo(b+j) & Benzo(k)fluoranthene	µg/L	4	-	-	-	-	-	-	<4	<4	<4	<4	<4	-	-	<4	<4
Acenaphthene	µg/L	1	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Acenaphthylene	µg/L	1	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Anthracene	µg/L	1	0.01	99	0.01	99	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benz(a)anthracene	µg/L	1	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo(a)pyrene	µg/L	0.5	0.1	99	0.1	99	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ (lower bound)*	µg/L	0.5	0.1	99	0.1	99	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(b)&(j)fluoranthene	µg/L	1	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo(g,h,i)perylene	µg/L	1	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo(k)fluoranthene	µg/L	1	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chrysene	µg/L	1	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dibenz(a,h)anthracene	µg/L	1	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Fluoranthene	µg/L	1	1	99	1	99	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Fluorene	µg/L	1	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Indeno(1,2,3-c,d)pyrene	µg/L	1	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Naphthalene	µg/L	1	16	95	70	95	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Phenanthrene	µg/L	1	0.6	99	0.6	99	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Pyrene	µg/L	1	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
PAH (Sum of Common 16 PAHs - Lab Reported)	µg/L	0.5	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total PAH (NEPM/WHO 16)	µg/L	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	<2
Phenols							-	-	-	-	-	-	-	-	-	-	-
Phenolics (Sum of total)	µg/L	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4,6-Dinitro-2-methylphenol	µg/L	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,3,4,6-Tetrachlorophenol	µg/L	1	10	99	20	Unknown	-	-	-	-	-	-	-	-	-	-	-
2,4,5-Trichlorophenol	µg/L	1	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	<2
2,4,6-Trichlorophenol	µg/L	1	3	99	3	Unknown	-	-	<2	<2	<2	<2	<2	-	-	<2	<2
2,4-Dichlorophenol	µg/L	1	160	95	160	Unknown	-	-	<2	<2	<2	<2	<2	-	-	<2	<2
2,6-Dichlorophenol	µg/L	1	34	Unknown	34	Unknown	-	-	<2	<2	<2	<2	<2	-	-	<2	<2
2-Chlorophenol	µg/L	1	490	95	490	Unknown	-	-	<2	<2	<2	<2	<2	-	-	<2	<2
4-Chloro-3-methylphenol	µg/L	1	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	<2
Pentachlorophenol	µg/L	2	3.6	99	11	99	-	-	<4	<4	<4	<4	<4	-	-	<4	<4
2,4-Dimethylphenol	µg/L	1	2	Unknown	2	Unknown	-	-	<2	<2	<2	<2	<2	-	-	<2	<2
2-Methylphenol	µg/L	1	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	<2
2-Nitrophenol	µg/L	1	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	<2
3- & 4- Methylphenol	µg/L	2	-	-	-	-	-	-	<4	<4	<4	<4	<4	-	-	<4	<4
Phenol	µg/L	1	320	95	400	95	-	-	<2	<2	<2	<2	<2	-	-	<2	<2
Polychlorinated Biphenyls							-	-	-	-	-	-	-	-	-	-	-
PCB (Sum of Total-Lab Reported)	µg/L	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SVOCs							-	-	-	-	-	-	-	-	-	-	-
Cyclohexane	µg/L	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds							-	-	-	-	-	-	-	-	-	-	-
1,3-Dichloropropene (Calculated)	µg/L		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	µg/L	2, 5	60	95	75	Unknown	-	-	<2	<2	<2	<2	<2	<2	<5	<2	<2
4-Chlorotoluene	µg/L	5	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,2,3-Trichlorobenzene	µg/L	5	3	99	10	Unknown	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,2,4-Trichlorobenzene	µg/L	2	85	99	20	99	-	-	<2	<2	<2	<2	<2	<2	<5	<2	<2
1,2-Dichlorobenzene	µg/L	2	160	95	160	95	-	-	<2	<2	<2	<2	<2	<2	<5	<2	<2
1,3-Dichlorobenzene	µg/L	2	260	95	350	Unknown	-	-	<2	<2	<2	<2	<2	<2	<5	<2	<2
2-Chlorotoluene	µg/L	5	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
Bromobenzene	µg/L	5	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
Chlorobenzene	µg/L	5	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,2,4-trimethylbenzene	µg/L	5	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,3,5-Trimethylbenzene	µg/L	5	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
Isopropylbenzene	µg/L	5	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
n-Butylbenzene	µg/L	5	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
n-Propylbenzene	µg/L	5	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
p-Isopropyltoluene	µg/L	5	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
sec-Butylbenzene	µg/L	5	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
Styrene	µg/L	5	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
tert-Butylbenzene	µg/L	5	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
Methyl Ethyl Ketone	µg/L	50	-	-	-	-	-	-	<50	<50	<50	<50	<50	<50	<50	<50	<50
2-Hexanone	µg/L	50	-	-	-	-	-	-	<50	<50	<50	<50	<50	<50	<50	<50	<50
Methyl iso-butyl ketone	µg/L	50	-	-	-	-	-	-	<50	<50	<50	<50	<50	<50	<50	<50	<50
Isophorone	µg/L	2	N.D.	Unknown	130	Unknown	-	-	<2	<2	<2	<2	<2	<2	-	<2	<2
Vinyl acetate	µg/L	50	-	-	-	-	-	-	<50	<50	<50	<50	<50	<50	<50	<50	<50
1,1,1,2-Tetrachloroethane	µg/L	5	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,1,2,2-Tetrachloroethane	µg/L	5	400	95	400	95	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5

Analyte	Units	EQL	ANZG Freshwater DGV	Freshwater Species Protection	ANZG Marine DGV	Marine Species Protection Level											
Well ID							SMW_BH003s	SMW_BH002	SMW_BH057	SMW_BH057_S	SMW_ENV009_W	SMW_ENV011_W	SMW_ENV010	SMW_BH043	SMW_BH064	SMW_ENV078	QA131119 9
Sample ID							SMW_BH003s	SMW_BH002	SMW_BH057	SMW_BH057_S	SMW_ENV009_W	SMW_ENV011_W	SMW_ENV010	SMW_BH043	SMW_BH064	SMW_ENV078	SMW_ENV078
Easting							315256	315413.7	316956	316958	316988	316959	316987	316907	316900	316893	316893
Northing							6256614	6256576	6256071	6256067	6256042	6256039	6256022	6255572	6255473	6255363	6255363
Location							Parramatta Station	Parramatta Station	Clyde	Clyde	Clyde	Clyde	Clyde	Clyde	Clyde	Clyde	Clyde
Target Unit							Alluvial Terrace	Ashfield Shale	Ashfield Shale	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Ashfield Shale	Ashfield Shale	Alluvial Terrace	Alluvial Terrace
Lithology							Sand	Sandstone	Sandstone	Sand	Clayey Sand	Clayey Sand	Sandy Clay	Siltstone	Siltstone	Clay	Clay
Depth							11	33.5	27.3	5.3	7.3	7	6.6	13.5	9.9	14.5	14.5
Sample Date							4/09/2018	4/09/2018	12/11/2019	12/11/2019	21/11/2019	21/11/2019	12/11/2019	20/08/2020	13/11/2019	13/11/2019	13/11/2019
Receiving Environment							Freshwater	Freshwater	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary
1,1,1-Trichloroethane	µg/L	5	270	95	270	95	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,1,2-Trichloroethane	µg/L	5	6500	95	1900	95	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,2,3-Trichloropropane	µg/L	5	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,2-Dibromo-3-chloropropane	µg/L	5	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,2-Dibromoethane	µg/L	5	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,1-Dichloroethane	µg/L	5	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,2-Dichloroethane	µg/L	5	1900	95	1900	95	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,1-Dichloroethene	µg/L	5	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
cis-1,2-Dichloroethene	µg/L	5	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
trans-1,2-dichloroethene	µg/L	5	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,2 - Dichloroethene (as sum of cis-1,2-Dichloroethene and trans-1,2-dichloroethene)	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloropropane	µg/L	5	900	95	900	95	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,3-Dichloropropane	µg/L	5	1100	95	1100	95	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
2,2-Dichloropropane	µg/L	5	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,1-Dichloropropene	µg/L	5	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
cis-1,3-Dichloropropene	µg/L	5	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
trans-1,3-dichloropropene	µg/L	5	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,3-dichloropropene (as sum of cis-1,3-Dichloropropene	µg/L	10	-	-	-	-	-	-	<10	<10	<10	<10	<10	<10	<10	<10	<10
cis-1,4-Dichloro-2-butene	µg/L	5	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
trans-1,4-Dichloro-2-butene	µg/L	5	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
Bromochloromethane	µg/L	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromodichloromethane	µg/L	5	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
Bromoform	µg/L	5	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
Bromomethane	µg/L	50	-	-	-	-	-	-	<50	<50	<50	<50	<50	<50	<50	<50	<50
Carbon disulfide	µg/L	5	20	Unknown	20	Unknown	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
Carbon tetrachloride	µg/L	5	240	95	240	95	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
Chlorodibromomethane	µg/L	5	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
Chloroethane	µg/L	50	-	-	-	-	-	-	<50	<50	<50	<50	<50	<50	<50	<50	<50
Chloroform	µg/L	5	770	95	770	95	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
Chloromethane	µg/L	50	-	-	-	-	-	-	<50	<50	<50	<50	<50	<50	<50	<50	<50
Dibromomethane	µg/L	5	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
Dichlorodifluoromethane	µg/L	50	-	-	-	-	-	-	<50	<50	<50	<50	<50	<50	<50	<50	<50
Hexachlorobutadiene	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	<2	<5	<2	<2
Hexachloroethane	µg/L	2	290	99	360	Unknown	-	-	<2	<2	<2	<2	<2	<2	-	<2	<2
Iodomethane	µg/L	5	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
Pentachloroethane	µg/L	5	80	95	80	95	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
Trichloroethene	µg/L	5	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
Tetrachloroethene	µg/L	5	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
Trichlorofluoromethane	µg/L	50	-	-	-	-	-	-	<50	<50	<50	<50	<50	<50	<50	<50	<50
Vinyl chloride	µg/L	50	-	-	-	-	-	-	<50	<50	<50	<50	<50	<50	<50	<50	<50
SVOCs							-	-	-	-	-	-	-	-	-	-	-
n-Nitrosomethylethylamine	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	-
n-Nitrosodiethylamine	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	-
N-Nitrosodi-n-butylamine	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	-
N-Nitrosodi-n-propylamine	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	-
1-Naphthylamine	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	-
n-Nitrosodiphenylamine & Diphenylamine	µg/L	4	-	-	-	-	-	-	<4	<4	<4	<4	<4	-	-	<4	-
2-Nitroaniline	µg/L	4	-	-	-	-	-	-	<4	<4	<4	<4	<4	-	-	<4	-
3-Nitroaniline	µg/L	4	-	-	-	-	-	-	<4	<4	<4	<4	<4	-	-	<4	-
4-Chloroaniline	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	-
2-methyl-5-nitroaniline	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	-
4-Nitroaniline	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	-
Aniline	µg/L	2	250	95	250	Unknown	-	-	<2	<2	<2	<2	<2	-	-	<2	-
Nitrobenzene	µg/L	2	550	95	550	Unknown	-	-	<2	<2	<2	<2	<2	-	-	<2	-
Pentachloronitrobenzene	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	-
1,3,5-Trinitrobenzene	µg/L	2	4	Unknown	4	Unknown	-	-	<2	<2	<2	<2	<2	-	-	<2	-
2,4-Dinitrotoluene	µg/L	4	65	95	65	Unknown	-	-	<4	<4	<4	<4	<4	-	-	<4	-
2,6-Dinitrotoluene	µg/L	4	-	-	-	-	-	-	<4	<4	<4	<4	<4	-	-	<4	-
Pentachlorobenzene	µg/L	2	1.5	99	1.5	99	-	-	<2	<2	<2	<2	<2	-	-	<2	-
Pronamide	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	-
2-Chloronaphthalene	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	-
3-Methylcholanthrene	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	-
7,12-Dimethylbenz(a)anthracene	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	-
Carbazole	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	-
Chlorobenzilate	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	-
Bis(2-ethylhexyl) phthalate	µg/L	10	-	-	-	-	-	-	<10	<10	<10	<10	<10	-	-	<10	-
Butylbenzyl phthalate	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	-
Diethyl phthalate	µg/L	2	1000	95	1000	Unknown	-	-	<2	<2	<2	<2	<2	-	-	<2	-
Dimethyl phthalate	µg/L	2	3700	95	3700	Unknown	-	-	<2	<2	<2	<2	<2	-	-	<2	-
Di-n-butyl phthalate	µg/L	2	10	99	10	Unknown	-	-	<2	<2	<2	<2	<2	-	-	<2	-
Di-n-octyl phthalate	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	-
2-(Acetylamino) fluorene	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	-
2-Picoline	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	-
3,3-Dichlorobenzidine	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	-
4-(Dimethylamino) azobenzene	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	-
4-Aminobiphenyl	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	-
4-Bromophenyl phenyl ether	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	-
4-Chlorophenyl phenyl ether	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	-
4-Nitroquinoline-n-oxide	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	-
Acetophenone	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	-
Azobenzene	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	-
Bis(2-chloroethoxy) methane	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	-
Bis(2-chloroethyl) ether	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	-
Dibenzofuran	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	-
Hexachlorocyclopentadiene	µg/L	10	-	-	-	-	-	-	<10	<10	<10	<10	<10	-	-	<10	-
Hexachloropropene	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	-
Methapyrilene	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	-
n-Nitrosomorpholine	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	-
N-Nitrosopiperidine	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	-
n-Nitrosopyrrolidine	µg/L	4	-	-	-	-	-	-	<4	<4	<4	<4	<4	-	-	<4	-
Phenacetin	µg/L	2	-	-	-	-	-	-	<2	<2	<2	<2	<2	-	-	<2	-
Per- and polyfluoroalkyl substances (PFAS)							-	-	-	-	-	-	-	-	-	-	-
10:2 Fluorotelomer sulfonic acid	µg/L	0.05	-	-	-	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4:2 Fluorotelomer sulfonic acid	µg/L	0.05	-	-	-	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
8:2 Fluorotelomer sulfonate	µg/L	0.05	-	-	-	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

Well ID	SMW_BH003s	SMW_BH002	SMW_BH057	SMW_BH057_S	SMW_ENV009_W	SMW_ENV011_W	SMW_ENV010	SMW_BH043	SMW_BH064	SMW_ENV078	QA131119 9
Sample ID	SMW_BH003s	SMW_BH002	SMW_BH057	SMW_BH057_S	SMW_ENV009_W	SMW_ENV011_W	SMW_ENV010	SMW_BH043	SMW_BH064	SMW_ENV078	SMW_ENV078
Easting	315256	315413.7	316956	316958	316988	316959	316987	316907	316900	316893	316893
Northing	6256614	6256576	6256071	6256067	6256042	6256039	6256022	6255572	6255473	6255363	6255363
Location	Parramatta Station	Parramatta Station	Clyde	Clyde	Clyde	Clyde	Clyde	Clyde	Clyde	Clyde	Clyde
Target Unit	Alluvial Terrace	Ashfield Shale	Ashfield Shale	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Ashfield Shale	Ashfield Shale	Alluvial Terrace	Alluvial Terrace
Lithology	Sand	Sandstone	Sandstone	Sand	Clayey Sand	Clayey Sand	Sandy Clay	Siltstone	Siltstone	Clay	Clay
Depth	11	33.5	27.3	5.3	7.3	7	6.6	13.5	9.9	14.5	14.5
Sample Date	4/09/2018	4/09/2018	12/11/2019	12/11/2019	21/11/2019	21/11/2019	12/11/2019	20/08/2020	13/11/2019	13/11/2019	13/11/2019
Receiving Environment	Freshwater	Freshwater	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary

Analyte	Units	EQL	ANZG Freshwater DGV	Freshwater Species Protection	ANZG Marine DGV	Marine Species Protection Level										
N-Et-FOSA	µg/L	0.05	-	-	-	-	-	-	<0.12	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.12	<0.12
N-Et-FOSE	µg/L	0.05	-	-	-	-	-	-	<0.12	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.12	<0.12
N-Me-FOSA	µg/L	0.05	-	-	-	-	-	-	<0.12	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.12	<0.12
N-Me-FOSE	µg/L	0.05	-	-	-	-	-	-	<0.12	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.12	<0.12
Perfluorobutanoic acid (PFBA)	µg/L	0.1	-	-	-	-	-	-	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	<0.2	<0.2
Perfluoroheptane sulfonic acid	µg/L	0.02	-	-	-	-	-	-	<0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	<0.05
Perfluoro-n-pentanoic acid (PFPeA)	µg/L	0.02	-	-	-	-	-	-	<0.05	<0.02	0.03	<0.02	<0.02	<0.02	2.07	<0.05	<0.05
Perfluoropentane sulfonic acid	µg/L	0.02	-	-	-	-	-	-	<0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	<0.05
PFDcS	µg/L	0.02	-	-	-	-	-	-	<0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	<0.05
N-methyl-perfluorooctanesulfonamidoacetic acid	µg/L	0.02	-	-	-	-	-	-	<0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	<0.05
Sum of PFHxS and PFOS (lab reported)	µg/L	0.01	-	-	-	-	-	-	<0.05	0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.05	<0.05
Sum of WA DER PFAS (n=10)	µg/L	0.01	-	-	-	-	-	-	<0.05	0.03	0.16	<0.01	<0.01	<0.01	3.43	<0.05	<0.05
Sum of PFASs (n=28)	µg/L	0.01	-	-	-	-	-	-	<0.05	0.03	0.16	<0.01	<0.01	<0.01	3.43	<0.05	<0.05
Perfluorobutanesulfonic acid (PFBS)	µg/L	0.02	-	-	-	-	-	-	<0.05	<0.02	0.09	<0.02	<0.02	<0.02	<0.02	<0.05	<0.05
Perfluorodecanoic acid (PFDA)	µg/L	0.02	-	-	-	-	-	-	<0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	<0.05
Perfluorododecanoic acid (PFDoA)	µg/L	0.02	-	-	-	-	-	-	<0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	<0.05
Perfluoroheptanoic acid (PFHpA)	µg/L	0.02	-	-	-	-	-	-	<0.05	<0.02	<0.02	<0.02	<0.02	<0.02	0.04	<0.05	<0.05
Perfluorooctanesulfonic acid (PFOS)	µg/L	0.01	0.13	-	0.13	-	-	-	<0.05	0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.05	<0.05
Perfluorooctanoate (PFOA)	µg/L	0.01	220	-	220	-	-	-	<0.05	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.05	<0.05
Perfluorohexanesulfonic acid (PFHxS)	µg/L	0.02	-	-	-	-	-	-	<0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	<0.05
Perfluorononanoic acid (PFNA)	µg/L	0.02	-	-	-	-	-	-	<0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	<0.05
Perfluorohexanoic acid (PFHxA)	µg/L	0.02	-	-	-	-	-	-	<0.05	<0.02	0.03	<0.02	<0.02	<0.02	1.02	<0.05	<0.05
6:2 Fluorotelomer Sulfonate (6:2 FtS)	µg/L	0.05	-	-	-	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
N-ethyl-perfluorooctanesulfonamidoacetic acid	µg/L	0.02	-	-	-	-	-	-	<0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	<0.05
Perfluorooctanesulfonamide (PFOSA)	µg/L	0.02	-	-	-	-	-	-	<0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	<0.05
Perfluorotetradecanoic acid (PFTeDA)	µg/L	0.05	-	-	-	-	-	-	<0.12	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.12	<0.12
Perfluorotridecanoic acid (PFTrDA)	µg/L	0.02	-	-	-	-	-	-	<0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	<0.05
Perfluoroundecanoic acid (PFUnA)	µg/L	0.02	-	-	-	-	-	-	<0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	<0.05

Analyte	Units	EQL	ANZG Freshwater DGV	Freshwater Species Protection	ANZG Marine DGV	Marine Species Protection Level	SMW_ENV077	SMW_ENV039_w	SMW_ENV145	SMW_ENV076	SMW_BH010	SMW_ENV042	SMW_ENV045	SMW_ENV151	SMW_ENV146	SMW_ENV150_s	SMW_ENV150_w
Well ID							SMW_ENV077	SMW_ENV039_w	SMW_ENV145	SMW_ENV076	SMW_BH010	SMW_ENV042	SMW_ENV045	SMW_ENV151	SMW_ENV146	SMW_ENV150_s	SMW_ENV150_w
Sample ID							SMW_ENV077	SMW_ENV039_w	SMW_ENV145	SMW_ENV076	SMW_BH010	SMW_ENV042	SMW_ENV045	SMW_ENV151	SMW_ENV146	SMW_ENV150_s	SMW_ENV150_w
Easting							316884	316919	317492	316847	317461	317463	317103	316903	317022	317399	317399
Northing							6255323	6255275	6255159	6255067	6254972	6254970	6254906	6254875	6254853	6254769	6254767
Location							Clyde	Clyde	Rosehill	Rosehill	Rosehill	Rosehill	Rosehill	Rosehill	Rosehill	Rosehill	Rosehill
Target Unit							Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Ashfield Shale	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace
Lithology							Clay	Clay	Clay	Clay	Siltstone	Clay	Clay	Clay	Clay	Clay	Clay
Depth							9	10.3	14	10	27.5	10.4	12.5	6.2	6.3	1	6
Sample Date							13/11/2019	29/11/2019	26/11/2019	26/11/2019	26/11/2019	26/11/2019	20/09/2019	20/09/2019	23/09/2019	20/11/2019	20/11/2019
Receiving Environment							Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary
General Parameters																	
Electrical Conductivity @ 25°C	µS/cm	1	2200	-	-	-	19200	33200	25400	21200	25100	24100	26900	21600	37800	30400	59000
pH (Lab)	pH units	0.01	6.5-8.5	-	7.0-8.5	-	6.73	6.95	6.96	7.58	7.45	6.27	7.13	7.64	6.96	3.84	7.53
Total Dissolved Solids @180°C	mg/L	5	-	-	-	-	13000	25800	16700	14900	18700	16200	18000	13600	26100	26500	43600
Hydrocarbon utilising bacteria	CFU/mL	1	-	-	-	-	-	<10	-	-	-	<10	-	-	-	-	-
Pseudomonas aeruginosa	CFU/100mL	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions							-	-	-	-	-	-	-	-	-	-	-
Sodium (Filtered)	mg/L	0.5	-	-	-	-	3410	5960	4320	3720	3860	4140	4330	3990	6220	5570	11400
Potassium (Filtered)	mg/L	0.5	-	-	-	-	9	23	15	28	73	13	15	10	16	84	117
Calcium (Filtered)	mg/L	0.5	-	-	-	-	98	403	318	494	983	214	644	202	518	608	1320
Magnesium (Filtered)	mg/L	0.5	-	-	-	-	477	1060	799	516	626	718	749	462	1140	1250	1580
Chloride	mg/L	1	-	-	-	-	5680	11400	8360	6880	8460	7830	10100	7920	12100	6510	18900
Fluoride	mg/L	0.1	-	-	-	-	<0.1	0.2	0.2	0.2	0.2	<0.1	0.3	0.3	<0.1	0.3	0.2
Sulphate (as SO4)	mg/L	1	-	-	-	-	1890	1770	782	354	592	701	515	576	2030	12200	4590
Bicarbonate Alkalinity (as CaCO3)	mg/L	1	-	-	-	-	213	460	217	840	393	59	637	678	<1	<1	147
Carbonate Alkalinity (as CaCO3)	mg/L	1	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Hydroxide Alkalinity (as CaCO3)	mg/L	1	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Alkalinity (as CaCO3)	mg/L	1	-	-	-	-	213	460	217	840	393	59	637	678	223	<1	147
Total Anions	meq/L	0.01	-	-	-	-	204	368	256	218	259	237	308	249	388	438	632
Total Cations	meq/L	0.01	-	-	-	-	193	367	270	230	270	250	282	222	391	378	695
Ionic Balance (Lab)	%	0.01	-	-	-	-	2.8	0.06	2.56	2.55	2.18	2.78	4.37	5.74	0.33	7.36	4.76
Nutrients							-	-	-	-	-	-	-	-	-	-	-
Nitrate (as N)	ug/L	10	-	-	-	-	<10	<10	<10	<10	<10	<10	<10	<10	<10	440	270
Nitrite (as N)	ug/L	10	-	-	-	-	<10	<10	<10	<10	<10	<10	<10	<10	<10	<100	680
Nitrogen (Total Oxidised)	ug/L	10	40	-	15		<10	<10	<10	<10	<10	<10	<10	<10	<10	440	950
Ammonia (as N)	ug/L	10	900	95	910	95	150	1190	1370	1070	5660	730	1690	90	100	8100	700
Total Kjeldahl Nitrogen (as N)	ug/L	200	-	-	-	-	<200	1700	1800	1500	6100	1100	2300	<200	<500	7000	300
Nitrogen (Total)	ug/L	200	350	-	300	-	<200	1700	1800	1500	6100	1100	2300	<200	<500	7400	1200
Reactive Phosphorus (as P)	ug/L	10	20	-	5	-	<10	<100	<10	<10	<10	<10	<10	<10	<10	<10	<10
Total Phosphorus (as P)	ug/L	10	25	-	30	-	40	120	<20	<20	<20	<20	30	<20	<50	40	80
Metals							-	-	-	-	-	-	-	-	-	-	-
Arsenic (Filtered)	µg/L	1	13	95	2.3	95	<1	<10	1	2	1	<1	3	1	<10	69	<10
Cadmium (Filtered)	µg/L	0.1	0.2	95	0.7	99	<0.1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	8.4	<1
Chromium (Filtered)	µg/L	1	1	95	4.4	95	<1	<10	1	2	1	1	<1	<1	<10	60	<10
Chromium (hexavalent) (Filtered)	µg/L	10	1	95	4.4	95	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Cobalt (Filtered)	µg/L	1	1.4	Unknown	1	95	11	28	4	6	1	14	14	2	14	637	<10
Copper (Filtered)	µg/L	1	1.4	95	1.3	95	<1	<10	2	2	1	3	2	<1	<10	51	<10
Iron (ferrous)	µg/L	50	-	-	-	-	-	14800	-	-	-	61000	-	-	-	-	-
Iron (Filtered)	µg/L	50	300	Unknown	300	Unknown	450	12200	9020	3010	1270	50300	5780	<50	<100	550000	<100
Lead (Filtered)	µg/L	1	3.4	95	4.4	95	<1	<10	<1	<1	<1	<1	<1	<1	<10	172	<10
Manganese (Filtered)	µg/L	1	1900	95	80	Unknown	143	1460	151	618	384	440	429	71	600	24800	76
Mercury (Filtered)	µg/L	0.1	0.06	99	0.1	99	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.4	0.2	<0.1
Nickel (Filtered)	µg/L	1	11	95	70	95	3	<10	7	<1	2	12	7	1	11	1110	<10
Zinc (Filtered)	µg/L	1	8	95	8	95	18	<50	18	<5	<5	46	18	<5	<50	3380	<50
Heavy Metals (Organo)							-	-	-	-	-	-	-	-	-	-	-
Tributyltin	ngSn/L	2	0.006	95	0.006	95	-	-	-	-	-	-	-	-	-	-	-
Dissolved Gases							-	-	-	-	-	-	-	-	-	-	-
Methane	µg/L	10	-	-	-	-	<10	15	<10	17	-	<10	<10	<10	<10	-	<10
Total Recoverable Hydrocarbons (TRHs)							-	-	-	-	-	-	-	-	-	-	-
TRH C10 - C14 Fraction	µg/L	50	100	-	100	-	<50	<50	<50	<50	<50	<50	<50	<50	<50	220	<50
TRH C15 - C28 Fraction	µg/L	100	100	-	100	-	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
TRH C29 - C36 Fraction	µg/L	50	100	-	100	-	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
TRH+C10 - C36 (Sum of total) (Lab Reported)	µg/L	50	100	-	100	-	<50	<50	<50	<50	<50	<50	<50	<50	<50	220	<50
TRH >C10 - C16 Fraction F2	µg/L	100	100	-	100	-	<100	<100	<100	<100	<100	<100	<100	<100	<100	200	<100
TRH >C10 - C16 Fraction Less Naphthalene (F2)	µg/L	50	100	-	100	-	<100	<100	<100	<100	<100	<100	<100	<100	<100	200	<100
TRH >C16 - C34 Fraction F3	µg/L	100	100	-	100	-	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
TRH >C34 - C40 Fraction F4	µg/L	100	100	-	100	-	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
TRH+C10 - C40 (Sum of total) (Lab Reported)	µg/L	100					<100	<100	<100	<100	<100	<100	<100	<100	<100	200	<100
Volatile Petroleum Hydrocarbons (PHCs)							-	-	-	-	-	-	-	-	-	-	-
TRH C6 - C9 Fraction	µg/L	20	100	-	100	-	<20	<20	<20	130	<20	<20	<20	<20	<20	20	<20
TRH C6 - C10 Fraction F1	µg/L	20	100	-	100	-	<20	<20	<20	130	<20	<20	<20	<20	<20	40	<20
TRH C6 - C10 Fraction Less BTEX F1	µg/L	20	-	-	-	-	<20	<20	<20	<20	<20	<20	<20	<20	<20	30	<20
BTEX							-	-	-	-	-	-	-	-	-	-	-
Benzene	µg/L	1	950	95	700	95	<1	<1	<1	117	<1	<1	<1	<1	<1	<1	<1
Toluene	µg/L	2	180	95	180	95	<2	<2	<2	4	<2	<2	<2	<2	<2	3	<2
Ethylbenzene	µg/L	2	80	95	80	95	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Xylenes (m & p)	µg/L	2	75	95	75	95	<2	<2	<2	<2	<2	<2	<2	<2	<2	6	<2
Xylene (o)	µg/L	2	350	95	470	Unknown	<2	<2	<2	<2	<2	<2	<2	<2	<2	5	<2
Xylenes (Sum of total) (Lab Reported)	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	11	<2
Naphthalene	ug/L	1-5*	16	95	70	95	<5	<5	<5	<5	<1	<5	<5	<5	<5	<5	<5
Total BTEX	µg/L	1	-	-	-	-	<1	<1	<1	121	<1	<1	<1	<1	<1	14	<1
Organochlorine Pesticides							-	-	-	-	-	-	-	-	-	-	-
p,p-DDE	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
a-BHC	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Aldrin	µg/L	2	0.001	Unknown	0.003	Unknown	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Dieldrin	µg/L	2	0.01	Unknown	0.01	Unknown	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Aldrin & Dieldrin (Sum of total) (Lab Reported)	µg/L	4	-	-	-	-	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4
b-BHC	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
cis-Chlordane	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
trans-Chlordane	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlordane (Sum of total)	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
d-BHC	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
DDD	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
DDE	µg/L	0.5	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
DDT	µg/L	4	0.006	99	0.0004	Unknown	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4
DDT+DDE+DDD (Sum of total) (Lab Reported)	µg/L	4	-	-	-	-	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4
Endosulfan I	µg/L	2	0.03	99	0.005	99	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Endosulfan II	µg/L	2	0.03	99	0.005	99	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Endosulfan (as sum of Endosulfan I and Endosulfan II)	µg/L	-	0.03	99	0.005	99	-	-	-	-	-	-	-	-	-	-	-
Endosulfan sulphate	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Endrin	µg/L	2	0.01	99	0.004	99	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Endrin aldehyde	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Endrin ketone	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
g-BHC	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Heptachlor	µg/L	2	0.01	99	0.0004	Unknown	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2

Analyte	Units	EQL	ANZG Freshwater DGV	Freshwater Species Protection	ANZG Marine DGV	Marine Species Protection Level	SMW_ENV077	SMW_ENV039_w	SMW_ENV145	SMW_ENV076	SMW_BH010	SMW_ENV042	SMW_ENV045	SMW_ENV151	SMW_ENV146	SMW_ENV150_s	SMW_ENV150_w
Well ID							SMW_ENV077	SMW_ENV039_w	SMW_ENV145	SMW_ENV076	SMW_BH010	SMW_ENV042	SMW_ENV045	SMW_ENV151	SMW_ENV146	SMW_ENV150_s	SMW_ENV150_w
Sample ID							SMW_ENV077	SMW_ENV039_w	SMW_ENV145	SMW_ENV076	SMW_BH010	SMW_ENV042	SMW_ENV045	SMW_ENV151	SMW_ENV146	SMW_ENV150_s	SMW_ENV150_w
Easting							316884	316919	317492	316847	317461	317463	317103	316903	317022	317399	317399
Northing							6255323	6255275	6255159	6255067	6254972	6254970	6254906	6254875	6254853	6254769	6254767
Location							Clyde	Clyde	Rosehill	Rosehill	Rosehill	Rosehill	Rosehill	Rosehill	Rosehill	Rosehill	Rosehill
Target Unit							Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Ashfield Shale	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace
Lithology							Clay	Clay	Clay	Clay	Siltstone	Clay	Clay	Clay	Clay	Clay	Clay
Depth							9	10.3	14	10	27.5	10.4	12.5	6.2	6.3	1	6
Sample Date							13/11/2019	29/11/2019	26/11/2019	26/11/2019	26/11/2019	26/11/2019	20/09/2019	20/09/2019	23/09/2019	20/11/2019	20/11/2019
Receiving Environment							Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary
Heptachlor epoxide	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Hexachlorobenzene	µg/L	4	0.05	99	0.05	99	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4
Methoxychlor	µg/L	2	0.005	Unknown	0.004	Unknown	-	-	-	-	-	-	-	-	-	-	-
Organophosphorous Pesticides							-	-	-	-	-	-	-	-	-	-	-
Azinphos-methyl	µg/L	0.5	0.02	95	0.01	Unknown	-	-	-	-	-	-	-	-	-	-	-
Bromophos-ethyl	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbophenothion	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlorfenvinphos	µg/L	0.5	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Chlorpyriphos	µg/L	0.5	0.01	95	0.009	95	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Chlorpyriphos-methyl	µg/L	0.5	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Demeton-s-methyl	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diazinon	µg/L	0.5	0.01	95	0.01	Unknown	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Dichlorvos	µg/L	0.5	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Dimethoate	µg/L	0.5	0.15	95	0.15	Unknown	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Ethion	µg/L	0.5	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Fenitrothion	µg/L	0.5	0.2	95	0.001	Unknown	-	-	-	-	-	-	-	-	-	-	-
Fenamiphos	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fenthion	µg/L	0.5	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Malathion	µg/L	0.5	0.05	95	0.05	Unknown	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Parathion-methyl	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Monocrotophos	µg/L	2	-	-	-	-	-	-	-	-	<2	-	-	-	-	-	-
Parathion	µg/L	2	0.004	95	0.004	Unknown	-	-	-	-	-	-	-	-	-	-	-
Pirimphos-ethyl	µg/L	0.5	-	-	-	-	<2	<2	<2	<2	-	<2	<2	<2	<2	<2	<2
Prothiofos	µg/L	0.5	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Ronnel	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PAHs							-	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene (TEQs)	µg/L	5	0.1	99	0.1	99	-	-	-	-	-	-	-	-	-	-	-
Benzo(b+j) & Benzo(k)fluoranthene	µg/L	4	-	-	-	-	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4
Acenaphthene	µg/L	1	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Acenaphthylene	µg/L	1	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Anthracene	µg/L	1	0.01	99	0.01	99	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benz(a)anthracene	µg/L	1	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo(a)pyrene	µg/L	0.5	0.1	99	0.1	99	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ (lower bound)*	µg/L	0.5	0.1	99	0.1	99	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(b)&(j)fluoranthene	µg/L	1	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo(g,h,i)perylene	µg/L	1	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo(k)fluoranthene	µg/L	1	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chrysene	µg/L	1	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dibenz(a,h)anthracene	µg/L	1	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Fluoranthene	µg/L	1	1	99	1	99	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Fluorene	µg/L	1	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Indeno(1,2,3-c,d)pyrene	µg/L	1	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Naphthalene	µg/L	1	16	95	70	95	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Phenanthrene	µg/L	1	0.6	99	0.6	99	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Pyrene	µg/L	1	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
PAH (Sum of Common 16 PAHs - Lab Reported)	µg/L	0.5	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total PAH (NEPM/WHO 16)	µg/L	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Phenols							-	-	-	-	-	-	-	-	-	-	-
Phenolics (Sum of total)	µg/L	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4,6-Dinitro-2-methylphenol	µg/L	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,3,4,6-Tetrachlorophenol	µg/L	1	10	99	20	Unknown	-	-	-	-	-	-	-	-	-	-	-
2,4,5-Trichlorophenol	µg/L	1	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
2,4,6-Trichlorophenol	µg/L	1	3	99	3	Unknown	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
2,4-Dichlorophenol	µg/L	1	160	95	160	Unknown	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
2,6-Dichlorophenol	µg/L	1	34	Unknown	34	Unknown	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
2-Chlorophenol	µg/L	1	490	95	490	Unknown	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
4-Chloro-3-methylphenol	µg/L	1	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Pentachlorophenol	µg/L	2	3.6	99	11	99	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4
2,4-Dimethylphenol	µg/L	1	2	Unknown	2	Unknown	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
2-Methylphenol	µg/L	1	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
2-Nitrophenol	µg/L	1	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
3- & 4- Methylphenol	µg/L	2	-	-	-	-	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4
Phenol	µg/L	1	320	95	400	95	<2	<2	<2	3	<2	<2	<2	<2	<2	<2	<2
Polychlorinated Biphenyls							-	-	-	-	-	-	-	-	-	-	-
PCB (Sum of Total-Lab Reported)	µg/L	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SVOCs							-	-	-	-	-	-	-	-	-	-	-
Cyclohexane	µg/L	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds							-	-	-	-	-	-	-	-	-	-	-
1,3-Dichloropropene (Calculated)	µg/L		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	µg/L	2, 5	60	95	75	Unknown	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
4-Chlorotoluene	µg/L	5	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,2,3-Trichlorobenzene	µg/L	5	3	99	10	Unknown	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,2,4-Trichlorobenzene	µg/L	2	85	99	20	99	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
1,2-Dichlorobenzene	µg/L	2	160	95	160	95	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
1,3-Dichlorobenzene	µg/L	2	260	95	350	Unknown	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
2-Chlorotoluene	µg/L	5	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Bromobenzene	µg/L	5	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Chlorobenzene	µg/L	5	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,2,4-trimethylbenzene	µg/L	5	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	6	<5
1,3,5-Trimethylbenzene	µg/L	5	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Isopropylbenzene	µg/L	5	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
n-Butylbenzene	µg/L	5	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
n-Propylbenzene	µg/L	5	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
p-Isopropyltoluene	µg/L	5	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
sec-Butylbenzene	µg/L	5	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Styrene	µg/L	5	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
tert-Butylbenzene	µg/L	5	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Methyl Ethyl Ketone	µg/L	50	-	-	-	-	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
2-Hexanone	µg/L	50	-	-	-	-	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Methyl iso-butyl ketone	µg/L	50	-	-	-	-	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Isophorone	µg/L	2	N.D.	Unknown	130	Unknown	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Vinyl acetate	µg/L	50	-	-	-	-	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
1,1,1,2-Tetrachloroethane	µg/L	5	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,1,2,2-Tetrachloroethane	µg/L	5	400	95	400	95	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5

Analyte	Units	EQL	ANZG Freshwater DGV	Freshwater Species Protection	ANZG Marine DGV	Marine Species Protection Level	SMW_ENV077	SMW_ENV039_w	SMW_ENV145	SMW_ENV076	SMW_BH010	SMW_ENV042	SMW_ENV045	SMW_ENV151	SMW_ENV146	SMW_ENV150_s	SMW_ENV150_w
Well ID							SMW_ENV077	SMW_ENV039_w	SMW_ENV145	SMW_ENV076	SMW_BH010	SMW_ENV042	SMW_ENV045	SMW_ENV151	SMW_ENV146	SMW_ENV150_s	SMW_ENV150_w
Sample ID							SMW_ENV077	SMW_ENV039_w	SMW_ENV145	SMW_ENV076	SMW_BH010	SMW_ENV042	SMW_ENV045	SMW_ENV151	SMW_ENV146	SMW_ENV150_s	SMW_ENV150_w
Easting							316884	316919	317492	316847	317461	317463	317103	316903	317022	317399	317399
Northing							6255323	6255275	6255159	6255067	6254972	6254970	6254906	6254875	6254853	6254769	6254767
Location							Clyde	Clyde	Rosehill	Rosehill	Rosehill	Rosehill	Rosehill	Rosehill	Rosehill	Rosehill	Rosehill
Target Unit							Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Ashfield Shale	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace
Lithology							Clay	Clay	Clay	Clay	Siltstone	Clay	Clay	Clay	Clay	Clay	Clay
Depth							9	10.3	14	10	27.5	10.4	12.5	6.2	6.3	1	6
Sample Date							13/11/2019	29/11/2019	26/11/2019	26/11/2019	26/11/2019	26/11/2019	20/09/2019	20/09/2019	23/09/2019	20/11/2019	20/11/2019
Receiving Environment							Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary
1,1,1-Trichloroethane	µg/L	5	270	95	270	95	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,1,2-Trichloroethane	µg/L	5	6500	95	1900	95	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,2,3-Trichloropropane	µg/L	5	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,2-Dibromo-3-chloropropane	µg/L	5	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,2-Dibromoethane	µg/L	5	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,1-Dichloroethane	µg/L	5	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,2-Dichloroethane	µg/L	5	1900	95	1900	95	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,1-Dichloroethene	µg/L	5	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
cis-1,2-Dichloroethene	µg/L	5	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	10	<5	<5
trans-1,2-dichloroethene	µg/L	5	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,2 - Dichloroethene (as sum of cis-1,2-Dichloroethene and trans-1,2-dichloroethene)	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloropropane	µg/L	5	900	95	900	95	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,3-Dichloropropane	µg/L	5	1100	95	1100	95	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
2,2-Dichloropropane	µg/L	5	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,1-Dichloropropene	µg/L	5	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
cis-1,3-Dichloropropene	µg/L	5	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
trans-1,3-dichloropropene	µg/L	5	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,3-dichloropropene (as sum of cis-1,3-Dichloropropene	µg/L	10	-	-	-	-	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
cis-1,4-Dichloro-2-butene	µg/L	5	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
trans-1,4-Dichloro-2-butene	µg/L	5	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Bromochloromethane	µg/L	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromodichloromethane	µg/L	5	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Bromoform	µg/L	5	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Bromomethane	µg/L	50	-	-	-	-	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Carbon disulfide	µg/L	5	20	Unknown	20	Unknown	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Carbon tetrachloride	µg/L	5	240	95	240	95	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Chlorodibromomethane	µg/L	5	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Chloroethane	µg/L	50	-	-	-	-	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Chloroform	µg/L	5	770	95	770	95	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Chloromethane	µg/L	50	-	-	-	-	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Dibromomethane	µg/L	5	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Dichlorodifluoromethane	µg/L	50	-	-	-	-	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Hexachlorobutadiene	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Hexachloroethane	µg/L	2	290	99	360	Unknown	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Iodomethane	µg/L	5	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Pentachloroethane	µg/L	5	80	95	80	95	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Trichloroethene	µg/L	5	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Tetrachloroethene	µg/L	5	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Trichlorofluoromethane	µg/L	50	-	-	-	-	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Vinyl chloride	µg/L	50	-	-	-	-	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
SVOCs							-	-	-	-	-	-	-	-	-	-	-
n-Nitrosomethylethylamine	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
n-Nitrosodiethylamine	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
N-Nitrosodi-n-butylamine	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
N-Nitrosodi-n-propylamine	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
1-Naphthylamine	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
n-Nitrosodiphenylamine & Diphenylamine	µg/L	4	-	-	-	-	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4
2-Nitroaniline	µg/L	4	-	-	-	-	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4
3-Nitroaniline	µg/L	4	-	-	-	-	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4
4-Chloroaniline	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
2-methyl-5-nitroaniline	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
4-Nitroaniline	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Aniline	µg/L	2	250	95	250	Unknown	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Nitrobenzene	µg/L	2	550	95	550	Unknown	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Pentachloronitrobenzene	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
1,3,5-Trinitrobenzene	µg/L	2	4	Unknown	4	Unknown	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
2,4-Dinitrotoluene	µg/L	4	65	95	65	Unknown	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4
2,6-Dinitrotoluene	µg/L	4	-	-	-	-	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4
Pentachlorobenzene	µg/L	2	1.5	99	1.5	99	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Pronamide	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
2-Chloronaphthalene	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
3-Methylcholanthrene	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
7,12-Dimethylbenz(a)anthracene	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Carbazole	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Chlorobenzilate	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Bis(2-ethylhexyl) phthalate	µg/L	10	-	-	-	-	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Butylbenzyl phthalate	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Diethyl phthalate	µg/L	2	1000	95	1000	Unknown	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Dimethyl phthalate	µg/L	2	3700	95	3700	Unknown	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Di-n-butyl phthalate	µg/L	2	10	99	10	Unknown	<2	<2	2	<2	<2	<2	6	<2	<2	<2	<2
Di-n-octyl phthalate	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
2-(Acetylamino) fluorene	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
2-Picoline	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
3,3-Dichlorobenzidine	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
4-(Dimethylamino) azobenzene	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
4-Aminobiphenyl	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
4-Bromophenyl phenyl ether	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
4-Chlorophenyl phenyl ether	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
4-Nitroquinoline-n-oxide	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Acetophenone	µg/L	2	-	-	-	-	<2	<2	<2	25	<2	<2	<2	<2	<2	<2	<2
Azobenzene	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Bis(2-chloroethoxy) methane	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Bis(2-chloroethyl) ether	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Dibenzofuran	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Hexachlorocyclopentadiene	µg/L	10	-	-	-	-	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Hexachloropropene	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Methapyrilene	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
n-Nitrosomorpholine	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
N-Nitrosopiperidine	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
n-Nitrosopyrrolidine	µg/L	4	-	-	-	-	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4
Phenacetin	µg/L	2	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Per- and polyfluoroalkyl substances (PFAS)							-	-	-	-	-	-	-	-	-	-	-
10:2 Fluorotelomer sulfonic acid	µg/L	0.05	-	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4:2 Fluorotelomer sulfonic acid	µg/L	0.05	-	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
8:2 Fluorotelomer sulfonate	µg/L	0.05	-	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

Analyte	Units	EQL	ANZG Freshwater DGV	Freshwater Species Protection	ANZG Marine DGV	Marine Species Protection Level	SMW_ENV077	SMW_ENV039_w	SMW_ENV145	SMW_ENV076	SMW_BH010	SMW_ENV042	SMW_ENV045	SMW_ENV151	SMW_ENV146	SMW_ENV150_s	SMW_ENV150_w
Well ID							SMW_ENV077	SMW_ENV039_w	SMW_ENV145	SMW_ENV076	SMW_BH010	SMW_ENV042	SMW_ENV045	SMW_ENV151	SMW_ENV146	SMW_ENV150_s	SMW_ENV150_w
Sample ID							SMW_ENV077	SMW_ENV039_w	SMW_ENV145	SMW_ENV076	SMW_BH010	SMW_ENV042	SMW_ENV045	SMW_ENV151	SMW_ENV146	SMW_ENV150_s	SMW_ENV150_w
Easting							316884	316919	317492	316847	317461	317463	317103	316903	317022	317399	317399
Northing							6255323	6255275	6255159	6255067	6254972	6254970	6254906	6254875	6254853	6254769	6254767
Location							Clyde	Clyde	Rosehill	Rosehill	Rosehill	Rosehill	Rosehill	Rosehill	Rosehill	Rosehill	Rosehill
Target Unit							Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Ashfield Shale	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace
Lithology							Clay	Clay	Clay	Clay	Siltstone	Clay	Clay	Clay	Clay	Clay	Clay
Depth							9	10.3	14	10	27.5	10.4	12.5	6.2	6.3	1	6
Sample Date							13/11/2019	29/11/2019	26/11/2019	26/11/2019	26/11/2019	26/11/2019	20/09/2019	20/09/2019	23/09/2019	20/11/2019	20/11/2019
Receiving Environment							Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary
N-Et-FOSA	µg/L	0.05	-	-	-	-	<0.12	<0.12	-	-	-	-	<0.12	<0.12	<0.05	<0.12	<0.12
N-Et-FOSE	µg/L	0.05	-	-	-	-	<0.12	<0.12	-	-	-	-	<0.12	<0.12	<0.05	<0.12	<0.12
N-Me-FOSA	µg/L	0.05	-	-	-	-	<0.12	<0.12	-	-	-	-	<0.12	<0.12	<0.05	<0.12	<0.12
N-Me-FOSE	µg/L	0.05	-	-	-	-	<0.12	<0.12	-	-	-	-	<0.12	<0.12	<0.05	<0.12	<0.12
Perfluorobutanoic acid (PFBA)	µg/L	0.1	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.1	<0.2	<0.2
Perfluoroheptane sulfonic acid	µg/L	0.02	-	-	-	-	<0.05	<0.05	-	-	-	-	<0.05	<0.05	<0.02	<0.05	<0.05
Perfluoro-n-pentanoic acid (PFPeA)	µg/L	0.02	-	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.02	<0.05	<0.05
Perfluoropentane sulfonic acid	µg/L	0.02	-	-	-	-	<0.05	<0.05	-	-	-	-	<0.05	<0.05	<0.02	<0.05	<0.05
PFDcS	µg/L	0.02	-	-	-	-	<0.05	<0.05	-	-	-	-	<0.05	<0.05	<0.02	<0.05	<0.05
N-methyl-perfluorooctanesulfonamidoacetic acid	µg/L	0.02	-	-	-	-	<0.05	<0.05	-	-	-	-	<0.05	<0.05	<0.02	<0.05	<0.05
Sum of PFHxS and PFOS (lab reported)	µg/L	0.01	-	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.1	<0.01	0.08	<0.05
Sum of WA DER PFAS (n=10)	µg/L	0.01	-	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.1	<0.01	0.08	<0.05
Sum of PFASs (n=28)	µg/L	0.01	-	-	-	-	<0.05	<0.05	-	-	-	-	<0.05	0.1	<0.01	0.08	<0.05
Perfluorobutanesulfonic acid (PFBS)	µg/L	0.02	-	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.02	<0.05	<0.05
Perfluorodecanoic acid (PFDA)	µg/L	0.02	-	-	-	-	<0.05	<0.05	-	-	-	-	<0.05	<0.05	<0.02	<0.05	<0.05
Perfluorododecanoic acid (PFDoA)	µg/L	0.02	-	-	-	-	<0.05	<0.05	-	-	-	-	<0.05	<0.05	<0.02	<0.05	<0.05
Perfluoroheptanoic acid (PFHpA)	µg/L	0.02	-	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.02	<0.05	<0.05
Perfluorooctanesulfonic acid (PFOS)	µg/L	0.01	0.13	-	0.13	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05
Perfluorooctanoate (PFOA)	µg/L	0.01	220	-	220	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05
Perfluorohexanesulfonic acid (PFHxS)	µg/L	0.02	-	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.1	<0.02	0.08	<0.05
Perfluorononanoic acid (PFNA)	µg/L	0.02	-	-	-	-	<0.05	<0.05	-	-	-	-	<0.05	<0.05	<0.02	<0.05	<0.05
Perfluorohexanoic acid (PFHxA)	µg/L	0.02	-	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.02	<0.05	<0.05
6:2 Fluorotelomer Sulfonate (6:2 FtS)	µg/L	0.05	-	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
N-ethyl-perfluorooctanesulfonamidoacetic acid	µg/L	0.02	-	-	-	-	<0.05	<0.05	-	-	-	-	<0.05	<0.05	<0.02	<0.05	<0.05
Perfluorooctanesulfonamide (PFOSA)	µg/L	0.02	-	-	-	-	<0.05	<0.05	-	-	-	-	<0.05	<0.05	<0.02	<0.05	<0.05
Perfluorotetradecanoic acid (PFTeDA)	µg/L	0.05	-	-	-	-	<0.12	<0.12	-	-	-	-	<0.12	<0.12	<0.05	<0.12	<0.12
Perfluorotridecanoic acid (PFTrDA)	µg/L	0.02	-	-	-	-	<0.05	<0.05	-	-	-	-	<0.05	<0.05	<0.02	<0.05	<0.05
Perfluoroundecanoic acid (PFUnA)	µg/L	0.02	-	-	-	-	<0.05	<0.05	-	-	-	-	<0.05	<0.05	<0.02	<0.05	<0.05

Analyte	Units	EQL	ANZG Freshwater DGV	Freshwater Species Protection	ANZG Marine DGV	Marine Species Protection Level										
Well ID							SMW_ENV044_w	SMW_ENV044_w	SMW_ENV144	SMW_ENV144	SMW_ENV149_w	SMW_ENV149_w	SMW_ENV148_W	SMW_BH070	SMW_BH121	SMW_BH120
Sample ID							SMW_ENV044_w	SMW_ENV044_w	SMW_ENV144	SMW_ENV144	SMW_ENV149_w	SMW_ENV149_w	SMW_ENV148_W	SMW_BH070	SMW_BH121	SMW_BH120
Easting							317364	317364	317395	317395	317419	317419	317467	320641	320533	321260
Northing							6254691	6254691	6254689	6254689	6254657	6254657	6254544	6253832	6253586	6253045
Location							Rosehill	Rosehill	Rosehill	Rosehill	Rosehill	Rosehill	Rosehill	Olympic Park	Olympic Park	Olympic Park
Target Unit							Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Ashfield Shale	Ashfield Shale	Ashfield Shale
Lithology							Clay	Clay	Clay	Clay	Clay	Clay	Clay	Siltstone	Siltstone	Siltstone
Depth							12.8	12.8	12.5	12.5	9	9	6.1	31.7	16	26.5
Sample Date							20/11/2019	23/03/2020	25/11/2019	20/03/2020	20/11/2019	20/03/2020	21/11/2019	4/12/2019	3/10/2019	4/10/2019
Receiving Environment							Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary
General Parameters																
Electrical Conductivity @ 25°C	µS/cm	1	2200	-	-	-	25200	-	25400	26700	25200	-	29200	33200	48700	16400
pH (Lab)	pH units	0.01	6.5-8.5	-	7.0-8.5	-	7.18	-	7.83	7.15	7.07	-	7.14	6.96	7.22	6.98
Total Dissolved Solids @180°C	mg/L	5	-	-	-	-	16400	-	15700	21300	15400	-	16300	25200	37000	10100
Hydrocarbon utilising bacteria	CFU/mL	1	-	-	-	-	-	-	<10	-	-	-	-	-	-	-
Pseudomonas aeruginosa	CFU/100mL	1	-	-	-	-	-	<1	-	<1	-	<1	-	-	-	-
Major Ions							-	-	-	-	-	-	-	-	-	-
Sodium (Filtered)	mg/L	0.5	-	-	-	-	3940	-	3980	3990	4500	-	4740	5060	9400	2770
Potassium (Filtered)	mg/L	0.5	-	-	-	-	44	-	17	15	10	-	10	75	100	42
Calcium (Filtered)	mg/L	0.5	-	-	-	-	957	-	529	468	290	-	354	1040	1310	233
Magnesium (Filtered)	mg/L	0.5	-	-	-	-	709	-	644	683	722	-	803	1050	1310	358
Chloride	mg/L	1	-	-	-	-	8380	-	8260	9150	8420	-	10900	11900	21400	5720
Fluoride	mg/L	0.1	-	-	-	-	0.3	-	-	0.4	0.4	-	0.2	0.3	0.2	0.3
Sulphate (as SO4)	mg/L	1	-	-	-	-	<1	58	292	364	638	622	667	864	2160	597
Bicarbonate Alkalinity (as CaCO3)	mg/L	1	-	-	-	-	947	-	567	502	307	-	259	603	230	600
Carbonate Alkalinity (as CaCO3)	mg/L	1	-	-	-	-	<1	-	<1	<1	<1	-	<1	<1	<1	<1
Hydroxide Alkalinity (as CaCO3)	mg/L	1	-	-	-	-	<1	-	<1	<1	<1	-	<1	<1	<1	<1
Total Alkalinity (as CaCO3)	mg/L	1	-	-	-	-	947	-	567	502	307	-	259	603	230	600
Total Anions	meq/L	0.01	-	-	-	-	255	-	250	276	257	-	326	366	653	186
Total Cations	meq/L	0.01	-	-	-	-	279	-	253	254	270	-	290	360	585	163
Ionic Balance (Lab)	%	0.01	-	-	-	-	4.36	-	0.5	4.2	2.46	-	5.89	0.74	5.54	6.64
Nutrients							-	-	-	-	-	-	-	-	-	-
Nitrate (as N)	ug/L	10	-	-	-	-	<10	<10	<10	<100	20	<10	10	<10	<50	10
Nitrite (as N)	ug/L	10	-	-	-	-	20	-	<10	<100	<10	-	<10	<10	<50	<10
Nitrogen (Total Oxidised)	ug/L	10	40	-	15		20	-	<10	<100	20	-	10	<10	50	<10
Ammonia (as N)	ug/L	10	900	95	910	95	3570	-	1270	1140	720	-	350	6890	3430	1640
Total Kjeldahl Nitrogen (as N)	ug/L	200	-	-	-	-	3800	-	1300	1000	800	-	<500	7000	3400	1700
Nitrogen (Total)	ug/L	200	350	-	300	-	3800	-	1300	1000	800	-	<500	7000	3400	1700
Reactive Phosphorus (as P)	ug/L	10	20	-	5	-	40	-	<10	<50	<10	-	<10	<10	<50	<10
Total Phosphorus (as P)	ug/L	10	25	-	30	-	30	-	<20	150	<10	-	<50	<50	160	20
Metals							-	-	-	-	-	-	-	-	-	-
Arsenic (Filtered)	µg/L	1	13	95	2.3	95	<1	-	2	4	2	-	1	4	<10	2
Cadmium (Filtered)	µg/L	0.1	0.2	95	0.7	99	<0.1	-	<0.1	<0.1	<0.1	-	<0.1	<0.1	<1	<0.1
Chromium (Filtered)	µg/L	1	1	95	4.4	95	<1	-	<1	<1	<1	-	<1	1	<10	<1
Chromium (hexavalent) (Filtered)	µg/L	10	1	95	4.4	95	<10	-	<10	-	<10	-	<10	-	<10	<10
Cobalt (Filtered)	µg/L	1	1.4	Unknown	1	95	<1	-	-	16	38	-	26	8	<10	10
Copper (Filtered)	µg/L	1	1.4	95	1.3	95	<1	-	3	<1	1	-	2	<1	<10	6
Iron (ferrous)	µg/L	50	-	-	-	-	-	8840	-	16300	-	-	-	-	-	-
Iron (Filtered)	µg/L	50	300	Unknown	300	Unknown	2990	-	-	14600	16600	21000	880	12000	10600	1120
Lead (Filtered)	µg/L	1	3.4	95	4.4	95	<1	-	<1	<1	<1	-	<1	<1	<10	<1
Manganese (Filtered)	µg/L	1	1900	95	80	Unknown	1220	1110	416	397	323	309	511	523	3100	441
Mercury (Filtered)	µg/L	0.1	0.06	99	0.1	99	<0.1	-	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	<0.1
Nickel (Filtered)	µg/L	1	11	95	70	95	<1	-	9	8	12	-	4	2	<10	67
Zinc (Filtered)	µg/L	1	8	95	8	95	16	-	26	13	16	-	10	<5	<50	73
Heavy Metals (Organo)							-	-	-	-	-	-	-	-	-	-
Tributyltin	ngSn/L	2	0.006	95	0.006	95	-	-	-	-	-	-	-	-	-	-
Dissolved Gases							-	-	-	-	-	-	-	-	-	-
Methane	µg/L	10	-	-	-	-	10900	4300	12	<10	<10	<10	<10	<10	<10	<10
Total Recoverable Hydrocarbons (TRHs)							-	-	-	-	-	-	-	-	-	-
TRH C10 - C14 Fraction	µg/L	50	100	-	100	-	<50	-	<50	<50	<50	-	<50	<50	<50	<50
TRH C15 - C28 Fraction	µg/L	100	100	-	100	-	<100	-	<100	<100	<100	-	<100	<100	<100	<100
TRH C29 - C36 Fraction	µg/L	50	100	-	100	-	<50	-	<50	<50	<50	-	<50	<50	<50	<50
TRH+C10 - C36 (Sum of total) (Lab Reported)	µg/L	50	100	-	100	-	<50	-	<50	<50	<50	-	<50	<50	<50	<50
TRH >C10 - C16 Fraction F2	µg/L	100	100	-	100	-	<100	-	<100	<100	<100	-	<100	<100	<100	<100
TRH >C10 - C16 Fraction Less Naphthalene (F2)	µg/L	50	100	-	100	-	<100	-	<100	<100	<100	-	<100	<100	<100	<100
TRH >C16 - C34 Fraction F3	µg/L	100	100	-	100	-	<100	-	<100	<100	<100	-	<100	<100	<100	<100
TRH >C34 - C40 Fraction F4	µg/L	100	100	-	100	-	<100	-	<100	<100	<100	-	<100	<100	<100	<100
TRH+C10 - C40 (Sum of total) (Lab Reported)	µg/L	100					<100	-	<100	<100	<100	-	<100	<100	<100	<100
Volatile Petroleum Hydrocarbons (PHCs)							-	-	-	-	-	-	-	-	-	-
TRH C6 - C9 Fraction	µg/L	20	100	-	100	-	<20	-	<20	<20	<20	-	<20	<20	<20	<20
TRH C6 - C10 Fraction F1	µg/L	20	100	-	100	-	<20	-	<20	<20	<20	-	<20	<20	<20	<20
TRH C6 - C10 Fraction Less BTEX F1	µg/L	20	-	-	-	-	<20	-	<20	<20	<20	-	<20	<20	<20	<20
BTEX							-	-	-	-	-	-	-	-	-	-
Benzene	µg/L	1	950	95	700	95	<1	-	<1	<1	<1	-	<1	<1	<1	<1
Toluene	µg/L	2	180	95	180	95	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Ethylbenzene	µg/L	2	80	95	80	95	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Xylenes (m & p)	µg/L	2	75	95	75	95	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Xylene (o)	µg/L	2	350	95	470	Unknown	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Xylenes (Sum of total) (Lab Reported)	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Naphthalene	ug/L	1-5*	16	95	70	95	<5	-	-	-	<5	-	<5	<5	<5	<5
Total BTEX	µg/L	1	-	-	-	-	<1	-	<1	<1	<1	-	<1	<1	<1	<1
Organochlorine Pesticides							-	-	-	-	-	-	-	-	-	-
p,p-DDE	µg/L	2	-	-	-	-	-	-	<2	<2	-	-	-	-	-	-
a-BHC	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Aldrin	µg/L	2	0.001	Unknown	0.003	Unknown	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Dieldrin	µg/L	2	0.01	Unknown	0.01	Unknown	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Aldrin & Dieldrin (Sum of total) (Lab Reported)	µg/L	4	-	-	-	-	<4	-	<4	<4	<4	-	<4	<4	<4	<4
b-BHC	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
cis-Chlordane	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
trans-Chlordane	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlordane (Sum of total)	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
d-BHC	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
DDD	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
DDE	µg/L	0.5	-	-	-	-	<2	-	-	-	<2	-	<2	<2	<2	<2
DDT	µg/L	4	0.006	99	0.0004	Unknown	<4	-	<4	<4	<4	-	<4	<4	<4	<4
DDT+DDE+DDD (Sum of total) (Lab Reported)	µg/L	4	-	-	-	-	<4	-	<4	<4	<4	-	<4	<4	<4	<4
Endosulfan I	µg/L	2	0.03	99	0.005	99	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Endosulfan II	µg/L	2	0.03	99	0.005	99	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Endosulfan (as sum of Endosulfan I and Endosulfan II)	µg/L	-	0.03	99	0.005	99	-	-	-	-	-	-	-	-	-	-
Endosulfan sulphate	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Endrin	µg/L	2	0.01	99	0.004	99	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Endrin aldehyde	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Endrin ketone	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
g-BHC	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Heptachlor	µg/L	2	0.01	99	0.0004	Unknown	<2	-	<2	<2	<2	-	<2	<2	<2	<2

Analyte	Units	EQL	ANZG Freshwater DGV	Freshwater Species Protection	ANZG Marine DGV	Marine Species Protection Level	SMW_ENV044_w	SMW_ENV044_w	SMW_ENV144	SMW_ENV144	SMW_ENV149_w	SMW_ENV149_w	SMW_ENV148_W	SMW_BH070	SMW_BH121	SMW_BH120
Well ID							SMW_ENV044_w	SMW_ENV044_w	SMW_ENV144	SMW_ENV144	SMW_ENV149_w	SMW_ENV149_w	SMW_ENV148_W	SMW_BH070	SMW_BH121	SMW_BH120
Sample ID							SMW_ENV044_w	SMW_ENV044_w	SMW_ENV144	SMW_ENV144	SMW_ENV149_w	SMW_ENV149_w	SMW_ENV148_W	SMW_BH070	SMW_BH121	SMW_BH120
Easting							317364	317364	317395	317395	317419	317419	317467	320641	320533	321260
Northing							6254691	6254691	6254689	6254689	6254657	6254657	6254544	6253832	6253586	6253045
Location							Rosehill	Rosehill	Rosehill	Rosehill	Rosehill	Rosehill	Rosehill	Olympic Park	Olympic Park	Olympic Park
Target Unit							Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Ashfield Shale	Ashfield Shale	Ashfield Shale
Lithology							Clay	Clay	Clay	Clay	Clay	Clay	Clay	Siltstone	Siltstone	Siltstone
Depth							12.8	12.8	12.5	12.5	9	9	6.1	31.7	16	26.5
Sample Date							20/11/2019	23/03/2020	25/11/2019	20/03/2020	20/11/2019	20/03/2020	21/11/2019	4/12/2019	3/10/2019	4/10/2019
Receiving Environment							Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary
Heptachlor epoxide	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Hexachlorobenzene	µg/L	4	0.05	99	0.05	99	<4	-	<4	<4	<4	-	<4	<4	<4	<4
Methoxychlor	µg/L	2	0.005	Unknown	0.004	Unknown	-	-	-	-	-	-	-	-	-	-
Organophosphorous Pesticides							-	-	-	-	-	-	-	-	-	-
Azinphos-methyl	µg/L	0.5	0.02	95	0.01	Unknown	-	-	-	-	-	-	-	-	-	-
Bromophos-ethyl	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbophenothion	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlorfenvinphos	µg/L	0.5	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Chlorpyriphos	µg/L	0.5	0.01	95	0.009	95	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Chlorpyriphos-methyl	µg/L	0.5	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Demeton-s-methyl	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diazinon	µg/L	0.5	0.01	95	0.01	Unknown	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Dichlorvos	µg/L	0.5	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Dimethoate	µg/L	0.5	0.15	95	0.15	Unknown	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Ethion	µg/L	0.5	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Fenitrothion	µg/L	0.5	0.2	95	0.001	Unknown	-	-	-	-	-	-	-	-	-	-
Fenamiphos	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fenthion	µg/L	0.5	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Malathion	µg/L	0.5	0.05	95	0.05	Unknown	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Parathion-methyl	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Monocrotophos	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	<2	<2	<2
Parathion	µg/L	2	0.004	95	0.004	Unknown	-	-	-	-	-	-	-	-	-	-
Pirimphos-ethyl	µg/L	0.5	-	-	-	-	<2	-	<2	<2	<2	-	<2	-	-	-
Prothiofos	µg/L	0.5	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Ronnel	µg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PAHs							-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene (TEQs)	µg/L	5	0.1	99	0.1	99	-	-	-	-	-	-	-	-	-	-
Benzo(b+j) & Benzo(k)fluoranthene	µg/L	4	-	-	-	-	<4	-	<4	<4	<4	-	<4	-	<4	<4
Acenaphthene	µg/L	1	-	-	-	-	<1	-	<1	<1	<1	-	<1	<1	<1	<1
Acenaphthylene	µg/L	1	-	-	-	-	<1	-	<1	<1	<1	-	<1	<1	<1	<1
Anthracene	µg/L	1	0.01	99	0.01	99	<1	-	<1	<1	<1	-	<1	<1	<1	<1
Benz(a)anthracene	µg/L	1	-	-	-	-	<1	-	<1	<1	<1	-	<1	<1	<1	<1
Benzo(a)pyrene	µg/L	0.5	0.1	99	0.1	99	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ (lower bound)*	µg/L	0.5	0.1	99	0.1	99	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5
Benzo(b)&(j)fluoranthene	µg/L	1	-	-	-	-	<1	-	<1	<1	<1	-	<1	<1	<1	<1
Benzo(g,h,i)perylene	µg/L	1	-	-	-	-	<1	-	<1	<1	<1	-	<1	<1	<1	<1
Benzo(k)fluoranthene	µg/L	1	-	-	-	-	<1	-	<1	<1	<1	-	<1	<1	<1	<1
Chrysene	µg/L	1	-	-	-	-	<1	-	<1	<1	<1	-	<1	<1	<1	<1
Dibenz(a,h)anthracene	µg/L	1	-	-	-	-	<1	-	<1	<1	<1	-	<1	<1	<1	<1
Fluoranthene	µg/L	1	1	99	1	99	<1	-	<1	<1	<1	-	<1	<1	<1	<1
Fluorene	µg/L	1	-	-	-	-	<1	-	<1	<1	<1	-	<1	<1	<1	<1
Indeno(1,2,3-c,d)pyrene	µg/L	1	-	-	-	-	<1	-	<1	<1	<1	-	<1	<1	<1	<1
Naphthalene	µg/L	1	16	95	70	95	<1	-	<1	<1	<1	-	<1	<1	<1	<1
Phenanthrene	µg/L	1	0.6	99	0.6	99	<1	-	<1	<1	<1	-	<1	<1	<1	<1
Pyrene	µg/L	1	-	-	-	-	<1	-	<1	<1	<1	-	<1	<1	<1	<1
PAH (Sum of Common 16 PAHs - Lab Reported)	µg/L	0.5	-	-	-	-	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5
Total PAH (NEPM/WHO 16)	µg/L	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Phenols							-	-	-	-	-	-	-	-	-	-
Phenolics (Sum of total)	µg/L	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4,6-Dinitro-2-methylphenol	µg/L	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,3,4,6-Tetrachlorophenol	µg/L	1	10	99	20	Unknown	-	-	-	-	-	-	-	-	-	-
2,4,5-Trichlorophenol	µg/L	1	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
2,4,6-Trichlorophenol	µg/L	1	3	99	3	Unknown	<2	-	<2	<2	<2	-	<2	<2	<2	<2
2,4-Dichlorophenol	µg/L	1	160	95	160	Unknown	<2	-	<2	<2	<2	-	<2	<2	<2	<2
2,6-Dichlorophenol	µg/L	1	34	Unknown	34	Unknown	<2	-	<2	<2	<2	-	<2	<2	<2	<2
2-Chlorophenol	µg/L	1	490	95	490	Unknown	<2	-	<2	<2	<2	-	<2	<2	<2	<2
4-Chloro-3-methylphenol	µg/L	1	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Pentachlorophenol	µg/L	2	3.6	99	11	99	<4	-	<4	<4	<4	-	<4	<4	<4	<4
2,4-Dimethylphenol	µg/L	1	2	Unknown	2	Unknown	<2	-	<2	<2	<2	-	<2	<2	<2	<2
2-Methylphenol	µg/L	1	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
2-Nitrophenol	µg/L	1	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
3- & 4- Methylphenol	µg/L	2	-	-	-	-	<4	-	<4	<4	<4	-	<4	<4	<4	<4
Phenol	µg/L	1	320	95	400	95	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Polychlorinated Biphenyls							-	-	-	-	-	-	-	-	-	-
PCB (Sum of Total-Lab Reported)	µg/L	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SVOCs							-	-	-	-	-	-	-	-	-	-
Cyclohexane	µg/L	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds							-	-	-	-	-	-	-	-	-	-
1,3-Dichloropropene (Calculated)	µg/L		-	-	-	-	-	-	<2	<2	-	-	-	-	-	-
1,4-Dichlorobenzene	µg/L	2, 5	60	95	75	Unknown	<2	-	<5	<5	<2	-	<2	<2	<2	<2
4-Chlorotoluene	µg/L	5	-	-	-	-	<5	-	<5	<5	<5	-	<5	<5	<5	<5
1,2,3-Trichlorobenzene	µg/L	5	3	99	10	Unknown	<5	-	<2	<2	<5	-	<5	<5	<5	<5
1,2,4-Trichlorobenzene	µg/L	2	85	99	20	99	<2	-	<2	<2	<2	-	<2	<2	<2	<2
1,2-Dichlorobenzene	µg/L	2	160	95	160	95	<2	-	<2	<2	<2	-	<2	<2	<2	<2
1,3-Dichlorobenzene	µg/L	2	260	95	350	Unknown	<2	-	<5	<5	<2	-	<2	<2	<2	<2
2-Chlorotoluene	µg/L	5	-	-	-	-	<5	-	<5	<5	<5	-	<5	<5	<5	<5
Bromobenzene	µg/L	5	-	-	-	-	<5	-	<5	<5	<5	-	<5	<5	<5	<5
Chlorobenzene	µg/L	5	-	-	-	-	<5	-	<5	<5	<5	-	<5	<5	<5	<5
1,2,4-trimethylbenzene	µg/L	5	-	-	-	-	<5	-	<5	<5	<5	-	<5	<5	<5	<5
1,3,5-Trimethylbenzene	µg/L	5	-	-	-	-	<5	-	<5	<5	<5	-	<5	<5	<5	<5
Isopropylbenzene	µg/L	5	-	-	-	-	<5	-	<5	<5	<5	-	<5	<5	<5	<5
n-Butylbenzene	µg/L	5	-	-	-	-	<5	-	<5	<5	<5	-	<5	<5	<5	<5
n-Propylbenzene	µg/L	5	-	-	-	-	<5	-	<5	<5	<5	-	<5	<5	<5	<5
p-Isopropyltoluene	µg/L	5	-	-	-	-	<5	-	<5	<5	<5	-	<5	<5	<5	<5
sec-Butylbenzene	µg/L	5	-	-	-	-	<5	-	<5	<5	<5	-	<5	<5	<5	<5
Styrene	µg/L	5	-	-	-	-	<5	-	<5	<5	<5	-	<5	<5	<5	<5
tert-Butylbenzene	µg/L	5	-	-	-	-	<5	-	<50	<50	<5	-	<5	<5	<5	<5
Methyl Ethyl Ketone	µg/L	50	-	-	-	-	<50	-	<50	<50	<50	-	<50	<50	<50	<50
2-Hexanone	µg/L	50	-	-	-	-	<50	-	<50	<50	<50	-	<50	<50	<50	<50
Methyl iso-butyl ketone	µg/L	50	-	-	-	-	<50	-	<2	<2	<50	-	<50	<50	<50	<50
Isophorone	µg/L	2	N.D.	Unknown	130	Unknown	<2	-	<50	<50	<2	-	<2	<2	<2	<2
Vinyl acetate	µg/L	50	-	-	-	-	<50	-	<5	<5	<50	-	<50	<50	<50	<50
1,1,1,2-Tetrachloroethane	µg/L	5	-	-	-	-	<5	-	<5	<5	<5	-	<5	<5	<5	<5
1,1,2,2-Tetrachloroethane	µg/L	5	400	95	400	95	<5	-	<5	<5	<5	-	<5	<5	<5	<5

Well ID	SMW_ENV044_w	SMW_ENV044_w	SMW_ENV144	SMW_ENV144	SMW_ENV149_w	SMW_ENV149_w	SMW_ENV148_W	SMW_BH070	SMW_BH121	SMW_BH120
Sample ID	SMW_ENV044_w	SMW_ENV044_w	SMW_ENV144	SMW_ENV144	SMW_ENV149_w	SMW_ENV149_w	SMW_ENV148_W	SMW_BH070	SMW_BH121	SMW_BH120
Easting	317364	317364	317395	317395	317419	317419	317467	320641	320533	321260
Northing	6254691	6254691	6254689	6254689	6254657	6254657	6254544	6253832	6253586	6253045
Location	Rosehill	Rosehill	Rosehill	Rosehill	Rosehill	Rosehill	Rosehill	Olympic Park	Olympic Park	Olympic Park
Target Unit	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Ashfield Shale	Ashfield Shale	Ashfield Shale
Lithology	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Siltstone	Siltstone	Siltstone
Depth	12.8	12.8	12.5	12.5	9	9	6.1	31.7	16	26.5
Sample Date	20/11/2019	23/03/2020	25/11/2019	20/03/2020	20/11/2019	20/03/2020	21/11/2019	4/12/2019	3/10/2019	4/10/2019
Receiving Environment	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary

Analyte	Units	EQL	ANZG Freshwater DGV	Freshwater Species Protection	ANZG Marine DGV	Marine Species Protection Level										
1,1,1-Trichloroethane	µg/L	5	270	95	270	95	<5	-	<5	<5	<5	-	<5	<5	<5	<5
1,1,2-Trichloroethane	µg/L	5	6500	95	1900	95	<5	-	<5	<5	<5	-	<5	<5	<5	<5
1,2,3-Trichloropropane	µg/L	5	-	-	-	-	<5	-	<5	<5	<5	-	<5	<5	<5	<5
1,2-Dibromo-3-chloropropane	µg/L	5	-	-	-	-	<5	-	<5	<5	<5	-	<5	<5	<5	<5
1,2-Dibromoethane	µg/L	5	-	-	-	-	<5	-	<5	<5	<5	-	<5	<5	<5	<5
1,1-Dichloroethane	µg/L	5	-	-	-	-	<5	-	<5	<5	<5	-	<5	<5	<5	<5
1,2-Dichloroethane	µg/L	5	1900	95	1900	95	<5	-	<5	<5	<5	-	<5	<5	<5	<5
1,1-Dichloroethene	µg/L	5	-	-	-	-	<5	-	-	-	<5	-	<5	<5	<5	<5
cis-1,2-Dichloroethene	µg/L	5	-	-	-	-	<5	-	<5	<5	<5	-	<5	<5	<5	<5
trans-1,2-dichloroethene	µg/L	5	-	-	-	-	<5	-	<5	<5	<5	-	<5	<5	<5	<5
1,2 - Dichloroethene (as sum of cis-1,2-Dichloroethene and trans-1,2-dichloroethene)	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloropropane	µg/L	5	900	95	900	95	<5	-	<5	<5	<5	-	<5	<5	<5	<5
1,3-Dichloropropane	µg/L	5	1100	95	1100	95	<5	-	<5	<5	<5	-	<5	<5	<5	<5
2,2-Dichloropropane	µg/L	5	-	-	-	-	<5	-	<5	<5	<5	-	<5	<5	<5	<5
1,1-Dichloropropene	µg/L	5	-	-	-	-	<5	-	<5	<5	<5	-	<5	<5	<5	<5
cis-1,3-Dichloropropene	µg/L	5	-	-	-	-	<5	-	<5	<5	<5	-	<5	<5	<5	<5
trans-1,3-dichloropropene	µg/L	5	-	-	-	-	<5	-	<5	<5	<5	-	<5	<5	<5	<5
1,3-dichloropropene (as sum of cis-1,3-Dichloropropene	µg/L	10	-	-	-	-	<10	-	-	-	<10	-	<10	<10	<10	<10
cis-1,4-Dichloro-2-butene	µg/L	5	-	-	-	-	<5	-	<5	<5	<5	-	<5	<5	<5	<5
trans-1,4-Dichloro-2-butene	µg/L	5	-	-	-	-	<5	-	<5	<5	<5	-	<5	<5	<5	<5
Bromochloromethane	µg/L	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromodichloromethane	µg/L	5	-	-	-	-	<5	-	<5	<5	<5	-	<5	<5	<5	<5
Bromoform	µg/L	5	-	-	-	-	<5	-	<5	<5	<5	-	<5	<5	<5	<5
Bromomethane	µg/L	50	-	-	-	-	<50	-	<50	<50	<50	-	<50	<50	<50	<50
Carbon disulfide	µg/L	5	20	Unknown	20	Unknown	<5	-	<5	<5	<5	-	<5	<5	<5	<5
Carbon tetrachloride	µg/L	5	240	95	240	95	<5	-	<5	<5	<5	-	<5	<5	<5	<5
Chlorodibromomethane	µg/L	5	-	-	-	-	<5	-	<5	<5	<5	-	<5	<5	<5	<5
Chloroethane	µg/L	50	-	-	-	-	<50	-	<50	<50	<50	-	<50	<50	<50	<50
Chloroform	µg/L	5	770	95	770	95	<5	-	<5	<5	<5	-	<5	<5	<5	<5
Chloromethane	µg/L	50	-	-	-	-	<50	-	<50	<50	<50	-	<50	<50	<50	<50
Dibromomethane	µg/L	5	-	-	-	-	<5	-	<5	<5	<5	-	<5	<5	<5	<5
Dichlorodifluoromethane	µg/L	50	-	-	-	-	<50	-	<50	<50	<50	-	<50	<50	<50	<50
Hexachlorobutadiene	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Hexachloroethane	µg/L	2	290	99	360	Unknown	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Iodomethane	µg/L	5	-	-	-	-	<5	-	<5	<5	<5	-	<5	<5	<5	<5
Pentachloroethane	µg/L	5	80	95	80	95	<5	-	<5	<5	<5	-	<5	<5	<5	<5
Trichloroethene	µg/L	5	-	-	-	-	<5	-	<5	<5	<5	-	<5	<5	<5	<5
Tetrachloroethene	µg/L	5	-	-	-	-	<5	-	<5	<5	<5	-	<5	<5	<5	<5
Trichlorofluoromethane	µg/L	50	-	-	-	-	<50	-	<50	<50	<50	-	<50	<50	<50	<50
Vinyl chloride	µg/L	50	-	-	-	-	<50	-	<50	<50	<50	-	<50	<50	<50	<50
SVOCs							-	-	-	-	-	-	-	-	-	-
n-Nitrosomethylethylamine	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
n-Nitrosodiethylamine	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
N-Nitrosodi-n-butylamine	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
N-Nitrosodi-n-propylamine	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
1-Naphthylamine	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
n-Nitrosodiphenylamine & Diphenylamine	µg/L	4	-	-	-	-	<4	-	<4	<4	<4	-	<4	<4	<4	<4
2-Nitroaniline	µg/L	4	-	-	-	-	<4	-	<4	<4	<4	-	<4	<4	<4	<4
3-Nitroaniline	µg/L	4	-	-	-	-	<4	-	<4	<4	<4	-	<4	<4	<4	<4
4-Chloroaniline	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
2-methyl-5-nitroaniline	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
4-Nitroaniline	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Aniline	µg/L	2	250	95	250	Unknown	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Nitrobenzene	µg/L	2	550	95	550	Unknown	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Pentachloronitrobenzene	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
1,3,5-Trinitrobenzene	µg/L	2	4	Unknown	4	Unknown	<2	-	<2	<2	<2	-	<2	<2	<2	<2
2,4-Dinitrotoluene	µg/L	4	65	95	65	Unknown	<4	-	<4	<4	<4	-	<4	<4	<4	<4
2,6-Dinitrotoluene	µg/L	4	-	-	-	-	<4	-	<4	<4	<4	-	<4	<4	<4	<4
Pentachlorobenzene	µg/L	2	1.5	99	1.5	99	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Pronamide	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
2-Chloronaphthalene	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
3-Methylcholanthrene	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
7,12-Dimethylbenz(a)anthracene	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Carbazole	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Chlorobenzilate	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Bis(2-ethylhexyl) phthalate	µg/L	10	-	-	-	-	<10	-	<10	<10	<10	-	<10	<10	<10	<10
Butylbenzyl phthalate	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Diethyl phthalate	µg/L	2	1000	95	1000	Unknown	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Dimethyl phthalate	µg/L	2	3700	95	3700	Unknown	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Di-n-butyl phthalate	µg/L	2	10	99	10	Unknown	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Di-n-octyl phthalate	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
2-(Acetylamino) fluorene	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
2-Picoline	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
3,3-Dichlorobenzidine	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
4-(Dimethylamino) azobenzene	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
4-Aminobiphenyl	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
4-Bromophenyl phenyl ether	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
4-Chlorophenyl phenyl ether	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
4-Nitroquinoline-n-oxide	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Acetophenone	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Azobenzene	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Bis(2-chloroethoxy) methane	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Bis(2-chloroethyl) ether	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Dibenzofuran	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Hexachlorocyclopentadiene	µg/L	10	-	-	-	-	<10	-	<10	<10	<10	-	<10	<10	<10	<10
Hexachloropropene	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Methapyrilene	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
n-Nitrosomorpholine	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
N-Nitrosopiperidine	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
n-Nitrosopyrrolidine	µg/L	4	-	-	-	-	<4	-	<4	<4	<4	-	<4	<4	<4	<4
Phenacetin	µg/L	2	-	-	-	-	<2	-	<2	<2	<2	-	<2	<2	<2	<2
Per- and polyfluoroalkyl substances (PFAS)							-	-	-	-	-	-	-	-	-	-
10:2 Fluorotelomer sulfonic acid	µg/L	0.05	-	-	-	-	<0.05	-	<0.05	<0.05	<0.05	-	<0.05	<0.05	<0.05	<0.05
4:2 Fluorotelomer sulfonic acid	µg/L	0.05	-	-	-	-	<0.05	-	<0.05	<0.05	<0.05	-	<0.05	<0.05	<0.05	<0.05
8:2 Fluorotelomer sulfonate	µg/L	0.05	-	-	-	-	<0.05	-	0.05	<0.05	<0.05	-	<0.05	<0.05	<0.05	<0.05

Analyte	Units	EQL	ANZG Freshwater DGV	Freshwater Species Protection	ANZG Marine DGV	Marine Species Protection Level	SMW_ENV044_w	SMW_ENV044_w	SMW_ENV144	SMW_ENV144	SMW_ENV149_w	SMW_ENV149_w	SMW_ENV148_W	SMW_BH070	SMW_BH121	SMW_BH120
Well ID							SMW_ENV044_w	SMW_ENV044_w	SMW_ENV144	SMW_ENV144	SMW_ENV149_w	SMW_ENV149_w	SMW_ENV148_W	SMW_BH070	SMW_BH121	SMW_BH120
Sample ID							SMW_ENV044_w	SMW_ENV044_w	SMW_ENV144	SMW_ENV144	SMW_ENV149_w	SMW_ENV149_w	SMW_ENV148_W	SMW_BH070	SMW_BH121	SMW_BH120
Easting							317364	317364	317395	317395	317419	317419	317467	320641	320533	321260
Northing							6254691	6254691	6254689	6254689	6254657	6254657	6254544	6253832	6253586	6253045
Location							Rosehill	Rosehill	Rosehill	Rosehill	Rosehill	Rosehill	Rosehill	Olympic Park	Olympic Park	Olympic Park
Target Unit							Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Alluvial Terrace	Ashfield Shale	Ashfield Shale	Ashfield Shale
Lithology							Clay	Clay	Clay	Clay	Clay	Clay	Clay	Siltstone	Siltstone	Siltstone
Depth							12.8	12.8	12.5	12.5	9	9	6.1	31.7	16	26.5
Sample Date							20/11/2019	23/03/2020	25/11/2019	20/03/2020	20/11/2019	20/03/2020	21/11/2019	4/12/2019	3/10/2019	4/10/2019
Receiving Environment							Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary	Upper Estuary
N-Et-FOSA	µg/L	0.05	-	-	-	-	<0.12	-	<0.05	<0.05	<0.12	-	<0.05	-	<0.12	<0.12
N-Et-FOSE	µg/L	0.05	-	-	-	-	<0.12	-	<0.05	<0.05	<0.12	-	<0.05	-	<0.12	<0.12
N-Me-FOSA	µg/L	0.05	-	-	-	-	<0.12	-	<0.05	<0.05	<0.12	-	<0.05	-	<0.12	<0.12
N-Me-FOSE	µg/L	0.05	-	-	-	-	<0.12	-	<0.05	<0.05	<0.12	-	<0.05	-	<0.12	<0.12
Perfluorobutanoic acid (PFBA)	µg/L	0.1	-	-	-	-	<0.2	-	<0.1	<0.1	<0.2	-	<0.1	<0.25	<0.2	<0.2
Perfluoroheptane sulfonic acid	µg/L	0.02	-	-	-	-	<0.05	-	<0.02	<0.02	<0.05	-	<0.02	-	<0.05	<0.05
Perfluoro-n-pentanoic acid (PFPeA)	µg/L	0.02	-	-	-	-	<0.05	-	<0.02	<0.02	<0.05	-	<0.02	<0.05	<0.05	<0.05
Perfluoropentane sulfonic acid	µg/L	0.02	-	-	-	-	<0.05	-	<0.02	<0.02	<0.05	-	<0.02	-	<0.05	<0.05
PFDcS	µg/L	0.02	-	-	-	-	<0.05	-	<0.02	<0.02	<0.05	-	<0.02	-	<0.05	<0.05
N-methyl-perfluorooctanesulfonamidoacetic acid	µg/L	0.02	-	-	-	-	<0.05	-	<0.02	<0.02	<0.05	-	<0.02	-	<0.05	<0.05
Sum of PFHxS and PFOS (lab reported)	µg/L	0.01	-	-	-	-	<0.05	-	<0.01	<0.01	<0.05	-	<0.01	<0.05	<0.05	<0.05
Sum of WA DER PFAS (n=10)	µg/L	0.01	-	-	-	-	<0.05	-	0.33	<0.01	<0.05	-	<0.01	<0.05	<0.05	<0.05
Sum of PFASs (n=28)	µg/L	0.01	-	-	-	-	<0.05	-	0.33	<0.01	<0.05	-	<0.01	-	<0.05	<0.05
Perfluorobutanesulfonic acid (PFBS)	µg/L	0.02	-	-	-	-	<0.05	-	<0.02	<0.02	<0.05	-	<0.02	<0.05	<0.05	<0.05
Perfluorodecanoic acid (PFDA)	µg/L	0.02	-	-	-	-	<0.05	-	<0.02	<0.02	<0.05	-	<0.02	-	<0.05	<0.05
Perfluorododecanoic acid (PFDoA)	µg/L	0.02	-	-	-	-	<0.05	-	<0.02	<0.02	<0.05	-	<0.02	-	<0.05	<0.05
Perfluoroheptanoic acid (PFHpA)	µg/L	0.02	-	-	-	-	<0.05	-	<0.02	<0.02	<0.05	-	<0.02	<0.05	<0.05	<0.05
Perfluorooctanesulfonic acid (PFOS)	µg/L	0.01	0.13	-	0.13	-	<0.05	-	<0.01	<0.01	<0.05	-	<0.01	<0.05	<0.05	<0.05
Perfluorooctanoate (PFOA)	µg/L	0.01	220	-	220	-	<0.05	-	<0.01	<0.01	<0.05	-	<0.01	<0.05	<0.05	<0.05
Perfluorohexanesulfonic acid (PFHxS)	µg/L	0.02	-	-	-	-	<0.05	-	<0.02	<0.02	<0.05	-	<0.02	<0.05	<0.05	<0.05
Perfluorononanoic acid (PFNA)	µg/L	0.02	-	-	-	-	<0.05	-	<0.02	<0.02	<0.05	-	<0.02	-	<0.05	<0.05
Perfluorohexanoic acid (PFHxA)	µg/L	0.02	-	-	-	-	<0.05	-	<0.02	<0.02	<0.05	-	<0.02	<0.05	<0.05	<0.05
6:2 Fluorotelomer Sulfonate (6:2 FtS)	µg/L	0.05	-	-	-	-	<0.05	-	0.28	<0.05	<0.05	-	<0.05	<0.05	<0.05	<0.05
N-ethyl-perfluorooctanesulfonamidoacetic acid	µg/L	0.02	-	-	-	-	<0.05	-	<0.02	<0.02	<0.05	-	<0.02	-	<0.05	<0.05
Perfluorooctanesulfonamide (PFOSA)	µg/L	0.02	-	-	-	-	<0.05	-	<0.02	<0.02	<0.05	-	<0.02	-	<0.05	<0.05
Perfluorotetradecanoic acid (PFTeDA)	µg/L	0.05	-	-	-	-	<0.12	-	<0.05	<0.05	<0.12	-	<0.05	-	<0.12	<0.12
Perfluorotridecanoic acid (PFTrDA)	µg/L	0.02	-	-	-	-	<0.05	-	<0.02	<0.02	<0.05	-	<0.02	-	<0.05	<0.05
Perfluoroundecanoic acid (PFUnA)	µg/L	0.02	-	-	-	-	<0.05	-	<0.02	<0.02	<0.05	-	<0.02	-	<0.05	<0.05

				Location	SMW_ENV283	SMW_ENV283s	SMW_WTP_BH13	SMW_WTP_BH13	SMW_WTP_BH14	SMW_WTP_BH14	SMW_WTP_BH15	SMW_WTP_BH18	SMW_WTP_BH18	SMW_WTP_BH19	SMW_WTP_BH22	SMW_WTP_BH23
				Field_ID	SMW-ENV283	SMW_ENV2835	QA500	SMW-BH13	SMW_BH14	QCB500	SMW_BH15	SMW_BH18	QCA700	SMW_BH19	SMW_BH22	SMW_WTP_BH23
				Sampled date	25/01/2022	17/01/2022	12/10/2021	12/10/2021	20/10/2021	20/10/2021	20/10/2021	20/10/2021	20/10/2021	31/01/2022	30/11/2021	7/02/2022
				Lab report	ES2202504	ES2201473	ES2136681	ES2136722	ES2137931	280861	ES2137931	ES2137931	ES2137931	ES2203272	ES2143766	ES2204131
Analyte	**Unit**	**LOR**	**ANZG (2018) Freshwater 95% / 99%**	**ANZG (2018) Marine water 95% / 99%**												
BTEX																
Benzene	mg/L	0.001	0.95	0.7	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.005	<0.001
Toluene	mg/L	0.001	0.18	0.18	<0.002	0.005	<0.002	<0.002	<0.002	0.001	0.006	<0.002	<0.002	<0.002	0.005	<0.002
Ethylbenzene	mg/L	0.001	0.08	0.08	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002
Xylenes (m & p)	mg/L	0.002	0.075	0.075	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002
Xylene (o)	mg/L	0.001	0.35	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002
Xylenes (Sum of total) (Lab Reported)	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Total BTEX	mg/L	0.001	-	-	<0.001	0.005	<0.001	<0.001	<0.001	-	0.006	<0.001	<0.001	<0.001	0.005	<0.001
Perfluorinated Compounds																
Perfluorodecane sulfonic acid (PFDS)	ug/L	0.002	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluoro-n-hexadecanoic acid	ug/L	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N-Methyl PFO sulfonamidoethanol (MeFOSE)	ug/L	0.005	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
N-methyl-PFO sulfonamidoacetic acid (MeFOSAA)	ug/L	0.002	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorooctanoic Acid (PFOA)	ug/L	0.002	19	19	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Perfluorooctane sulfonic acid (PFOS)	ug/L	0.002	0.00023	0.00023	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Perfluorohexane sulfonic acid (PFHxS)	ug/L	0.002	-	-	<0.02	0.02	<0.02	<0.02	<0.02	<0.01	<0.02	<0.02	<0.02	<0.01	<0.01	<0.01
Sum of PFHxS and PFOS (lab reported)	ug/L	0.002	-	-	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sum of US EPA PFAS (PFOS + PFOA)	ug/L	0.01	-	-	-	-	-	-	-	<0.01	-	-	-	-	-	-
Sum of WA DER PFAS (n=10)	ug/L	0.002	-	-	<0.01	0.03	<0.01	<0.01	<0.01	-	<0.01	<0.01	<0.01	0.12	<0.01	<0.01
Sum of PFASs (n=28 - Lab Reported)	ug/L	0.002	-	-	<0.01	0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.12	<0.01	<0.01
Perfluorobutanoic acid (PFBA)	ug/L	0.01	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.02	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorohexanoic acid (PFHxA)	ug/L	0.002	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.01	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluoroheptanoic acid (PFHpA)	ug/L	0.002	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.01	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorodecanoic acid (PFDA)	ug/L	0.002	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluoropentanoic acid (PFPeA)	ug/L	0.002	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorononanoic acid (PFNA)	ug/L	0.002	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.01	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorotetradecanoic acid (PFTeDA)	ug/L	0.005	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Perfluorotridecanoic acid (PFTrDA)	ug/L	0.002	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.1	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorododecanoic acid (PFDoDA)	ug/L	0.002	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluoroundecanoic acid (PFUnDA)	ug/L	0.002	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluoroheptane sulfonic acid (PFHpS)	ug/L	0.002	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.01	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluoropentane sulfonic acid (PFPeS)	ug/L	0.002	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.01	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorobutane sulfonic acid (PFBS)	ug/L	0.002	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.01	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
4:2 Fluorotelomer sulfonic acid (4:2 FTSA)	ug/L	0.005	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	ug/L	0.005	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.05	0.12	<0.05	<0.05
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	ug/L	0.005	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
10:2 Fluorotelomer sulfonic acid (10:2 FTSA)	ug/L	0.005	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
N-Ethyl PFO sulfonamide (EtFOSA)	ug/L	0.005	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
N-Ethyl PFO sulfonamidoethanol (EtFOSE)	ug/L	0.005	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
N-Methyl PFO sulfonamide (MeFOSA)	ug/L	0.005	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Perfluorooctane sulfonamide (FOSA)	ug/L	0.002	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.1	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
N-ethyl-PFO sulfonamidoacetic acid (EtFOSAA)	ug/L	0.002	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
TRH - HSL																
TRH+C10 - C40 (Sum of total) (Lab Reported)	mg/L	0.05	-	-	<0.1	0.16	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1	0.17	<0.1
TRH C6 - C10 Fraction F1	mg/L	0.01	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.01	<0.02	<0.02	<0.02	<0.02	<0.1	<0.02
TRH C6 - C10 Fraction Less BTEX F1	mg/L	0.01	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.01	<0.02	<0.02	<0.02	<0.02	<0.1	<0.02
TRH >C10 - C16 Fraction F2	mg/L	0.05	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TRH >C10 - C16 Fraction Less Naphthalene F2	mg/L	0.05	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TRH >C16 - C34 Fraction F3	mg/L	0.1	-	-	<0.1	0.16	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.17	<0.1
TRH >C34 - C40 Fraction F4	mg/L	0.1	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TRH Waste Classification																
TRH C6 - C9 Fraction	mg/L	0.01	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.01	<0.02	<0.02	<0.02	<0.02	<0.1	<0.02
TRH C10 - C14 Fraction	mg/L	0.05	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
TRH C15 - C28 Fraction	mg/L	0.1	-	-	<0.1	0.19	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.18	<0.1
TRH C29 - C36 Fraction	mg/L	0.05	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
TRH+C10 - C36 (Sum of total) (Lab Reported)	mg/L	0.05	-	-	<0.05	0.19	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.18	<0.05
Microbiological																
Enterococci	CFU/100 mL	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Faecal Coliforms	cfu/100ml	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Amino Aliphatics																
n-Nitrosodiethylamine	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
N-Nitrosodi-n-butylamine	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
N-Nitrosodi-n-propylamine	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
n-Nitrosomethylethylamine	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Amino Aromatics																
1-Naphthylamine	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
n-Nitrosodiphenylamine & Diphenylamine	mg/L	0.004	-	-	<0.004	<0.004	<0.004	<0.004	<0.004	-	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Anilines																
2-Nitroaniline	mg/L	0.004	-	-	<0.004	<0.004	<0.004	<0.004	<0.004	<0.005	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
3-Nitroaniline	mg/L	0.004	-	-	<0.004	<0.004	<0.004	<0.004	<0.004	<0.005	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
4-Chloroaniline	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
4-Nitroaniline	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
2-methyl-5-nitroaniline	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Aniline	mg/L	0.002	0.25	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002

				Location	SMW_ENV283	SMW_ENV283s	SMW_WTP_BH13	SMW_WTP_BH13	SMW_WTP_BH14	SMW_WTP_BH14	SMW_WTP_BH15	SMW_WTP_BH18	SMW_WTP_BH18	SMW_WTP_BH19	SMW_WTP_BH22	SMW_WTP_BH23
				Field_ID	SMW-ENV283	SMW_ENV2835	QA500	SMW-BH13	SMW_BH14	QCB500	SMW_BH15	SMW_BH18	QCA700	SMW_BH19	SMW_BH22	SMW_WTP_BH23
				Sampled date	25/01/2022	17/01/2022	12/10/2021	12/10/2021	20/10/2021	20/10/2021	20/10/2021	20/10/2021	20/10/2021	31/01/2022	30/11/2021	7/02/2022
				Lab report	ES2202504	ES2201473	ES2136681	ES2136722	ES2137931	280861	ES2137931	ES2137931	ES2137931	ES2203272	ES2143766	ES2204131
Analyte	**Unit**	**LOR**	**ANZG (2018) Freshwater 95% / 99%**	**ANZG (2018) Marine water 95% / 99%**												
E-Nitrobenzenes																
Nitrobenzene	mg/L	0.002	0.55	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Pentachloronitrobenzene	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Explosives																
1,3,5-Trinitrobenzene	mg/L	0.002	0.004	-	<0.002	<0.002	<0.002	<0.002	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
2,4-Dinitrotoluene	mg/L	0.004	0.065	-	<0.004	<0.004	<0.004	<0.004	<0.004	-	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
2,6-Dinitrotoluene	mg/L	0.004	-	-	<0.004	<0.004	<0.004	<0.004	<0.004	<0.005	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Halogenated Benzenes																
1,2,3-Trichlorobenzene	mg/L	0.005	0.003	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
1,2,4-Trichlorobenzene	mg/L	0.002	0.085	0.02	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
1,2-Dichlorobenzene	mg/L	0.002	0.16	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
1,3-Dichlorobenzene	mg/L	0.002	0.26	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
1,4-Dichlorobenzene	mg/L	0.002	0.06	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
2-Chlorotoluene	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
4-Chlorotoluene	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Bromobenzene	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Chlorobenzene	mg/L	0.005	0.055	0.055	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Hexachlorobenzene	mg/L	0.0005	0.00005	0.00005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Pentachlorobenzene	mg/L	0.002	0.0015	0.0015	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Heavy metals																
Arsenic (Filtered)	mg/L	0.001	0.013	-	0.002	<0.001	<0.001	<0.001	0.001	0.001	0.007	<0.001	<0.001	0.001	<0.01	0.001
Cadmium (Filtered)	mg/L	0.0001	0.0002	0.0007	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.001	<0.0001
Chromium (Filtered)	mg/L	0.001	0.0033	0.027	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001
Chromium (hexavalent) (Filtered)	mg/L	0.01	0.001	0.0044	<0.01	<0.01	<0.01	<0.01	<0.01	<0.005	0.02	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt (Filtered)	mg/L	0.001	0.0014	0.001	0.001	0.01	0.044	0.049	0.024	0.023	0.031	0.042	0.045	0.007	0.018	0.025
Copper (Filtered)	mg/L	0.001	0.0014	0.0013	<0.001	0.003	0.002	<0.001	<0.001	<0.001	<0.001	0.002	0.002	2.33	<0.01	<0.001
Iron (Filtered)	mg/L	0.05	0.3	0.3	1.93	0.76	0.62	<0.05	3.8	4.4	13.8	4.06	4.14	0.06	21.1	2.62
Lead (Filtered)	mg/L	0.001	0.0034	0.0044	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001
Manganese (Filtered)	mg/L	0.001	1.9	0.08	1	0.033	0.286	0.254	0.183	0.2	0.659	0.136	0.132	1.13	2.78	2.98
Mercury (Filtered)	mg/L	0.0001	0.00006	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Nickel (Filtered)	mg/L	0.001	0.011	0.07	0.001	0.002	0.017	0.018	0.008	0.007	0.009	0.016	0.016	0.006	<0.01	0.015
Zinc (Filtered)	mg/L	0.005	0.008	0.008	0.04	0.017	0.188	0.088	0.025	0.025	0.697	0.054	0.057	0.015	0.115	<0.005
Herbicides																
Pronamide	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
MAH																
1,2,4-trimethylbenzene	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
1,3,5-Trimethylbenzene	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Isopropylbenzene	mg/L	0.005	0.03	0.03	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
n-Butylbenzene	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
n-Propylbenzene	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
p-Isopropyltoluene	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
sec-Butylbenzene	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Styrene	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
tert-Butylbenzene	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Organochlorine Pesticides																
p,p-DDE	mg/L	0.0005	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
a-BHC	mg/L	0.0005	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Aldrin	mg/L	0.0005	0.000001	0.000003	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Aldrin & Dieldrin (Sum of total) (Lab Reported)	mg/L	0.0005	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
b-BHC	mg/L	0.0005	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Chlordane (Sum of total)	mg/L	0.0005	0.00003	0.000001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
cis-Chlordane	mg/L	0.0005	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
trans-Chlordane	mg/L	0.0005	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
d-BHC	mg/L	0.0005	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
DDD	mg/L	0.0005	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
DDT	mg/L	0.002	0.000006	0.0000004	<0.002	<0.002	<0.002	<0.002	<0.002	<0.0002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
DDT+DDE+DDD (Sum of total) (Lab Reported)	mg/L	0.0005	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Dieldrin	mg/L	0.0005	0.00001		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Endosulfan I	mg/L	0.0005	0.00003	0.000005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Endosulfan II	mg/L	0.0005	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Endosulfan sulphate	mg/L	0.0005	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Endrin	mg/L	0.0005	0.00001	0.000004	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Endrin aldehyde	mg/L	0.0005	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Endrin ketone	mg/L	0.0005	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
g-BHC	mg/L	0.0005	0.0002	0.000007	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Heptachlor	mg/L	0.0005	0.00001	0.0000004	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Heptachlor epoxide	mg/L	0.0005	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Methoxychlor	mg/L	0.002	0.000005	0.000004	<0.002	<0.002	<0.002	<0.002	<0.002	<0.0002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Organophosphorous Pesticides																
Azinphos-methyl	mg/L	0.0005	0.00002	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Bromophos-ethyl	mg/L	0.0005	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Carbophenothion	mg/L	0.0005	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Chlorfenvinphos	mg/L	0.0005	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Chlorpyriphos	mg/L	0.0005	0.00001	0.000009	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005

Analyte	Unit	LOR	ANZG (2018) Freshwater 95% / 99%	ANZG (2018) Marine water 95% / 99%	Location	SMW_ENV283	SMW_ENV283s	SMW_WTP_BH13	SMW_WTP_BH13	SMW_WTP_BH14	SMW_WTP_BH14	SMW_WTP_BH15	SMW_WTP_BH18	SMW_WTP_BH18	SMW_WTP_BH19	SMW_WTP_BH22	SMW_WTP_BH23
					Field_ID	SMW-ENV283	SMW_ENV2835	QA500	SMW-BH13	SMW_BH14	QCB500	SMW_BH15	SMW_BH18	QCA700	SMW_BH19	SMW_BH22	SMW_WTP_BH23
					Sampled date	25/01/2022	17/01/2022	12/10/2021	12/10/2021	20/10/2021	20/10/2021	20/10/2021	20/10/2021	20/10/2021	31/01/2022	30/11/2021	7/02/2022
					Lab report	ES2202504	ES2201473	ES2136681	ES2136722	ES2137931	280861	ES2137931	ES2137931	ES2137931	ES2203272	ES2143766	ES2204131
Chlorpyriphos-methyl	mg/L	0.0005	-	-		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Diazinon	mg/L	0.0005	0.00001	-		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Dichlorvos	mg/L	0.0005	-	-		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Dimethoate	mg/L	0.0005	0.00015	-		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Ethion	mg/L	0.0005	-	-		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Fenamiphos	mg/L	0.0005	-	-		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Fenthion	mg/L	0.0005	-	-		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Malathion	mg/L	0.0005	0.00005	-		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Parathion-methyl	mg/L	0.002	-	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Monocrotophos	mg/L	0.002	-	-		<0.002	<0.002	<0.002	<0.002	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Parathion	mg/L	0.002	0.000004	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.0002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Pirimphos-ethyl	mg/L	0.0005	-	-		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Prothiofos	mg/L	0.0005	-	-		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Other																	
Methane	ug/L	10	1600	1600		1380	<10	<10	<10	138	97	<10	<10	<10	770	89	30
PAH																	
Acenaphthene	mg/L	0.001	-	-		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Acenaphthylene	mg/L	0.001	-	-		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Anthracene	mg/L	0.001	0.00001	0.00001		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Benz(a)anthracene	mg/L	0.001	-	-		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Benzo(a)pyrene	mg/L	0.0005	0.0001	0.0001		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Benzo(a)pyrene TEQ (lower bound)*	mg/L	0.0005	-	-		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Benzo(b)&(j)fluoranthene	mg/L	0.001	-	-		<0.001	<0.001	<0.001	<0.001	<0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Benzo(b+j) & Benzo(k)fluoranthene	mg/L	0.004	-	-		-	<0.004	-	-	-	<0.002	-	-	-	-	-	-
Benzo(g,h,i)perylene	mg/L	0.001	-	-		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Benzo(k)fluoranthene	mg/L	0.001	-	-		<0.001	<0.001	<0.001	<0.001	<0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chrysene	mg/L	0.001	-	-		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Dibenz(a,h)anthracene	mg/L	0.001	-	-		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Fluoranthene	mg/L	0.001	0.001	0.001		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Fluorene	mg/L	0.001	-	-		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Indeno(1,2,3-c,d)pyrene	mg/L	0.001	-	-		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Naphthalene	mg/L	0.001	0.016	0.07		<0.001	<0.001	<0.001	<0.001	<0.005 - 0.002	<0.002 - 0.007	<0.001	<0.001	<0.001	<0.001	<0.005 - 0.0043	<0.001
Phenanthrene	mg/L	0.001	0.0006	0.0006		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Pyrene	mg/L	0.001	-	-		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
PAH (Sum of Common 16 PAHs - Lab Reported)	mg/L	0.0005	-	-		<0.0005	<0.0005	<0.0005	<0.0005	0.002	-	<0.0005	<0.0005	<0.0005	<0.0005	0.0043	<0.0005
PAH-Others																	
1-Methylnaphthalene	mg/L	0.002	-	-		-	-		-	-	-	-	-		-	-	-
2-Chloronaphthalene	mg/L	0.002	-	-		<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
2-Methylnaphthalene	mg/L	0.002	-	-		<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
3-Methylcholanthrene	mg/L	0.002	-	-		<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
7,12-Dimethylbenz(a)anthracene	mg/L	0.002	-	-		<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Pesticides-Others																	
Carbazole	mg/L	0.002	-	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Chlorobenzilate	mg/L	0.002	-	-		<0.002	<0.002	<0.002	<0.002	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Demeton-s-methyl	mg/L	0.0005	-	-		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Phenolics																	
2,4-Dimethylphenol	mg/L	0.002	0.002	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
2-Methylphenol	mg/L	0.002	-	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
2-Nitrophenol	mg/L	0.002	-	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
3- & 4- Methylphenol	mg/L	0.004	-	-		<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Phenol	mg/L	0.002	0.32	0.4		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Phenolics-Halogenated																	
2,4,5-Trichlorophenol	mg/L	0.002				<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
2,4,6-Trichlorophenol	mg/L	0.002	0.003	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
2,4-Dichlorophenol	mg/L	0.002	0.16	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
2,6-Dichlorophenol	mg/L	0.002	0.034	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
2-Chlorophenol	mg/L	0.002	0.49	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
4-Chloro-3-methylphenol	mg/L	0.002	-	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Pentachlorophenol	mg/L	0.004	0.0036	0.011		<0.004	<0.004	<0.004	<0.004	<0.004	<0.01	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Phthalates																	
Bis(2-ethylhexyl) phthalate	mg/L	0.01	0.001	-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Butylbenzyl phthalate	mg/L	0.002	-	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Diethyl phthalate	mg/L	0.002	1	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Dimethyl phthalate	mg/L	0.002	3.7	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Di-n-butyl phthalate	mg/L	0.002	0.01	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Di-n-octyl phthalate	mg/L	0.002				<0.002	<0.002	<0.002	<0.002	<0.002	<0.01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Sample Quality Parameters																	
Electrical Conductivity @ 25°C	uS/cm	1	-	-		17,500	5430	26,700	24,600	12,100	11,000	25,400	16,300	15,500	22,000	58,100	14,500
pH (Lab)	pH_Units	0.01	-	-		7.81	5.73	7.02	6.81	6.27	6.4	6.66	6.02	5.89	7.24	6.56	6.61
Total Dissolved Solids @180°C	mg/L	10	-	-		12,300	3650	17,400	16,200	8780	7800	19,200	11,500	10,700	14,100	43,200	11,400
Sodium (Filtered)	mg/L	1	-	-		2380	814	3760	4170	2080	1900	4380	2600	2640	3280	10,600	2860
Potassium (Filtered)	mg/L	1	-	-		53	3	10	13	9	11	17	7	8	58	108	36
Calcium (Filtered)	mg/L	1	-	-		580	13	140	153	84	72	313	91	92	648	1530	438
Magnesium (Filtered)	mg/L	1	-	-		418	63	541	603	315	310	726	324	327	398	2280	351

				Location	SMW_ENV283	SMW_ENV283s	SMW_WTP_BH13	SMW_WTP_BH13	SMW_WTP_BH14	SMW_WTP_BH14	SMW_WTP_BH15	SMW_WTP_BH18	SMW_WTP_BH18	SMW_WTP_BH19	SMW_WTP_BH22	SMW_WTP_BH23
				Field_ID	SMW-ENV283	SMW_ENV2835	QA500	SMW-BH13	SMW_BH14	QCB500	SMW_BH15	SMW_BH18	QCA700	SMW_BH19	SMW_BH22	SMW_WTP_BH23
				Sampled date	25/01/2022	17/01/2022	12/10/2021	12/10/2021	20/10/2021	20/10/2021	20/10/2021	20/10/2021	20/10/2021	31/01/2022	30/11/2021	7/02/2022
				Lab report	ES2202504	ES2201473	ES2136681	ES2136722	ES2137931	280861	ES2137931	ES2137931	ES2137931	ES2203272	ES2143766	ES2204131
Analyte	**Unit**	**LOR**	**ANZG (2018) Freshwater 95% / 99%**	**ANZG (2018) Marine water 95% / 99%**												
Chloride	mg/L	1	-	-	5660	1360	8170	7670	4110	3800	8740	5550	5290	6300	20,900	5640
pH Redox	pH unit	0.01	-	-	6.45	5.77	6.49	6.4	6.22	-	6.55	5.9	5.78	7.21	6.16	6.6
Sulphate (as SO4) (Filtered)	mg/L	1	-	-	115	309	1020	926	488	-	888	692	653	529	3400	259
Bicarbonate Alkalinity (as CaCO3)	mg/L	1	-	-	1090	85	238	182	129	120	478	55	41	648	80	622
Carbonate Alkalinity (as CaCO3)	mg/L	1	-	-	<1	<1	<1	<1	<1	<5	<1	<1	<1	<1	<1	<1
Hydroxide Alkalinity (as CaCO3)	mg/L	1	-	-	<1	<1	<1	<1	<1	<5	<1	<1	<1	<1	<1	<1
Total Alkalinity (as CaCO3)	mg/L	1	-	-	1090	85	238	182	129	120	478	55	41	648	80	622
Nitrate (as N)	mg/L	0.01	2.4	-	0.02	0.03	0.03	0.05	0.02	<0.005	<0.01	0.02	0.02	<0.01	<0.1	0.02
Nitrite (as N)	mg/L	0.01	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.005	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate + Nitrite (as N)	mg/L	0.01	0.04	0.015	0.02	0.03	0.03	0.05	0.02	-	<0.01	0.02	0.02	<0.01	<0.1	0.02
Ammonia (as N)	mg/L	0.01	0.9	0.91	3.77	0.07	0.39	0.29	0.29	0.36	1.28	0.3	0.32	4.3	7.1	3.22
Total Kjeldahl Nitrogen (as N)	mg/L	0.1	-	-	3.8	0.3	0.6	<1	1.5	-	1.6	0.7	0.7	4.3	7.4	3.4
Nitrogen (Total)	mg/L	0.1	0.5	0.3	3.8	0.3	0.6	<1	1.5	0.4	1.6	0.7	0.7	4.3	7.4	3.4
Fluoride	mg/L	0.1	-	-	0.3	<0.1	<0.1	<0.1	0.1	<0.1	0.4	<0.1	<0.1	0.1	<0.1	0.7
Reactive Phosphorus (as P)	mg/L	0.01	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.01	<0.01	<0.01	0.07	<0.01
Total Phosphorus (as P)	mg/L	0.01	0.05	0.03	0.11	0.03	<0.05	0.1	1.01	0.07	2.09	0.01	<0.01	0.08	<0.1	<0.05
Total Suspended Solids	mg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Anions	meq/L	0.01	-	-	184	46.5	256	239	129	-	274	172	164	202	662	177
Total Cations	meq/L	0.01	-	-	168	41.3	215	239	121	-	266	144	146	209	728	176
Ionic Balance (Lab)	%	0.01	-	-	4.43	5.9	8.72	0.06	3.15	-2	1.53	8.71	5.51	1.84	4.74	0.24
Dissolved Oxygen	mg/L	0.1	-	-	5.3	5.8	6.6	7.4	7.4	-	6.4	9.4	9.1	9.6	3.6	8.6
Redox Potential	mV	0.1	-	-	52.9	316	66	148	107	-	24.3	178	136	209	18	-4.9
Solvents																
Methyl Ethyl Ketone	mg/L	0.05	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2-Hexanone	mg/L	0.05	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Methyl iso-butyl ketone	mg/L	0.05	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Isophorone	mg/L	0.002	-	0.13	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Vinyl acetate	mg/L	0.05	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
SVOCs																
2-(Acetylamino) fluorene	mg/L	0.002	-	-	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
2-Picoline	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
3,3-Dichlorobenzidine	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
4-(Dimethylamino) azobenzene	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
4-Aminobiphenyl	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
4-Bromophenyl phenyl ether	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
4-Chlorophenyl phenyl ether	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
4-Nitroquinoline-n-oxide	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Acetophenone	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Azobenzene	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Bis(2-chloroethoxy) methane	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Bis(2-chloroethyl) ether	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Dibenzofuran	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Hexachlorocyclopentadiene	mg/L	0.01	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.005	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Hexachloropropene	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Methapyrilene	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
n-Nitrosomorpholine	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
N-Nitrosopiperidine	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
n-Nitrosopyrrolidine	mg/L	0.004	-	-	<0.004	<0.004	<0.004	<0.004	<0.004	-	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Phenacetin	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Volatile Organic Compounds																
1,1,1,2-Tetrachloroethane	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
1,1,2,2-Tetrachloroethane	mg/L	0.005	0.4	0.4	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
1,1,1-Trichloroethane	mg/L	0.005	0.27	0.27	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
1,1,2-Trichloroethane	mg/L	0.005	6.5	1.9	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
1,2,3-Trichloropropane	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
1,2-Dibromo-3-chloropropane	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
1,2-Dibromoethane	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
1,1-Dichloroethane	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
1,2-Dichloroethane	mg/L	0.005	1.9	1.9	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
1,1-Dichloroethene	mg/L	0.005	0.7	0.7	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
cis-1,2-Dichloroethene	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
trans-1,2-dichloroethene	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
1,2-Dichloropropane	mg/L	0.005	0.9	0.9	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
1,3-Dichloropropane	mg/L	0.005	1.1	1.1	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
2,2-Dichloropropane	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
1,1-Dichloropropene	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
cis-1,3-Dichloropropene	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
trans-1,3-dichloropropene	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
cis-1,4-Dichloro-2-butene	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
trans-1,4-Dichloro-2-butene	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Bromodichloromethane	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Bromoform	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Bromomethane	mg/L	0.05	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Carbon disulfide	mg/L	0.005	0.02		<0.005	<0.005	<0.005	<0.005	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

				Location	SMW_ENV283	SMW_ENV283s	SMW_WTP_BH13	SMW_WTP_BH13	SMW_WTP_BH14	SMW_WTP_BH14	SMW_WTP_BH15	SMW_WTP_BH18	SMW_WTP_BH18	SMW_WTP_BH19	SMW_WTP_BH22	SMW_WTP_BH23
				Field_ID	SMW-ENV283	SMW_ENV2835	QA500	SMW-BH13	SMW_BH14	QCB500	SMW_BH15	SMW_BH18	QCA700	SMW_BH19	SMW_BH22	SMW_WTP_BH23
				Sampled date	25/01/2022	17/01/2022	12/10/2021	12/10/2021	20/10/2021	20/10/2021	20/10/2021	20/10/2021	20/10/2021	31/01/2022	30/11/2021	7/02/2022
				Lab report	ES2202504	ES2201473	ES2136681	ES2136722	ES2137931	280861	ES2137931	ES2137931	ES2137931	ES2203272	ES2143766	ES2204131
Analyte	**Unit**	**LOR**	**ANZG (2018) Freshwater 95% / 99%**	**ANZG (2018) Marine water 95% / 99%**												
Carbon tetrachloride	mg/L	0.005	0.24	0.24	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Chlorodibromomethane	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Chloroethane	mg/L	0.05	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Chloroform	mg/L	0.005	0.77	0.77	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Chloromethane	mg/L	0.05	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Dibromomethane	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Dichlorodifluoromethane	mg/L	0.05	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Hexachlorobutadiene	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Hexachloroethane	mg/L	0.002	0.29	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Iodomethane	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Pentachloroethane	mg/L	0.005	0.08	0.08	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Trichloroethene	mg/L	0.005	0.33	0.33	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Tetrachloroethene	mg/L	0.005	0.07	0.07	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Trichlorofluoromethane	mg/L	0.05	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Vinyl chloride	mg/L	0.05	0.1	0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

Notes

ANZG 2018 95% level of species protection values adopted unless otherwise stated
ANZG 2018 99% level of species protection fresh water values adopted as default values for bioaccumulating substances: chlordane, DDT, endosulfan, endrin, heptachlor, hexachlorobenzene, toxaphene, anthracene, benzo(a)pyrene, fluoranthene, phenanthrene, 2,3,4,6-tetrachlorophenol, 2,4,6-trichlorophenol, pentachlorophenol, dibutylphthalate, hexachloroethane, 1,2,3,4-tetrachlorobenzene, 1,2,3,5-tetrachlorobenzene , 1,2,3-trichlorobenzene, 1,2,4,5-tetrachlorobenzene, 1,2,4-trichlorobenzene, 1,3,5-trichlorobenzene, pentachlorobenzene, 2,3,4,6-tetrachlorophenol, 2,4,6-trichlorophenol , pentachlorophenol, mercury
ANZG 2018 99% level of species protection marine water values adopted as default values for bioaccumulating substances: endosulfan, endrin, , hexachlorobenzene, anthracene, benzo(a)pyrene, fluoranthene, phenanthrene, pentachlorophenol, 1,2,3,4-tetrachlorobenzene, 1,2,3,5-tetrachlorobenzene, 1,2,4,5-tetrachlorobenzene, 1,2,4-trichlorobenzene, 1,3,5-trichlorobenzene pentachlorobenzene, cadmium, mercury
ANZG 2018 unknown level of species protection fresh water values adopted for: aldrin , dieldrin, methoxychlor, 2,6-dichlorophenol, bis(2-ethylhexyl) phthalate, 1,3,5-trinitrobenzene, chromium (CrIII value adopted), cobalt
ANZG 2018 unknown level of species protection marine water values adopted for: aldrin, chlordane, DDT, heptachlor, lindane, methoxychlor, manganese
As (V) value adopted as criterion for arsenic
p-xylene value adopted as criterion for the sum of m- & p-xylene
NEPM 2020 default 99% level of species protection values adopted for PFOA and PFOS
TIWA (2013) 95% level of species protection grading value adopted as criterion for nitrate

				Location	SMW_WTP_BH25s	SMW_WTP_BH26	SMW_WTP_BH27	SMW_WTP_BH27	SMW_WTP_BH30	SMW_WTP_BH30	SMW_WTP_BH30s	SMW_WTP_BH40	SMW_WTP_BH40	SMW_WTP_BH41	SMW_WTP_BH41
				Field_ID	SMW_BH255	SMW-BH26	SMW-BH27	QCA 2300	SMW-BH30	SMW-BH30	SMW-BH305	SMW_BH40	QCA 2800	SMW_BH41	QCB2100
				Sampled date	8/10/2021	12/10/2021	24/01/2022	24/01/2022	12/10/2021	16/02/2022	12/10/2021	4/02/2022	4/02/2022	20/01/2022	20/01/2022
				Lab report	ES2136318	ES2136681	ES2202507	ES2202507	ES2136681	ES2205286	ES2136681	ES2203848	ES2203848	ES2201886	287146
Analyte	**Unit**	**LOR**	**ANZG (2018) Freshwater 95% / 99%**	**ANZG (2018) Marine water 95% / 99%**											
BTEX															
Benzene	mg/L	0.001	0.95	0.7	0.004	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Toluene	mg/L	0.001	0.18	0.18	<0.002	0.004	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001
Ethylbenzene	mg/L	0.001	0.08	0.08	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001
Xylenes (m & p)	mg/L	0.002	0.075	0.075	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Xylene (o)	mg/L	0.001	0.35	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001
Xylenes (Sum of total) (Lab Reported)	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	-
Total BTEX	mg/L	0.001	-	-	0.004	0.004	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
Perfluorinated Compounds															
Perfluorodecane sulfonic acid (PFDS)	ug/L	0.002	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluoro-n-hexadecanoic acid	ug/L	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-
N-Methyl PFO sulfonamidoethanol (MeFOSE)	ug/L	0.005	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
N-methyl-PFO sulfonamidoacetic acid (MeFOSAA)	ug/L	0.002	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorooctanoic Acid (PFOA)	ug/L	0.002	19	19	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	0.03
Perfluorooctane sulfonic acid (PFOS)	ug/L	0.002	0.00023	0.00023	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.23	0.03	0.1
Perfluorohexane sulfonic acid (PFHxS)	ug/L	0.002	-	-	0.05	<0.02	<0.02	<0.02	<0.02	<0.01	<0.02	<0.01	0.03	0.75	0.76
Sum of PFHxS and PFOS (lab reported)	ug/L	0.002	-	-	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.26	0.78	0.86
Sum of US EPA PFAS (PFOS + PFOA)	ug/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	0.12
Sum of WA DER PFAS (n=10)	ug/L	0.002	-	-	0.06	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	0.26	1.8	-
Sum of PFASs (n=28 - Lab Reported)	ug/L	0.002	-	-	0.06	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	0.26	2.1	2
Perfluorobutanoic acid (PFBA)	ug/L	0.01	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.07
Perfluorohexanoic acid (PFHxA)	ug/L	0.002	-	-	<0.02	<0.02	<0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.43	0.29
Perfluoroheptanoic acid (PFHpA)	ug/L	0.002	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.03	0.02
Perfluorodecanoic acid (PFDA)	ug/L	0.002	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluoropentanoic acid (PFPeA)	ug/L	0.002	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.06	0.06
Perfluorononanoic acid (PFNA)	ug/L	0.002	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.01
Perfluorotetradecanoic acid (PFTeDA)	ug/L	0.005	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.5
Perfluorotridecanoic acid (PFTrDA)	ug/L	0.002	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.1
Perfluorododecanoic acid (PFDoDA)	ug/L	0.002	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05
Perfluoroundecanoic acid (PFUnDA)	ug/L	0.002	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluoroheptane sulfonic acid (PFHpS)	ug/L	0.002	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.01
Perfluoropentane sulfonic acid (PFPeS)	ug/L	0.002	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.3	0.28
Perfluorobutane sulfonic acid (PFBS)	ug/L	0.002	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.48	0.42
4:2 Fluorotelomer sulfonic acid (4:2 FTSA)	ug/L	0.005	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	ug/L	0.005	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	ug/L	0.005	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.02
10:2 Fluorotelomer sulfonic acid (10:2 FTSA)	ug/L	0.005	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.02
N-Ethyl PFO sulfonamide (EtFOSA)	ug/L	0.005	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1
N-Ethyl PFO sulfonamidoethanol (EtFOSE)	ug/L	0.005	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.5
N-Methyl PFO sulfonamide (MeFOSA)	ug/L	0.005	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Perfluorooctane sulfonamide (FOSA)	ug/L	0.002	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.1
N-ethyl-PFO sulfonamidoacetic acid (EtFOSAA)	ug/L	0.002	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
TRH - HSL															
TRH+C10 - C40 (Sum of total) (Lab Reported)	mg/L	0.05	-	-	0.29	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05
TRH C6 - C10 Fraction F1	mg/L	0.01	-	-	0.54	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.01
TRH C6 - C10 Fraction Less BTEX F1	mg/L	0.01	-	-	0.54	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.01
TRH >C10 - C16 Fraction F2	mg/L	0.05	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05
TRH >C10 - C16 Fraction Less Naphthalene F2	mg/L	0.05	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05
TRH >C16 - C34 Fraction F3	mg/L	0.1	-	-	0.29	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TRH >C34 - C40 Fraction F4	mg/L	0.1	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TRH Waste Classification															
TRH C6 - C9 Fraction	mg/L	0.01	-	-	0.54	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.01
TRH C10 - C14 Fraction	mg/L	0.05	-	-	0.06	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
TRH C15 - C28 Fraction	mg/L	0.1	-	-	0.32	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TRH C29 - C36 Fraction	mg/L	0.05	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1
TRH+C10 - C36 (Sum of total) (Lab Reported)	mg/L	0.05	-	-	0.38	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Microbiological															
Enterococci	CFU/100 mL	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Faecal Coliforms	cfu/100ml	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Amino Aliphatics															
n-Nitrosodiethylamine	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	-
N-Nitrosodi-n-butylamine	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005
N-Nitrosodi-n-propylamine	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005
n-Nitrosomethylethylamine	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	-
Amino Aromatics															
1-Naphthylamine	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005
n-Nitrosodiphenylamine & Diphenylamine	mg/L	0.004	-	-	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	-
Anilines															
2-Nitroaniline	mg/L	0.004	-	-	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.005
3-Nitroaniline	mg/L	0.004	-	-	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.005
4-Chloroaniline	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005
4-Nitroaniline	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005
2-methyl-5-nitroaniline	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005
Aniline	mg/L	0.002	0.25	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005

				Location	SMW_WTP_BH25s	SMW_WTP_BH26	SMW_WTP_BH27	SMW_WTP_BH27	SMW_WTP_BH30	SMW_WTP_BH30	SMW_WTP_BH30s	SMW_WTP_BH40	SMW_WTP_BH40	SMW_WTP_BH41	SMW_WTP_BH41
				Field_ID	SMW_BH255	SMW-BH26	SMW-BH27	QCA 2300	SMW-BH30	SMW-BH30	SMW-BH305	SMW_BH40	QCA 2800	SMW_BH41	QCB2100
				Sampled date	8/10/2021	12/10/2021	24/01/2022	24/01/2022	12/10/2021	16/02/2022	12/10/2021	4/02/2022	4/02/2022	20/01/2022	20/01/2022
				Lab report	ES2136318	ES2136681	ES2202507	ES2202507	ES2136681	ES2205286	ES2136681	ES2203848	ES2203848	ES2201886	287146
Analyte	**Unit**	**LOR**	**ANZG (2018) Freshwater 95% / 99%**	**ANZG (2018) Marine water 95% / 99%**											
E-Nitrobenzenes															
Nitrobenzene	mg/L	0.002	0.55	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005
Pentachloronitrobenzene	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005
Explosives															
1,3,5-Trinitrobenzene	mg/L	0.002	0.004	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	-
2,4-Dinitrotoluene	mg/L	0.004	0.065	-	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	-
2,6-Dinitrotoluene	mg/L	0.004	-	-	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.005
Halogenated Benzenes															
1,2,3-Trichlorobenzene	mg/L	0.005	0.003	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001
1,2,4-Trichlorobenzene	mg/L	0.002	0.085	0.02	0.004	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001
1,2-Dichlorobenzene	mg/L	0.002	0.16	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001
1,3-Dichlorobenzene	mg/L	0.002	0.26	-	0.015	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001
1,4-Dichlorobenzene	mg/L	0.002	0.06	-	0.024	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001
2-Chlorotoluene	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001
4-Chlorotoluene	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001
Bromobenzene	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001
Chlorobenzene	mg/L	0.005	0.055	0.055	0.567	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001
Hexachlorobenzene	mg/L	0.0005	0.00005	0.00005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002
Pentachlorobenzene	mg/L	0.002	0.0015	0.0015	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Heavy metals															
Arsenic (Filtered)	mg/L	0.001	0.013	-	0.011	0.002	0.004	0.002	0.002	0.038	<0.01	<0.01	<0.01	<0.001	<0.001
Cadmium (Filtered)	mg/L	0.0001	0.0002	0.0007	<0.0001	<0.0001	0.0004	0.0002	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.0001	<0.0001
Chromium (Filtered)	mg/L	0.001	0.0033	0.027	<0.001	0.001	0.001	<0.001	<0.001	0.002	<0.01	<0.01	<0.01	<0.001	<0.001
Chromium (hexavalent) (Filtered)	mg/L	0.01	0.001	0.0044	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.005
Cobalt (Filtered)	mg/L	0.001	0.0014	0.001	<0.001	0.059	0.083	0.077	0.054	0.007	0.065	0.053	0.053	0.017	0.015
Copper (Filtered)	mg/L	0.001	0.0014	0.0013	<0.001	<0.001	0.014	0.013	0.002	<0.001	<0.01	<0.01	<0.01	<0.001	<0.001
Iron (Filtered)	mg/L	0.05	0.3	0.3	22.7	88.4	5.8	5.71	10	1.46	0.85	1.39	1.29	1.06	0.95
Lead (Filtered)	mg/L	0.001	0.0034	0.0044	<0.001	<0.001	0.01	0.009	<0.001	<0.001	<0.01	<0.01	<0.01	<0.001	<0.001
Manganese (Filtered)	mg/L	0.001	1.9	0.08	0.255	0.178	0.376	0.348	2.81	1.79	1.63	2.3	2.33	0.246	0.23
Mercury (Filtered)	mg/L	0.0001	0.00006	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00005
Nickel (Filtered)	mg/L	0.001	0.011	0.07	<0.001	0.034	0.064	0.059	0.011	0.006	0.034	0.013	0.013	0.009	0.007
Zinc (Filtered)	mg/L	0.005	0.008	0.008	0.012	0.069	0.152	0.132	0.024	0.046	0.35	<0.05	<0.05	0.012	0.013
Herbicides															
Pronamide	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	-
MAH															
1,2,4-trimethylbenzene	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001
1,3,5-Trimethylbenzene	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001
Isopropylbenzene	mg/L	0.005	0.03	0.03	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001
n-Butylbenzene	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001
n-Propylbenzene	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001
p-Isopropyltoluene	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001
sec-Butylbenzene	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001
Styrene	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001
tert-Butylbenzene	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001
Organochlorine Pesticides															
p,p-DDE	mg/L	0.0005	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002
a-BHC	mg/L	0.0005	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002
Aldrin	mg/L	0.0005	0.000001	0.000003	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002
Aldrin & Dieldrin (Sum of total) (Lab Reported)	mg/L	0.0005	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	-
b-BHC	mg/L	0.0005	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002
Chlordane (Sum of total)	mg/L	0.0005	0.00003	0.000001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	-
cis-Chlordane	mg/L	0.0005	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002
trans-Chlordane	mg/L	0.0005	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002
d-BHC	mg/L	0.0005	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002
DDD	mg/L	0.0005	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002
DDT	mg/L	0.002	0.000006	0.0000004	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.0002
DDT+DDE+DDD (Sum of total) (Lab Reported)	mg/L	0.0005	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	-
Dieldrin	mg/L	0.0005	0.00001		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002
Endosulfan I	mg/L	0.0005	0.00003	0.000005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002
Endosulfan II	mg/L	0.0005	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002
Endosulfan sulphate	mg/L	0.0005	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002
Endrin	mg/L	0.0005	0.00001	0.000004	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002
Endrin aldehyde	mg/L	0.0005	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002
Endrin ketone	mg/L	0.0005	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002
g-BHC	mg/L	0.0005	0.0002	0.000007	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002
Heptachlor	mg/L	0.0005	0.00001	0.0000004	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002
Heptachlor epoxide	mg/L	0.0005	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002
Methoxychlor	mg/L	0.002	0.000005	0.000004	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.0002
Organophosphorous Pesticides															
Azinphos-methyl	mg/L	0.0005	0.00002	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002
Bromophos-ethyl	mg/L	0.0005	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002
Carbophenothion	mg/L	0.0005	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	-
Chlorfenvinphos	mg/L	0.0005	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	-
Chlorpyriphos	mg/L	0.0005	0.00001	0.000009	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002

Analyte	Unit	LOR	ANZG (2018) Freshwater 95% / 99%	ANZG (2018) Marine water 95% / 99%	Location	SMW_WTP_BH25s	SMW_WTP_BH26	SMW_WTP_BH27	SMW_WTP_BH27	SMW_WTP_BH30	SMW_WTP_BH30	SMW_WTP_BH30s	SMW_WTP_BH40	SMW_WTP_BH40	SMW_WTP_BH41	SMW_WTP_BH41
					Field_ID	SMW_BH255	SMW-BH26	SMW-BH27	QCA 2300	SMW-BH30	SMW-BH30	SMW-BH305	SMW_BH40	QCA 2800	SMW_BH41	QCB2100
					Sampled date	8/10/2021	12/10/2021	24/01/2022	24/01/2022	12/10/2021	16/02/2022	12/10/2021	4/02/2022	4/02/2022	20/01/2022	20/01/2022
					Lab report	ES2136318	ES2136681	ES2202507	ES2202507	ES2136681	ES2205286	ES2136681	ES2203848	ES2203848	ES2201886	287146
Chlorpyriphos-methyl	mg/L	0.0005	-	-		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002
Diazinon	mg/L	0.0005	0.00001	-		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002
Dichlorvos	mg/L	0.0005	-	-		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002
Dimethoate	mg/L	0.0005	0.00015	-		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002
Ethion	mg/L	0.0005	-	-		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002
Fenamiphos	mg/L	0.0005	-	-		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002
Fenthion	mg/L	0.0005	-	-		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002
Malathion	mg/L	0.0005	0.00005	-		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002
Parathion-methyl	mg/L	0.002	-	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Monocrotophos	mg/L	0.002	-	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	-
Parathion	mg/L	0.002	0.000004	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.0002
Pirimphos-ethyl	mg/L	0.0005	-	-		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	-
Prothiofos	mg/L	0.0005	-	-		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	-
Other																
Methane	ug/L	10	1600	1600		4310	54	<10	<10	<10	34	<10	<10	<10	32	28
PAH																
Acenaphthene	mg/L	0.001	-	-		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Acenaphthylene	mg/L	0.001	-	-		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Anthracene	mg/L	0.001	0.00001	0.00001		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Benz(a)anthracene	mg/L	0.001	-	-		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Benzo(a)pyrene	mg/L	0.0005	0.0001	0.0001		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001
Benzo(a)pyrene TEQ (lower bound)*	mg/L	0.0005	-	-		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	-
Benzo(b)&(j)fluoranthene	mg/L	0.001	-	-		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
Benzo(b+j) & Benzo(k)fluoranthene	mg/L	0.004	-	-		<0.004	-	-	-	-	<0.004	-	-	-	-	<0.002
Benzo(g,h,i)perylene	mg/L	0.001	-	-		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Benzo(k)fluoranthene	mg/L	0.001	-	-		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
Chrysene	mg/L	0.001	-	-		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Dibenz(a,h)anthracene	mg/L	0.001	-	-		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Fluoranthene	mg/L	0.001	0.001	0.001		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Fluorene	mg/L	0.001	-	-		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Indeno(1,2,3-c,d)pyrene	mg/L	0.001	-	-		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Naphthalene	mg/L	0.001	0.016	0.07		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Phenanthrene	mg/L	0.001	0.0006	0.0006		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Pyrene	mg/L	0.001	-	-		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
PAH (Sum of Common 16 PAHs - Lab Reported)	mg/L	0.0005	-	-		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	-
PAH-Others																
1-Methylnaphthalene	mg/L	0.002	-	-		-	-	-		-	-	-	-		-	
2-Chloronaphthalene	mg/L	0.002	-	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
2-Methylnaphthalene	mg/L	0.002	-	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
3-Methylcholanthrene	mg/L	0.002	-	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
7,12-Dimethylbenz(a)anthracene	mg/L	0.002	-	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Pesticides-Others																
Carbazole	mg/L	0.002	-	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005
Chlorobenzilate	mg/L	0.002	-	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	-
Demeton-s-methyl	mg/L	0.0005	-	-		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	-
Phenolics																
2,4-Dimethylphenol	mg/L	0.002	0.002	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
2-Methylphenol	mg/L	0.002	-	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
2-Nitrophenol	mg/L	0.002	-	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
3- & 4- Methylphenol	mg/L	0.004	-	-		<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Phenol	mg/L	0.002	0.32	0.4		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Phenolics-Halogenated																
2,4,5-Trichlorophenol	mg/L	0.002				<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
2,4,6-Trichlorophenol	mg/L	0.002	0.003	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
2,4-Dichlorophenol	mg/L	0.002	0.16	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
2,6-Dichlorophenol	mg/L	0.002	0.034	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
2-Chlorophenol	mg/L	0.002	0.49	-		0.004	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
4-Chloro-3-methylphenol	mg/L	0.002	-	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Pentachlorophenol	mg/L	0.004	0.0036	0.011		<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.01
Phthalates																
Bis(2-ethylhexyl) phthalate	mg/L	0.01	0.001	-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.05
Butylbenzyl phthalate	mg/L	0.002	-	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Diethyl phthalate	mg/L	0.002	1	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Dimethyl phthalate	mg/L	0.002	3.7	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Di-n-butyl phthalate	mg/L	0.002	0.01	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Di-n-octyl phthalate	mg/L	0.002				<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Sample Quality Parameters																
Electrical Conductivity @ 25°C	uS/cm	1	-	-		3100	11,400	17,800	17,700	31,800	16,800	37,700	28,000	28,300	10,300	9,800
pH (Lab)	pH_Units	0.01	-	-		7.54	5.22	4.51	4.55	7.14	6.02	7.09	7.06	7.16	6.04	6
Total Dissolved Solids @180°C	mg/L	10	-	-		2150	7100	11,000	10,900	23,400	20,900	26,300	23,600	23,800	6680	7200
Sodium (Filtered)	mg/L	1	-	-		286	1670	2740	2720	4580	3740	5180	5450	5530	1800	1700
Potassium (Filtered)	mg/L	1	-	-		26	2	6	6	15	210	12	14	14	6	5.4
Calcium (Filtered)	mg/L	1	-	-		228	71	166	160	612	714	568	515	526	118	97
Magnesium (Filtered)	mg/L	1	-	-		77	245	417	416	982	620	1240	1040	1070	262	240

Analyte	Unit	LOR	ANZG (2018) Freshwater 95% / 99%	ANZG (2018) Marine water 95% / 99%	Location	SMW_WTP_BH25s	SMW_WTP_BH26	SMW_WTP_BH27	SMW_WTP_BH27	SMW_WTP_BH30	SMW_WTP_BH30	SMW_WTP_BH30s	SMW_WTP_BH40	SMW_WTP_BH40	SMW_WTP_BH41	SMW_WTP_BH41
					Field_ID	SMW_BH255	SMW-BH26	SMW-BH27	QCA 2300	SMW-BH30	SMW-BH30	SMW-BH305	SMW_BH40	QCA 2800	SMW_BH41	QCB2100
					Sampled date	8/10/2021	12/10/2021	24/01/2022	24/01/2022	12/10/2021	16/02/2022	12/10/2021	4/02/2022	4/02/2022	20/01/2022	20/01/2022
					Lab report	ES2136318	ES2136681	ES2202507	ES2202507	ES2136681	ES2205286	ES2136681	ES2203848	ES2203848	ES2201886	287146
Chloride	mg/L	1	-	-		320	3300	6190	6130	9920	6370	11,500	10,700	10,700	3250	2900
pH Redox	pH unit	0.01	-	-		7.11	4.76	4.53	4.5	6.74	5.93	6.53	6.42	6.42	5.82	-
Sulphate (as SO4) (Filtered)	mg/L	1	-	-		398	816	612	572	983	6290	1800	1300	1310	1060	-
Bicarbonate Alkalinity (as CaCO3)	mg/L	1	-	-		898	6	<1	<1	555	312	276	279	286	132	130
Carbonate Alkalinity (as CaCO3)	mg/L	1	-	-		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<5
Hydroxide Alkalinity (as CaCO3)	mg/L	1	-	-		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<5
Total Alkalinity (as CaCO3)	mg/L	1	-	-		898	6	<1	<1	555	312	276	279	286	132	130
Nitrate (as N)	mg/L	0.01	2.4	-		0.02	<0.01	0.01	0.01	0.01	<0.01	<0.01	<0.01	<0.01	0.03	<0.005
Nitrite (as N)	mg/L	0.01	-	-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.005
Nitrate + Nitrite (as N)	mg/L	0.01	0.04	0.015		0.02	<0.01	0.01	0.01	0.01	<0.01	0.02	<0.01	<0.01	0.03	-
Ammonia (as N)	mg/L	0.01	0.9	0.91		15.3	0.17	0.11	0.1	1.22	0.91	0.09	0.1	0.11	0.15	0.047
Total Kjeldahl Nitrogen (as N)	mg/L	0.1	-	-		16.9	0.7	0.2	0.2	1	12.9	<0.5	<0.5	<0.5	0.2	-
Nitrogen (Total)	mg/L	0.1	0.5	0.3		16.9	0.7	0.2	0.2	1	12.9	<0.5	<0.5	<0.5	0.2	0.1
Fluoride	mg/L	0.1	-	-		0.5	0.2	0.4	0.7	0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1
Reactive Phosphorus (as P)	mg/L	0.01	-	-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-
Total Phosphorus (as P)	mg/L	0.01	0.05	0.03		0.03	<0.05	0.03	0.03	0.1	0.02	<0.05	<0.05	<0.05	<0.02	<0.05
Total Suspended Solids	mg/L	5	-	-		-	-	-	-	-	-	-	-	-	-	-
Total Anions	meq/L	0.01	-	-		35.2	110	187	185	311	317	367	334	335	116	-
Total Cations	meq/L	0.01	-	-		30.8	96.4	162	161	311	333	356	349	355	106	-
Ionic Balance (Lab)	%	0.01	-	-		6.71	6.68	7.28	6.99	0.07	2.5	1.57	2.08	2.95	4.72	-2
Dissolved Oxygen	mg/L	0.1	-	-		4.9	4.6	8.5	7.6	6.1	2.7	5	7.5	7.5	7.3	-
Redox Potential	mV	0.1	-	-		78.9	156	292	302	55.1	-65.8	58	52	64.9	117	-
Solvents																
Methyl Ethyl Ketone	mg/L	0.05	-	-		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-
2-Hexanone	mg/L	0.05	-	-		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-
Methyl iso-butyl ketone	mg/L	0.05	-	-		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-
Isophorone	mg/L	0.002	-	0.13		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005
Vinyl acetate	mg/L	0.05	-	-		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-
SVOCs																
2-(Acetylamino) fluorene	mg/L	0.002	-	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
2-Picoline	mg/L	0.002	-	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	-
3,3-Dichlorobenzidine	mg/L	0.002	-	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	-
4-(Dimethylamino) azobenzene	mg/L	0.002	-	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005
4-Aminobiphenyl	mg/L	0.002	-	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	-
4-Bromophenyl phenyl ether	mg/L	0.002	-	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005
4-Chlorophenyl phenyl ether	mg/L	0.002	-	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005
4-Nitroquinoline-n-oxide	mg/L	0.002	-	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	-
Acetophenone	mg/L	0.002	-	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005
Azobenzene	mg/L	0.002	-	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005
Bis(2-chloroethoxy) methane	mg/L	0.002	-	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005
Bis(2-chloroethyl) ether	mg/L	0.002	-	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005
Dibenzofuran	mg/L	0.002	-	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005
Hexachlorocyclopentadiene	mg/L	0.01	-	-		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.005
Hexachloropropene	mg/L	0.002	-	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Methapyrilene	mg/L	0.002	-	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
n-Nitrosomorpholine	mg/L	0.002	-	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005
N-Nitrosopiperidine	mg/L	0.002	-	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005
n-Nitrosopyrrolidine	mg/L	0.004	-	-		<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	-
Phenacetin	mg/L	0.002	-	-		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005
Volatile Organic Compounds																
1,1,1,2-Tetrachloroethane	mg/L	0.005	-	-		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001
1,1,2,2-Tetrachloroethane	mg/L	0.005	0.4	0.4		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001
1,1,1-Trichloroethane	mg/L	0.005	0.27	0.27		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001
1,1,2-Trichloroethane	mg/L	0.005	6.5	1.9		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001
1,2,3-Trichloropropane	mg/L	0.005	-	-		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001
1,2-Dibromo-3-chloropropane	mg/L	0.005	-	-		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001
1,2-Dibromoethane	mg/L	0.005	-	-		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001
1,1-Dichloroethane	mg/L	0.005	-	-		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001
1,2-Dichloroethane	mg/L	0.005	1.9	1.9		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001
1,1-Dichloroethene	mg/L	0.005	0.7	0.7		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001
cis-1,2-Dichloroethene	mg/L	0.005	-	-		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.002
trans-1,2-dichloroethene	mg/L	0.005	-	-		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001
1,2-Dichloropropane	mg/L	0.005	0.9	0.9		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001
1,3-Dichloropropane	mg/L	0.005	1.1	1.1		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001
2,2-Dichloropropane	mg/L	0.005	-	-		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001
1,1-Dichloropropene	mg/L	0.005	-	-		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001
cis-1,3-Dichloropropene	mg/L	0.005	-	-		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001
trans-1,3-dichloropropene	mg/L	0.005	-	-		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001
cis-1,4-Dichloro-2-butene	mg/L	0.005	-	-		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
trans-1,4-Dichloro-2-butene	mg/L	0.005	-	-		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
Bromodichloromethane	mg/L	0.005	-	-		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001
Bromoform	mg/L	0.005	-	-		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001
Bromomethane	mg/L	0.05	-	-		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01
Carbon disulfide	mg/L	0.005	0.02			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-

					Location	SMW_WTP_BH25s	SMW_WTP_BH26	SMW_WTP_BH27	SMW_WTP_BH27	SMW_WTP_BH30	SMW_WTP_BH30	SMW_WTP_BH30s	SMW_WTP_BH40	SMW_WTP_BH40	SMW_WTP_BH41	SMW_WTP_BH41
					Field_ID	SMW_BH255	SMW-BH26	SMW-BH27	QCA 2300	SMW-BH30	SMW-BH30	SMW-BH305	SMW_BH40	QCA 2800	SMW_BH41	QCB2100
					Sampled date	8/10/2021	12/10/2021	24/01/2022	24/01/2022	12/10/2021	16/02/2022	12/10/2021	4/02/2022	4/02/2022	20/01/2022	20/01/2022
					Lab report	ES2136318	ES2136681	ES2202507	ES2202507	ES2136681	ES2205286	ES2136681	ES2203848	ES2203848	ES2201886	287146
Analyte		**Unit**	**LOR**	**ANZG (2018) Freshwater 95% / 99%**	**ANZG (2018) Marine water 95% / 99%**											
	Carbon tetrachloride	mg/L	0.005	0.24	0.24	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001
	Chlorodibromomethane	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001
	Chloroethane	mg/L	0.05	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01
	Chloroform	mg/L	0.005	0.77	0.77	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001
	Chloromethane	mg/L	0.05	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01
	Dibromomethane	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001
	Dichlorodifluoromethane	mg/L	0.05	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01
	Hexachlorobutadiene	mg/L	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001
	Hexachloroethane	mg/L	0.002	0.29	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
	Iodomethane	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
	Pentachloroethane	mg/L	0.005	0.08	0.08	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002
	Trichloroethene	mg/L	0.005	0.33	0.33	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.003
	Tetrachloroethene	mg/L	0.005	0.07	0.07	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.002
	Trichlorofluoromethane	mg/L	0.05	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01
	Vinyl chloride	mg/L	0.05	0.1	0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01

Notes

ANZG 2018 95% level of species protection values adopted unless otherwise stated
ANZG 2018 99% level of species protection fresh water values adopted as default values for bioaccumulating substances: chlordane, DDT, endosulfan, endrin, heptachlor, hexachlorobenzene, toxaphene, anthracene, benzo(a)pyrene, fluoranthene, phenanthrene, 2,3,4,6-tetrachlorophenol, 2,4,6-trichlorophenol, pentachlorophenol, dibutylphthalate, hexachloroethane, 1,2,3,4-tetrachlorobenzene, 1,2,3,5-tetrachlorobenzene , 1,2,3-trichlorobenzene, 1,2,4,5-tetrachlorobenzene, 1,2,4-trichlorobenzene, 1,3,5-trichlorobenzene, pentachlorobenzene, 2,3,4,6-tetrachlorophenol, 2,4,6-trichlorophenol , pentachlorophenol, mercury
ANZG 2018 99% level of species protection marine water values adopted as default values for bioaccumulating substances: endosulfan, endrin, , hexachlorobenzene, anthracene, benzo(a)pyrene, fluoranthene, phenanthrene, pentachlorophenol, 1,2,3,4-tetrachlorobenzene, 1,2,3,5-tetrachlorobenzene, 1,2,4,5-tetrachlorobenzene, 1,2,4-trichlorobenzene, 1,3,5-trichlorobenzene pentachlorobenzene, cadmium, mercury
ANZG 2018 unknown level of species protection fresh water values adopted for: aldrin , dieldrin, methoxychlor, 2,6-dichlorophenol, bis(2-ethylhexyl) phthalate, 1,3,5-trinitrobenzene, chromium (CrIII value adopted), cobalt
ANZG 2018 unknown level of species protection marine water values adopted for: aldrin, chlordane, DDT, heptachlor, lindane, methoxychlor, manganese
As (V) value adopted as criterion for arsenic
p-xylene value adopted as criterion for the sum of m- & p-xylene
NEPM 2020 default 99% level of species protection values adopted for PFOA and PFOS
TIWA (2013) 95% level of species protection grading value adopted as criterion for nitrate

Analyte	Unit	LOR	ANZG (2018) Freshwater 95%	ANZG (2018) Marine water 95%	Location	SMW_ENV801	SMW_ENV801S	SMW_ENV806	SMW_ENV806	SMW_ENV808	SMW_ENV809	SMW_ENV811	SMW_WTP_BH14	SMW_WTP_BH15
					Field_ID	SMW_ENV801	SMW-ENV801S	SMW-ENV806	SMW_ENV806	SMW-ENV808	SMW_ENV809	SMW-ENV811	SMW_BH14	SMW_BH15
					Sampled date	20/10/2021	11/10/2021	21/10/2021	1/12/2021	11/10/2021	8/10/2021	12/10/2021	20/10/2021	20/10/2021
					Lab report	ES2137931	ES2136518	ES2138069	ES2143985	ES2136518	ES2136318	ES2136722	ES2137931	ES2137931
BTEX														
Benzene	mg/L	0.001	0.95	0.7		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Toluene	mg/L	0.001	0.18	0.18		<0.002	<0.002	<0.002	<0.002	0.333	<0.002	<0.002	<0.002	0.006
Ethylbenzene	mg/L	0.001	0.08	0.08		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Xylenes (m & p)	mg/L	0.002	0.075	0.075		<0.002	0.002	<0.002	<0.002	0.002	<0.002	<0.002	<0.002	<0.002
Xylene (o)	mg/L	0.001	0.35			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Xylenes (Sum of total) (Lab Reported)	mg/L	0.002				<0.002	0.002	<0.002	<0.002	0.002	<0.002	<0.002	<0.002	<0.002
Total BTEX	mg/L	0.001				<0.001	0.002	<0.001	<0.001	0.335	<0.001	<0.001	<0.001	0.006
Perfluorinated Compounds														
Perfluorodecane sulfonic acid (PFDS)	ug/L	0.002				<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluoro-n-hexadecanoic acid	ug/L	0.005				-	-	-	-	-	-	-	-	-
N-Methyl PFO sulfonamidoethanol (MeFOSE)	ug/L	0.005				<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
N-methyl-PFO sulfonamidoacetic acid (MeFOSAA)	ug/L	0.002				<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorooctanoic Acid (PFOA)	ug/L	0.002	19	19		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Perfluorooctane sulfonic acid (PFOS)	ug/L	0.002	0.00023	0.00023		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Perfluorohexane sulfonic acid (PFHxS)	ug/L	0.002				<0.02	<0.02	<0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Sum of PFHxS and PFOS (lab reported)	ug/L	0.002				<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01
Sum of US EPA PFAS (PFOS + PFOA)	ug/L	0.01				-	-	-	-	-	-	-	-	-
Sum of WA DER PFAS (n=10)	ug/L	0.002				<0.01	<0.01	<0.01	0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Sum of PFASs (n=28 - Lab Reported)	ug/L	0.002				<0.01	<0.01	<0.01	0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Perfluorobutanoic acid (PFBA)	ug/L	0.01				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorohexanoic acid (PFHxA)	ug/L	0.002				<0.02	<0.02	<0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluoroheptanoic acid (PFHpA)	ug/L	0.002				<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorodecanoic acid (PFDA)	ug/L	0.002				<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluoropentanoic acid (PFPeA)	ug/L	0.002				<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorononanoic acid (PFNA)	ug/L	0.002				<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorotetradecanoic acid (PFTeDA)	ug/L	0.005				<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Perfluorotridecanoic acid (PFTrDA)	ug/L	0.002				<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorododecanoic acid (PFDoDA)	ug/L	0.002				<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluoroundecanoic acid (PFUnDA)	ug/L	0.002				<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluoroheptane sulfonic acid (PFHpS)	ug/L	0.002				<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluoropentane sulfonic acid (PFPeS)	ug/L	0.002				<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorobutane sulfonic acid (PFBS)	ug/L	0.002				<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
4:2 Fluorotelomer sulfonic acid (4:2 FTSA)	ug/L	0.005				<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	ug/L	0.005				<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	ug/L	0.005				<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
10:2 Fluorotelomer sulfonic acid (10:2 FTSA)	ug/L	0.005				<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
N-Ethyl PFO sulfonamide (EtFOSA)	ug/L	0.005				<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
N-Ethyl PFO sulfonamidoethanol (EtFOSE)	ug/L	0.005				<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
N-Methyl PFO sulfonamide (MeFOSA)	ug/L	0.005				<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Perfluorooctane sulfonamide (FOSA)	ug/L	0.002				<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
N-ethyl-PFO sulfonamidoacetic acid (EtFOSAA)	ug/L	0.002				<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
TRH - HSL														
TRH+C10 - C40 (Sum of total) (Lab Reported)	mg/L	0.05				0.15	1.21	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TRH C6 - C10 Fraction F1	mg/L	0.01				<0.02	<0.02	<0.02	<0.02	0.57	0.02	<0.02	<0.02	<0.02
TRH C6 - C10 Fraction Less BTEX F1	mg/L	0.01				<0.02	<0.02	<0.02	<0.02	0.24	0.02	<0.02	<0.02	<0.02
TRH >C10 - C16 Fraction F2	mg/L	0.05				0.15	1.06	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TRH >C10 - C16 Fraction Less Naphthalene F2	mg/L	0.05				0.14	0.83	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TRH >C16 - C34 Fraction F3	mg/L	0.1				<0.1	0.15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TRH >C34 - C40 Fraction F4	mg/L	0.1				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TRH Waste Classification														
TRH C6 - C9 Fraction	mg/L	0.01				<0.02	<0.02	<0.02	<0.02	0.56	0.02	<0.02	<0.02	<0.02
TRH C10 - C14 Fraction	mg/L	0.05				0.06	0.94	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
TRH C15 - C28 Fraction	mg/L	0.1				0.14	0.31	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TRH C29 - C36 Fraction	mg/L	0.05				<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
TRH+C10 - C36 (Sum of total) (Lab Reported)	mg/L	0.05				0.2	1.25	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Microbiological														
Enterococci	CFU/100 mL	1				-	-	-	-	-	-	-	-	-
Faecal Coliforms	cfu/100ml	1				-	-	-	-	-	-	-	-	-

Location	SMW_ENV801	SMW_ENV801S	SMW_ENV806	SMW_ENV806	SMW_ENV808	SMW_ENV809	SMW_ENV811	SMW_WTP_BH14	SMW_WTP_BH15
Field_ID	SMW_ENV801	SMW-ENV801S	SMW-ENV806	SMW_ENV806	SMW-ENV808	SMW_ENV809	SMW-ENV811	SMW_BH14	SMW_BH15
Sampled date	20/10/2021	11/10/2021	21/10/2021	1/12/2021	11/10/2021	8/10/2021	12/10/2021	20/10/2021	20/10/2021
Lab report	ES2137931	ES2136518	ES2138069	ES2143985	ES2136518	ES2136318	ES2136722	ES2137931	ES2137931

Analyte	Unit	LOR	ANZG (2018) Freshwater 95%	ANZG (2018) Marine water 95%								
Amino Aliphatics												
n-Nitrosodiethylamine	mg/L	0.002			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
N-Nitrosodi-n-butylamine	mg/L	0.002			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
N-Nitrosodi-n-propylamine	mg/L	0.002			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
n-Nitrosomethylethylamine	mg/L	0.002			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Amino Aromatics												
1-Naphthylamine	mg/L	0.002			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
n-Nitrosodiphenylamine & Diphenylamine	mg/L	0.004			<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Anilines												
2-Nitroaniline	mg/L	0.004			<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
3-Nitroaniline	mg/L	0.004			<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
4-Chloroaniline	mg/L	0.002			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
4-Nitroaniline	mg/L	0.002			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
2-methyl-5-nitroaniline	mg/L	0.002			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Aniline	mg/L	0.002	0.25		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
E-Nitrobenzenes												
Nitrobenzene	mg/L	0.002	0.55		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Pentachloronitrobenzene	mg/L	0.002			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Explosives												
1,3,5-Trinitrobenzene	mg/L	0.002	0.004		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
2,4-Dinitrotoluene	mg/L	0.004	0.065		<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
2,6-Dinitrotoluene	mg/L	0.004			<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Halogenated Benzenes												
1,2,3-Trichlorobenzene	mg/L	0.005	0.003		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
1,2,4-Trichlorobenzene	mg/L	0.002	0.085	0.02	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
1,2-Dichlorobenzene	mg/L	0.002	0.16		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
1,3-Dichlorobenzene	mg/L	0.002	0.26		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
1,4-Dichlorobenzene	mg/L	0.002	0.06		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
2-Chlorotoluene	mg/L	0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
4-Chlorotoluene	mg/L	0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Bromobenzene	mg/L	0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Chlorobenzene	mg/L	0.005	0.055	0.055	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Hexachlorobenzene	mg/L	0.0005	0.00005	0.00005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Pentachlorobenzene	mg/L	0.002	0.0015	0.0015	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Heavy metals												
Arsenic (Filtered)	mg/L	0.001	0.013		<0.001	0.001	<0.01	<0.001	0.001	<0.001	<0.01	0.001	0.007
Cadmium (Filtered)	mg/L	0.0001	0.0002	0.0007	0.0001	<0.0001	<0.001	0.0002	<0.0001	<0.0001	<0.001	<0.0001	<0.0001
Chromium (Filtered)	mg/L	0.001	0.0033	0.027	<0.001	<0.001	<0.01	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001
Chromium (hexavalent) (Filtered)	mg/L	0.01	0.001	0.0044	<0.1	<0.01	<0.1	<0.01	<0.1	<0.01	<0.01	<0.01	0.02
Cobalt (Filtered)	mg/L	0.001	0.0014	0.001	0.056	0.002	0.027	0.046	0.036	0.022	0.062	0.024	0.031
Copper (Filtered)	mg/L	0.001	0.0014	0.0013	<0.001	<0.001	<0.01	0.001	<0.001	<0.001	<0.01	<0.001	<0.001
Iron (Filtered)	mg/L	0.05			5.98	8.11	0.16	0.35	9.25	0.53	4.14	3.8	13.8
Lead (Filtered)	mg/L	0.001	0.0034	0.0044	<0.001	<0.001	<0.01	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001
Manganese (Filtered)	mg/L	0.001	1.9	1.9	0.505	0.062	0.366	0.562	0.889	0.05	0.338	0.183	0.659
Mercury (Filtered)	mg/L	0.0001	0.00006	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Nickel (Filtered)	mg/L	0.001	0.011	0.07	0.022	<0.001	0.015	0.023	0.014	0.012	0.037	0.008	0.009
Zinc (Filtered)	mg/L	0.005	0.008	0.008	0.064	0.005	0.08	0.072	0.027	0.044	0.074	0.025	0.697
Herbicides												
Pronamide	mg/L	0.002			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
MAH												
1,2,4-trimethylbenzene	mg/L	0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
1,3,5-Trimethylbenzene	mg/L	0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Isopropylbenzene	mg/L	0.005	0.03	0.03	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
n-Butylbenzene	mg/L	0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
n-Propylbenzene	mg/L	0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
p-Isopropyltoluene	mg/L	0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
sec-Butylbenzene	mg/L	0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Styrene	mg/L	0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
tert-Butylbenzene	mg/L	0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

Analyte	Unit	LOR	ANZG (2018) Freshwater 95%	ANZG (2018) Marine water 95%	Location	SMW_ENV801	SMW_ENV801S	SMW_ENV806	SMW_ENV806	SMW_ENV808	SMW_ENV809	SMW_ENV811	SMW_WTP_BH14	SMW_WTP_BH15
					Field_ID	SMW_ENV801	SMW-ENV801S	SMW-ENV806	SMW_ENV806	SMW-ENV808	SMW_ENV809	SMW-ENV811	SMW_BH14	SMW_BH15
					Sampled date	20/10/2021	11/10/2021	21/10/2021	1/12/2021	11/10/2021	8/10/2021	12/10/2021	20/10/2021	20/10/2021
					Lab report	ES2137931	ES2136518	ES2138069	ES2143985	ES2136518	ES2136318	ES2136722	ES2137931	ES2137931
Organochlorine Pesticides														
p,p-DDE	mg/L	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
a-BHC	mg/L	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Aldrin	mg/L	0.0005	0.000001	0.000003	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Aldrin & Dieldrin (Sum of total) (Lab Reported)	mg/L	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
b-BHC	mg/L	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Chlordane (Sum of total)	mg/L	0.0005	0.00003	0.000001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
cis-Chlordane	mg/L	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
trans-Chlordane	mg/L	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
d-BHC	mg/L	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
DDD	mg/L	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
DDT	mg/L	0.002	0.000006	0.0000004	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
DDT+DDE+DDD (Sum of total) (Lab Reported)	mg/L	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Dieldrin	mg/L	0.0005	0.00001		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Endosulfan I	mg/L	0.0005	0.00003	0.000005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Endosulfan II	mg/L	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Endosulfan sulphate	mg/L	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Endrin	mg/L	0.0005	0.00001	0.000004	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Endrin aldehyde	mg/L	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Endrin ketone	mg/L	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
g-BHC	mg/L	0.0005	0.0002	0.000007	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Heptachlor	mg/L	0.0005	0.00001	0.0000004	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Heptachlor epoxide	mg/L	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Methoxychlor	mg/L	0.002	0.000005	0.000004	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Organophosphorous Pesticides														
Azinphos-methyl	mg/L	0.0005	0.00002		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Bromophos-ethyl	mg/L	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Carbophenothion	mg/L	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Chlorfenvinphos	mg/L	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Chlorpyriphos	mg/L	0.0005	0.00001	0.000009	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Chlorpyriphos-methyl	mg/L	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Diazinon	mg/L	0.0005	0.00001		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Dichlorvos	mg/L	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Dimethoate	mg/L	0.0005	0.00015		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Ethion	mg/L	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Fenamiphos	mg/L	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Fenthion	mg/L	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Malathion	mg/L	0.0005	0.00005		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Parathion-methyl	mg/L	0.002			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Monocrotophos	mg/L	0.002			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Parathion	mg/L	0.002	0.000004		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Pirimphos-ethyl	mg/L	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Prothiofos	mg/L	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Other														
Methane	ug/L	10	1600	1600	16	**1750**	16	<10	13	<10	47	138	<10
PAH														
Acenaphthene	mg/L	0.001			0.0197	0.035	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Acenaphthylene	mg/L	0.001			<0.001	0.0019	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Anthracene	mg/L	0.001	0.00001	0.00001	**0.0041**	**0.0018**	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Benz(a)anthracene	mg/L	0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Benzo(a)pyrene	mg/L	0.0005	0.0001	0.0001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Benzo(a)pyrene TEQ (lower bound)*	mg/L	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Benzo(b)&(j)fluoranthene	mg/L	0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Benzo(b+j) & Benzo(k)fluoranthene	mg/L	0.004			-	-	-	<0.004	-	<0.004	-	-	-
Benzo(g,h,i)perylene	mg/L	0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Benzo(k)fluoranthene	mg/L	0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chrysene	mg/L	0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Dibenz(a,h)anthracene	mg/L	0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Fluoranthene	mg/L	0.001	0.001	0.001	0.0013	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Fluorene	mg/L	0.001			0.0102	0.0139	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Indeno(1,2,3-c,d)pyrene	mg/L	0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Naphthalene	mg/L	0.001	0.016	0.07	0.0026 - 0.008	0.232 - 0.414	<0.001	<0.001	0.003 - 0.033	<0.001	<0.001	<0.005 - 0.002	<0.001

Analyte	Unit	LOR	ANZG (2018) Freshwater 95%	ANZG (2018) Marine water 95%	Location	SMW_ENV801	SMW_ENV801S	SMW_ENV806	SMW_ENV806	SMW_ENV808	SMW_ENV809	SMW_ENV811	SMW_WTP_BH14	SMW_WTP_BH15
					Field_ID	SMW_ENV801	SMW-ENV801S	SMW-ENV806	SMW_ENV806	SMW-ENV808	SMW_ENV809	SMW-ENV811	SMW_BH14	SMW_BH15
					Sampled date	20/10/2021	11/10/2021	21/10/2021	1/12/2021	11/10/2021	8/10/2021	12/10/2021	20/10/2021	20/10/2021
					Lab report	ES2137931	ES2136518	ES2138069	ES2143985	ES2136518	ES2136318	ES2136722	ES2137931	ES2137931
Phenanthrene	mg/L	0.001	0.0006	0.0006		0.0125	0.0076	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Pyrene	mg/L	0.001				<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
PAH (Sum of Common 16 PAHs - Lab Reported)	mg/L	0.0005				0.0504	0.474	<0.0005	<0.0005	0.003	<0.0005	<0.0005	0.002	<0.0005
PAH-Others														
1-Methylnaphthalene	mg/L	0.002				-	-	-	-	-	-	-	-	-
2-Chloronaphthalene	mg/L	0.002				<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
2-Methylnaphthalene	mg/L	0.002				<0.002	0.056	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
3-Methylcholanthrene	mg/L	0.002				<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
7,12-Dimethylbenz(a)anthracene	mg/L	0.002				<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Pesticides-Others														
Carbazole	mg/L	0.002				<0.002	0.007	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Chlorobenzilate	mg/L	0.002				<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Demeton-s-methyl	mg/L	0.0005				<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Phenolics														
2,4-Dimethylphenol	mg/L	0.002	0.002			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
2-Methylphenol	mg/L	0.002				<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
2-Nitrophenol	mg/L	0.002				<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
3- & 4- Methylphenol	mg/L	0.004				<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Phenol	mg/L	0.002	0.32	0.4		<0.002	<0.002	<0.002	<0.002	0.004	<0.002	<0.002	<0.002	<0.002
Phenolics-Halogenated														
2,4,5-Trichlorophenol	mg/L	0.002				<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
2,4,6-Trichlorophenol	mg/L	0.002	0.003			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
2,4-Dichlorophenol	mg/L	0.002	0.16			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
2,6-Dichlorophenol	mg/L	0.002	0.034			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
2-Chlorophenol	mg/L	0.002	0.49			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
4-Chloro-3-methylphenol	mg/L	0.002				<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Pentachlorophenol	mg/L	0.004	0.0036	0.011		<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Phthalates														
Bis(2-ethylhexyl) phthalate	mg/L	0.01	0.001			<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Butylbenzyl phthalate	mg/L	0.002				<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Diethyl phthalate	mg/L	0.002	1			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Dimethyl phthalate	mg/L	0.002	3.7			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Di-n-butyl phthalate	mg/L	0.002	0.01			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Di-n-octyl phthalate	mg/L	0.002				<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Sample Quality Parameters														
Electrical Conductivity @ 25°C	uS/cm	1				32,800	571	32,200	25,300	24,500	20,700	30,000	12,100	25,400
pH (Lab)	pH_Units	0.01				6.08	6.74	6.57	6.84	6.86	6.03	6.1	6.27	6.66
Total Dissolved Solids @180°C	mg/L	10				25,400	343	24,600	19,700	17,800	11,400	19,200	8780	19,200
Sodium (Filtered)	mg/L	1				5460	44	5400	4950	4230	3230	5500	2080	4380
Potassium (Filtered)	mg/L	1				18	7	17	12	12	9	10	9	17
Calcium (Filtered)	mg/L	1				212	38	249	230	281	102	214	84	313
Magnesium (Filtered)	mg/L	1				1000	10	1040	855	693	545	1040	315	726
Chloride	mg/L	1				11,000	67	12,100	7880	8380	6440	9470	4110	8740
pH Redox	pH unit	0.01				5.92	6.7	6.08	6.11	6.49	5.54	5.52	6.22	6.55
Sulphate (as SO4) (Filtered)	mg/L	1				1130	18	1330	1100	1070	900	1420	488	888
Bicarbonate Alkalinity (as CaCO3)	mg/L	1				167	175	198	48	364	34	61	129	478
Carbonate Alkalinity (as CaCO3)	mg/L	1				<1	<1	<1	<1	<1	<1	<1	<1	<1
Hydroxide Alkalinity (as CaCO3)	mg/L	1				<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Alkalinity (as CaCO3)	mg/L	1				167	175	198	48	364	34	61	129	478
Nitrate (as N)	mg/L	0.01	2.4			0.01	0.53	0.02	<0.01	<0.01	0.08	<0.01	0.02	<0.01
Nitrite (as N)	mg/L	0.01				<0.01	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01
Nitrate + Nitrite (as N)	mg/L	0.01				0.01	0.53	0.02	<0.01	<0.01	0.1	<0.01	0.02	<0.01
Ammonia (as N)	mg/L	0.01	0.9	0.91		0.49	0.32	0.21	0.18	0.49	0.15	0.15	0.29	1.28
Total Kjeldahl Nitrogen (as N)	mg/L	0.1				0.6	0.4	<0.5	<0.5	0.7	0.2	<1	1.5	1.6
Nitrogen (Total)	mg/L	0.1				0.6	0.9	<0.5	<0.5	0.7	0.3	<1	1.5	1.6
Fluoride	mg/L	0.1				<0.1	0.2	<0.1	<0.1	0.2	<0.1	<0.1	0.1	0.4
Reactive Phosphorus (as P)	mg/L	0.01				<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total Phosphorus (as P)	mg/L	0.01				0.01	0.02	<0.05	0.05	0.11	<0.02	<0.1	1.01	2.09
Total Suspended Solids	mg/L	5				-	-	-	-	-	-	-	-	-
Total Anions	meq/L	0.01				337	5.76	373	246	266	201	298	129	274
Total Cations	meq/L	0.01				331	5.25	333	297	255	191	336	121	266
Ionic Balance (Lab)	%	0.01				0.95	4.96	5.61	9.44	2.03	2.66	5.97	3.15	1.53

					Location	SMW_ENV801	SMW_ENV801S	SMW_ENV806	SMW_ENV806	SMW_ENV808	SMW_ENV809	SMW_ENV811	SMW_WTP_BH14	SMW_WTP_BH15
					Field_ID	SMW_ENV801	SMW-ENV801S	SMW-ENV806	SMW_ENV806	SMW-ENV808	SMW_ENV809	SMW-ENV811	SMW_BH14	SMW_BH15
					Sampled date	20/10/2021	11/10/2021	21/10/2021	1/12/2021	11/10/2021	8/10/2021	12/10/2021	20/10/2021	20/10/2021
					Lab report	ES2137931	ES2136518	ES2138069	ES2143985	ES2136518	ES2136318	ES2136722	ES2137931	ES2137931
Analyte		**Unit**	**LOR**	**ANZG (2018) Freshwater 95%**	**ANZG (2018) Marine water 95%**									
	Dissolved Oxygen	mg/L	0.1			7.1	8.8	4.5	7.8	8.5	8.3	5.1	7.4	6.4
	Redox Potential	mV	0.1			97	-38.6	137	209	-6.4	218	156	107	24.3
Solvents														
	Methyl Ethyl Ketone	mg/L	0.05			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	2-Hexanone	mg/L	0.05			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Methyl iso-butyl ketone	mg/L	0.05			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Isophorone	mg/L	0.002		0.13	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
	Vinyl acetate	mg/L	0.05			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
SVOCs														
	2-(Acetylamino) fluorene	mg/L	0.002			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
	2-Picoline	mg/L	0.002			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
	3,3-Dichlorobenzidine	mg/L	0.002			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
	4-(Dimethylamino) azobenzene	mg/L	0.002			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
	4-Aminobiphenyl	mg/L	0.002			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
	4-Bromophenyl phenyl ether	mg/L	0.002			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
	4-Chlorophenyl phenyl ether	mg/L	0.002			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
	4-Nitroquinoline-n-oxide	mg/L	0.002			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
	Acetophenone	mg/L	0.002			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
	Azobenzene	mg/L	0.002			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
	Bis(2-chloroethoxy) methane	mg/L	0.002			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
	Bis(2-chloroethyl) ether	mg/L	0.002			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
	Dibenzofuran	mg/L	0.002			0.006	0.012	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
	Hexachlorocyclopentadiene	mg/L	0.01			<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	Hexachloropropene	mg/L	0.002			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
	Methapyrilene	mg/L	0.002			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
	n-Nitrosomorpholine	mg/L	0.002			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
	N-Nitrosopiperidine	mg/L	0.002			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
	n-Nitrosopyrrolidine	mg/L	0.004			<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
	Phenacetin	mg/L	0.002			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Volatile Organic Compounds														
	1,1,1,2-Tetrachloroethane	mg/L	0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
	1,1,2,2-Tetrachloroethane	mg/L	0.005	0.4	0.4	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
	1,1,1-Trichloroethane	mg/L	0.005	0.27	0.27	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
	1,1,2-Trichloroethane	mg/L	0.005	6.5	1.9	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
	1,2,3-Trichloropropane	mg/L	0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
	1,2-Dibromo-3-chloropropane	mg/L	0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
	1,2-Dibromoethane	mg/L	0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
	1,1-Dichloroethane	mg/L	0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
	1,2-Dichloroethane	mg/L	0.005	1.9	1.9	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
	1,1-Dichloroethene	mg/L	0.005	0.7	0.7	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
	cis-1,2-Dichloroethene	mg/L	0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
	trans-1,2-dichloroethene	mg/L	0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
	1,2-Dichloropropane	mg/L	0.005	0.9	0.9	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
	1,3-Dichloropropane	mg/L	0.005	1.1	1.1	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
	2,2-Dichloropropane	mg/L	0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
	1,1-Dichloropropene	mg/L	0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
	cis-1,3-Dichloropropene	mg/L	0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
	trans-1,3-dichloropropene	mg/L	0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
	cis-1,4-Dichloro-2-butene	mg/L	0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
	trans-1,4-Dichloro-2-butene	mg/L	0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
	Bromodichloromethane	mg/L	0.005			<0.005	<0.005	<0.005	<0.005	<0.005	0.006	<0.005	<0.005	<0.005
	Bromoform	mg/L	0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
	Bromomethane	mg/L	0.05			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Carbon disulfide	mg/L	0.005	0.02		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
	Carbon tetrachloride	mg/L	0.005	0.24	0.24	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
	Chlorodibromomethane	mg/L	0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
	Chloroethane	mg/L	0.05			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Chloroform	mg/L	0.005	0.77	0.77	<0.005	<0.005	<0.005	<0.005	0.019	0.035	0.006	<0.005	<0.005
	Chloromethane	mg/L	0.05			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Dibromomethane	mg/L	0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
	Dichlorodifluoromethane	mg/L	0.05			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Hexachlorobutadiene	mg/L	0.002			<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002

					Location	SMW_ENV801	SMW_ENV801S	SMW_ENV806	SMW_ENV806	SMW_ENV808	SMW_ENV809	SMW_ENV811	SMW_WTP_BH14	SMW_WTP_BH15
					Field_ID	SMW_ENV801	SMW-ENV801S	SMW-ENV806	SMW_ENV806	SMW-ENV808	SMW_ENV809	SMW-ENV811	SMW_BH14	SMW_BH15
					Sampled date	20/10/2021	11/10/2021	21/10/2021	1/12/2021	11/10/2021	8/10/2021	12/10/2021	20/10/2021	20/10/2021
					Lab report	ES2137931	ES2136518	ES2138069	ES2143985	ES2136518	ES2136318	ES2136722	ES2137931	ES2137931
Analyte		**Unit**	**LOR**	**ANZG (2018) Freshwater 95%**	**ANZG (2018) Marine water 95%**									
	Hexachloroethane	mg/L	0.002	0.29		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
	Iodomethane	mg/L	0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
	Pentachloroethane	mg/L	0.005	0.08	0.08	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
	Trichloroethene	mg/L	0.005	0.33	0.33	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
	Tetrachloroethene	mg/L	0.005	0.07	0.07	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
	Trichlorofluoromethane	mg/L	0.05			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Vinyl chloride	mg/L	0.05	0.1	0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

Notes

ANZG 2018 95% level of species protection values adopted unless otherwise stated
ANZG 2018 99% level of species protection fresh water values adopted as default values for bioaccumulating substances: chlordane, DDT, endosulfan, endrin, heptachlor, hexachlorobenzene, toxaphene, anthracene, benzo(a)pyrene, fluoranthene, phenanthrene, 2,3,4,6-tetrachlorophenol, 2,4,6-trichlorophenol, pentachlorophenol, dibutylphthalate, hexachloroethane, 1,2,3,4-tetrachlorobenzene, 1,2,3,5-tetrachlorobenzene , 1,2,3-trichlorobenzene, 1,2,4,5-tetrachlorobenzene, 1,2,4-trichlorobenzene, 1,3,5-trichlorobenzene, pentachlorobenzene, 2,3,4,6-tetrachlorophenol, 2,4,6-trichlorophenol , pentachlorophenol, mercury
ANZG 2018 99% level of species protection marine water values adopted as default values for bioaccumulating substances: endosulfan, endrin, , hexachlorobenzene, anthracene, benzo(a)pyrene, fluoranthene, phenanthrene, pentachlorophenol, 1,2,3,4-tetrachlorobenzene, 1,2,3,5-tetrachlorobenzene, 1,2,4,5-tetrachlorobenzene, 1,2,4-trichlorobenzene, 1,3,5-trichlorobenzene pentachlorobenzene, cadmium, mercury
ANZG 2018 unknown level of species protection fresh water values adopted for: aldrin , dieldrin, methoxychlor, 2,6-dichlorophenol, bis(2-ethylhexyl) phthalate, 1,3,5-trinitrobenzene, chromium (CrIII value adopted), cobalt
ANZG 2018 unknown level of species protection marine water values adopted for: aldrin, chlordane, DDT, heptachlor, lindane, methoxychlor, manganese
As (V) value adopted as criterion for arsenic
p-xylene value adopted as criterion for the sum of m- & p-xylene
NEPM 2020 default 99% level of species protection values adopted for PFOA and PFOS
TIWA (2013) 95% level of species protection grading value adopted as criterion for nitrate
BGS (2016) value adopted as criterion for methane

APPENDIX B SURFACE WATER MONITORING DATA

			Field	Physico-Chemical & Major Ions	Inorganics		Nutrients						Metals																		
			Turbidity	pH (Lab)	Electrical Conductivity (Non Compensated)	Salinity	Ammonia as N (filtered)	Kjeldahl Nitrogen Total	Nitrate (as N) (filtered)	Nitrite (as N) (filtered)	Nitrogen (Total)	Reactive Phosphorus as P (Orthophosphate as P) (filtered)	Aluminium	Aluminium (filtered)	Arsenic	Arsenic (filtered)	Cadmium	Cadmium (filtered)	Chromium (hexavalent) (filtered)	Chromium (Trivalent)	Chromium (III+VI)	Chromium (III+VI) (filtered)	Copper	Copper (filtered)	Iron	Iron (filtered)	Lead	Lead (filtered)	Manganese	Manganese (filtered)	Mercury
			NTU	-	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	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	mg/L
EQL			0.1		1	1	0.005	0.1	0.005	0.005	0.1	0.005	0.01	0.01	0.001	0.001	0.0001	0.0001	0.001	0.005	0.001	0.001	0.001	0.001	0.01	0.01	0.001	0.001	0.005	0.005	0.00005
ANZG (2018) Freshwater 90% LOSP Toxicant DGVs							1.43						0.08	0.08			0.0004	0.0004	0.006				0.0018	0.0018			0.0056	0.0056	2.5	2.5	0.0019
ANZG (2018) Freshwater 95% LOSP Toxicant DGVs							0.9						0.055	0.055			0.0002	0.0002	0.001				0.0014	0.0014			0.0034	0.0034	1.9	1.9	0.0006
ANZG (2018) Freshwater 99% LOSP Toxicant DGVs							0.32						0.027	0.027			0.00006	0.00006	0.00001				0.001	0.001			0.001	0.001	1.2	1.2	0.00006
Field ID	**Date**	**Matrix Type**																													
SW01	17/05/2022	Water	3.0	7.3	4,700	3,000	0.68	1.2	0.21	0.049	1.5	0.098	-	-	0.001	0.002	<0.0001	<0.0001	<0.001	<0.005	<0.001	<0.001	0.002	0.002	0.36	0.11	<0.001	<0.001	0.26	0.27	<0.00005
	27/05/2022	Water	5.6	7.9	1,500	940	0.16	0.6	0.57	0.051	1.3	0.092	-	-	0.001	0.001	<0.0001	<0.0001	<0.001	<0.005	<0.001	<0.001	0.003	0.002	0.33	0.08	<0.001	<0.001	0.032	0.03	<0.00005
	3/06/2022	Water	5.4	7.0	18,000	12,000	0.73	1.4	0.02	0.044	1.5	0.11	0.21	<0.01	0.001	0.001	<0.0001	<0.0001	<0.001	<0.005	<0.001	<0.001	0.002	<0.001	0.87	0.53	0.001	<0.001	0.33	0.35	<0.00005
SW02	17/05/2022	Water	3.0	7.2	12,000	7,700	0.38	0.6	0.40	0.055	1.0	0.083	-	-	0.001	0.002	<0.0001	<0.0001	<0.001	<0.005	<0.001	<0.001	0.002	0.001	0.29	0.07	<0.001	<0.001	0.14	0.14	<0.00005
	27/05/2022	Water	3.3	7.6	5,500	3,500	0.090	0.7	0.50	0.047	1.3	0.053	-	-	0.001	0.001	<0.0001	<0.0001	<0.001	<0.005	<0.001	<0.001	0.003	0.002	0.29	0.1	<0.001	<0.001	0.048	0.047	<0.00005
	3/06/2022	Water	1.6	7.3	21,000	13,000	0.37	0.8	0.16	0.041	1	0.059	0.05	<0.01	0.001	<0.001	<0.0001	<0.0001	<0.001	<0.005	<0.001	<0.001	0.002	<0.001	0.32	0.09	<0.001	<0.001	0.23	0.23	<0.00005
SW03	17/05/2022	Water	5.7	7.2	26,000	17,000	0.25	0.5	0.22	0.023	0.8	0.060	-	-	0.002	0.002	<0.0001	<0.0001	<0.001	<0.005	0.003	<0.001	0.003	<0.001	0.58	0.02	0.003	<0.001	0.07	0.067	<0.00005
	27/05/2022	Water	15	7.5	12,000	7,600	0.13	0.5	0.39	0.025	1	0.03	-	-	0.002	0.002	<0.0001	<0.0001	<0.001	<0.005	0.001	<0.001	0.003	0.002	0.58	0.08	0.004	<0.001	0.064	0.061	<0.00005
	3/06/2022	Water	2.4	7.3	26,000	16,000	0.24	0.5	0.19	0.026	0.7	0.04	0.06	<0.01	0.001	0.001	0.0002	<0.0001	<0.001	<0.005	<0.001	<0.001	0.002	<0.001	0.25	0.03	0.002	<0.001	0.09	0.082	<0.00005
SW04	17/05/2022	Water	8.6	7.9	430	280	0.19	0.3	0.66	0.028	1.0	0.03	-	-	0.001	<0.001	<0.0001	<0.0001	<0.001	<0.005	0.001	<0.001	0.004	0.002	1.1	0.54	0.003	0.001	0.12	0.089	<0.00005
	27/05/2022	Water	15	7.9	410	260	0.058	0.4	0.63	0.023	1.0	0.02	-	-	<0.001	<0.001	<0.0001	<0.0001	<0.001	<0.005	0.001	<0.001	0.005	0.003	0.6	0.31	0.002	<0.001	0.049	0.035	<0.00005
	3/06/2022	Water	7.8	8.0	880	560	0.51	3.0	0.54	0.054	3.6	0.03	0.25	0.05	<0.001	<0.001	0.0002	<0.0001	<0.001	<0.005	<0.001	<0.001	0.003	0.002	0.41	0.2	0.001	<0.001	0.039	0.026	<0.00005
SW05	17/05/2022	Water	16	7.8	440	280	0.17	0.3	0.65	0.026	1	0.03	-	-	0.002	<0.001	0.0003	<0.0001	<0.001	<0.005	0.001	<0.001	0.004	0.003	0.92	0.48	0.003	<0.001	0.11	0.077	<0.00005
	27/05/2022	Water	13	7.8	410	260	0.085	0.4	0.47	0.018	0.9	0.02	-	-	<0.001	<0.001	<0.0001	<0.0001	<0.001	<0.005	<0.001	<0.001	0.003	0.002	0.76	0.31	0.002	<0.001	0.054	0.034	<0.00005
	3/06/2022	Water	3.6	7.9	880	560	0.51	2.9	0.54	0.053	3.5	0.02	0.23	0.02	<0.001	<0.001	<0.0001	<0.0001	<0.001	<0.005	<0.001	<0.001	0.003	0.002	0.62	0.19	0.001	<0.001	0.073	0.054	<0.00005
SW06	17/05/2022	Water	5.4	7.3	15,000	9,900	0.29	0.4	0.37	0.023	0.8	0.05	-	-	0.001	0.001	<0.0001	<0.0001	<0.001	<0.005	<0.001	<0.001	0.002	0.001	0.54	0.11	0.001	<0.001	0.085	0.081	<0.00005
	27/05/2022	Water	4.9	7.4	23,000	15,000	0.27	0.5	0.21	0.020	0.7	0.04	-	-	0.001	0.001	<0.0001	<0.0001	<0.001	<0.005	0.002	<0.001	0.001	<0.001	0.5	0.07	0.001	<0.001	0.062	0.056	<0.00005
	3/06/2022	Water	2.2	7.5	25,000	16,000	0.25	1	0.19	0.025	1.2	0.04	0.08	0.02	<0.001	<0.001	<0.0001	<0.0001	0.001	<0.005	<0.001	<0.001	0.001	0.001	0.23	0.04	<0.001	<0.001	0.048	0.045	<0.00005
SW07	17/05/2022	Water	3.4	7.8	820	530	0.12	0.3	0.35	0.020	0.7	0.04	-	-	0.001	0.001	<0.0001	<0.0001	<0.001	<0.005	<0.001	<0.001	0.002	0.002	0.58	0.15	<0.001	<0.001	0.11	0.11	<0.00005
	27/05/2022	Water	3.7	8.0	800	520	0.034	0.4	0.33	0.022	0.8	0.03	-	-	0.001	0.001	<0.0001	<0.0001	<0.001	<0.005	<0.001	<0.001	0.001	0.001	0.56	0.2	<0.001	<0.001	0.1	0.1	<0.00005
	3/06/2022	Water	4.3	7.9	840	540	0.057	0.4	0.26	0.015	0.7	0.04	0.04	<0.01	<0.001	<0.001	<0.0001	<0.0001	<0.001	<0.005	<0.001	<0.001	0.001	<0.001	0.6	0.24	<0.001	<0.001	0.066	0.061	<0.00005
SW08	17/05/2022	Water	7.4	7.2	9,800	6,300	0.25	0.5	0.45	0.033	0.9	0.03	-	-	0.002	0.002	<0.0001	<0.0001	<0.001	<0.005	<0.001	<0.001	0.003	0.002	0.65	0.18	0.005	0.001	0.1	0.11	<0.00005
	27/05/2022	Water	19	7.4	12,000	7,600	0.17	0.6	0.39	0.021	1.0	0.03	-	-	0.003	0.002	<0.0001	<0.0001	<0.001	<0.005	0.001	<0.001	0.004	0.002	0.93	0.26	0.008	0.002	0.07	0.064	<0.00005
	3/06/2022	Water	3.0	7.2	25,000	16,000	0.22	0.6	0.23	0.024	0.8	0.04	0.06	<0.01	0.001	0.001	<0.0001	<0.0001	<0.001	<0.005	<0.001	<0.001	0.002	0.001	0.26	0.02	0.001	<0.001	0.078	0.074	<0.00005
SW09	27/05/2022	Water	2.1	8.1	1,600	1,000	0.039	0.5	0.77	0.051	1.3	0.03	-	-	0.001	0.001	<0.0001	<0.0001	<0.001	<0.005	<0.001	<0.001	0.002	0.002	0.2	0.06	<0.001	<0.001	0.1	0.1	<0.00005
	3/06/2022	Water	3.5	8.1	2,900	1,800	0.17	0.7	1.2	0.068	2.0	0.03	0.28	<0.01	<0.001	<0.001	<0.0001	<0.0001	0.001	<0.005	<0.001	<0.001	0.006	0.002	0.73	0.02	0.002	<0.001	0.072	0.062	<0.00005

Statistics

Number of Results	26	26	26	26	26	26	26	26	26	26	9	9	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
Number of Detects	26	26	26	26	26	26	26	26	26	26	9	3	19	16	3	0	2	0	7	0	26	20	26	26	16	3	26	26	0		
Minimum Concentration	1.6	7	410	260	0.034	0.3	0.02	0.015	0.7	0.02	0.04	<0.01	0.001	0.001	<0.0001	<0.0001	0.001	<0.005	0.001	<0.001	0.001	0.001	0.2	0.02	0.001	0.001	0.032	0.026	<0.00005		
Minimum Detect	1.6	7	410	260	0.034	0.3	0.02	0.015	0.7	0.02	0.04	0.02	0.001	0.001	0.0002	ND	0.001	ND	0.001	ND	0.001	0.001	0.2	0.02	0.001	0.001	0.032	0.026	ND		
Maximum Concentration	19	8.1	26,000	17,000	0.73	3	1.2	0.068	3.6	0.11	0.28	0.05	0.003	0.002	0.0003	<0.0001	0.001	<0.005	0.003	<0.001	0.006	0.003	1.1	0.54	0.008	0.002	0.33	0.35	<0.00005		
Maximum Detect	19	8.1	26,000	17,000	0.73	3	1.2	0.068	3.6	0.11	0.28	0.05	0.003	0.002	0.0003	ND	0.001	ND	0.003	ND	0.006	0.003	1.1	0.54	0.008	0.002	0.33	0.35	ND		
Average Concentration *	6.5	7.6	9,497	6,082	0.25	0.77	0.42	0.034	1.2	0.045	0.14	0.013	0.0011	0.001	0.000071	0.00005	0.00054	0.0025	0.00075	0.0005	0.0027	0.0015	0.54	0.17	0.0017	0.0006	0.1	0.094	0.000025		
Median Concentration *	4.6	7.55	5,100	3,250	0.205	0.5	0.39	0.026	1	0.04	0.08	0.005	0.001	0.001	0.00005	0.00005	0.0005	0.0025	0.0005	0.0005	0.0025	0.002	0.57	0.11	0.001	0.0005	0.0755	0.0705	0.000025		
Standard Deviation *	4.9	0.34	9,745	6,242	0.19	0.69	0.24	0.015	0.75	0.025	0.099	0.015	0.00062	0.00058	0.000062	0	0.00014	0	0.00057	0	0.0012	0.00077	0.24	0.15	0.0018	0.00032	0.07	0.077	0		
95% UCL (Student's-t) *	8.115	7.709	12,761	8,173	0.309	1.002	0.501	0.039	1.481	0.0535	0.202	0.0228	0.0013	0.00123	0.000091898	0.00005	0.00058398	0.0025	0.00094098	0.0005	0.00307	0.0018	0.622	0.224	0.00232	0.00070229	0.124	0.12	0.000025		
% of Detects	100	100	100	100	100	100	100	100	100	100	100	33	73	62	12	0	8	0	27	0	100	77	100	100	62	12	100	100	0		
% of Non-Detects	0	0	0	0	0	0	0	0	0	0	0	67	27	38	88	100	92	100	73	100	0	23	0	0	38	88	0	0	100		

* A Non Detect Multiplier of 0.5 has been applied.

Comments

#1 NIL (+)VE

Environmental Standards

ANZG, March 2021, ANZG (2018) Freshwater 90% LOSP Toxicant DGVs
ANZG, March 2021, ANZG (2018) Freshwater 95% LOSP Toxicant DGVs
ANZG, March 2021, ANZG (2018) Freshwater 99% LOSP Toxicant DGVs

			Field	Physico-Chemical & Major Ions						TRH							TPH					BTEX				
			Turbidity	pH (Lab)	Mercury (filtered)	Nickel	Nickel (filtered)	Phosphorus	Zinc	Zinc (filtered)	C6-C10	C6-C10 (F1 minus BTEX)	C10-C16	C10-C16 (F2 minus Naphthalene)	C16-C34	C34-C40	C10-C40 (Sum of total)	C6-C9	C10-C14	C15-C28	C29-C36	C10-C36 (Sum of total)	Benzene	Toluene	Ethylbenzene	Xylene (m & p)	Xylene (o)
			NTU	-	mg/L	mg/L	mg/L	mg/L	mg/L	mg/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			0.1		0.00005	0.001	0.001	0.05	0.001	0.001	10	10	50	50	100	100	50	10	50	100	100	50	1	1	1	2	1
ANZG (2018) Freshwater 90% LOSP Toxicant DGVs					0.0019	0.013	0.013		0.015	0.015													1,300	230	110		470
ANZG (2018) Freshwater 95% LOSP Toxicant DGVs					0.0006	0.011	0.011		0.008	0.008													950	180	80		350
ANZG (2018) Freshwater 99% LOSP Toxicant DGVs					0.00006	0.008	0.008		0.0024	0.0024													600	110	50		200
Field ID	**Date**	**Matrix Type**																									
SW01	**17/05/2022**	**Water**	**3.0**	**7.3**	<0.00005	<0.001	**0.001**	**0.2**	**0.027**	**0.016**	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50	<1	<1	<1	<2	<1
	27/05/2022	**Water**	**5.6**	**7.9**	<0.00005	**0.002**	**0.002**	**0.1**	**0.025**	**0.014**	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50	<1	<1	<1	<2	<1
	3/06/2022	**Water**	**5.4**	**7.0**	<0.00005	**0.002**	**0.001**	**0.3**	**0.06**	**0.035**	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50	<1	<1	<1	<2	<1
SW02	**17/05/2022**	**Water**	**3.0**	**7.2**	<0.00005	<0.001	<0.001	**0.1**	**0.025**	**0.018**	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50	<1	<1	<1	<2	<1
	27/05/2022	**Water**	**3.3**	**7.6**	<0.00005	**0.001**	**0.002**	**0.08**	**0.027**	**0.02**	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50	<1	<1	<1	<2	<1
	3/06/2022	**Water**	**1.6**	**7.3**	<0.00005	**0.001**	**0.001**	**0.1**	**0.038**	**0.028**	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50	<1	<1	<1	<2	<1
SW03	**17/05/2022**	**Water**	**5.7**	**7.2**	<0.00005	<0.001	<0.001	**0.1**	**0.024**	**0.012**	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50	<1	<1	<1	<2	<1
	27/05/2022	**Water**	**15**	**7.5**	<0.00005	**0.001**	**0.001**	**0.09**	**0.033**	**0.024**	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50	<1	<1	<1	<2	<1
	3/06/2022	**Water**	**2.4**	**7.3**	<0.00005	**0.001**	**0.001**	**0.07**	**0.036**	**0.03**	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50	<1	<1	<1	<2	<1
SW04	**17/05/2022**	**Water**	**8.6**	**7.9**	<0.00005	<0.001	**0.001**	**0.08**	**0.022**	**0.01**	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50	<1	<1	<1	<2	<1
	27/05/2022	**Water**	**15**	**7.9**	<0.00005	**0.002**	**0.001**	<0.05	**0.022**	**0.009**	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50	<1	<1	<1	<2	<1
	3/06/2022	**Water**	**7.8**	**8.0**	<0.00005	**0.002**	<0.001	<0.05	**0.036**	**0.008**	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50	<1	<1	<1	<2	<1
SW05	**17/05/2022**	**Water**	**16**	**7.8**	<0.00005	**0.001**	<0.001	**0.08**	**0.036**	**0.009**	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50	<1	<1	<1	<2	<1
	27/05/2022	**Water**	**13**	**7.8**	<0.00005	<0.001	<0.001	**0.07**	**0.017**	**0.007**	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50	<1	<1	<1	<2	<1
	3/06/2022	**Water**	**3.6**	**7.9**	<0.00005	**0.001**	<0.001	**0.06**	**0.017**	**0.008**	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50	<1	<1	<1	<2	<1
SW06	**17/05/2022**	**Water**	**5.4**	**7.3**	<0.00005	<0.001	<0.001	**0.09**	**0.012**	**0.008**	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50	<1	<1	<1	<2	<1
	27/05/2022	**Water**	**4.9**	**7.4**	<0.00005	<0.001	**0.001**	**0.07**	**0.011**	**0.007**	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50	<1	<1	<1	<2	<1
	3/06/2022	**Water**	**2.2**	**7.5**	<0.00005	**0.001**	<0.001	**0.08**	**0.013**	**0.009**	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50	<1	<1	<1	<2	<1
SW07	**17/05/2022**	**Water**	**3.4**	**7.8**	<0.00005	<0.001	<0.001	**0.1**	**0.015**	**0.009**	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50	<1	<1	<1	<2	<1
	27/05/2022	**Water**	**3.7**	**8.0**	<0.00005	**0.001**	**0.001**	**0.09**	**0.011**	**0.009**	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50	<1	<1	<1	<2	<1
	3/06/2022	**Water**	**4.3**	**7.9**	<0.00005	**0.001**	<0.001	**0.09**	**0.01**	**0.007**	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50	<1	<1	<1	<2	<1
SW08	**17/05/2022**	**Water**	**7.4**	**7.2**	<0.00005	<0.001	**0.001**	**0.09**	**0.033**	**0.026**	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50	<1	<1	<1	<2	<1
	27/05/2022	**Water**	**19**	**7.4**	<0.00005	**0.002**	**0.001**	**0.09**	**0.04**	**0.028**	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50	<1	<1	<1	<2	<1
	3/06/2022	**Water**	**3.0**	**7.2**	<0.00005	**0.001**	**0.001**	**0.09**	**0.032**	**0.026**	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50	<1	<1	<1	<2	<1
SW09	**27/05/2022**	**Water**	**2.1**	**8.1**	<0.00005	**0.002**	**0.002**	**0.05**	**0.02**	**0.016**	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50	<1	<1	<1	<2	<1
	3/06/2022	**Water**	**3.5**	**8.1**	<0.00005	**0.002**	**0.002**	**0.09**	**0.049**	**0.018**	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50	<1	<1	<1	<2	<1

Statistics

Number of Results	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**
Number of Detects	**26**	**26**	**0**	**17**	**16**	**24**	**26**	**26**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Minimum Concentration	**1.6**	**7**	**<0.00005**	**0.001**	**0.001**	**0.05**	**0.01**	**0.007**	**<10**	**<10**	**<50**	**<50**	**<100**	**<100**	**<50**	**<10**	**<50**	**<100**	**<100**	**<50**	**<1**	**<1**	**<1**	**<2**	**<1**
Minimum Detect	**1.6**	**7**	**ND**	**0.001**	**0.001**	**0.05**	**0.01**	**0.007**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**
Maximum Concentration	**19**	**8.1**	**<0.00005**	**0.002**	**0.002**	**0.3**	**0.06**	**0.035**	**<10**	**<10**	**<50**	**<50**	**<100**	**<100**	**<50**	**<10**	**<50**	**<100**	**<100**	**<50**	**<1**	**<1**	**<1**	**<2**	**<1**
Maximum Detect	**19**	**8.1**	**ND**	**0.002**	**0.002**	**0.3**	**0.06**	**0.035**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**
Average Concentration *	**6.5**	**7.6**	**0.000025**	**0.0011**	**0.00096**	**0.093**	**0.027**	**0.016**	**5**	**5**	**25**	**25**	**50**	**50**	**25**	**5**	**25**	**50**	**50**	**25**	**0.5**	**0.5**	**0.5**	**1**	**0.5**
Median Concentration *	**4.6**	**7.55**	**0.000025**	**0.001**	**0.001**	**0.09**	**0.025**	**0.013**	**5**	**5**	**25**	**25**	**50**	**50**	**25**	**5**	**25**	**50**	**50**	**25**	**0.5**	**0.5**	**0.5**	**1**	**0.5**
Standard Deviation *	**4.9**	**0.34**	**0**	**0.0006**	**0.00051**	**0.053**	**0.012**	**0.0086**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
95% UCL (Student's-t) *	**8.115**	**7.709**	**0.000025**	**0.0013**	**0.00113**	**0.11**	**0.0308**	**0.0187**	**5**	**5**	**25**	**25**	**50**	**50**	**25**	**5**	**25**	**50**	**50**	**25**	**0.5**	**0.5**	**0.5**	**1**	**0.5**
% of Detects	**100**	**100**	**0**	**65**	**62**	**92**	**100**	**100**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
% of Non-Detects	**0**	**0**	**100**	**35**	**38**	**8**	**0**	**0**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

* A Non Detect Multiplier of 0.5 has been applied.

Comments

#1 NIL (+)VE

Environmental Standards

ANZG, March 2021, ANZG (2018) Freshwater 90% LOSP Toxicant DGVs
ANZG, March 2021, ANZG (2018) Freshwater 95% LOSP Toxicant DGVs
ANZG, March 2021, ANZG (2018) Freshwater 99% LOSP Toxicant DGVs

	Field	Physico-Chemical & Major Ions	PAH																		Perfluoroalkyl Sulfonic Acids			Perfluoroalkyl Carboxylic Acid	Fluorotelomer Sulfonic Acids		PFOS/PFOA	PFAS Totals
	Turbidity	pH (Lab)	Naphthalene	Naphthalene (BTEX)	Benzo(b+j+k)fluoranthene	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(g,h,i)perylene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Phenanthrene	Pyrene	Benzo(a)pyrene TEQ	PAHs (Sum of positives)	Perfluorohexane sulfonic acid (PFHxS)	Sum of PFHxS and PFOS	Perfluorooctanesulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	6:2 Fluorotelomer sulfonic acid (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	Sum of US EPA PFAS (PFOS + PFOA)*	Sum of PFAS
	NTU	-	µg/L	µg/L	mg/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	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL	0.1		1	1	0.002	1	1	1	1	1	1	1	1	1	1	1	1	1	0.005	0.001	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01
ANZG (2018) Freshwater 90% LOSP Toxicant DGVs			37	37				1.5		0.4				1.7			4											
ANZG (2018) Freshwater 95% LOSP Toxicant DGVs			16	16				0.4		0.2				1.4			2											
ANZG (2018) Freshwater 99% LOSP Toxicant DGVs			2.5	2.5				0.01		0.1				1			0.6											
Field ID	**Date**	**Matrix Type**																										
SW01	**17/05/2022**	**Water**	**3.0**	**7.3**	<1	<1	<0.002	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.005	0[#1]	**0.03**	**0.14**	**0.11**	**0.02**	<0.01	<0.02	**0.13**	**0.16**
	27/05/2022	**Water**	**5.6**	**7.9**	<1	<1	<0.002	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.005	0[#1]	**0.03**	**0.15**	**0.13**	**0.02**	<0.01	<0.02	**0.14**	**0.17**
	3/06/2022	**Water**	**5.4**	**7.0**	<1	<1	<0.002	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.005	0[#1]	**0.02**	**0.09**	**0.07**	<0.01	<0.01	<0.02	**0.07**	**0.09**
SW02	**17/05/2022**	**Water**	**3.0**	**7.2**	<1	<1	<0.002	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.005	0[#1]	**0.02**	**0.1**	**0.07**	**0.02**	<0.01	<0.02	**0.09**	**0.11**
	27/05/2022	**Water**	**3.3**	**7.6**	<1	<1	<0.002	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.005	0[#1]	**0.02**	**0.1**	**0.08**	**0.01**	<0.01	<0.02	**0.09**	**0.11**
	3/06/2022	**Water**	**1.6**	**7.3**	<1	<1	<0.002	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.005	0[#1]	**0.02**	**0.05**	**0.04**	**0.01**	<0.01	<0.02	**0.05**	**0.06**
SW03	**17/05/2022**	**Water**	**5.7**	**7.2**	<1	<1	<0.002	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.005	0[#1]	**0.02**	**0.04**	**0.03**	<0.01	<0.01	<0.02	**0.03**	**0.04**
	27/05/2022	**Water**	**15**	**7.5**	<1	<1	<0.002	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.005	0[#1]	**0.02**	**0.07**	**0.05**	**0.02**	<0.01	<0.02	**0.07**	**0.09**
	3/06/2022	**Water**	**2.4**	**7.3**	<1	<1	<0.002	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.005	0[#1]	**0.02**	**0.04**	**0.03**	<0.01	<0.01	<0.02	**0.03**	**0.04**
SW04	**17/05/2022**	**Water**	**8.6**	**7.9**	<1	<1	<0.002	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.005	0[#1]	**0.02**	**0.05**	**0.03**	**0.01**	<0.01	<0.02	**0.05**	**0.07**
	27/05/2022	**Water**	**15**	**7.9**	<1	<1	<0.002	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.005	0[#1]	**0.01**	**0.04**	**0.02**	**0.01**	<0.01	<0.02	**0.04**	**0.05**
	3/06/2022	**Water**	**7.8**	**8.0**	<1	<1	<0.002	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.005	0[#1]	**0.02**	**0.04**	**0.03**	**0.01**	<0.01	<0.02	**0.04**	**0.06**
SW05	**17/05/2022**	**Water**	**16**	**7.8**	<1	<1	<0.002	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.005	0[#1]	**0.02**	**0.06**	**0.04**	**0.02**	<0.01	<0.02	**0.06**	**0.08**
	27/05/2022	**Water**	**13**	**7.8**	<1	<1	<0.002	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.005	0[#1]	<0.01	**0.03**	**0.03**	**0.01**	<0.01	<0.02	**0.04**	**0.04**
	3/06/2022	**Water**	**3.6**	**7.9**	<1	<1	<0.002	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.005	0[#1]	**0.02**	**0.05**	**0.03**	**0.02**	<0.01	<0.02	**0.04**	**0.06**
SW06	**17/05/2022**	**Water**	**5.4**	**7.3**	<1	<1	<0.002	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.005	0[#1]	**0.01**	**0.03**	**0.02**	<0.01	<0.01	<0.02	**0.02**	**0.03**
	27/05/2022	**Water**	**4.9**	**7.4**	<1	<1	<0.002	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.005	0[#1]	<0.01	**0.02**	**0.02**	<0.01	<0.01	<0.02	**0.02**	**0.02**
	3/06/2022	**Water**	**2.2**	**7.5**	<1	<1	<0.002	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.005	0[#1]	**0.01**	**0.02**	**0.01**	<0.01	<0.01	<0.02	**0.01**	**0.02**
SW07	**17/05/2022**	**Water**	**3.4**	**7.8**	<1	<1	<0.002	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.005	0[#1]	**0.02**	**0.05**	**0.03**	**0.02**	<0.01	<0.02	**0.05**	**0.06**
	27/05/2022	**Water**	**3.7**	**8.0**	<1	<1	<0.002	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.005	0[#1]	**0.01**	**0.04**	**0.02**	**0.01**	<0.01	<0.02	**0.04**	**0.05**
	3/06/2022	**Water**	**4.3**	**7.9**	<1	<1	<0.002	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.005	0[#1]	**0.01**	**0.03**	**0.02**	**0.01**	<0.01	<0.02	**0.03**	**0.04**
SW08	**17/05/2022**	**Water**	**7.4**	**7.2**	<1	<1	<0.002	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.005	0[#1]	**0.03**	**0.1**	**0.07**	**0.02**	<0.01	<0.02	**0.08**	**0.11**
	27/05/2022	**Water**	**19**	**7.4**	<1	<1	<0.002	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.005	0[#1]	**0.01**	**0.05**	**0.04**	<0.01	<0.01	<0.02	**0.04**	**0.05**
	3/06/2022	**Water**	**3.0**	**7.2**	<1	<1	<0.002	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.005	0[#1]	**0.02**	**0.06**	**0.04**	**0.01**	<0.01	<0.02	**0.05**	**0.07**
SW09	**27/05/2022**	**Water**	**2.1**	**8.1**	<1	<1	<0.002	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.005	0[#1]	**0.02**	**0.07**	**0.04**	**0.02**	<0.01	<0.02	**0.06**	**0.08**
	3/06/2022	**Water**	**3.5**	**8.1**	<1	<1	<0.002	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.005	0[#1]	**0.04**	**0.12**	**0.08**	**0.02**	<0.01	<0.02	**0.1**	**0.14**

Statistics

Number of Results	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**
Number of Detects	**26**	**26**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**26**	**24**	**26**	**26**	**19**	**0**	**0**	**26**	**26**
Minimum Concentration	**1.6**	**7**	**<1**	**<1**	**<0.002**	**<1**	**<1**	**<1**	**<1**	**<1**	**<1**	**<1**	**<1**	**<1**	**<1**	**<1**	**<1**	**<1**	**<0.005**	**0**	**0.01**	**0.02**	**0.01**	**0.01**	**<0.01**	**<0.02**	**0.01**	**0.02**
Minimum Detect	**1.6**	**7**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**0**	**0.01**	**0.02**	**0.01**	**0.01**	**ND**	**ND**	**0.01**	**0.02**
Maximum Concentration	**19**	**8.1**	**<1**	**<1**	**<0.002**	**<1**	**<1**	**<1**	**<1**	**<1**	**<1**	**<1**	**<1**	**<1**	**<1**	**<1**	**<1**	**<1**	**<0.005**	**0**	**0.04**	**0.15**	**0.13**	**0.02**	**<0.01**	**<0.02**	**0.14**	**0.17**
Maximum Detect	**19**	**8.1**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**0**	**0.04**	**0.15**	**0.13**	**0.02**	**ND**	**ND**	**0.14**	**0.17**
Average Concentration *	**6.5**	**7.6**	**0.5**	**0.5**	**0.001**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.0025**	**0**	**0.018**	**0.063**	**0.045**	**0.013**	**0.005**	**0.01**	**0.057**	**0.073**
Median Concentration *	**4.6**	**7.55**	**0.5**	**0.5**	**0.001**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.0025**	**0**	**0.02**	**0.05**	**0.035**	**0.01**	**0.005**	**0.01**	**0.05**	**0.06**
Standard Deviation *	**4.9**	**0.34**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.0082**	**0.036**	**0.03**	**0.0064**	**0**	**0**	**0.032**	**0.04**
95% UCL (Student's-t) *	**8.115**	**7.709**	**0.5**	**0.5**	**0.001**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.0025**	**0**	**0.0212**	**0.0751**	**0.0553**	**0.0146**	**0.005**	**0.01**	**0.0674**	**0.0865**
% of Detects	**100**	**100**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**100**	**92**	**100**	**100**	**73**	**0**	**0**	**100**	**100**
% of Non-Detects	**0**	**0**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**0**	**8**	**0**	**0**	**27**	**100**	**100**	**0**	**0**

* A Non Detect Multiplier of 0.5 has been applied.

Comments

#1 NIL (+)VE

Environmental Standards

ANZG, March 2021, ANZG (2018) Freshwater 90% LOSP Toxicant DGVs
ANZG, March 2021, ANZG (2018) Freshwater 95% LOSP Toxicant DGVs
ANZG, March 2021, ANZG (2018) Freshwater 99% LOSP Toxicant DGVs

CONTACT US

www.epicenvironmental.com.au
1800 779 363
enquiries@epicenvironmental.com.au

http://www.epicenvironmental.com.au/

Appendix C – Flora and Fauna Briefing Note

Briefing Note

To: Candice Somerville

E | candice.somerville@gamuda.com.au

Cc: Nathan Baker, Thomas Buchan

E | nbaker@umwelt.com.au, tbuchan@umwelt.com.au

From: Rachel Musgrave

Date: 13 January 2023

Purpose

This briefing note was prepared for Gamuda Australia Lang O'Rourke Consortium (GLC) to assess the impacts to biodiversity resulting from the installation of a pipeline to relocate the treated water discharge from Duck Creek to Duck River for the Sydney Metro West (SMW) – Western Tunnelling Package (WTP) project.

It specifically addresses impacts to biodiversity values for portions of the pipeline alignment outside of the approved Clyde Maintenance and Stabling Facility (MSF) construction site boundary that was assessed under *SSI-10038-Mod-2 The Sydney Metro West Westmead to The Bays and Sydney CBD – Modification 2 (Clyde Stabling and Maintenance Facility)*; and approved 3 June 2022 *(SSI-10038-Mod-2)*.

Outcomes/Key Messages

One (1) native plant community type (PCT) was identified within the study area for the proposed works, being PCT 4091 Grey Mangrove-River Mangrove Forest. This PCT does not conform to any threatened ecological communities (TECs) listed under the NSW *Biodiversity Conservation Act 2016* (BC Act) or Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). There will be no direct impacts (including trimming of vegetation) to this PCT as a result of the proposed works.

One (1) endangered ecological community (EEC) listed under the BC Act and EPBC Act (Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions) was identified within the study area. Impacts to this community have been avoided.

No threatened species listed under the BC Act or EPBC Act were identified in the study area, however detailed seasonal surveys were not undertaken. Due to the small area of vegetation and habitat impacted by the proposed works, it is unlikely that a significant impact on any threatened biota listed under the BC Act and EPBC Act would occur as a result of the proposed works.

Assessments of significance were not undertaken for any threatened flora or fauna species.

Inspired People.
Dedicated Team.
Quality Outcomes.

Umwelt (Australia) Pty Limited

ABN 18 059 519 041

T| 1300 793 267
E| info@umwelt.com.au

www.umwelt.com.au

In this document

1.0 Background

Umwelt (Australia) Pty Limited (Umwelt) was engaged by GLC to undertake a biodiversity assessment for the Clyde Water Treatment Plant (WTP) discharge route associated with the SMW – WTP (the Project). The proposed works are required to divert treated water from the Clyde MSF construction site through a purpose-built pipeline, which will discharge into Duck River. This technical memorandum documents an assessment of potential impacts from the proposed works on biodiversity values, with a focus on impacts to threatened biota listed under the BC Act and EPBC Act.

1.1 The Proposed Works

The proposal includes a change to the location of the treated water discharge and the method for delivery of the treated water. Treated water will be discharged directly to Duck River via a purpose-built pipeline rather than discharge to Duck Creek via stormwater infrastructure as described by the *Sydney Metro West - Westmead to The Bays and Sydney CBD (Concept and Stage 1) Environmental Impact Statement* (EIS, 15 April 2020). Work will include:

- Installation of 2 x 200 millimetre (mm) diameter high density polyethylene (HDPE) pipes from the Primary WTP to discharge to Duck River.
- Installation of 1 x 160 mm diameter HDPE pipe to be used by the follow-on contractor. The WTP that will discharge to this pipeline is not the subject of this Consistency Assessment and will be addressed separately through the GLC Environmental Protection Licence (EPL).
- Installation of pipework to deliver construction water from Clyde MSF back to the Primary WTP and recycled water from the Primary WTP to Clyde MSF for reuse on site.
- Pipework will generally be above-ground, and will be supported by precast concrete blocks approximately 600 x 600 x 1200 mm long, installed at approximately 1.3-meter (m) spacings
- Crossing of Duck Creek will be via an existing Sydney Water aqueduct.
- The pipework will generally be within the EIS construction site except for:
    - Shirley Street - approximately 70 m from the southeast corner of the Rosehill site to the Sydney Water aqueduct. Installation of the underground pipework along Shirley Street will involve the excavation of a trench approximately 1 m wide and 800 mm deep, and will be undertaken within the mulched road verge.
    - Transport for NSW (TfNSW) – approximately 200 m from the south tip of the Clyde MSF site to Duck River. Construction in this location will require a disturbance width of 3 m to provide an access track for pipeline installation and maintenance.
- Minor trench excavation along Shirly Street (as described above) and between the edge of the M4 and the Duck River embankment. Pipework will be below ground in these sections to reduce infrastructure in public areas.
- Discharge to Duck River via diffuser pipes.

No additional clearing will be required for pipeline installation within the construction site boundaries.

Outside the approved construction site boundary the pipeline route will be constructed to avoid clearance or trimming of mangroves. Despite efforts to avoid impacts to native vegetation, some minor trimming of overhanging branches, including those on canopy species such as Eucalypts may be required.

The track to facilitate the construction of the pipeline and ongoing maintenance between the southern end of the Clyde MSF site and Duck River will be approximately 3 m in width and will follow the flattest contour between the M4 and Duck Creek embankments. Earthworks will be required to establish a suitable access track for the installation of the discharge route as well as the future inspection and maintenance regime. The track will follow the existing ground surface with minor trimming to establish a suitable grade and crossfall on the track. If poor ground is encountered along the route, removal of approximately 300 mm of the ground surface and replacement with a suitable material may be required.

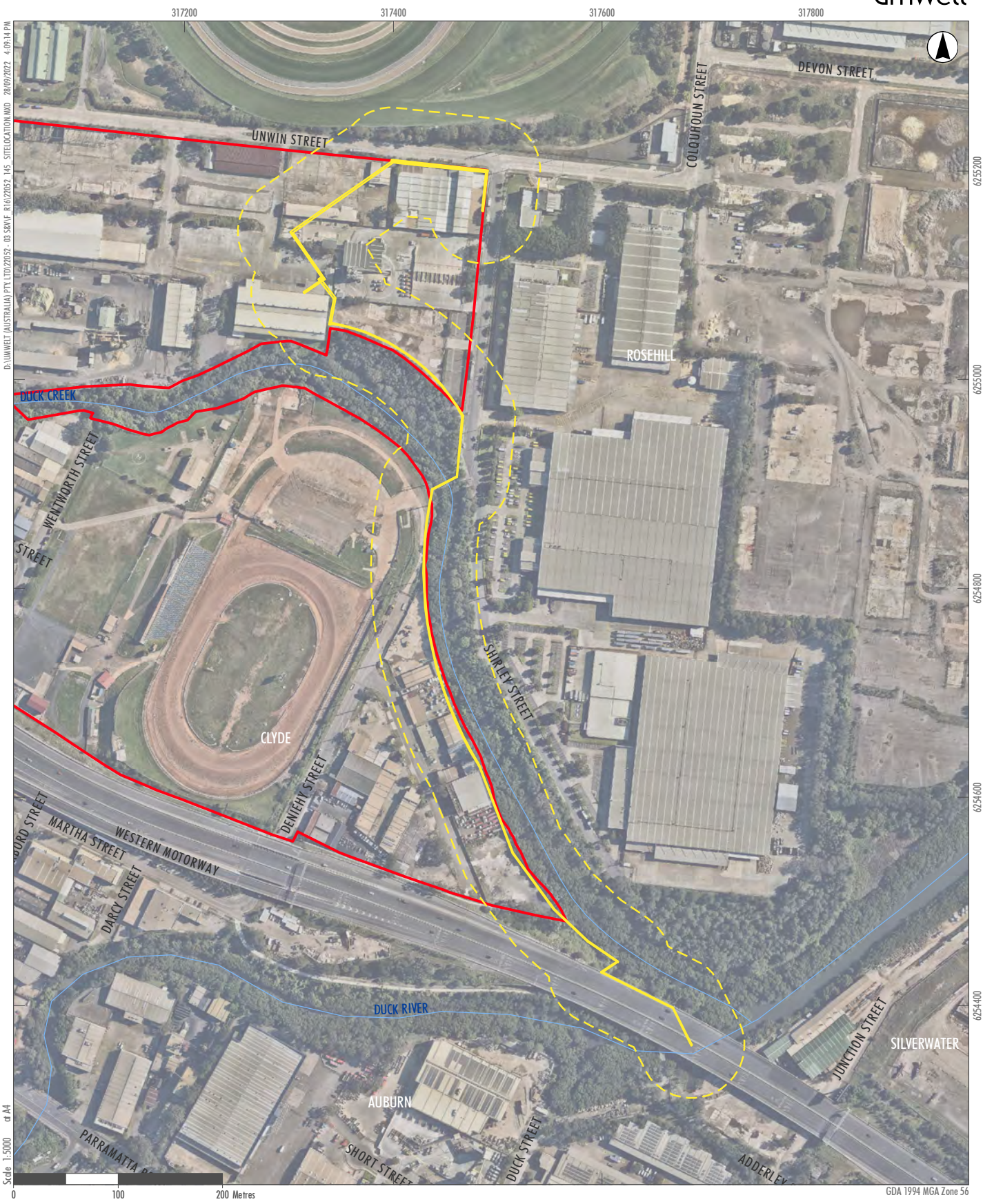
1.2 Locality

The proposal site is located within the City of Parramatta Local Government Area (LGA), approximately between 17 kilometres (km) west of the Sydney Central Business District (CBD).

The majority of the works are situated within the Clyde MSF construction site boundary such that this assessment specifically addresses impacts to biodiversity values for portions of the pipeline alignment outside of the approved boundary.

A biodiversity study area was determined to capture all potential direct and indirect impacts caused by the proposed works and was established by buffering the proposed pipeline route by 50 metres.

The approved Clyde MSF construction site boundary, proposed pipeline route, study area and other features relevant to this assessment are shown in **Figure 1.1**.



D:\UMWELT (AUSTRALIA) PTY LTD\22052 - 03 S&V\F_R16\22052_145_SITELOCATION.MXD 28/09/2022 4:09:14 PM

Scale 1:5000 at A4

Legend

- Approved Surface Construction Boundary
- Study Area
- CSMF Pipeline Route
- Drainage Line

FIGURE 1.1

Site Location

Image Source: Nearmap (August 2022) Data source: DFSI (2021)

2.0 Assessment Methodology

A high-level desktop assessment and subsequent site inspection was undertaken on 25 August 2022 to assess the existing environment of the site. Further details are provided in the sections below.

The full set of Project approvals documentation was considered but was not directly relevant to the biodiversity assessment documented in this technical memorandum. Similarly, additional biodiversity matters relating to the Clyde MSF site are addressed in SSI-10038-Mod-2 but again, they are not directly relevant to this biodiversity assessment. The key reference item within the overall Project approvals documentation (i.e. beyond public databases etc) was therefore the Biodiversity Development Assessment Report (BDAR) (Jacobs, 2020) that was prepared to support the EIS.

2.1 Desktop Assessment

A review of relevant public databases and literature was undertaken in August 2022 to identify threatened and migratory species, endangered populations, TECs and their habitats that have previously been recorded within the locality. For this purpose, a 10 km radius around the study area was applied. Threatened species, migratory species, endangered populations and TECs (listed under the BC Act, NSW *Fisheries Management Act 1994* (FM Act) and the EPBC Act) that have the potential to occur within the locality were also considered based on the type of habitat present and the NSW bioregion within which the study area occurs.

Databases and literature reviewed as part of this assessment include:

- A search of the Department of Planning and Environment (DPE) BioNet Atlas based on a 10 km radius around the site.
- A search of the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) Protected Matters Search Tool (PMST) based on a 10 km radius around the study area.
- A search of the BioNet Threatened Biodiversity Data Collection (TBDC).
- A search of the Biodiversity Values Map Threshold Tool (BVMTT).
- A search of the NSW eSPADE spatial viewer.
- A search of the National Flying-fox monitoring viewer accessed by the DCCEEW Interactive Flying-fox Web Viewer.
- A search of the NSW Spatial Services Historical Imagery Viewer Portal.

2.2 Vegetation Mapping

The following sets of regional vegetation mapping were reviewed to inform the assessment of the vegetation communities present within the study area:

- The NSW State Vegetation Type Map (SVTM), 2022 (DPE, 2022).
- Native Vegetation of the Sydney Metropolitan Area – Version 3.1, 2016. VIS_ID 4489 (OEH, 2016).

Additionally, the findings of the BDAR (Jacobs, 2020), as prepared to support the EIS for the Project, were also considered for the assessment of vegetation communities.

2.3 Site Visit

A site visit was conducted on 25 August 2022. An Umwelt ecologist inspected the site to record observations of any threatened and/or migratory species, endangered populations, TECs and any other ecological features that had the potential to be impacted. All investigations were limited to the extent of the study area**.**

Rapid data assessments to record the flora species occurring in the areas of the study area were conducted at points using random meanders as described by Cropper (1993). Six rapid data assessments were undertaken to capture the structural variation in vegetation communities, the variation in species diversity across the study area and to define changes in abiotic conditions (the occurrence of creek lines and past disturbances). The rapid data assessments recorded the dominant species present, the frequency of their occurrence (common, uncommon, or rare) and their status as either threatened, native or non-native (to the Sydney Basin Bioregion).

The presence of fauna habitat within the study area was also assessed. Specific attention was paid to the potential occurrence of hollow bearing trees, course woody debris, semi-permanent waterbodies and structures with the potential to support bat roosts.

2.4 Limitations

Field surveys were conducted over one day in August 2022. In addition to the surveys undertaken, the full spectrum of flora and fauna species and ecological processes likely to occur on the study area were considered by identifying potential habitats for such species and assessing the potential for these species to occur on the study area based on previous records, the type and condition of habitats present, the land use of the study area and its landscape context.

As stated by the DEC (2004a):

> '*The absence of a species from survey data does not necessarily mean it does not inhabit the survey area. It may simply mean that the species was not detected at that time with the survey method adopted and the prevailing seasonal or climatic conditions.'*

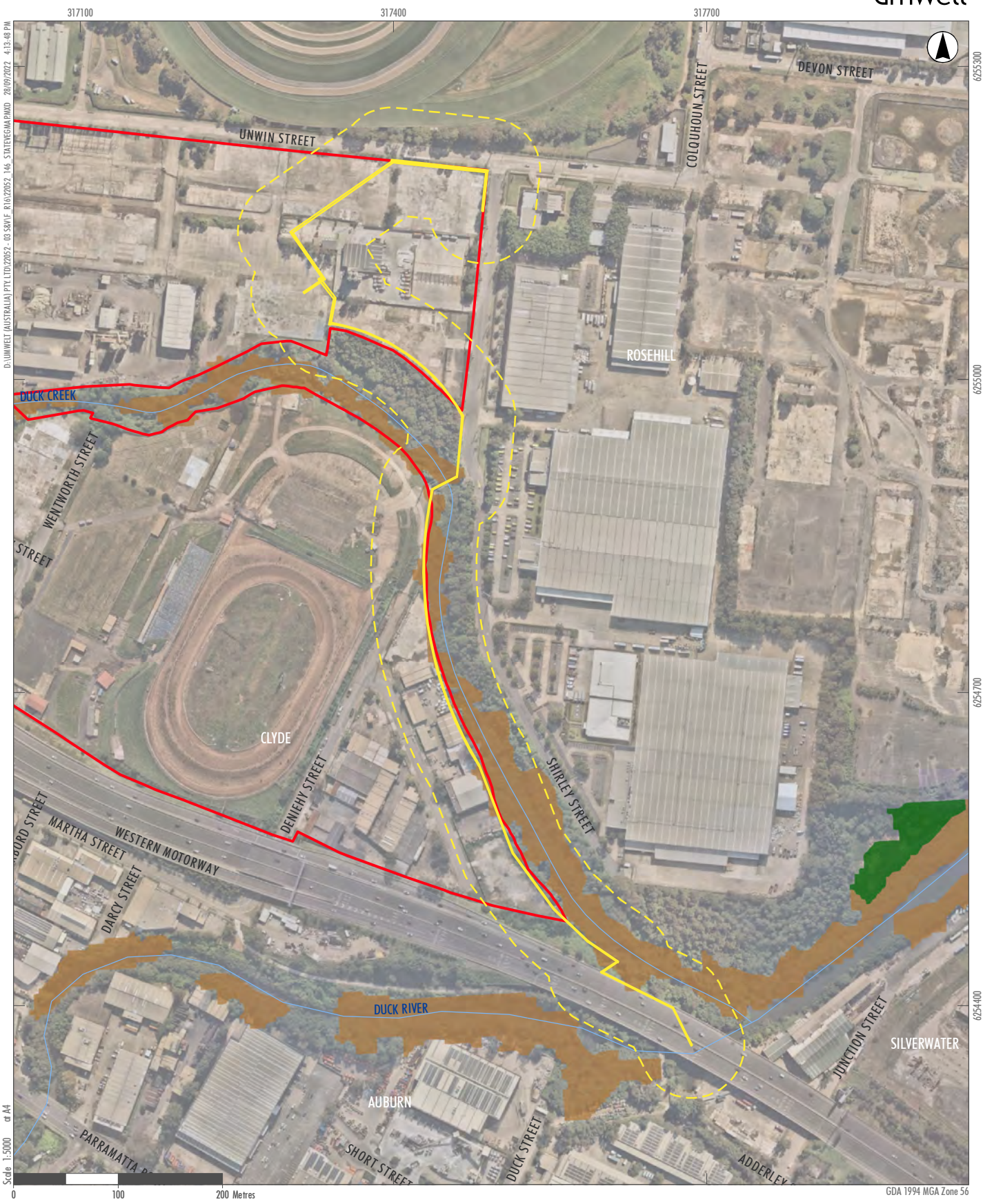
Accordingly, the relative brevity of the survey and its timing mean that the full spectrum of flora and fauna species, as well as ecological processes, likely to occur on the subject study area may not be fully quantified or described in this report.

3.0 Results

3.1 Vegetation Communities

3.1.1 Review of Regional Mapping

The NSW State vegetation map (DPE 2022), VIS 4489 vegetation mapping (OEH, 2016) and BDAR (Jacobs, 2020) identified several patches of PCTs along the riparian zones of Duck Creek. The approved Clyde MSF construction site boundary, proposed pipeline route, study area and State vegetation map (DPE 2022) are shown in **Figure 3.1** below. Since the preparation of the EIS, several PCTs have been replaced by a new type and is now a 'Decommissioned PCT'. For the purpose of this assessment, the most recent PCT classifications were used.



Legend

- Approved Surface Construction Boundary
- Study Area
- CSMF Pipeline Route
- Drainage Line

Native Vegetation

- PCT : 4091, Grey Mangrove-River Mangrove Forest
- PCT : 4097, Samphire Saltmarsh

FIGURE 3.1

State Vegetation Mapping (DPE 2022)

Image Source: Nearmap (April 2022) Data source: DFSI (2021)

Three PCTs are mapped in the study area and downstream of the study area on the banks of Duck River as described in **Table 3.1**. PCT 4091 Grey Mangrove-River Mangrove Forest is mapped as the dominant vegetation type along Duck Creek.

Table 3.1 Mapped PCTs within the Study Area

PCT	Decommissioned PCT used in the BDAR (Jacobs, 2020)	BC Act	EPBC Act	Location in the study area
4091 Grey Mangrove-River Mangrove Forest	PCT 920 Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	N/A	N/A	Mapped on the eastern and western banks of Duck Creek
4097 Samphire Saltmarsh	1126 Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions Endangered Ecological Community (EEC)	Subtropical and Temperate Coastal Saltmarsh Vulnerable Ecological community (VEC)	Mapped approximately 200 m north-east of the study area on the western edge of Duck River
4028 Estuarine Swamp Oak Twig-rush Forest	1234 Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions EEC	Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland ecological community EEC	Mapped approximately 400 m north-east of the study area on the western edge of Duck River

3.1.2 Soil Landscape

The *Soil Landscapes of the Sydney 1:100,000 Sheet* (Chapman *et al*., 2009) mapped the study area as 'Disturbed Terrain' soil landscape. The areas included in this soil landscape are often previous swamps, estuaries and wetlands that have been subject to land modification. The geology is mostly artificial fill and comprises dredged estuarine sand and mud, demolition rubble, industrial, household waste, rocks and local soil materials. The vegetation within this soil landscape is mostly cleared land covered with opportunist weeds such as Cobbler's peg (*Bidens pilosa*), Purple top (*Verbena bonariensis*), Ribwort (*Plantago lanceolata*), Kikuyu (*Cenchrus clandestinus*), Couch (*Cynodon dactylon*) and Paspalum (*Paspalum dilatatum*).

3.1.3 Biodiversity Values Map

Duck Creek and Duck River are mapped as 'Coastal Management Act – Wetlands' and Ducks River is mapped as 'Threatened species or communities with potential for serious and irreversible impacts' on the BVMTT as shown in **Figure 3.2** below. This area is considered important habitat for specific migratory shorebirds listed under both the BC Act and EPBC Act. A number of these migratory shorebirds, including Curlew Sandpiper (*Calidris ferruginea*) are considered entities where impacts to areas of mapped important habitat have the potential to be serious and irreversible (SAII).

3.1.4 Coastal Management Area

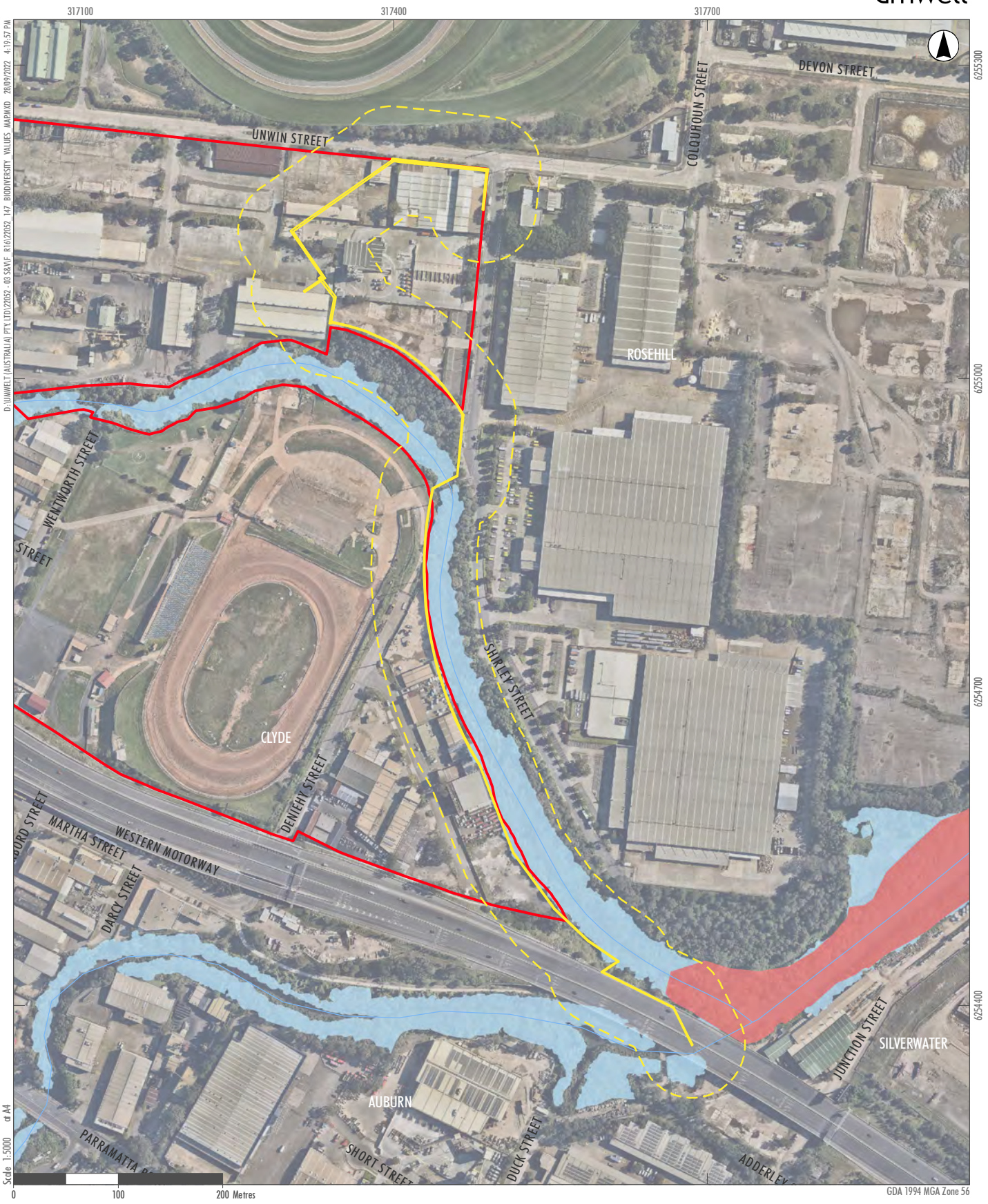
The riparian zone along Duck Creek and Duck River is mapped as 'Coastal Wetlands' and 'Proximity Area for Coastal Wetlands' on the *State Environmental Planning Policy (Resilience and Hazards) 2021* Coastal Management map layer.

3.1.5 Historical Aerial Imagery

A review of the NSW Spatial Services Historical Imagery Viewer was undertaken to understand the history of the study area and surrounding native vegetation communities. The landscape around the study area was generally cleared for industrial and recreational use since the 1970s, with high degrees of disturbance evident since the 1940s.

Remnant vegetation is consistently visible along the riparian zones of Duck Creek and Duck River with clearance events in the broader landscape visible in the 1955, 1970, 1986 historic aerials. It appears that native vegetation has been re-established in the land adjoining the riparian corridors of Duck Creek and Duck River between 2006 and 2022.

Refer to **Figure 3.3** to **Figure 3.6** below for the changes in landscape since the 1940s.



Legend

- Approved Surface Construction Boundary
- Study Area
- CSMF Pipeline Route
- Drainage Line

Biodiversity Values

- Coastal Management Act - Wetlands
- Threatened species or communities with potential for serious and irreversible impacts

FIGURE 3.2

Biodiversity Values Map

Image Source: Nearmap (August 2022) Data source: DFSI (2021)

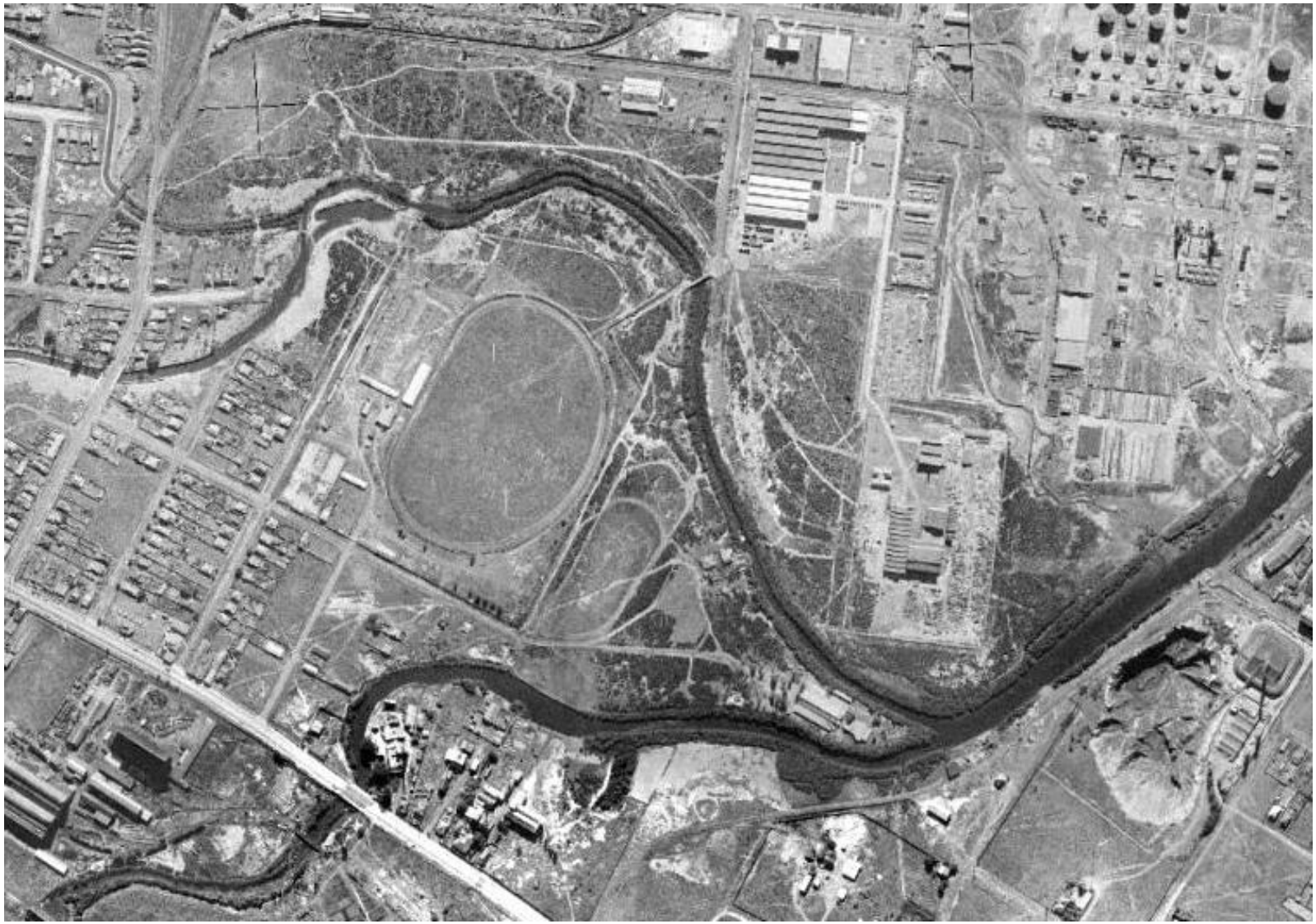


Figure 3.3 Aerial Imagery from 1943

Figure 3.4 Aerial Imagery from 1970

Figure 3.5 Aerial Imagery from 2006

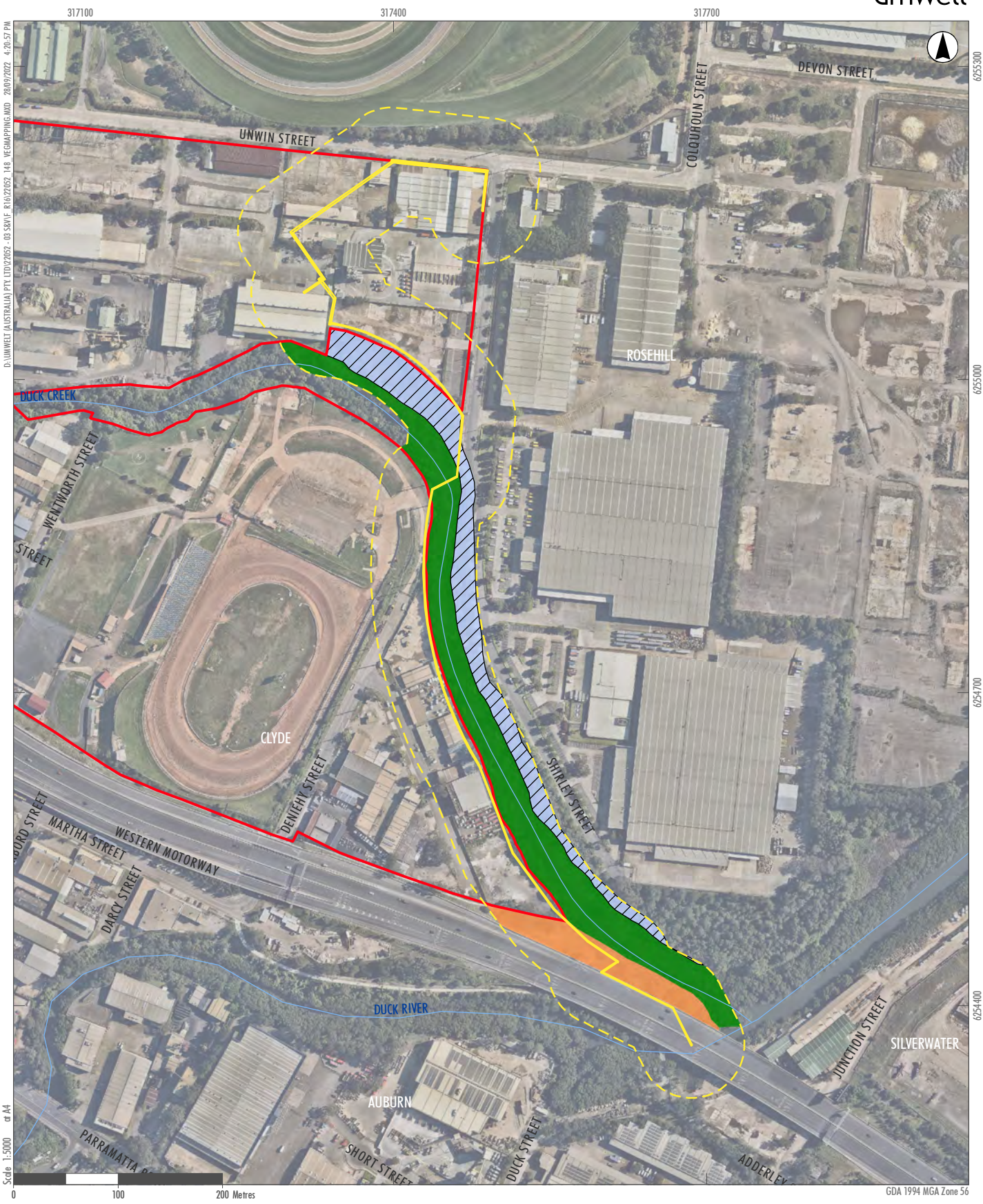
Figure 3.6 Aerial Imagery from 2022

3.1.6 Site Visit

The site visit identified two native PCTs in the study area as described in **Table 3.2**. Refer to **Figure 3.7** for the indicative location of these vegetation communities. A full list of the species recorded during the site visit is presented in Attachment B. One PCT identified during the desktop assessment, PCT 4097 Samphire Saltmarsh, was not recorded in the study area during the site visit.

Table 3.2 Plant Community Types within the Study Area

PCT	Decommissioned PCT used in the BDAR (Jacobs, 2020)	BC Act	EPBC Act	Description	Area in the study area (ha)
4091 Grey Mangrove-River Mangrove Forest	PCT 920 Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	NA	NA	This vegetation community comprises a homogeneous stand of Grey Mangrove (*Avicennia marina)* on the tidal flats of Duck Creek. Ground layer is sparse to absent with some saltmarsh species colonising the banks of the Creek.	2.27 ha
4028 Estuarine Swamp Oak Twig-rush Forest	1234 Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions EEC	Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland ecological community EEC	The vegetation in the northern portion of the study area along Shirley Street near Duck Creek comprises a stand of planted vegetation. The canopy is dominated by Swamp She-Oak (*Casuarina glauca), Pittosporum undulatum, Eucalyptus* spp. and *Melaleuca* spp. This vegetation type has a high degree of exotic cover with a large infestation of Balloon vine (*Cardiospermum grandiflorum*) visible from Shirley Street.	1.28 ha
Exotic grassland	N/A	N/A	N/A	This vegetation community is located in the southern portion of the alignment, on the northern side of the M4 highway. The vegetation comprises mostly exotic species including Lantana (*Lantana camara*), Madeira Vine (*Anredera cordifolia*), Balloon vine (*Cardiospermum grandiflorum*), Pellitory (*Parietaria judaica*), Cobbler's peg (*Bidens pilosa*), and Paddy's Lucerne (*Sida rhombifolia*).	0.51 ha



Legend

- Approved Surface Construction Boundary
- Study Area
- CSMF Pipeline Route
- Drainage Line

EEC Vegetation listed under the BC and EPBC Act

- Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions

Vegetation Mapping

- PCT : 4028, Estuarine Swamp Oak Twig-rush Forest
- PCT : 4091, Grey Mangrove-River Mangrove Forest
- Exotic vegetation

FIGURE 3.7

Vegetation Mapping

Image Source: Nearmap (August 2022) Data source: DFSI (2021)

3.2 Threatened Species

3.2.1 Threatened Flora

The desktop assessment identified 34 threatened flora species and two endangered flora populations that have been previously recorded in or have the potential to occur in the study area (Attachment A). Of these, five were identified as having a moderate or higher likelihood of occurring within the study area based on known habitat preference and distribution as identified in **Table 3.3**. The potential habitat for these species and population was assessed as part of the site visit.

Table 3.3 Threatened Flora with a Moderate or Higher Likelihood of Occurring Within the Study Area

Common Name	Scientific Name	BC Act	EPBC Act	Likelihood of occurrence
Acacia pubescens	Downy Wattle	V	V	Moderate
Persicaria elatior	*Knotweed, Tall Knotweed*	-	V	Moderate
Wahlenbergia multicaulis	Tadgell's Bluebell in the local government areas of Auburn, Bankstown, Baulkham Hills, Canterbury, Hornsby, Parramatta and Strathfield	EP	-	Moderate
Wilsonia backhousei	Narrow-leafed Wilsonia	V	-	Moderate
Zannichellia palustris		E	-	Moderate

V = Vulnerable
E = Endangered
EP = Endangered Population

3.2.2 Threatened Fauna

No threatened fauna species listed under the BC Act or EPBC Act were recorded in the study area during the site investigation. The desktop assessment identified 46 threatened fauna species and one threatened fauna populations that have been previously recorded in or have the potential to occur in the study area (Attachment A). Of these, seven were identified as having a moderate or higher likelihood of occurring within the study area based on known habitat preference and distribution **Table 3.4.**

Table 3.4 Threatened Fauna with a Moderate or Higher Likelihood of Occurring Within the Study Area

Common Name	Scientific Name	BC Act	EPBC Act	Likelihood of occurrence
Aves				
Australian Fairy Tern	*Sternula nereis nereis*	-	V	Moderate
White-fronted Chat	*Epthianura albifrons*	V,EP		Moderate
Mammals				
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	V	-	Moderate
Greater Broad-nosed Bat	*Scoteanax rueppellii*	V	-	Moderate
Grey-headed Flying-fox	*Pteropus poliocephalus*	V	V	High
Southern Myotis	*Myotis macropus*	V	-	High
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	V	-	Moderate

V = Vulnerable
EP = Endangered Population

3.2.3 Grey-headed Flying Fox Camps

Three Grey-headed Flying Fox camps were identified within 10 kms of the study area, including:

- Clyde (234) – located approximately one kms south of the study area.
- Parramatta Park 1 (134) – located approximately 3.6 kms west of the study area.
- Gladesville (481) – located approximately nine kms east of the study area.

The study area contains potential foraging habitat for the Grey-headed Flying Fox roosting at nearby camps. The Grey-headed flying fox has been observed foraging on the fruit of the Grey mangrove (*Avicennia marina)* (Eby and Law 2008). It is considered unlikely that the patch of Grey Mangrove in the study area would comprise important habitat for the local population of Grey-headed Flying fox, as previous studies on the foraging preferences of the species concluded that they predominately foraging on the nectar and pollen of species from the genus *Ficus, Eucalyptus, Corymbia, Angophora, Melaleuca*, *Syzygium* and *Banksia* (Eby and Law 2008, DAWE 2021).

3.2.4 Tree Hollows and Log Habitat

No tree hollows or log habitat were recorded within the study area during the site visit. No tree hollows or log habitat are expected to be disturbed as part of the proposed works.

3.2.5 Migratory Species

The desktop assessment identified 46 migratory fauna species that have been previously recorded in or have the potential to occur in the study area (Attachment A). Of these, 11 species were considered to have broadly suitable habitat within the study area, with the species listed in **Table 3.5.** These species may forage and move through the vegetation within the study area – as well as the airspace above it – as they migrate up and down the coast.

Table 3.5 Migratory Species with a Moderate or Higher Likelihood of Occurring Within the Study Area

Common Name	Scientific Name	BC Act	EPBC Act	Likelihood of Occurrence
Bar-tailed Godwit	*Limosa lapponica*	-	C,J,K	Moderate
Caspian Tern	*Hydroprogne caspia*	-	J	Moderate
Common Greenshank	*Tringa nebularia*	-	C,J,K	Moderate
Common Sandpiper	*Actitis hypoleucos*	-	C,J,K	Moderate
Curlew Sandpiper	*Calidris ferruginea*	E	CE,C,J,K	Moderate
Great Knot	*Calidris tenuirostris*	V	CE,C,J,K	Moderate
Latham's Snipe	*Gallinago hardwickii*	-	J,K	Moderate
Pectoral Sandpiper	*Calidris melanotos*	-	J,K	Moderate
Sharp-tailed Sandpiper	*Calidris acuminata*	-	C,J,K	Moderate
Terek Sandpiper	*Xenus cinereus*	V	C,J,K	Moderate
Yellow Wagtail	*Motacilla flava*	-	C,J,K	Moderate
V = Vulnerable E = Endangered EP = Endangered Population CE = Critically Endangered	C = CAMBA J = Jamba R = ROKAMBA			

4.0 Potential Impacts

4.1 Direct Impacts

4.1.1 Vegetation Removal/Trimming

No tree removal is required as part of the proposed works. There may be minor trimming of overhanging branches from surrounding street trees where necessary, which will not involve the complete clearing of the individual plant. There will be no trimming of mangroves within PCT 4091 as discussed in **Section 1.1.**

As such, there will be no impact to PCT 4091 should vegetation trimming of surrounding street trees be required.

4.2 Ground Disturbances

The proposed works will require minor trenching for the installation of pipes within the exotic grassland in the southern portion of the proposal site. The study area is located in a modified landscape, which includes paved pedestrian pathways, industrial land and cleared exotic vegetation. The ground stratum will be disturbed during the proposed works, including through the movement of vehicles on unpaved surfaces and excavation works.

4.3 Indirect Impacts

The proposed works have the potential to indirectly impact the biodiversity occurring within the study area. These indirect impacts and a description of how they may impact the biodiversity present in the study area are outlined in **Table 4.2**.

Table 4.2 Indirect Impacts to Biodiversity

Indirect impact	Explanation	Affected biodiversity
Erosion	Ground disturbing works may lead to erosion in adjacent areas. This may come as a result from trenching works.	All vegetation communities within the study area.
Spread of weeds and exotic species	The movement of machinery and people have the potential to spread invasive weeds.	All vegetation communities within the study area.
Spread of pathogens and disease	Soil borne pathogens with the potential to infect plants e.g., *Phytophthora cinnamomi*, may be mobilised by the proposed works.	All vegetation communities within the study area. Potentially vegetation occurring outside of the study area.
Noise and vibration	The proposed works would temporarily alter the noise environment within the study area.	The flying patterns and foraging/hunting behaviour of the and microbats may be altered if construction activities are to occur at night.
Changes to the light environment	The proposed works will be undertaken during the day. If any works are required to occur at night, there is potential to alter the light environment within the study area.	The flying patterns and foraging/hunting behaviour of the grey-headed flying-Fox, nocturnal birds, and microbats may be altered if construction activities are to occur at night

4.4 Habitat Connectivity

The proposed works would form a small gap in the vegetated riparian corridor. Due to the small size of the gap, the proposed works are unlikely to impede movement of fauna or prevent seed dispersal or pollination through the corridor or adjoining areas of habitat in the landscape.

5.0 Mitigation Measures

Mitigation measures and safeguards to avoid and minimise the impacts of the proposed works on the biodiversity values identified in the study area are detailed in **Table 5.1** below. The proposed mitigation measures are consistent with those detailed within the Flora and Fauna Management Plan for the Clyde MSF site.

Table 5.1 Mitigation Measures

Impact	Mitigation	Timing
Trimming of vegetation	Minimised during site works, specifically attempting to avoid setting up near native vegetation where possible.	Detailed design
	Establishment of exclusion zones.	Prior to and during the proposed works
Impacts to threatened species	A no-go zone should be placed around any potential Grey Mangrove-River Mangrove Forest within the study area to avoid unintended disturbance during proposed works.	Prior to and during proposed works
Spread of pathogens and disease	Hygiene controls for all vehicles, equipment and people working in the study area.	During proposed works
	Machinery will be washed following best practice hygiene protocols prior to being brought to site to prevent the spread of weeds, seeds, pathogens and fungi.	Prior to proposed works
Spread of weeds and exotic species	Hygiene controls for all vehicles, equipment and people working in the study area.	During proposed works
	All weed material removed will be disposed of in a suitable waste facility and not mulched on site. This is to avoid the reintroduction and further spread of weeds in the area.	During proposed works
	Machinery will be washed following best practice hygiene protocols prior to being brought to site to prevent the spread of weeds, seeds, pathogens and fungi (DPIE, 2020)	Prior to proposed works
Edge effects	Establishment of trimming limits and exclusion zones.	During proposed works
Erosion	Establishment of appropriate erosion and sediment controls.	During proposed works

6.0 Conclusion

This technical memorandum documents an assessment of potential impacts to biodiversity resulting from the installation of a pipeline to relocate the treated water discharge from Duck Creek to Duck River for the SMW – WTP project. The proposed works as detailed in **Section 1.1** include installation of above ground pipework along the northern portions of the alignment, with some minor trench excavation for below ground pipework between the edge of the M4 and the Duck River embankment.

A site visit was conducted on the 25 August 2022 to inform the assessment of biodiversity values present onsite and to determine the occurrence of any threatened biodiversity that may be impacted by the proposed works. A patch of PCT 4091 Grey Mangrove-River Mangrove Forest was identified within the study area and within the proposed works footprint. There will be no impacts to PCT 4091 as there will be

no removal or trimming of mangroves. There may be trimming of overhanging branches from nearby street trees and canopy species such as Eucalypts, however this will not involve the complete clearing of the individual plant. Areas of exotic vegetation will also be impacted for the creation of an access track and minor trenching works. Indirect impacts in the context of the PCT 4091 and exotic vegetation under assessment are not considered significant and will be further minimised with the implementation of the mitigation documented in **Section 5.0** of this technical memorandum.

No other significant impacts to biodiversity or threatened species habitat have been identified as likely to occur as a result of the proposed works. As such no assessment of significance has been prepared to assess the impacts of the proposed works.

7.0 References

DAWE (2021) National Recovery Plan for the Grey-headed Flying-fox '*Pteropus poliocephalus'*, Department of Agriculture, Water and the Environment, Canberra, March. CC BY 4.0.

DPE (2022) NSW State Vegetation Type Map. Department of Planning and Environment.

DPIE (2020) Hygiene guidelines Protocols to protect priority biodiversity areas in NSW from *Phytophthora cinnamomi*, myrtle rust, amphibian chytrid fungus and invasive plants. NSW and Department of Planning, Industry and Environment.

Eby, P. and Law, B. (2008). Ranking the feeding habitats of Grey-headed Flying-foxes for conservation management. A report for a report for The Department of Environment and Climate Change and Water (NSW) & The Department of Environment, Water, Heritage and the Arts.

Chapman G.A., Murphy C.L., Tille P.J., Atkinson G. and Morse R.J. (2009). Soil Landscapes of the Sydney 1:100,000 Sheet.

Cropper, S. C. (1993). Management of endangered plants Department of Agriculture, Water and the Environment , CSIRO, East Melbourne.

Jacobs (2020). Westmead to The Bays and Sydney CBD - Environmental Impact Statement Concept and Stage 1 - Technical Paper 10 Biodiversity development assessment report.

OEH (2016) Native Vegetation of the Sydney Metropolitan Area - Version 3.1, 2016. VIS_ID 4489. NSW Office of Environment and Heritage, Sydney.

Attachment A Likelihood of Occurrence Table

Likelihood	Criteria
Recorded	The species was observed in the study area during the current survey.
High	It is highly likely that a species inhabits the study area and is dependent on identified suitable habitat (i.e. for breeding or important life cycle periods such as winter flowering resources), has been recorded recently in the locality (10km) and is known or likely to maintain resident populations in the study area. Also includes species known or likely to visit the study area during regular seasonal movements or migration.
Moderate	Potential habitat is present in the study area. Species unlikely to maintain sedentary populations, however may seasonally use resources within the study area opportunistically or during migration. The species is unlikely to be dependent (i.e. for breeding or important life cycle periods such as winter flowering resources) on habitat within the study area, or habitat is in a modified or degraded state. Includes cryptic flowering flora species that were not seasonally targeted by surveys and that have not been recorded.
Low	It is unlikely that the species inhabits the study area and has not been recorded recently in the locality (10km). It may be an occasional visitor, but habitat similar to the study area is widely distributed in the local area, meaning that the species is not dependent (i.e. for breeding or important life cycle periods such as winter flowering resources) on available habitat. Specific habitat is not present in the study area or the species are a non-cryptic perennial flora species that were specifically targeted by surveys and not recorded.
None	Suitable habitat is absent from the study area.

Habitat Assessment Table – Threatened Flora

Scientific name	Common Name	BC Act	EPBC Act	Source	Habitat Preference	Likelihood of occurrence
Acacia bynoeana	Bynoe's Wattle, Tiny Wattle	-	V	PMST	Bynoe's wattle is found in central eastern NSW, from the Hunter District (Morisset) south to the Southern Highlands and west to the Blue Mountains. Occurs in heath or dry sclerophyll forest on sandy soils. Seems to prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches.	None. Suitable habitat is absent from the study area.
Acacia pubescens	Downy Wattle	V	V	Bionet, PMST	Concentrated around the Bankstown-Fairfield-Rookwood area and the Pitt Town area. Occurs on alluviums, shales and at the intergrade between shales and sandstones. Occurs in open woodland and forest, in a variety of plant communities, including Cooks River/Castlereagh Ironbark Forest, Shale/Gravel Transition Forest and Cumberland Plain Woodland.	Moderate. This species is known to grow on disturbed land.
Allocasuarina glareicola	*Allocasuarina glareicola*	-	E	PMST	Primarily restricted to the Richmond (NW Cumberland Plain) district. Grows in Castlereagh woodland on lateritic soil.	None. Suitable habitat is absent from the study area.
Caladenia tessellata	Thick-lipped Spider-orchid, Daddy Long-legs	-	V	PMST	The Thick Lip Spider Orchid is known from the Sydney area (old records), Wyong, Ulladulla and Braidwood in NSW. Generally found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil.	None. Suitable habitat is absent from the study area.
Callistemon linearifolius	Netted Bottle Brush	V	-	Bionet	Recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW. Grows in dry sclerophyll forest on the coast and adjacent ranges.	None. Suitable habitat is absent from the study area.
Cryptostylis hunteriana	Leafless Tongue-orchid	V	V	PMST	The Leafless Tongue Orchid has been recorded from as far north as Gibraltar Range National Park south into Victoria around the coast as far as Orbost. It is known historically from a number of localities on the NSW south coast and has been observed in recent years at many sites between Batemans Bay and Nowra (although it is uncommon at all sites). Does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland.	None. Suitable habitat is absent from the study area.

Scientific name	Common Name	BC Act	EPBC Act	Source	Habitat Preference	Likelihood of occurrence
Darwinia biflora	*Darwinia biflora*	V	V	PMST	Recorded in Ku-ring-gai, Hornsby, Baulkham Hills and Ryde local government areas. Occurs on the edges of weathered shale-capped ridges, where these intergrade with Hawkesbury Sandstone.	None. Suitable habitat is absent from the study area.
Dillwynia tenuifolia	*Dillwynia tenuifolia*	V	-	Bionet	The core distribution is the Cumberland Plain from Windsor and Penrith east to Dean Park near Colebee. In western Sydney, may be locally abundant particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays.	None. Suitable habitat is absent from the study area.
Epacris purpurascens var. purpurascens	*Epacris purpurascens var. purpurascens*	V	-	Bionet	Recorded from Gosford in the north, to Narrabeen in the east, Silverdale in the west and Avon Dam vicinity in the South. Found in a range of habitat types, most of which have a strong shale soil influence.	None. Suitable habitat is absent from the study area.
Eucalyptus nicholii	Narrow-leaved Black Peppermint	V	V	Bionet	This species is sparsely distributed but widespread on the New England Tablelands from Nundle to north of Tenterfield, being most common in central portions of its range. Typically grows in dry grassy woodland, on shallow soils of slopes and ridges. Found primarily on infertile soils derived from granite or metasedimentary rock.	None. Suitable habitat is absent from the study area.
Eucalyptus scoparia	Wallangarra White Gum	E	V	Bionet	In NSW it is known from only three locations near Tenterfield, including Bald Rock National Park. Found in open eucalypt forest, woodland and heaths on well-drained granite/rhyolite hilltops, slopes and rocky outcrops, typically at high altitudes.	None. Suitable habitat is absent from the study area.
Genoplesium baueri	Yellow Gnat-orchid, Bauer's Midge Orchid, Brittle Midge Orchid	E	E	PMST	The species has been recorded from locations between Ulladulla and Port Stephens. Grows in dry sclerophyll forest and moss gardens over sandstone.	None. Suitable habitat is absent from the study area.
Grammitis stenophylla	Narrow-leaf Finger Fern	E	-	Bionet	Moist places, usually near streams, on rocks or in trees, in rainforest and moist eucalypt forest.	None. Suitable habitat is absent from the study area.
Grevillea beadleana	Beadle's Grevillea	E	E	Bionet	Known from four separate areas, all in north-east NSW: the Torrington area west of Tenterfield, Oxley Wild Rivers National Park, Guy Fawkes River National Park and at Chambigne Nature Reserve	None. Suitable habitat is absent from the study area.

Scientific name	Common Name	BC Act	EPBC Act	Source	Habitat Preference	Likelihood of occurrence
					south-west of Grafton. Occurs in open eucalypt forest and woodland with a shrubby understorey on granite.	
Macadamia integrifolia	Macadamia Nut	-	V	Bionet	Not known to occur naturally in the wild in NSW.	None. Suitable habitat is absent from the study area.
Melaleuca deanei	Deane's Melaleuca	V	V	PMST	Deane's Paperbark occurs in two distinct areas, in the Ku-ring-gai/Berowra and Holsworthy/Wedderburn areas respectively. The species occurs mostly in ridgetop woodland, with only 5% of sites in heath on sandstone.	None. Suitable habitat is absent from the study area.
Persicaria elatior	Knotweed, Tall Knotweed	V	V	PMST	Tall Knotweed has been recorded in south-eastern NSW, Moruya State Forest near Turlinjah, the Upper Avon River catchment north of Robertson, Bermagui, and Picton Lakes. This species normally grows in damp places, especially beside streams and lakes.	Moderate. Broadly suitable riparian/wetland habitat is present in the study area.
Persoonia hirsuta	Hairy Geebung, Hairy Persoonia	E	E	PMST	*Persoonia hirsuta* has a scattered distribution around Sydney. Found in clayey and sandy soils in dry sclerophyll open forest, woodland and heath, primarily on the Mittagong Formation and on the upper Hawkesbury Sandstone.	None. Suitable habitat is absent from the study area.
Persoonia nutans	Nodding Geebung	E	E	Bionet	Restricted to the Cumberland Plain in western Sydney, between Richmond in the north and Macquarie Fields in the south. Northern populations are confined to aeolian and alluvial sediments and occur in a range of sclerophyll forest and woodland vegetation communities, with the majority of individuals occurring within Agnes Banks Woodland or Castlereagh Scribbly Gum Woodland and some in Cooks River / Castlereagh Ironbark Forests.	None. Suitable habitat is absent from the study area.
Pimelea curviflora var. curviflora	*Pimelea curviflora var. curviflora*	V	V	PMST	Confined to the coastal area of the Sydney and Illawarra regions. Occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands.	None. Suitable habitat is absent from the study area.
Pimelea spicata	Spiked Rice-flower	E	E	Bionet, PMST	Once widespread on the Cumberland Plain, the Spiked Rice-flower occurs in two disjunct areas; the Cumberland Plain and the Illawarra. In both the Cumberland Plain and Illawarra environments this species is found on well-structured clay soils.	None. Suitable habitat is absent from the study area.

Scientific name	Common Name	BC Act	EPBC Act	Source	Habitat Preference	Likelihood of occurrence
Pomaderris brunnea	Rufous Pomaderris, Brown Pomaderris	V	V	PMST	Brown Pomaderris is found in a very limited area around the Colo, Nepean and Hawkesbury Rivers, including the Bargo area and near Camden. Brown Pomaderris grows in moist woodland or forest on clay and alluvial soils of flood plains and creek lines.	None. Suitable habitat is absent from the study area.
Pomaderris prunifolia	*P. prunifolia* in the Parramatta, Auburn, Strathfield and Bankstown Local Government Areas	EP	-	Bionet	Known from only three sites within the listed local government areas, at Rydalmere, within Rookwood Cemetery and at The Crest of Bankstown. It is known to occur along a road reserve near a creek, among grass species on sandstone, as well as in a small gully of degraded Cooks River / Castlereagh Ironbark Forest on shale soils.	None. Suitable habitat is absent from the study area.
Pterostylis saxicola	Sydney Plains Greenhood	E	E	PMST	Restricted to western Sydney between Freemans Reach in the north and Picton in the south. Most commonly found growing in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines.	None. Suitable habitat is absent from the study area.
Pultenaea pedunculata	Matted Bush-pea	E	-	Bionet	In NSW, the Matted Bush-pea is represented by just three disjunct populations, in the Cumberland Plains in Sydney, the coast between Tathra and Bermagui and the Windellama area south of Goulburn.NSW populations are generally among woodland vegetation, but plants have also been found on road batters and coastal cliffs.	None. Suitable habitat is absent from the study area.
Rhodamnia rubescens	Scrub Turpentine	CE	CE	Bionet, PMST	Occurs in coastal districts north from Batemans Bay in New South Wales, approximately 280 km south of Sydney, to areas inland of Bundaberg in Queensland. Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils.	None. Suitable habitat is absent from the study area.
Rhodomyrtus psidioides	Native Guava	CE	V	PMST	Occurs from Broken Bay, approximately 90 km north of Sydney, New South Wales, to Maryborough in Queensland. Pioneer species found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest often near creeks and drainage lines.	None. Suitable habitat is absent from the study area.
Syzygium paniculatum	Magenta Lilly Pilly	E	V	Bionet, PMST	The Magenta Lilly Pilly is found only in NSW, in a narrow, linear coastal strip from Upper Lansdowne to Conjola State Forest.	None. Suitable habitat is absent from the study area.

Scientific name	Common Name	BC Act	EPBC Act	Source	Habitat Preference	Likelihood of occurrence
					Magenta Lilly Pilly occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities.	
Tetratheca glandulosa	*Tetratheca glandulosa*	V	-	Bionet	Restricted to the following Local Government Areas: Baulkham Hills, Gosford, Hawkesbury, Hornsby, Ku-ring-gai, Pittwater, Ryde, Warringah, and Wyong. Associated with shale-sandstone transition habitat where shale-cappings occur over sandstone, with associated soil landscapes such as Lucas Heights, Gymea, Lambert and Faulconbridge.	None. Suitable habitat is absent from the study area.
Thesium australe	Austral Toadflax, Toadflax	V	V	PMST	Austral Toad-flax is found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast.	None. Suitable habitat is absent from the study area.
Triplarina imbricata	Creek Triplarina	E	E	Bionet	The species was previously recorded in Parramatta, near Sydney, however, the species is no longer thought to occur in this area. Occurs along watercourses in low open forest with Water Gum (*Tristaniopsis laurina*) or in montane bogs, often with *Baekea amissa*.	None. Suitable habitat is absent from the study area.
Wahlenbergia multicaulis	Tadgell's Bluebell in the local government areas of Auburn, Bankstown, Baulkham Hills, Canterbury, Hornsby, Parramatta and Strathfield	EP	-	Bionet	Found across the Hornsby LGA and Western Sydney in disturbed sites and grows in a variety of habitats including forest, woodland, scrub, grassland and the edges of watercourses and wetlands. Typically occurs in damp, disturbed sites (with natural or human disturbance of various forms), typically amongst other herbs rather than in the open.	Moderate. Broadly suitable riparian/wetland habitat is present in the study area.
Wilsonia backhousei	Narrow-leafed Wilsonia	V	-	Bionet	In NSW, Narrow-leaf Wilsonia is found on the coast between Mimosa Rocks National Park and Wamberal north of Sydney. This is a species of the margins of salt marshes and lakes.	Moderate. Broadly suitable riparian/wetland habitat is present in the study area.

Scientific name	Common Name	BC Act	EPBC Act	Source	Habitat Preference	Likelihood of occurrence
Zannichellia palustris	*Zannichellia palustris*	E		Bionet	In NSW, known from the lower Hunter and in Sydney Olympic Park. Grows in fresh or slightly saline stationary or slowly flowing water.	Moderate. Broadly suitable riparian/wetland habitat is present in the study area.

Habitat Assessment Table – Threatened Fauna

**Marine and pelagic species, and shorebird species have been assessed as having a nil likelihood of occurrence and are not included in this table.*

Common Name	Scientific Name	BC Act	EPBC Act	Source	Habitat Preference	Likelihood of occurrence
Amphibians						
Green and Golden Bell Frog	*Litoria aurea*	E	V	Bionet, PMST	Large populations in NSW are located around coastal and near coastal areas of the metropolitan areas of Sydney, Shoalhaven and mid north coast. It Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.). Optimum habitat includes unshaded water-bodies which are free of predatory fish (such as the Plague Minnow, *Gambusia holbrooki*) and have a grassy area nearby.	Low. Unlikely to inhabit to study are due to lack of characteristic habitat resources.
Aves						
Australasian Bittern	*Botaurus poiciloptilus*	E	E	Bionet	Australasian Bitterns are widespread but uncommon over south-eastern Australia. In NSW they may be found over most of the state except for the far north-west. Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (*Typha* spp.) and spikerushes (*Eleocharis* spp.)	None. Suitable habitat is absent from the study area.
Australian Fairy Tern	*Sternula nereis nereis*	-	V	PMST	The Fairy Tern nests on sheltered sandy beaches, spits and banks above the high tide line and below vegetation. The species has been found in embayments of a variety of habitats including offshore, estuarine or lacustrine (lake) islands, wetlands and mainland coastline.	Moderate. Potential habitat is present in the study area.
Australian Painted Snipe	*Rostratula australis*	E	E	Bionet	Inhabits shallow inland wetlands, either freshwater or brackish water bodies. Nests on the ground amongst tall reed-like vegetation near water, and feeds near the water's edge and on mudflats.	Low. Unlikely to inhabit to study are due to lack of characteristic habitat resources.

Common Name	Scientific Name	BC Act	EPBC Act	Source	Habitat Preference	Likelihood of occurrence
Barking Owl	*Ninox connivens*	V	-	Bionet	Inhabits woodland and open forest, including fragmented remnants and agricultural land. It is flexible in its habitat use, and hunting can extend in to closed forests. Roosts in shaded portions of tree canopies in species such as *Acacia* spp. and *Casuarina* spp.	None. Suitable habitat is absent from the study area.
Black Bittern	*Ixobrychus flavicollis*	V	-	Bionet	The Black Bittern has a wide distribution, from southern NSW north to Cape York and along the north coast to the Kimberley region. Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves.	Low. Unlikely to inhabit to study are due to lack of characteristic habitat resources.
Black Falcon	*Falco subniger*	V	-	Bionet	The Black Falcon is widely, but sparsely, distributed in New South Wales, mostly occurring in inland regions.	None. Suitable habitat is absent from the study area.
Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	V	-	Bionet	The Dusky Woodswallow has a large but sparse distribution covering much of southern Australia. It primarily inhabits dry and open eucalypts forests and woodlands but has on occasion been observed in the bordering agricultural land.	None. Suitable habitat is absent from the study area.
Eastern Bristlebird	*Dasyornis brachypterus*	E	E	Bionet	The distribution of the Eastern Bristlebird has contracted to three disjunct areas of south-eastern Australia. Habitat for central and southern populations is characterised by dense, low vegetation including heath and open woodland with a heathy understorey.	None. Suitable habitat is absent from the study area.
Eastern Grass Owl	*Tyto longimembris*	V	-	PMST	Eastern Grass Owls have been recorded occasionally in all mainland states of Australia but are most common in northern and north-eastern Australia. In NSW they are more likely to be resident in the north-east. Found in areas of tall grass, including grass tussocks, in swampy areas, grassy plains, swampy heath, and in cane grass or sedges on flood plains.	None. Suitable habitat is absent from the study area.
Eastern Osprey	*Pandion cristatus*	V	-	Bionet	Eastern Ospreys are found right around the Australian coast line, except for Victoria and Tasmania. Favour coastal areas, especially the mouths of large rivers, lagoons and lakes.	Low. Unlikely to inhabit to study are due to lack of characteristic habitat resources.

Common Name	Scientific Name	BC Act	EPBC Act	Source	Habitat Preference	Likelihood of occurrence
Flame Robin	*Petroica phoenicea*	V	-	Bionet	The Flame Robin is endemic to south eastern Australia, and ranges from near the Queensland border to south east South Australia and also in Tasmania. Breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes. Prefers clearings or areas with open understoreys. Occasionally occurs in temperate rainforest, and also in herbfields, heathlands, shrublands and sedgelands at high altitudes.	None. Suitable habitat is absent from the study area.
Freckled Duck	*Stictonetta naevosa*	V	-	PMST	The Freckled Duck is found primarily in south-eastern and south-western Australia, occurring as a vagrant elsewhere. Prefer permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds.	Low. Unlikely to inhabit to study are due to lack of characteristic habitat resources.
Gang-gang Cockatoo	*Callocephalon fimbriatum*	V	E	Bionet	Occupies tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests in winter. In summer this species prefers open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry coastal forests.	None. Suitable habitat is absent from the study area.
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	V	V	Bionet	The species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina. Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. Black Sheoak (*Allocasuarina littoralis)* and Forest Sheoak (*A. torulosa*) are important foods.	None. Suitable habitat is absent from the study area.

Common Name	Scientific Name	BC Act	EPBC Act	Source	Habitat Preference	Likelihood of occurrence
Grey Falcon	*Falco hypoleucos*	E	V	Bionet	The Grey Falcon is sparsely distributed in NSW, chiefly throughout the Murray-Darling Basin, with the occasional vagrant east of the Great Dividing Range. 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. Also occurs near wetlands where surface water attracts prey.	Low. Unlikely to inhabit to study are due to lack of characteristic habitat resources.
Little Eagle	*Hieraaetus morphnoides*	V	-	Bionet, PMST	Occupies habitats rich in prey, such as birds, reptiles and mammals, within open eucalypt forest, woodland or open woodland. Requires tall living trees for building a large stick nest and preys on birds, reptiles and mammals and occasionally carrion.	None. Suitable habitat is absent from the study area.
Little Lorikeet	*Glossopsitta pusilla*	V	-	Bionet	Mostly occur in dry, open eucalypt forests and woodlands. Have been recorded from both old-growth and logged forests in the eastern part of their range, and in remnant woodland patches and roadside vegetation on the western slopes. Nest in small hollows (entrance about three centimetres) of *Eucalyptus* spp. between 2-15 metres above the ground.	None. Suitable habitat is absent from the study area.
Masked Owl	*Tyto novaehollandiae*	V	-	PSMT	Lives in dry eucalypt forests and woodlands up to 1110 metres ASL. Predominantly hunts in forests but has been observed foraging along roadsides and along forest margins. Roosts in eucalypt forested gullies, utilising large tree hollows and or even caves.	None. Suitable habitat is absent from the study area.
Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit	*Limosa lapponica baueri*	-	V	Bionet	The species is most frequently recorded along major coastal river estuaries and sheltered embayments, particularly the Tweed, Richmond, Clarence, Macleay, Hastings, Hunter and Shoalhaven river estuaries, Port Stephens and Botany Bay. It is found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. Less frequently it occurs in salt lakes and brackish wetlands, sandy ocean beaches and rock platforms.	Low. Unlikely to inhabit to study are due to lack of characteristic habitat resources.

Common Name	Scientific Name	BC Act	EPBC Act	Source	Habitat Preference	Likelihood of occurrence
Painted Honeyeater	*Grantiella picta*	V	V	Bionet	Occurs in eucalyptus woodland and forests with a preference for mistletoe (Amyema spp.). Can also occur along watercourses and in farmland. Nests from spring to autumn in outer canopy of eucalypts, she-oak, paperbark and mistletoe branches.	None. Suitable habitat is absent from the study area.
Pilotbird	*Pycnoptilus floccosus*	-	V	Bionet	Pilotbirds are endemic to south-east Australia. Pilotbirds are strictly terrestrial, living on the ground in dense forests with heavy undergrowth – typically in wet sclerophyll forests in temperate zones in moist gullies with dense undergrowth or dry sclerophyll forests and woodlands occupying dry slopes and ridges.	None. Suitable habitat is absent from the study area.
Powerful Owl	*Ninox strenua*	V	-	Bionet	Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. Require large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. Nest in large tree hollows, at least 0.5 metres deep, in large eucalypts, with DBH of 80-240 centimetres) that are at least 150 years old.	None. Suitable habitat is absent from the study area.
Red Goshawk	*Erythrotriorchis radiatus*	CE	V	Bionet	The species is very rare in NSW, extending south to about 30°S, with most records north of this, in the Clarence River Catchment, and a few around the lower Richmond and Tweed Rivers. In NSW, preferred habitats include mixed subtropical rainforest, Melaleuca swamp forest and riparian Eucalyptus forest of coastal rivers.	None. Suitable habitat is absent from the study area.

Common Name	Scientific Name	BC Act	EPBC Act	Source	Habitat Preference	Likelihood of occurrence
Regent Honeyeater	*Anthochaera phrygia*	CE	CE	Bionet, PMST	Inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. In NSW the distribution is very patchy and mainly confined to the two main breeding areas at Capertee Valley and the Bundarra-Barraba region and surrounding fragmented woodlands. Also found in drier coastal woodlands and forests. Inhabits dry open forest and woodland, particularly Box-Ironbark woodland and riparian forests of River She-oak. These habitats have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. Key eucalypt species include Mugga Ironbark, Yellow Box, Blakely's Red Gum, White Box and Swamp Mahogany.	Low. Unlikely to inhabit to study are due to lack of characteristic habitat resources.
Scarlet Robin	*Petroica boodang*	V	-	Bionet	In NSW, this species occurs from the coast to the inland slopes. The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs.	None. Suitable habitat is absent from the study area.
Spotted Harrier	*Circus assimilis*	V	-	Bionet	The Spotted Harrier occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges. Occurs in grassy open woodland including Acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands.	Low. Unlikely to inhabit to study are due to lack of characteristic habitat resources.
Swift Parrot	*Lathamus discolor*	E	CE	Bionet	In NSW the Swift Parrot has been recorded on the coast and south west slopes, occurring in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany (Eucalyptus robusta), Spotted Gum (Corymbia maculata), Red Bloodwood (C. gummifera), Mugga Ironbark (E. sideroxylon), and White Box (E. albens).	None. Suitable habitat is absent from the study area.

Common Name	Scientific Name	BC Act	EPBC Act	Source	Habitat Preference	Likelihood of occurrence
Turquoise Parrot	*Neophema pulchella*	V	-	Bionet	Occupies mostly on upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (Eucalyptus sideroxylon), White Box (E. albens), Inland Grey Box (E. microcarpa), Yellow Box (E. melliodora), Blakely's Red Gum (E. blakelyi) and Forest Red Gum (E. tereticornis). Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks, river sheoaks (nesting habitat) and tea-trees.	None. Suitable habitat is absent from the study area.
Varied Sittella	*Daphoenositta chrysoptera*	V	-	Bionet	Inhabits most of mainland Australia except the treeless deserts and open grasslands. It inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland.	None. Suitable habitat is absent from the study area.
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	V	Mig	Bionet	Habitat includes coastlines, estuaries, large rivers and lakes. It has occasionally been recorded over adjacent habitats. This species builds a large stick nest in a tall tree and very rarely on artificial structures.	Low. Unlikely to inhabit to study are due to lack of characteristic habitat resources.
White-fronted Chat	*Epthianura albifrons*	V, EP	-	Bionet, PMST	In NSW, the species occurs mostly in the southern half of the state, in damp open habitats along the coast, and near waterways in the western part of the state. Along the coastline, it is found predominantly in saltmarsh vegetation but also in open grasslands and sometimes in low shrubs bordering wetland areas.	Moderate. Potential habitat is present in the study area.
Gastropoda						
Cumberland Plain Land Snail	*Meridolum corneovirens*	E	-	Bionet	Primarily occurs in Cumberland Pain Woodland – a grassy, open woodland with stands of denser vegetation.	None. Suitable habitat is absent from the study area.

Common Name	Scientific Name	BC Act	EPBC Act	Source	Habitat Preference	Likelihood of occurrence
Dural Land Snail	*Pommerhelix duralensis*	E	E	Bionet	The species is a shale-influenced-habitat specialist, which occurs in low densities along the western and northwest fringes of the Cumberland IBRA subregion on shale-sandstone transitional landscapes. The species has a strong affinity for communities in the interface region between shale-derived and sandstone-derived soils, with forested habitats that have good native cover and woody debris.	None. Suitable habitat is absent from the study area.
Mammals						
Eastern Coastal Free-tailed Bat	*Micronomus norfolkensis*	V	-	Bionet	Habitat preferences include dry eucalypt forest and coastal woodlands but also include the riparian zones of rainforests and wet sclerophyll forests. Forages above forest canopy or forest edge. Usually roosts in tree hollows but roosts have been found in buildings.	Low. Unlikely to inhabit to study are due to lack of characteristic habitat resources.
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	V	-	Bionet	Occurs in the south-east coast and ranges of Australia. This bat prefers moist habitat that supports trees taller than 20 m. It will roost in eucalypt hollows but on occasion has been found in buildings and under loose bark still partially attached to trees. It will hunt flying insects just above or below the tree canopy.	Moderate. Potential habitat is present in the study area.
Greater Broad-nosed Bat	*Scoteanax rueppellii*	V	-	PMST	Occurs in a variety of habitats including rainforest, dry and wet sclerophyll forest and eucalypt woodland. Large hollow bearing trees required for roosting.	Moderate. Potential habitat is present in the study area.
Greater Glider	*Petauroides volans*		E	Bionet	The greater glider (southern and central) occurs in eastern Australia, where it has a broad.	None. Suitable habitat is absent from the study area.
Grey-headed Flying-fox	*Pteropus poliocephalus*	V	V	Bionet	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are commonly found in gullies, close to water, in vegetation with a dense canopy. They travel up to 50 kilometres to forage, on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines.	High. The site contains potential foraging habitat for the Grey-headed Flying Fox roosting at nearby camps at Clyde.

Common Name	Scientific Name	BC Act	EPBC Act	Source	Habitat Preference	Likelihood of occurrence
Koala	*Phascolarctos cinereus*	E	E	Bionet	Inhabits a range of eucalypt forest and woodland communities. Adequate floristic diversity, availability of feed trees (primarily Eucalyptus tereticornis and E. viminalis) and presence of mature trees very important. Preferred food tree species vary with locality and there are quite distinct regional preferences. They are able to persist in fragmented habitats, and even survive in isolated trees across a predominantly agricultural landscape.	None. Suitable habitat is absent from the study area.
Large Bent-winged Bat	*Miniopterus orianae oceanensis*	V	-	Bionet	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. They form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. This species tends to hunt in forested areas.	Low. Unlikely to inhabit to study are due to lack of characteristic habitat resources.
Large-eared Pied Bat, Large Pied Bat	*Chalinolobus dwyeri*	V	V	Bionet	Roosts in disused mine shafts, caves, overhangs and disused Fairy Martin nests for shelter and to raise young. Also potentially roost in tree hollows. Occurs in low to mid-elevation dry open forest and woodlands, preferably with extensive cliffs, caves or gullies. Largely restricted to the interface of sandstone escarpment for roost habitat and relatively fertile valleys for foraging habitat.	Low. Unlikely to inhabit to study are due to lack of characteristic habitat resources
Southern Myotis	*Myotis macropus*	V	-	Bionet	This species generally roost in groups of 10-15 close to water in caves, mine shafts, hollow bearing trees, storm water channels, buildings, under bridges and in dense foliage. They forage over streams and pools catching insects and small fish.	High. The riparian corridor of Ducks Creek and Ducks River may provide foraging habitat for the Southern Myotis. No breeding habitat occurs in the study area.
Spotted-tailed Quoll	*Dasyurus maculatus*	V	E	Bionet	Utilises a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites.	None. Suitable habitat is absent from the study area.

Common Name	Scientific Name	BC Act	EPBC Act	Source	Habitat Preference	Likelihood of occurrence
Yellow-bellied Glider (south-eastern)	*Petaurus australis australis*	V	V	PMST	The Yellow-bellied Glider is found along the eastern coast to the western slopes of the Great Dividing Range, from southern Queensland to Victoria. Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Forest type preferences vary with latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south.	None. Suitable habitat is absent from the study area.
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	V	-	Bionet	The Yellow-bellied Sheathtail-bat is a wide-ranging species found across northern and eastern Australia. Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows.	Moderate. Potential habitat is present in the study area.
Migratory						
Bar-tailed Godwit	*Limosa lapponica*	-	C,J,K	Bionet	The species is most frequently recorded along major coastal river estuaries and sheltered embayments, particularly the Tweed, Richmond, Clarence, Macleay, Hastings, Hunter and Shoalhaven river estuaries, Port Stephens and Botany Bay. It is found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. Less frequently it occurs in salt lakes and brackish wetlands, sandy ocean beaches and rock platforms.	Moderate. Potential habitat is present in the study area.
Black-tailed Godwit	*Limosa limosa*	V	C,J,K	Bionet	In NSW, it is most frequently recorded at Kooragang Island (Hunter River estuary), with occasional records elsewhere along the coast, and inland. Usually found in sheltered bays, estuaries and lagoons with large intertidal mudflats and/or sandflats. Further inland, it can also be found on mudflats and in water less than 10 cm deep, around muddy lakes and swamps.	Low. Unlikely to inhabit to study are due to lack of characteristic habitat resources.

Common Name	Scientific Name	BC Act	EPBC Act	Source	Habitat Preference	Likelihood of occurrence
Broad-billed Sandpiper	*Limicola falcinellus*	V	C,J,K	Bionet, PMST	In NSW, the main site for the species is the Hunter River estuary, with birds occasionally reaching the Shoalhaven estuary. Favour sheltered parts of the coast such as estuarine sandflats and mudflats, harbours, embayments, lagoons, saltmarshes and reefs as feeding and roosting habitat. Occasionally, individuals may be recorded in sewage farms or within shallow freshwater lagoons. Broad-billed Sandpipers roost on banks on sheltered sand, shell or shingle beaches.	Low. Unlikely to inhabit to study are due to lack of characteristic habitat resources.
Caspian Tern	*Hydroprogne caspia*	-	J	Bionet, PMST	The Caspian Tern is mostly found in sheltered coastal embayments (harbours, lagoons, inlets, bays, estuaries and river deltas) and those with sandy or muddy margins are preferred. They also occur on near-coastal or inland terrestrial wetlands that are either fresh or saline, especially lakes (including ephemeral lakes), waterholes, reservoirs, rivers and creeks. They also use artificial wetlands, including reservoirs, sewage ponds and saltworks.	Moderate. Potential habitat is present in the study area.
Common Greenshank	*Tringa nebularia*	-	C,J,K	PMST	Found in both coastal and inland areas where estuaries, mudflats, swamps, lagoons, lakes and billabongs occur.	Moderate. Potential habitat is present in the study area.
Common Sandpiper	*Actitis hypoleucos*	-	C,J,K	Bionet, PMST	A wetland species that flies just above the ground/water. Will fly higher and faster when migrating to and from Australia.	Moderate. Potential habitat is present in the study area.
Curlew Sandpiper	*Calidris ferruginea*	E	CE,C,J,K	Bionet	Coastal migratory species with a NSW distribution from Hastings Point to Shoalhaven Heads. Found in open, sandy beaches with exposed sand bars and rocky outcrops. Rare use of near-coastal wetlands.	Moderate. Potential habitat is present in the study area.
Eastern Curlew	*Numenius madagascariensis*	-	CE,C,J,K	Bionet	A primarily coastal distribution. Found in all states, particularly the north, east, and south-east regions including Tasmania. Rarely recorded inland. Mainly forages on soft sheltered intertidal sand flats or mudflats, open and without vegetation or cover. Breeds in the northern hemisphere.	Low. Unlikely to inhabit to study are due to lack of characteristic habitat resources.

Common Name	Scientific Name	BC Act	EPBC Act	Source	Habitat Preference	Likelihood of occurrence
Fork-tailed Swift	*Apus pacificus*	-	C,J,K	Bionet	The Fork-tailed Swift is almost exclusively aerial, flying from less than one metre to at least 300 metres above ground and probably much higher.	Low. Unlikely to inhabit to study are due to lack of characteristic habitat resources.
Great Knot	*Calidris tenuirostris*	V	CE,C,J,K	Bionet	In NSW, the species has been recorded at scattered sites along the coast down to about Narooma. Occurs within sheltered, coastal habitats containing large, intertidal mudflats or sandflats, including inlets, bays, harbours, estuaries and lagoons.	Moderate. Potential habitat is present in the study area.
Greater Sand Plover, Large Sand Plover	*Charadrius leschenaultii*	-	C,J,K	Bionet, PMST	In NSW, the species has been recorded between the northern rivers and the Illawarra, with most records coming from the Clarence and Richmond estuaries. Almost entirely restricted to coastal areas in NSW, occurring mainly on sheltered sandy, shelly or muddy beaches or estuaries with large intertidal mudflats or sandbanks.	Low. Unlikely to inhabit to study are due to lack of characteristic habitat resources.
Latham's Snipe	*Gallinago hardwickii*	-	J,K	Bionet	Latham's Snipe has been recorded in low vegetation around wetlands, in marshes and in irrigated crops.	Moderate. Potential habitat is present in the study area.
Little Tern	*Sternula albifrons*	E	C,J,K	PMST	The Little Tern is found on the north, east and south-east Australian coasts, from Shark Bay in Western Australia to the Gulf of St Vincent in South Australia. Almost exclusively coastal, preferring sheltered environments; however may occur several kilometres from the sea in harbours, inlets and rivers (with occasional offshore islands or coral cay records).	Low. Unlikely to inhabit to study are due to lack of characteristic habitat resources.
Pectoral Sandpiper	*Calidris melanotos*	-	J,K	Bionet	This sandpiper is found in coastal wetlands, particularly those with fringing vegetation and mudflats.	Moderate. Potential habitat is present in the study area.
Red Knot	*Calidris canutus*	-	E,C,J,K	Bionet	In NSW, this species is recorded in small numbers along some of the major river estuaries and sheltered embayments of the coastline, in particular the Hunter River estuary. The Red Knot mainly occurs in small numbers on intertidal mudflats, estuaries, bays, inlets, lagoons, harbours and sandflats and sandy beaches of sheltered coasts. It is occasionally found on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms	Low. Unlikely to inhabit to study are due to lack of characteristic habitat resources.

Common Name	Scientific Name	BC Act	EPBC Act	Source	Habitat Preference	Likelihood of occurrence
					and is a rare visitor to terrestrial saline wetlands and freshwater swamps.	
Red-necked Stint	*Calidris ruficollis*	-	C,J,K	Bionet	The Red-necked Stint is widespread within Australia during its non-breeding period and is distributed along most of the Australian coastline with large densities on the Victorian and Tasmanian coasts. The Red-necked Stint has been recorded in all coastal regions, and found inland in all states when conditions are suitable.	Low. Unlikely to inhabit to study are due to lack of characteristic habitat resources.
Ruddy Turnstone	*Arenaria interpres*	-	C,J,K	Bionet, PMST	The Ruddy Turnstone is widespread within Australia during its non-breeding period of the year records of inland populations. It strongly prefers rocky shores or beaches where there are large deposits of rotting seaweed.	Low. Unlikely to inhabit to study are due to lack of characteristic habitat resources.
Sharp-tailed Sandpiper	*Calidris acuminata*	-	C,J,K	Bionet	Habitat for this species includes both fresh and saltwater swamps, lagoons, lakes and dams.	Moderate. Potential habitat is present in the study area.
Terek Sandpiper	*Xenus cinereus*	V	C,J,K	PSMT	The two main sites for the species in NSW are the Richmond River estuary and the Hunter River estuary. Favours mudbanks and sandbanks located near mangroves, but may also be observed on rocky pools and reefs, and occasionally up to 10 km inland around brackish pools.	Moderate. Potential habitat is present in the study area.
White-throated Needletail	*Hirundapus caudacutus*	V	V,C,J,K	Bionet, PMST	An aerial species found in feeding concentrations over cities, hilltops and timbered ranges.	Low. Unlikely to inhabit to study are due to lack of characteristic habitat resources.
Yellow Wagtail	*Motacilla flava*	-	C,J,K	Bionet	This species has most commonly been observed in open country ear swamps, salt marshes, sewerage ponds and grasslands.	Moderate. Potential habitat is present in the study area.

Attachment B Species Identified During Rapid Flora Surveys

Species name	Common Name	Status (native, non-native)
Canopy Species		
Eucalyptus fibrosa	Red Ironbark	Native
Corymbia citriodora	Yellow Bloodwood	Native
Casuarina glauca	Swamp Oak	Native
Midstorey Species		
Acacia decurrens	Green wattle	Native
Lantana camara	Lantana	Non-native
Avicennia marina	Grey Mangrove	Native
Ricinus communis	Castor Oil Plant	Non-native
Ground Cover Species		
Anredera cordifolia	Madeira Vine	Non-native
Cardiospermum grandiflorum	Balloon Vine	Non-native
Parietaria judaica	Pellitory	Non-native
Sida rhombifolia	Paddy's Lucerne	Non-native
Paspalum urvillei	Giant Paspalum	Non-native
Bidens pilosa	Cobbler's Pegs	Non-native
Paspalum dilatatum	Paspalum	Non-native
Ehrharta erecta	Panic Veldtgrass	Non-native
Sonchus oleraceus	Cowthistle	Non-native
Ageratina adenophora	Crofton Weed	Non-native

Appendix D – Temporary works design of proposed discharge pipeline route

SYDNEY METRO WEST - TEMPORARY WORKS

WESTERN TUNNELLING PACKAGE
CLYDE WATER TREATMENT PLANT
DISCHARGE PIPELINE ROUTE

DRAWING LIST

DRAWING NUMBER	TITLE
GENERAL	
SMWSTWTP-GLO-CLJ-BD700-TW-DRG-551000	COVER PAGE AND DRAWING LIST
SMWSTWTP-GLO-CLJ-BD700-TW-DRG-551001	CONSTRUCTION NOTES
PLAN / DETAILS	
SMWSTWTP-GLO-CLJ-BD700-TW-DRG-551002	GENERAL ARRANGEMENT PLAN
SMWSTWTP-GLO-CLJ-BD700-TW-DRG-551010	DETAILS - SHEET 1
SMWSTWTP-GLO-CLJ-BD700-TW-DRG-551011	DETAILS - SHEET 2

100mm AT FULL SIZE   Plot Date: 14/12/22 - 11:59   Cad File: \\SYDDATA02\projects\000170\7\CLJ-551 Discharge line for Perm & Handover WTP\Drawings\SMWSTWTP-GLO-CLJ-BD700-TW-DRG-551000 (Duck Creek Cover Page & Drawing List).dwg

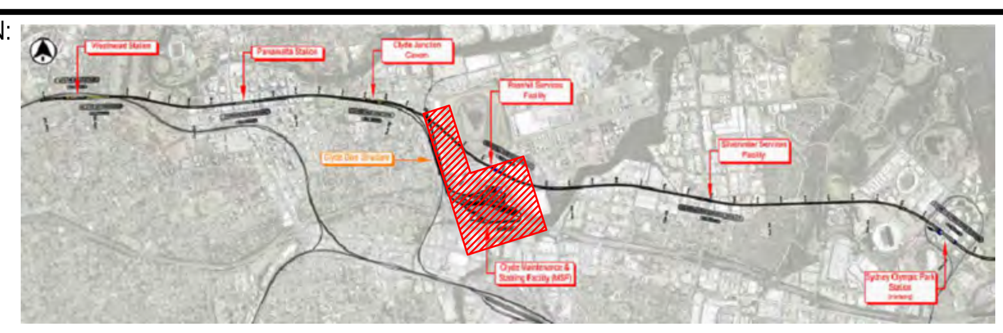
OFFICIAL

FOR REVIEW AND COMMENT

No.	Amendment Description	Design by	Verified by	Approved by	Date
A	DESIGN STAGE 3 100% SUBMISSION	S.G.	P.D.	S.G.	14.12.22

SCALES: N.T.S.

KEYPLAN:



CLIENT: NSW GOVERNMENT | sydney METRO

PRINCIPAL AEO: GAMUDA Australia | LAING O'ROURKE

The information shown on this drawing is for the purposes of the Sydney Metro Project only. No warranty is given or implied as to its suitability for any other purpose. The Service Providers accept no liability arising from the use of this drawing and the information shown thereon for any purpose other than the Sydney Metro Project.

SERVICE PROVIDERS: HATCH

DRAWN	S.WOOD	14.12.2022
DESIGNED	S.GERRISH	14.12.2022
DRG CHECK	P.DAVISON	14.12.2022
DESIGN CHECK	P.DAVISON	14.12.2022
APPROVED	S.GERRISH	14.12.2022

SYDNEY METRO WEST - TEMPORARY WORKS
WESTERN TUNNELLING PACKAGE
CLYDE WATER TREATMENT PLANT
DISCHARGE PIPELINE ROUTE
COVER PAGE & DRAWING LIST

DOCUMENT No: SHEET: 1 OF 1   ©

STATUS: STAGE 3 100% SUBMISSION   EDMS NO:

DRG No. SMWSTWTP-GLO-CLJ-BD700-TW-DRG-551000   REV A   VER

A1 Original | Co-ordinate System: GDA20/MGA Zone 56 | Height Datum: A.H.D | This sheet may be prepared using colour and may be incomplete if copied | NOTE: Do not scale from this drawing.

GENERAL:

1. THESE DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL ARCHITECTURAL AND OTHER CONSULTANTS' DRAWINGS AND SPECIFICATIONS AND WITH SUCH OTHER WRITTEN INSTRUCTIONS AS MAY BE ISSUED DURING THE COURSE OF THE CONTRACT. ALL DISCREPANCIES SHALL BE REFERRED TO THE ARCHITECT AND ENGINEER BEFORE PROCEEDING WITH THE WORK.
2. DIMENSIONS SHALL NOT BE OBTAINED BY SCALING THESE DRAWINGS.
3. ALL DIMENSIONS ARE IN MILLIMETRES AND ALL LEVELS ARE IN METRES UNLESS NOTED OTHERWISE.
4. SETTING OUT DIMENSIONS SHOWN ON THE DRAWINGS SHALL BE VERIFIED BY THE CONTRACTOR.
5. DURING CONSTRUCTION, THE STRUCTURE SHALL BE MAINTAINED IN A STABLE CONDITION AND NO PART SHALL BE OVER-STRESSED. TEMPORARY STRUCTURES, FORMWORK, FALSEWORK, TEMPORARY BRACING, SHORING AND THE LIKE SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR.
6. ALL WORKMANSHIP AND MATERIALS SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF THE CURRENT EDITIONS, INCLUDING AMENDMENTS, OF THE RELEVANT STANDARDS AND CODES OF PRACTICE, EXCEPT AS VARIED BY THE CONTRACT DOCUMENTS AND THE LAWS AND REQUIREMENTS OF STATUTORY AUTHORITIES.
7. ALL WORK IS TO BE CARRIED OUT IN ACCORDANCE WITH ALL WORKCOVER REQUIREMENTS AND OCCUPATIONAL HEALTH AND SAFETY ACT REGULATIONS.
8. WHERE THE ENGINEERS ARE ENGAGED FOR INSPECTIONS AND/OR SUPERVISION, A MINIMUM OF 24 HOURS NOTICE SHALL BE GIVEN.
9. CONSTRUCTION USING THESE DRAWINGS SHALL NOT COMMENCE UNTIL A CONSTRUCTION CERTIFICATE IS ISSUED BY THE PRINCIPAL CERTIFYING AUTHORITY.

DESIGN LOADING:

1. PERMANENT AND IMPOSED LOADINGS IN ACCORDANCE WITH AS/NZ1170 PART 1 (U.N.O.). REFER TO DRAWINGS FOR SPECIFIC VEHICLE, STRUCTURE AND SURCHARGE LOADING ALLOWANCES.
2. EARTHQUAKE LOADS IN ACCORDANCE WITH AS1170.4
   ANNUAL PROBABILITY OF EXCEEDANCE = 1:50
   PROBABILITY FACTOR (Kp) = 0.035
   HAZARD FACTOR (Z) = 0.08
   SUB-SOIL CLASS = Be
4. EXPOSURE CLASSIFICATIONS TO AS3600
   BELOW-GROUND = A2
   ABOVE-GROUND = B1
5. DESIGN LIFE
   HANDOVER WORKS = 10 YEARS
   ALL OTHER WORKS = 3 YEARS

GROUND PREPARATION:

1. EXCAVATION AND GROUND PREPARATION SHALL BE CARRIED OUT IN ACCORDANCE WITH TfNSW D&C R44 FOLLOWING THE RECOMMENDATIONS OF THE GEOTECHNICAL ENGINEER AND ANY ADDITIONAL INSTRUCTIONS THAT MAY BE PROVIDED BY A GEOTECHNICAL ENGINEER DURING THE COURSE OF THE PROJECT.
2. IN THE ABSENCE OF SPECIFIC GEOTECHNICAL ADVICE REGARDING GROUND PREPARATION, THE SITE SHALL BE PREPARED IN ACCORDANCE WITH THE FOLLOWING NOTES.
3. STRIP ALL VEGETATION, TOPSOIL, ROOT AFFECTED OR OTHER POTENTIALLY DELETERIOUS MATERIAL AND CUT SITE WHERE REQUIRED TO LEVELS INDICATED.
4. ANY EXISTING FILL MATERIAL UNDER PROPOSED AREA OF CONSTRUCTION TO BE REMOVED AND REPLACED WITH COMPACTED FILL.
5. FOLLOWING STRIPPING, THE EXPOSED SUBGRADE MATERIALS SHALL BE PROOF ROLLED WITH 5 PASSES OF A 10 TONNE ROLLER TO IDENTIFY ANY WET OR EXCESSIVELY DEFLECTING MATERIAL (SOFT SPOTS). ALL SUCH AREAS ARE TO BE OVER EXCAVATED AND BACKFILLED WITH AN APPROVED SELECT MATERIAL.
6. WHERE FILLING IS REQUIRED, LAY SELECT FILL MATERIAL IN NEAR HORIZONTAL LAYERS NOT EXCEEDING 200mm LOOSE THICKNESS AND COMPACTED AT OPTIMUM MOISTURE CONTENT ±2%, TO 80% MIN. DENSITY INDEX FOR COHESIONLESS SOILS OR 98% MIN. STANDARD DENSITY INDEX FOR COHESIVE SOILS.
7. TESTING OF SUBGRADE AND FILLING COMPACTION TO BE IN ACCORDANCE WITH LEVEL 2 TESTING AS DESCRIBED IN AS3798-2007.
8. THE CONTRACTOR SHALL IMPLEMENT APPROPRIATE MEASURES TO ENSURE STABILITY OF EXISTING ADJOINING FOOTINGS WHERE EXCAVATION IS REQUIRED BELOW THE LEVEL OF THE FOOTING.

SAFETY IN DESIGN:

1. IN UNDERTAKING THE DESIGN LINDSAY DYNAN HAVE MADE REFERENCE TO SAFE WORK AUSTRALIA'S CODE OF CONDUCT FOR THE SAFE DESIGN OF STRUCTURES. THE METHOD OF CONSTRUCTION AND SAFETY CONTROLS DURING CONSTRUCTION IS THE RESPONSIBILITY OF THE CONTRACTOR.
2. IF ANY ELEMENT PRESENTS DIFFICULTY IN RESPECT TO CONSTRUCTION, SAFETY OR FUTURE MAINTENANCE & DEMOLITION THE MATTER SHOULD BE REFERRED TO THE ENGINEER FOR RESOLUTION BEFORE PROCEEDING.
3. THE DETERMINATION OF SAFE WORK METHOD REMAINS THE RESPONSIBILITY OF THE CONTRACTOR.

SURVEY:

1. SURVEY INFORMATION USED FOR DESIGN PURPOSES SUPPLIED AS FOLLOWS:
   - SURVEY INFORMATION USED FOR DESIGN PURPOSES SUPPLIED BY AFJV
2. ALL LEVELS ARE TO AUSTRALIAN HEIGHT DATUM (AHD).
3. SURVEY COORDINATE SYSTEM IS MAP GRID OF AUSTRALIA (GDA 2020).
4. THE CONTRACTOR SHALL PREPARE WORK AS EXECUTED DRAWINGS FOR THE WORKS AS REQUIRED BY THE SUPERINTENDENT.
7. THE CONTRACTOR SHALL VERIFY THE SURVEY AND SHALL NOTIFY THE SUPERINTENDENT AND ENGINEER OF ANY SURVEY DISCREPANCIES AT LEAST TWO WEEKS PRIOR TO COMMENCEMENT OF WORKS.
8. ANY REGISTERED SURVEY MARKS WITHIN THE WORKS AREA OR CLOSE PROXIMITY THAT WILL BE DESTROYED, MUST BE APPROVED BY THE SURVEYORS GENERAL BEFORE CONSTRUCTION COMMENCES. DESTROYED REGISTERED SURVEY MARKS ARE TO BE REPLACED WITH AN EQUIVALENT STANDARD MARK IN ACCORDANCE WITH THE RELEVANT STANDARD AND IN AS DIRECTED BY THE SURVEYOR GENERAL, PRIOR TO REMOVAL OF THE EXISTING MARK. IT SHALL ALSO BE COORDINATED AND DOCUMENTED TO EQUIVALENT LANDS DEPARTMENT STANDARDS.
9. DAMAGED SURVEY MONUMENTS ARE TO BE REPAIRED OR REINSTATED TO THE SATISFACTION OF THE SURVEYOR GENERAL.

FOUNDATIONS:

1. FOR SHALLOW FOOTING SYSTEMS AND PAVEMENTS FOUNDATION MATERIAL SHALL HAVE A UNIFORM, STABLE SAFE BEARING CAPACITY OF 150kPa (U.N.O). FOUNDATION MATERIAL SHALL BE APPROVED BY A GEOTECHNICAL ENGINEER FOR THIS PRESSURE BEFORE PLACING CONCRETE IN FOOTINGS.
2. FOOTING EXCAVATIONS SHALL BE CLEANED TO REMOVE ALL LOOSE OR SOFTENED MATERIAL AND DEBRIS PRIOR TO PLACING OF CONCRETE.
3. WHERE SIDE SHEAR IS REQUIRED TO BE DEVELOPED, CLEAN AND ROUGHEN THE SIDES OF THE EXCAVATION TO THE SATISFACTION OF THE ENGINEER.
4. CONCRETE SHOULD BE POURED AS SOON AS POSSIBLE AFTER EXCAVATION. IF EXCAVATIONS ARE LIKELY TO REMAIN OPEN FOR MORE THAN 24 HOURS THE CONTRACTOR IS TO IMPLEMENT APPROPRIATE MEASURES TO PROTECT THE FOUNDATION BASE
5. PRIOR TO ANY EXCAVATION NEAR EXISTING FOOTINGS THE CONTRACTOR SHALL DETERMINE THE DEPTH OF FOUNDING OR EXISTING FOOTINGS BY LOCAL INVESTIGATORY EXCAVATION. GENERAL EXCAVATION SHALL NOT PROCEED BELOW A LEVEL OF 150mm ABOVE THE UNDERSIDE OF EXISTING FOOTINGS UNTIL INSTRUCTION IS OBTAINED FROM THE ENGINEER ON PROCEDURES AND PRECAUTIONS TO BE TAKEN.
6. LOCATE ALL PIPES, RETAINING WALLS AND EXCAVATION OUTSIDE A 1:2 (VERTICAL:HORIZONTAL) ZONE OF INFLUENCE FROM THE BOTTOM EDGE OF THE FOOTING.

CONCRETE:

1. ALL WORKMANSHIP AND MATERIALS SHALL BE IN ACCORDANCE WITH TfNSW D&C R53, EXCEPT WHERE VARIED BY THE CONTRACT DOCUMENTS OR THESE DRAWINGS.
2. CONCRETE SUPPLY AND REQUIRED PROPERTIES SHALL BE IN ACCORDANCE TO AS1379:2007.
3. CONCRETE ELEMENTS WHICH HAVE A FLY ASH CONTENT GREATER THAN OR EQUAL TO 50% OF THE TOTAL CEMENTITIOUS CONTENT, OR A SLAG CONTENT THAT IS GREATER THAN OR EQUAL TO 70% OF THE TOTAL CEMENTITIOUS CONTENT, MUST DEVELOP AND APPLY A CURING REGIME THAT WILL ENSURE THAT THE CONCRETE ELEMENT WILL ACHIEVE THE INTENT OF THE DURABILITY DESIGN.
4. DETAILS OF CONCRETE MIX, AGGREGATE SOURCE AND SIZE, METHOD OF CURING AND FINISH SHALL BE SUBMITTED FOR PRINCIPAL'S REVIEW
5. USE TYPE 'GP' CEMENT UNLESS OTHERWISE SPECIFIED.
6. CONCRETE QUALITY SHALL CONFORM TO THE FOLLOWING (U.N.O.):

ELEMENT	SLUMP (mm)	MAX. AGGREGATE SIZE (mm)	STRENGTH GRADE (MPa)	MAX. SHRINKAGE STRAIN (µm)
ALL (U.N.O.)	100	20	N40	-

7. ALL CONCRETE SUPPLIED ON THE PROJECT IS TO BE A PRE-APPROVED PROJECT SPECIFIC SYDNEY METRO MIX DESIGN, CONSIDERING DURABILITY AND SUSTAINABILITY REQUIREMENTS.
8. ALL CONCRETE SHALL BE SUBJECT TO PROJECT ASSESSMENT AND TESTING TO AS1379.
9. CONSOLIDATE ALL CONCRETE BY MECHANICAL VIBRATION. CURE ALL CONCRETE SURFACES AS DIRECTED IN THE SPECIFICATION. (IF NO SPECIFICATION, IN ACCORDANCE WITH TfNSW D&C R53).
10. FOR ALL FALLS IN SLAB, DRIP GROOVES, REGLETS, CHAMFERS ETC REFER TO ARCHITECTS DRAWINGS AND SPECIFICATION.
11. NO HOLES OR CHASES OTHER THAN THOSE SHOWN ON THE STRUCTURAL DRAWINGS SHALL BE MADE IN CONCRETE MEMBERS WITHOUT THE PRIOR APPROVAL OF THE ENGINEER.
12. CONSTRUCTION JOINTS WHERE NOT SHOWN ON DRAWINGS SHALL BE LOCATED SUBJECT TO THE APPROVAL OF THE ENGINEER.
13. CONCRETE THICKNESSES SHOWN DO NOT INCLUDE THICKNESS OF APPLIED FINISHES.
14. BEAM DEPTHS ARE NOTED FIRST AND INCLUDE SLAB THICKNESSES, IF ANY.
15. FORMWORK: THE DESIGN, CERTIFICATION, CONSTRUCTION AND PERFORMANCE OF THE FORMWORK, FALSEWORK AND BACKPROPPING SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR. THE PROPOSED METHOD OF INSTALLATION AND REMOVAL OF FORMWORK IS TO BE SUBMITTED TO THE SUPERINTENDENT FOR COMMENT PRIOR TO WORK BEING CARRIED OUT.

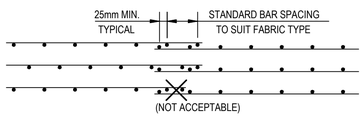
REINFORCEMENT:

1. ALL REINFORCEMENT WORKS AND MATERIALS SHALL COMPLY WITH TfNSW D&C R53.
2. FIX REINFORCEMENT AS SHOWN ON THE DRAWINGS. THE TYPE AND GRADE IS INDICATED BY THE SYMBOL AS SHOWN BELOW ON THE DRAWINGS. THIS IS FOLLOWED BY A NUMERAL WHICH INDICATES A SIZE IN MILLIMETRES OF THE REINFORCEMENT.
   N - HOT-ROLLED DEFORMED BAR (GRADE D500N)
   R - PLAIN ROUND BAR (GRADE R250N)
   SL - SQUARE MESH (GRADE 500L)
   RL - RECTANGULAR MESH (GRADE 500L)
3. PROVIDE BAR SUPPORTS OR SPACERS TO GIVE CONCRETE COVER TO ALL REINFORCEMENT.
4. WELDING OF REINFORCEMENT WILL NOT BE PERMITTED UNLESS SHOWN ON THE STRUCTURAL DRAWINGS OR AS REQUIRED BY THE ELECTRICAL EARTHING DESIGNER.
5. SPLICES IN REINFORCEMENT SHALL BE MADE ONLY IN THE POSITIONS SHOWN. THE WRITTEN APPROVAL OF THE ENGINEER SHALL BE OBTAINED FOR ANY OTHER SPLICES WHERE THE LAP LENGTH IS NOT SHOWN.
6. CLEAR CONCRETE COVER TO REINFORCEMENT IS AS FOLLOWS UNLESS SHOWN OTHERWISE ON THE DRAWINGS:

ELEMENT	BOTTOM (mm)	SIDES (mm)	TOP (mm)
ALL (U.N.O.)	50	50	50
PAVEMENTS	30*	30*	60
RETAINING WALLS / HOBS / UPSTANDS	40	30*	30
RETAINING WALL FOOTINGS	50	50	30
PILES	100	75	75
BENTONITE FARM SLAB	40	40	30

* DENOTES PAVEMENT POURED ON 0.2mm POLYETHYLENE SHEET (BLACK PLASTIC). SIDE FACE OF PAVEMENT / RETAINING WALLS TO BE FORMED

7. COVER TO REINFORCEMENT ENDS TO BE 50mm (U.N.O.).
8. PROVIDE N12-450 SUPPORT BARS TO TOP REINFORCEMENT AS REQUIRED, LAP 450 (U.N.O.).
9. HOOKS, BENDS, SPLICES AND LAPS TO BE IN ACCORDANCE WITH AS3600.
10. AT SPLICES FABRIC SHALL BE LAPPED AS FOLLOWS:



11. LAP LENGTHS AS PER THE TABLE BELOW.

TENSION LAPS			COMPRESSION LAPS
BAR SIZE	TOP BARS IN BANDS & BEAMS	ALL OTHER BARS	
N12	570	480	450
N16	800	700	640
N20	1150	950	800
N24	1500	1250	960
N28	1850	1500	1120
N32	2250	1800	1280
N36	2700	2100	1440

REINFORCEMENT EARTHING:

1. STEEL REINFORCEMENT IN CONCRETE SLABS AND FOOTINGS TO BE MADE ELECTRICALLY CONTINUOUS BY WELDING AS DIRECTED BY THE EARTHING DESIGNER.
2. STEEL PLATE EARTHING TABS SHALL BE WELDED TO THE REINFORCEMENT IN LOCATIONS NOMINATED BY THE EARTHING DESIGNER. TABS SHALL PROJECT FROM THE CONCRETE SURFACE TO ENABLE BOLTED CONNECTION TO AN EXTERNAL EARTHING SYSTEM.

SHOTCRETE:

1. SHOTCRETE IS SPRAYED CONCRETE WITH MAXIMUM CONCRETE AGGREGATE SIZE 20mm, PROJECTED AT HIGH VELOCITY INTO FORM TO PRODUCE A DENSE HOMOGENOUS MASS.
2. SHOTCRETE IS TO BE MIXED IN ACCORDANCE WITH TfNSW D&C R68 TO THE SUPERVISING ENGINEER'S APPROVAL. ALL CONSTITUENTS SHALL BE UNIFORMLY DISPERSED THROUGHOUT THE MIX (U.N.O.).
3. THE SURFACE TO BE SPRAYED SHALL BE TRIMMED, COMPACTED AND GRADED AS REQUIRED BY THE TOLERANCES REFLECTED ON THE DOCUMENTS, AND DAMP BEFORE THE APPLICATION OF SPRAYED CONCRETE.
4. THE REINFORCEMENT INDICATED ON THE DRAWINGS IS TO BE PLACED AND SECURED ACCURATELY TO THE SPECIFIED COVERS.
5. JOINTS WITHIN THE SHOTCRETE SHALL BE TO THE APPROVAL OF THE ENGINEER, AND WILL GENERALLY BE TRIMMED AT AN ANGLE OF 30° TO THE HORIZONTAL IN AN APPROVED POSITION.

SUSTAINABILITY:

THE FOLLOWING ARE PROJECT SUSTAINABILITY REQUIREMENTS:

1. THE TUNNELLING CONTRACTOR MUST MINIMISE EMBODIED CARBON AND LIFECYCLE IMPACTS BY USING, WHERE PRACTICABLE:
   A. BLENDED CEMENT THAT CONTAINS SUPPLEMENTARY CEMENTITIOUS MATERIALS, SUCH AS FLY ASH AND GROUND GRANULATED BLAST FURNACE SLAG
   B. LOW CARBON CONCRETE INCLUDING GEOPOLYMER CONCRETE WHERE FEASIBLE
   C. AGGREGATE CONTAINING RECOVERED PRODUCTS SUCH AS GLASS, PLASTIC AND CONCRETE
   D. RECYCLED STEEL, INCLUDING IN CONCRETE REINFORCING; AND
   E. SPOIL GENERATED ON-SITE
2. THE TUNNELLING CONTRACTOR MUST USE RECYCLED AND RECYCLABLE MATERIALS WHERE POSSIBLE, WITHOUT COMPROMISE TO THE STRUCTURAL INTEGRITY, LONGEVITY AND VISUAL QUALITY OF MATERIALS AND STRUCTURES.
3. REINFORCING & STRUCTURAL STEEL MUST
   A. BE SOURCED FROM
      a. SUPPLIERS CERTIFIED UNDER AUSTRALASIAN CERTIFICATION AUTHORITY FOR REINFORCING AND STRUCTURAL STEEL (ACRS), OR
      b. SUPPLIERS CERTIFIED BY A "DEMONSTRATED EQUIVALENT" ASSOCIATION OR ORGANISATION, WHERE AGREED BY THE PRINCIPAL'S REPRESENTATIVE
   B. BE SOURCED FROM STEELMAKERS WITH AN ISO 14001:2015 ENVIRONMENTAL MANAGEMENT SYSTEM CERTIFICATION
4. STRUCTURAL STEEL MUST BE IN ACCORDANCE WITH AS5131:2016 AND CERTIFIED THROUGH THE NATIONAL STRUCTURAL STEELWORK COMPLIANCE SCHEME
5. POLYVINYL CHLORIDE MUST BE COMPLIANT WITH THE GREEN BUILDING COUNCIL OF AUSTRALIA (GBCA) BEST PRACTICE GUIDELINES FOR POLYVINYL-CHLORIDE (PVC) IN THE BUILT ENVIRONMENT
6. ALL TIMBER PRODUCTS FOR THE PROJECT MUST BE SOURCED FROM EITHER:
   A. RE-USED TIMBER
   B. POST-CONSUMER RECYCLED TIMBER
   C. FOREST STEWARDSHIP COUNCIL (FSC) CERTIFIED TIMBER SOURCED WITHIN AUSTRALIA; OR
   D. PROGRAMME FOR THE ENDORSEMENT OF FOREST CERTIFICATION (PEFC) CERTIFIED TIMBER SOURCED WITHIN AUSTRALIA.
7. THE TUNNELLING CONTRACTOR MUST USE REUSABLE FORMWORK WHERE PRACTICABLE
8. CONCRETE MUST BE SOURCED FROM MEMBERS OF:
   A. CEMENT CONCRETE & AGGREGATES AUSTRALIA OR
   B. A "SIMILAR" ASSOCIATION OR ORGANISATION BY AGREEMENT WITH THE PRINCIPAL'S REPRESENTATIVE
9. CONCRETE MIX DESIGNS MUST ACHIEVE AN OVERALL PROJECT PORTLAND CEMENT CONTENT REDUCTION AS FOLLOW:
   A. FOR CONCRETE ELEMENT THICKER THAN 500MM WITH ONE EXPOSED PRIMARY SURFACE, THE CEMENTITIOUS CONTENT MUST CONTAIN AT LEAST 50% FLY-ASH OR 70% SLAG
   B. FOR ALL OTHER CONCRETE ELEMENT, THE CEMENTITIOUS CONTENT MUST CONTAIN AT LEAST 30% FLY-ASH OR 55% SLAG.
   C. TERNARY BLEND MIXES ARE ALLOWED PROVIDING THEY COMPLY WITH ALL OTHER TECHNICAL REQUIREMENTS AND CAN BE DEMONSTRATED TO HAVE A LOWER EMBODIED GREENHOUSE GAS FOOTPRINT ASSOCIATED WITH CEMENTITIOUS MATERIALS COMPARED TO A BENCHMARK CONCRETE MIX. THIS PERFORMANCE-BASED ASSESSMENT IS TO BE DONE IN ACCORDANCE WITH PS.4.5.2.3.(E).(II) AND SUBMITTED FOR PRINCIPAL'S REVIEW
10. THE MAXIMUM CEMENTITIOUS CONTENT FOR CONCRETE USED IN THE WORKS WITH A DESIGN CHARACTERISTIC :
    A. 20 MPA MUST BE 280kg PER CUBIC METRE OF CONCRETE
    B. 25 MPA MUST BE 310kg PER CUBIC METRE OF CONCRETE
    C. 32 MPA MUST BE 360kg PER CUBIC METRE OF CONCRETE
    D. 40 MPA MUST BE 420kg PER CUBIC METRE OF CONCRETE
    E. 50 MPA MUST BE 450kg PER CUBIC METRE OF CONCRETE
    F. 65 MPA MUST BE 500kg PER CUBIC METRE OF CONCRETE
    G. GREATER THAN 65 MPA IS SUBJECT TO THE SUBMISSION OF METHOD STATEMENTS FOR PERFORMANCE BASED ASSESSMENT AND PRINCIPAL'S REVIEW
11. AT LEAST 50% OF FINE AGGREGATE (SAND) INPUTS IN THE CONCRETE ARE MANUFACTURED SAND OR OTHER ALTERNATIVE MATERIAL (MEASURED BY MASS)
12. A MINIMUM 30% OF TOTAL MIX WATER FOR CONCRETE IS FROM CAPTURED OR RECLAIMED WATER
13. PROPOSED MATERIALS, INCLUDING ALL INFORMATION AND DATA SHEETS REQUIRED TO DEMONSTRATE THE MATERIALS MEET THE REQUIREMENTS OF THE SPECIFICATION, SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL PRIOR TO USE.
14. TUNNEL ANNULAR GROUTING MIX WITH A MAXIMUM CEMENTITIOUS MATERIAL CARBON FOOTPRINT OF 250kg Co^2-E/m^3 OR GREATER THAN 50% FLY ASH REPLACEMENT
15. TUNNEL SEGMENT CONCRETE MIX WITH A MAXIMUM CEMENTITIOUS MATERIAL CARBON FOOTPRINT OF 270kg Co^2-E/m^3.

TIMBER:

1. ALL WORKMANSHIP, MATERIALS, DETAILING AND SIZING SHALL BE IN ACCORDANCE WITH AS1684 & AS1720 (U.N.O.)
2. ALL NAILS, BOLTS, NUTS, SCREWS, WASHERS & TIMBER PLATE FASTENERS TO BE HOT-DIP GALVANISED.
3. ALL NAILS TO BE Ø3.75 x 75mm LONG MINIMUM (U.N.O.).
4. TIMBER TO BE FREE OF DEFECTS AT JOINTS.

DRAINAGE:

1. SELECTION AND INSTALLATION OF PITS, PIPES, TANKS AND TRENCHES SHALL BE IN ACCORDANCE WITH THE CURRENT EDITION OF TfNSW D&C R11, LOCAL AND STATUTORY REQUIREMENTS (U.N.O.).
2. THE CONTRACTOR SHALL IDENTIFY AND LOCATE ALL SERVICES PRIOR TO COMMENCEMENT OF CONSTRUCTION.
3. SEDIMENT AND EROSION CONTROLS TO BE PROVIDED IN ACCORDANCE WITH ALL LOCAL AND STATUTORY REGULATIONS.
4. WHERE REQUIRED, STORMWATER EASEMENTS SHALL BE OBTAINED BY THE OWNER. ALL NEGOTIATIONS/COMPENSATION PAYMENTS AND THE INTEGRATION OF ANY EASEMENTS INTO THE TITLE DOCUMENTS SHALL BE BY THE OWNER UNLESS AGREED OTHERWISE.
5. PIPE POSITIONS ARE INDICATIVE ONLY. FINAL POSITIONS TO BE DETERMINED ON-SITE AND SHALL CONFORM WITH THE INTENT OF THE DESIGN.
6. THE ENGINEER SHALL BE ADVISED IF ANY EXISTING STRUCTURES ARE WITHIN THE ZONE OF INFLUENCE OF AN EXCAVATION. ANY REQUIRED UNDER-PINNING OR PIERING SHALL BE PROVIDED.
7. WHERE EXCAVATING ADJACENT TO BOUNDARIES, ADEQUATE SHORING SHALL BE PROVIDED.
8. THE CONTRACTOR SHALL ENSURE THAT ALL NEW STRUCTURES ARE FOUNDED BELOW THE ZONE OF INFLUENCE OF ANY EXCAVATIONS WHETHER THEY BE FOR PIPELINES, TANKS OR OTHER DRAINAGE FACILITIES.
9. UNLESS NOTED OTHERWISE, THE MAXIMUM DEVIATION FROM NOMINATED LEVELS SHALL BE ±10mm, EXCEPT IN INSTANCES WHERE SUCH A DEVIATION COULD HAVE ADVERSE EFFECTS, IN WHICH CASE THE ENGINEER SHALL BE CONSULTED.
10. LOAD CLASS FOR COVERS/GRATES SHALL BE IN ACCORDANCE WITH TfNSW D&C R11.
11. UNTIL COMPLETION OF ALL WORKS, THE CONTRACTOR SHALL FIRSTLY FILTER ALL STORMWATER IN ACCORDANCE WITH APPROVED DETAILS TO ENSURE THE REMOVAL OF ALL CONCRETE AND PLASTERING FINES, AND OTHER BUILDING SITE POLLUTANTS.
12. THE CONTRACTOR SHALL SEEK DIRECTION BEFORE COMMENCING ANY EXCAVATION THAT MAY RESULT IN DAMAGE TO ANY EXISTING TREES.
13. RETAINING STRUCTURES SHALL BE PROVIDED AS REQUIRED IN ORDER TO ACHIEVE THE LEVELS NOMINATED ON THE DRAWINGS. THESE STRUCTURES SHALL COMPLY WITH ALL LOCAL AND STATUTORY REGULATIONS, AND MAY REQUIRE DESIGN BY AN ENGINEER.
14. UNLESS NOTED OTHERWISE, WHERE A PIT INVERT IS BELOW THE INVERT OF THE LOWEST OUTLET PIPE, THE CONTRACTOR SHALL EITHER PROVIDE DRAINAGE HOLES IN THE BASE OF THE PIT OR ELSE FILL THE BASE OF THE PIT WITH MASS CONCRETE TO THE INVERT OF THE LOWEST OUTLET PIPE.
15. WHERE REQUIRED BY REGULATIONS, STEP IRONS IN ACCORDANCE WITH AS1657 SHALL BE INSTALLED IN DEEP PITS/TANKS TO ALLOW ACCESS FOR MAINTENANCE. PIT COVERS OVER DEEP PITS SHALL BE 'CHILD-PROOFED' BY BOLTING THEM DOWN, EXCEPT WHERE THE COVER WEIGHS OVER 30kg.
16. ALL IMPERVIOUS SURFACES SHALL BE GRADED SUCH THAT THEY ARE FREE DRAINING.
17. WHERE REQUIRED BY THE PRINCIPAL, WORK-AS-EXECUTED DETAILS SHALL BE PREPARED BY A REGISTERED SURVEYOR/CHARTERED PROFESSIONAL ENGINEER VERIFYING THAT THE DRAINAGE SYSTEM HAS BEEN CONSTRUCTED IN ACCORDANCE WITH THE DRAWINGS. ANY DEVIATIONS FROM THE APPROVED PLANS SHALL BE NOTED AND BROUGHT TO THE ATTENTION OF THE ENGINEER. ADEQUATE INSPECTIONS SHOULD BE CARRIED OUT DURING THE COURSE OF CONSTRUCTION.
18. WHERE AN ENGINEER'S CERTIFICATE WILL BE REQUIRED, THE ENGINEER SHALL BE CALLED ON TO INSPECT THE WORKS PRIOR TO ANY CONCRETE POURS, PRIOR TO BACKFILLING AROUND ANY TANKS, AND AT THE COMPLETION OF WORKS. THE ENGINEER SHALL BE GIVEN A MINIMUM OF 72 HOURS NOTICE BEFORE AN INSPECTION IS REQUIRED.
19. ANY PROPOSED ALTERATIONS TO THE DETAILS SHOWN ON THE DRAWINGS SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL.
20. LEAF SCREENS, SILT CONTROLS AND ANY OTHER POLLUTANT CONTROL DEVICES SHALL BE REGULARLY SERVICED TO ENSURE THAT THE DRAINAGE SYSTEM REMAINS UNBLOCKED AND OPERATES AS ORIGINALLY INTENDED.
21. OVERLAND FLOW PATHS SHALL BE REGULARLY MAINTAINED AND KEPT FREE OF OBSTRUCTIONS TO THE FLOW OF WATER.
22. SUBSOIL DRAINAGE LINES SHALL BE PROVIDED BEHIND RETAINING WALLS AND OTHER AREAS AS REQUIRED TO RELIEVE HYDROSTATIC PRESSURE AND DRAIN GROUND WATERS. CONNECT INTO THE DRAINAGE SYSTEM IN SUCH A WAY AS TO AVOID BACKFLOW OF STORMWATER INTO THE SUBSOIL DRAINAGE LINE. IF IN DOUBT REFER TO ENGINEER.
23. NEW FENCES, RETAINING WALLS AND OTHER LANDSCAPING ITEMS SHALL BE DETAILED IN SUCH A WAY SO AS TO AVOID IMPOUNDING OR DIVERTING SURFACE WATERS ON TO ADJOINING PROPERTIES.
24. UPON COMPLETION, PIPE/PIT EXCAVATIONS SHALL BE BACKFILLED WITH SUITABLE COMPACTED MATERIAL IN ACCORDANCE WITH NOTES BELOW.
25. ALL PVC PIPES ARE TO BE:-
    a. SEWER GRADE (U.N.O.)
    b. INSTALLED AND BACKFILLED IN ACCORDANCE WITH AS2566.1
27. ALL CONCRETE PIPES ARE TO BE:-
    a. STRENGTH LOAD CLASS 4 (U.N.O.)
    b. INSTALLED AND BACKFILLED IN ACCORDANCE WITH AS3725 WITH CLASS H2 BEDDING SUPPORT
28. ALL PIPES ARE TO BE INSTALLED WITH 600mm MINIMUM COVER (FLEXIBLE PAVEMENTS) or 450mm MINIMUM COVER (RIGID PAVEMENTS). WHERE ADEQUATE COVER CANNOT BE PROVIDED PIPES SHALL BE ENCASED IN CONCRETE, REFER TO ENGINEER FOR DETAILS.
29. THE CONTRACTOR SHALL ADEQUATELY SHIELD PIPES AGAINST CONSTRUCTION AND PERMANENT LOADS.
30. PIPES HAVE BEEN DESIGNED TO WITHSTAND SM1600 TRAFFIC LOADING IN ACCORDANCE WITH AS5100.

OFFICIAL

FOR REVIEW AND COMMENT

No.	Amendment Description	Design by	Verified by	Approved by	Date
A	DESIGN STAGE 3 100% SUBMISSION	S.G.	P.D.	S.G.	14.12.22

SCALES: N.T.S.

KEYPLAN:

CLIENT: NSW GOVERNMENT | sydney METRO

PRINCIPAL AEO: GAMUDA Australia | LAING O'ROURKE

The information shown on this drawing is for the purposes of the Sydney Metro Project only. No warranty is given or implied as to its suitability for any other purpose. The Service Providers accept no liability arising from the use of this drawing and the information shown thereon for any purpose other than the Sydney Metro Project.

SERVICE PROVIDERS: HATCH

DRAWN	S.WOOD	14.12.2022
DESIGNED	S.GERRISH	14.12.2022
DRG CHECK	P.DAVISON	14.12.2022
DESIGN CHECK	P.DAVISON	14.12.2022
APPROVED	S.GERRISH	14.12.2022

SYDNEY METRO WEST - TEMPORARY WORKS

WESTERN TUNNELLING PACKAGE
CLYDE WATER TREATMENT PLANT
DISCHARGE PIPELINE ROUTE
CONSTRUCTION NOTES

DOCUMENT No: | SHEET: 1 OF 1 | ©
STATUS: STAGE 3 100% SUBMISSION | EDMS NO:
DRG No. SMWSTWTP-GLO-CLJ-BD700-TW-DRG-551001 | REV A | VER

A1 Original | Co-ordinate System: GDA20/MGA Zone 56 | Height Datum: A.H.D | This sheet may be prepared using colour and may be incomplete if copied | NOTE: Do not scale from this drawing.

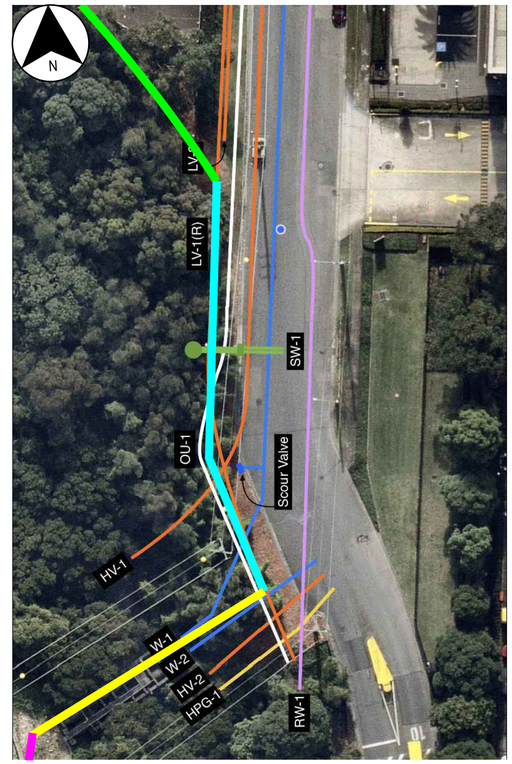
Cad File: \\SYDDATA02\projects\00010072\CJ-551 Discharge line for Perm & Handover WTP\Drawings\SM\WSTWTP-GLO-CLJ-BD700-TW-DRG-551001 (Duck Creek Construction Notes).dwg
Plot Date: 14/12/22 - 11:59
100mm A1 FULL SIZE

WATER TREATMENT PLANT DISCHARGE PIPELINE ROUTE - GENERAL ARRANGMENT PLAN

SCALE 1:2000

NOTES

1. REFER TO DRAWING SMWSTWTP-GLO-CLJ-BD700-TW-DRG-551001 FOR GENERAL NOTES
2. COLOURED LINEWORK ON THIS DRAWING INDICATES APPROXIMATE ROUTE OF DISCHARGE PIPELINE FROM THE WATER TREATMENT PLANT TO OUTLET POINT IN DUCK RIVER. THE ROUTE IS SHOWN IN APPROXIMATE LOCATION ONLY AND ACTUAL ALIGNMENT OF PIPELINE MAY NEED TO BE LOCALLY ADJUSTED IN SOME LOCATIONS TO SUIT EXISTING SITE FEATURES, UTILITIES AND THE LIKE.
3. THE NUMBER OF PIPES AND PIPE SUPPORT CONDITIONS VARY ALONG THE LENGTH OF THE PIPELINE. DETAILS 'A' TO 'F' NOTED ON GENERAL ARRANGEMENT PLAN INDICATE THE TYPICAL CONFIGURATION AND SUPPORT DETAILS OF PIPES FOR EACH SECTION OF COLOURED LINEWORK.
4. REFER TO DRAWINGS SMWSTWTP-GLO-CLJ-BD700-TW-DRG-551010 AND SMWSTWTP-GLO-CLJ-BD700-TW-DRG-551011 FOR DETAILS 'A' TO 'F' (EXCLUDING DETAIL 'D').



INSET 1 - SHIRLEY STREET EXISTING UTILITIES

SCALE 1:400

NOTES:

1. EXISTING UTILITIES WITHIN AND ADJACENT TO SHIRLEY STREET HAVE BEEN TAKEN FROM SERVICE LOCATION REPORT PREPARED BY WARD UTILITIES DATED 22 NOVEMBER 2022 (WARD JOB No. 726).
2. REFER TO THE ABOVEMENTIONED SERVICE LOCATION REPORT FOR DETAILS OF SERVICE TYPE, METHOD OF LOCATION, APPROXIMATE DEPTH ETC. PRIOR TO DETERMINING FINAL ALIGNMENT OF PROPOSED DISCHARGE PIPELINE AND COMMENCEMENT OF ANY EXCAVATION.
3. PROPOSED DISCHARGE PIPELINE ROUTE (DETAIL C) SHOWN INDICATIVELY ONLY. GLC TO CARRY OUT FURTHER NON-DESTRUCTIVE INVESTIGATION OF EXISTING SERVICES AND COORDINATE WITH EXISTING ASSET OWNERS AS REQUIRED TO SELECT FINAL ALIGNMENT.

OFFICIAL

FOR REVIEW AND COMMENT

No.	Amendment Description	Design by	Verified by	Approved by	Date
A	DESIGN STAGE 3 100% SUBMISSION	S.G.	P.D.	S.G.	14.12.22

SCALES:

0 20 40 60 80 100 120m
SCALE 1:2000 AT A1 SIZE

0 4 8 12 16 20 24m
SCALE 1:400 AT A1 SIZE

KEYPLAN:

CLIENT: NSW GOVERNMENT | sydney METRO

PRINCIPAL AEO: GAMUDA Australia | LAING O'ROURKE

SERVICE PROVIDERS: HATCH

The information shown on this drawing is for the purposes of the Sydney Metro Project only. No warranty is given or implied as to its suitability for any other purpose. The Service Providers accept no liability arising from the use of this drawing and the information shown thereon for any purpose other than the Sydney Metro Project.

DRAWN	S.WOOD	14.12.2022
DESIGNED	S.GERRISH	14.12.2022
DRG CHECK	P.DAVISON	14.12.2022
DESIGN CHECK	P.DAVISON	14.12.2022
APPROVED	S.GERRISH	14.12.2022

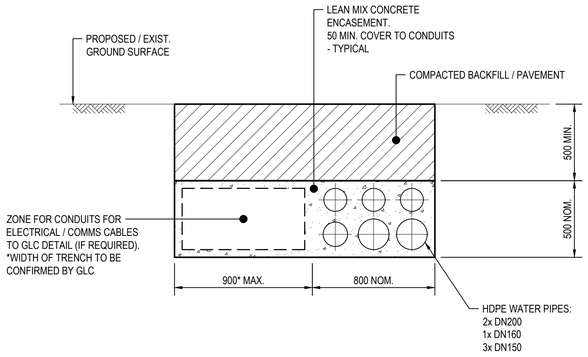
SYDNEY METRO WEST - TEMPORARY WORKS

WESTERN TUNNELLING PACKAGE
CLYDE WATER TREATMENT PLANT
DISCHARGE PIPELINE ROUTE
GENERAL ARRANGEMENT PLAN

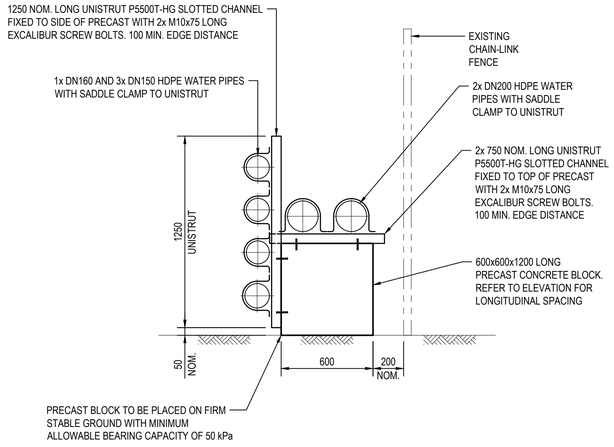
DOCUMENT No: | SHEET: 1 OF 1 | ©
STATUS: STAGE 3 100% SUBMISSION | EDMS NO:
DRG No. SMWSTWTP-GLO-CLJ-BD700-TW-DRG-551002 | REV A | VER

A1 Original | Co-ordinate System: GDA20/MGA Zone 56 | Height Datum: A.H.D | This sheet may be prepared using colour and may be incomplete if copied | NOTE: Do not scale from this drawing.

Cad File: \\SYDDATA02\projects\00010172\CLJ-SS1 Discharge line for Perm & Handover WTP\Drawings\SMWSTWTP-GLO-CLJ-BD700-TW-DRG-551002 (Duck Creek Discharge Line General Arrangement Plan).dwg
Plot Date: 14/12/22 - 11:59
100mm AT FULL SIZE

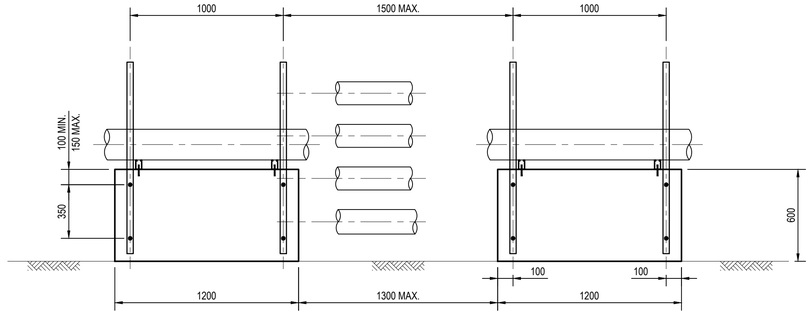


DETAIL A
SCALE 1:20
551002



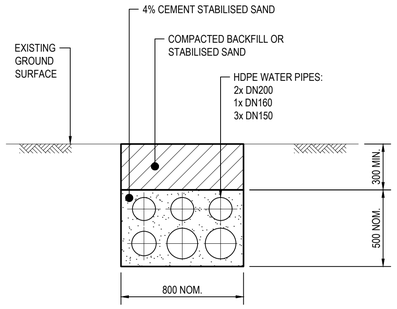
DETAIL B
SCALE 1:20
551002

SECTION

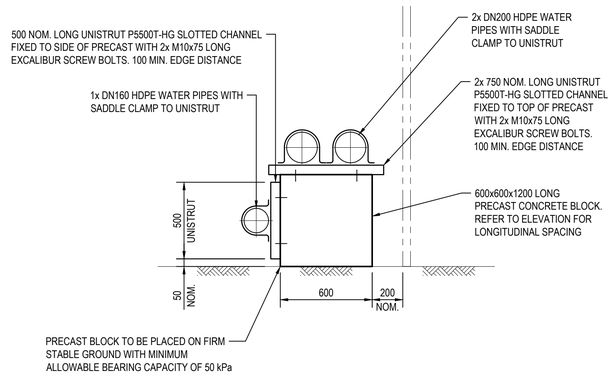


DETAIL B
SCALE 1:20
551002

ELEVATION

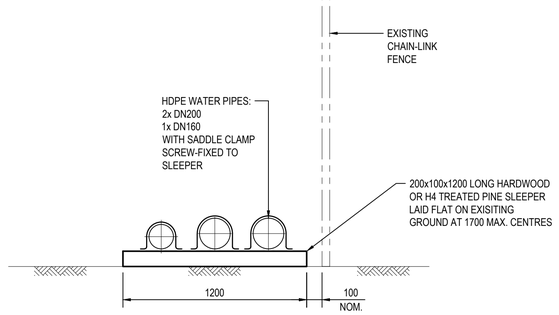


DETAIL C
SCALE 1:20
551002



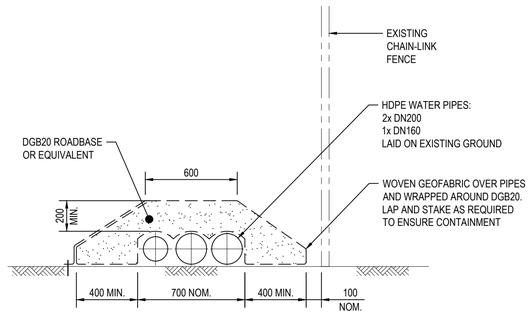
DETAIL E
SCALE 1:20
551002

OPTION 1



DETAIL E
SCALE 1:20
551002

OPTION 2



NOTE:

ON-GROUND PIPE RESTRAINT TO BE MINIMUM 4m IN LENGTH AT 50m MAXIMUM SPACING AND AT ALL CHANGES IN DIRECTION OF PIPES EXCEEDING 15 DEGREES IN PLAN OR ELEVATION.

DETAIL E
SCALE 1:20
551002

OPTION 3

OFFICIAL

FOR REVIEW AND COMMENT

No.	Amendment Description	Design by	Verified by	Approved by	Date
A	DESIGN STAGE 3 100% SUBMISSION	S.G.	P.D.	S.G.	14.12.22

SCALES:

0 0.2 0.4 0.6 0.8 1.0 1.2m
SCALE 1:20 AT A1 SIZE

KEYPLAN:

CLIENT: NSW GOVERNMENT | sydney METRO

PRINCIPAL AEO: GAMUDA Australia | LAING O'ROURKE

SERVICE PROVIDERS: HATCH

The information shown on this drawing is for the purposes of the Sydney Metro Project only. No warranty is given or implied as to its suitability for any other purpose. The Service Providers accept no liability arising from the use of this drawing and the information shown thereon for any purpose other than the Sydney Metro Project.

DRAWN	S.WOOD	14.12.2022
DESIGNED	S.GERRISH	14.12.2022
DRG CHECK	P.DAVISON	14.12.2022
DESIGN CHECK	P.DAVISON	14.12.2022
APPROVED	S.GERRISH	14.12.2022

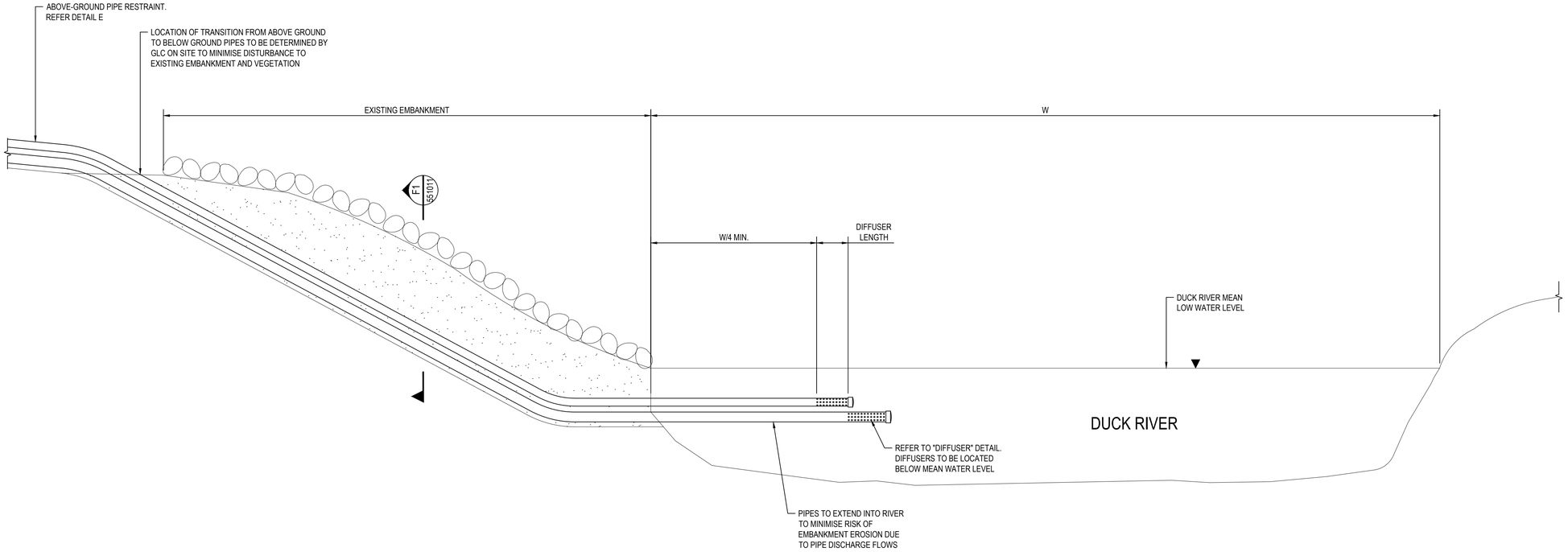
SYDNEY METRO WEST - TEMPORARY WORKS

WESTERN TUNNELLING PACKAGE
CLYDE WATER TREATMENT PLANT
DISCHARGE PIPELINE ROUTE
DETAILS - SHEET 1

DOCUMENT No: | SHEET: 1 OF 1 | ©
STATUS: STAGE 3 100% SUBMISSION | EDMS NO:
DRG No. SMWSTWTP-GLO-CLJ-BD700-TW-DRG-551010 | REV A | VER

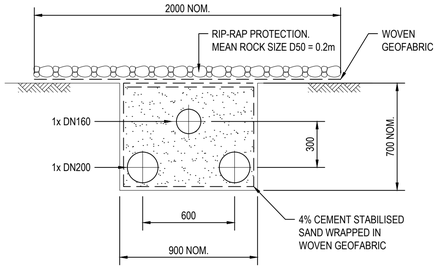
A1 Original | Co-ordinate System: GDA20/MGA Zone 56 | Height Datum: A.H.D | This sheet may be prepared using colour and may be incomplete if copied | NOTE: Do not scale from this drawing.

Plot Date: 14/12/22 - 12:00 | Cad File: \SYDDATA02\projects\5001\70172\CLJ-551 Discharge line for Perm & Handover WTP\Drawings\SMWSTWTP-GLO-CLJ-BD700-TW-DRG-551010_551011 (Dusk Creek Discharge Line Details).dwg | 100mm AT FULL SIZE



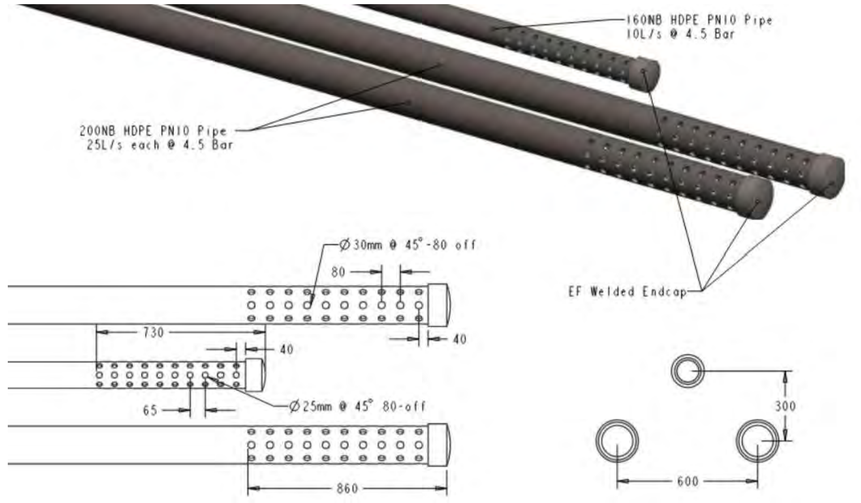
NOTE:
PROFILE OF EMBANKMENT AND RIVER BED SHOWN INDICATIVELY ONLY.

DETAIL F
N.T.S.
551002



NOTES:
1. DISCHARGE PIPES TO BE ALIGNED NOMINALLY 20 DEGREES DOWNSTREAM (IN PLAN) WHEN PIPES ENTER DUCK RIVER.
2. GLC TO OBTAIN NECESSARY APPROVALS FROM COUNCIL, NSW DEPARTMENT OF PRIMARY INDUSTRIES (DPI) AND OTHER AUTHORITIES AS REQUIRED PRIOR TO DISTURBING ANY WATERFRONT LAND.

SECTION F1
SCALE 1:20
551011



DIFFUSER DETAIL
N.T.S.

OFFICIAL

FOR REVIEW AND COMMENT

No.	Amendment Description	S.G. Design by	P.D. Verified by	S.G. Approved by	14.12.22 Date
A	DESIGN STAGE 3 100% SUBMISSION				

SCALES:
0 0.2 0.4 0.6 0.8 1.0 1.2m
SCALE 1:20 AT A1 SIZE

KEYPLAN:

CLIENT: NSW GOVERNMENT / sydney METRO

PRINCIPAL AEO: GAMUDA Australia / LAING O'ROURKE

SERVICE PROVIDERS: HATCH

The information shown on this drawing is for the purposes of the Sydney Metro Project only. No warranty is given or implied as to its suitability for any other purpose. The Service Providers accept no liability arising from the use of this drawing and the information shown thereon for any purpose other than the Sydney Metro Project.

DRAWN	S.WOOD	14.12.2022
DESIGNED	S.GERRISH	14.12.2022
DRG CHECK	P.DAVISON	14.12.2022
DESIGN CHECK	P.DAVISON	14.12.2022
APPROVED	S.GERRISH	14.12.2022

SYDNEY METRO WEST - TEMPORARY WORKS

WESTERN TUNNELLING PACKAGE
CLYDE WATER TREATMENT PLANT
DISCHARGE PIPELINE ROUTE
DETAILS - SHEET 2

DOCUMENT No: | SHEET: 1 OF 1 | ©
STATUS: STAGE 3 100% SUBMISSION | EDMS NO:
DRG No. SMWSTWTP-GLO-CLJ-BD700-TW-DRG-551011 | REV A | VER

A1 Original | Co-ordinate System: GDA20/MGA Zone 56 | Height Datum: A.H.D | This sheet may be prepared using colour and may be incomplete if copied | NOTE: Do not scale from this drawing.

Cad File: \\SYDDATA02\projects\500017072\CJ-551 Discharge line for Perm & Handover WTP Drawings\SMWSTWTP-GLO-CLJ-BD700-TW-DRG-551010_551011 (Duck Creek Discharge Line Details).dwg
Plot Date: 14/12/22 - 12:00
100mm AT FULL SIZE