WOODSIDE ENERGY LTD

Karratha Gas Plant

Chemical Characterisation and Whole Effluent Toxicity Testing Assessment

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PROJECT 411012-01338 - 411012-01338-EN-REP-00001: Karratha Gas Plant - Chemical Characterisation and Whole Effluent Toxicity Testing Assessment

Rev	Description	Originator	Reviewer	Worley Approver	Revision Date	Customer Approver	Approval Date
Rev B	Issued for client comments	L. Chiaroni	S. Watts	M. Westera	01 July 2026		
Rev 0	Issue for use	L. Chiaroni	M. Westera	M. Westera	24 July 2026		

Executive Summary

Woodside commissioned Worley to undertake chemical characterisation and whole effluent toxicity (WET) testing of treated wastewater discharges from the Karratha Gas Plant (KGP) in accordance with the North West Shelf (NWS) Project Extension Marine Environmental Quality Management Plan (MEQMP) Revision 4, as required by Condition 5-3 of Ministerial Statement 1233. The assessment included sampling and analysis of the Jetty Outfall and Administration (Admin) Drain discharges in December 2025, together with comparison to historical WET testing undertaken for the Jetty Outfall discharge in 2018.

Most analytes were either not detected or present at low concentrations. Organic contaminants, including BTEX, PAHs, phenols and chlorophenols, were below analytical detection limits in both discharges. Hydrocarbons were detected at low concentrations and were dominated by heavier fractions characteristic of weathered petroleum residues. Key heavy metals including arsenic, cadmium, selenium, and mercury were below detection limits in both discharges. Some metals/metalloids exceeded the ANZG (2018) 99% default guideline values (DGVs) for both Admin Drain and Jetty Outfall discharges, however when applying expected dilutions, all concentrations of bioavailable (i.e. dissolved component) metals/metalloids were below ANZG (2018) 99% DGVs at the boundary of the respective moderate ecological protection areas (MEPAs).

Elevated ammonia concentrations were recorded in the Admin Drain discharge, whereas ammonia was below detection limits at the Jetty Outfall discharge.

No new or emerging contaminants of concern were identified within the suite of analytes assessed, and the overall contaminant profile was consistent with historical monitoring results.

WET testing indicated that the Jetty Outfall discharge exhibited relatively low toxicity, with five of eight chronic test species showing no measurable effects at 100% effluent concentration. Comparison with 2018 results demonstrated a marked reduction in toxicity, indicating improved effluent quality over time. The Admin Drain exhibited measurable toxicity across all tested species, with the greatest sensitivity observed in marine invertebrates.

Species sensitivity distribution (SSD) analysis indicated that the Jetty Outfall requires approximately 1:19 dilution to achieve a 99% species protection level, substantially less than the minimum dilution predicted (1:400) at the boundary of the Jetty Outfall MEPA. For the Admin Drain, SSD analysis indicates that a dilution of approximately 1:150 is required to achieve the same level of protection (99% species protection level), which is greater than the expected minimum dilution (1:14) at the boundary of the Admin Drain MEPA.

Overall, the assessment confirms that the Jetty Outfall discharge is consistent with the environmental objectives of the MEQMP and Ministerial Statement 1233 based on measured toxicity SSD-derived dilution requirements and validated dilution estimates at the MEPA boundary. The Admin Drain exhibited elevated toxicity relative to the Jetty Outfall and warrants further assessment, per requirements of the MEQMP.

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Acronyms and abbreviations

Acronym/Abbreviation	Definition
ANZG	Australian and New Zealand Guidelines for Fresh and Marine Water Quality
BOD	Biochemical oxygen demand
BTEX	Benzene, toluene, ethylbenzene, and xylenes
CFU	Colony-forming units
CI	Confidence interval
CoA	Certificate of analysis
CoC	Chain of custody
CPI	Corrugated plate interceptors
DGV	Default guideline value
DOC	Dissolved organic carbon
EC10	Effect in 10% of test organisms
EC50	Effect in 50% of test organisms
EPA	Environmental Protection Authority
EQC	Environmental quality criteria
EQG	Environmental quality guideline
EQMF	Environmental Quality Management Framework
EQO	Environmental quality objectives
EQS	Environmental quality standard
ESA	Ecotox Services Australasia
EV	Environmental values
KGP	Karratha Gas Plant
LNG	Liquefied natural gas
LOEC	Lowest observed effect concentration
LOR	Limit of reporting
MEPA	Moderate ecological protection area
MEQMP	Marine Environmental Quality Management Plan
MPN	Most probable number
NATA	National Association of Testing Authorities
NOEC	No observed effect concentration
OCW	Oil-contaminated water
PAH	Polycyclic aromatic hydrocarbon

Acronym/Abbreviation	Definition
PC95	Concentration protective of 95% of species (from SSD)
PC99	Concentration protective of 99% of species (from SSD)
QA/QC	Quality assurance quality control
SSD	Species sensitivity distribution
TOC	Total organic carbon
TDS	Total dissolved solids
TIE	Toxicity identification evaluation
TPH	Total petroleum hydrocarbons
TRH	Total recoverable hydrocarbons
TSS	Total suspended solids
WET	Whole effluent toxicity

1. Introduction

1.1 Background

The Karratha Gas Plant (KGP) operated by Woodside Energy (Woodside) is located on the Burrup Peninsula in the Pilbara region of Western Australia and serves as the onshore processing hub for the North West Shelf (NWS) Project.

The NWS Project Extension has received State and Federal environmental approvals and is intended to support the continued operation of the NWS Project facilities beyond 2030 for the processing of remaining NWS reserves and third-party gas, subject to applicable conditions.

Treated wastewater generated at KGP is discharged to the marine environment via two licensed discharge points: the Jetty Outfall and the Admin Drain (Figure 1-1).

These discharges are regulated under Part V of the *Environmental Protection Act 1986* (WA) and are managed in accordance with the Marine Environmental Quality Management Plan (MEQMP), which is required under Ministerial Statement No. 1233.

Figure 1-1 Wastewater discharge locations at Karratha Gas Plant (source: Woodside)

1.2 Ministerial Statement 1233

The NWS Project Extension operates under State Ministerial Statement 1233, which includes conditions relevant to the protection of marine environmental quality. Conditions include the implementation of the Marine Environment Quality Management Plan (MEQMP) to ensure wastewater discharges from KGP are unlikely to significantly impact the marine environment.

1.3 MEQMP and environmental quality criteria

The MEQMP provides a framework to manage potential impacts of planned discharges on marine environmental quality. The MEQMP applies spatially defined levels of ecological protection around each discharge point, which set allowable levels of change to the receiving environment. Both the Admin Drain and Jetty Outfall have a spatially defined moderate ecological protection area (MEPA), beyond which a high (i.e. 99% species protection level) must be achieved.

Specifically, the MEQMP:

- identifies environmental values (EVs) to be protected, including ecosystem health, fishing and aquaculture, recreation, and aesthetics;
- establishes environmental quality objectives (EQOs), with a primary objective to maintain identified EVs;
- defines environmental quality criteria (EQC), including environmental quality guidelines (EQGs) and environmental quality standards (EQSs), which provide quantitative triggers for assessing discharge performance; and
- incorporates monitoring and adaptive management to ensure ongoing compliance.

EQC are used to assess whether EQOs are being achieved. This relationship is summarized in Figure 1-2.

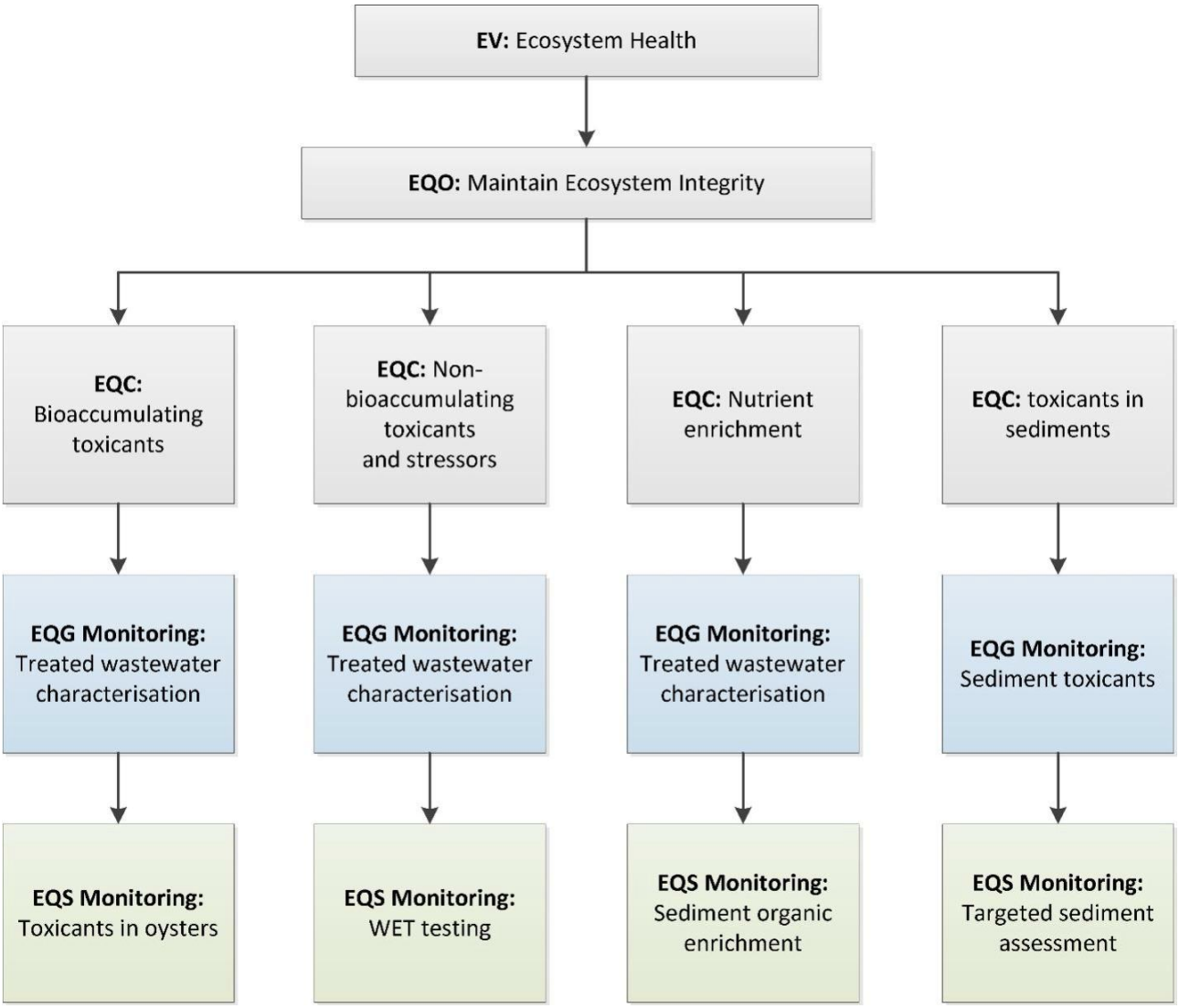


Figure 1-2 Environmental quality objectives, criteria, and monitoring programs for maintaining the environmental value Ecosystem Health (Woodside 2021)

EQGs form one type of EQC and represent quantitative investigative trigger values that, if achieved, indicate that the associated EQO is likely being met. Exceedance of an EQG does not necessarily indicate environmental harm; however, it triggers further assessment, including assessment against the relevant EQS, to determine whether additional monitoring and/or management actions are required, in accordance with the framework set out in the MEQMP (Woodside 2021).

1.4 Historical whole effluent toxicity (WET) testing

In recognition of the variability in wastewater composition and receiving environment conditions over time, the MEQMP adopts an adaptive management approach. This includes periodic full-suite chemical characterisation, triennial WET testing for the Jetty Outfall, and ongoing review of monitoring outcomes to confirm that EQOs continue to be achieved.

WET testing provides a key line of evidence for assessing the potential for treated effluent discharges to cause adverse biological effects in the receiving marine environment. By evaluating the combined effects of both measured and unmeasured constituents, WET testing complements chemical characterisation and supports the demonstration of environmental acceptability under Ministerial Statement 1233.

Historical WET testing of Jetty Outfall discharges was undertaken in 2006, 2010 and 2018. No historical WET testing has been completed for the Admin Drain discharge. The 2018 assessment derived species sensitivity distribution (SSD) guideline values of 1.7% effluent (PC95) and 0.36% effluent (PC99), equivalent to dilution factors of approximately 1:59 and 1:280, respectively.

WET testing undertaken in 2025 included both the Jetty Outfall and Admin Drain discharges. The WET testing suite comprised the eight species assessed in 2018 (Section 2.4), with the addition of *Ecklonia radiata* to broaden representation of ecologically relevant marine taxa.

While historical comparisons provide useful context, changes to test battery composition and SSD methodology limit direct comparison of derived PC values between years.

1.5 Site description

1.5.1 Jetty Outfall

The Jetty Outfall discharge location sits within a spatially defined MEPA (Figure 1-3), which was first established in DoE (2006). The MEPA extends a minimum of approximately 500 m from the Jetty Outfall. For the EV 'ecosystem health' a high level of ecological protection (99% species protection) must be achieved immediately beyond the MEPA.

Modelling predicts a minimum of 1:400 dilutions are achieved within 500m under 95% of conditions (Phillips 2019).

The Jetty Outfall discharge stream contains treated water originating from the KGP oil-contaminated water (OCW) system. The OCW comprises networks of drainage pipework within the LNG and Domgas processing areas that collect oil-contaminated and potentially oil-contaminated water, directing flows to corrugated plate interceptors (CPIs) as the primary treatment to remove oil, and then holding basins to allow settling, residence time, and aeration to remove organic and chemical contaminants. Comingled wastewater then flows into final holding basin T6701 where it is sampled prior to discharge to the marine environment via the Jetty Outfall (Figure 1-3).

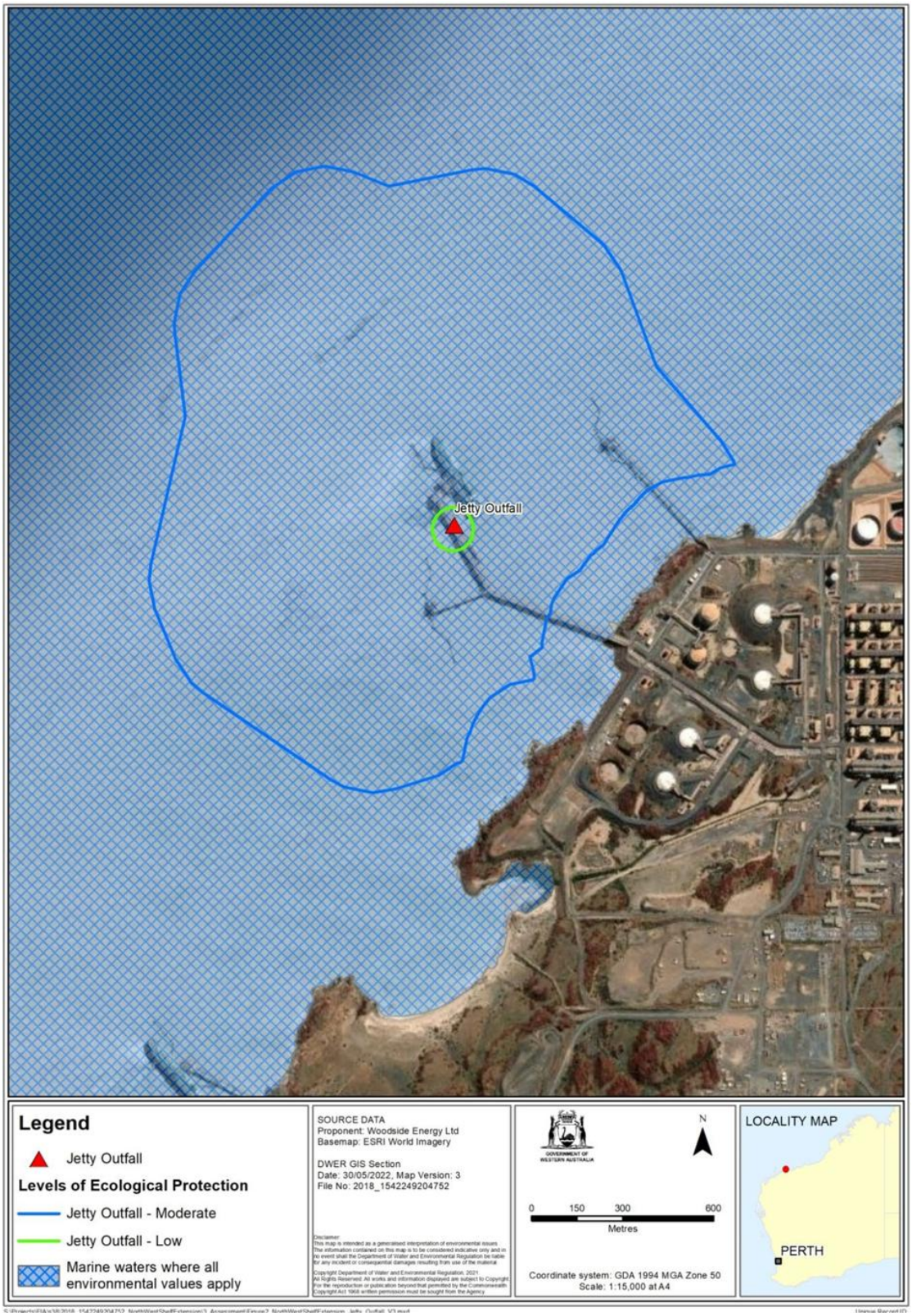


Figure 1-3 Jetty Outfall Levels of Ecological Protection (taken from Ministerial Statement 1233)

1.5.2 Admin Drain

The Admin Drain receives water from the following sources: treated effluent from the sewage treatment plant final holding tank, water discharged from the demineralisation water plant, and water from the stormwater drainage network (Woodside 2021).

The Admin Drain MEPA extends 70 m from the point where the channel known as "No Name Creek" discharges into "No Name Bay" via a culvert under the site boundary road (Figure 1-4). For the EV 'ecosystem health' a high level of ecological protection (99% species protection) must be achieved immediately beyond the MEPA. A field validation study indicated approximately 14 dilutions are achieved at the edge of the MEPA (Woodside 2021).

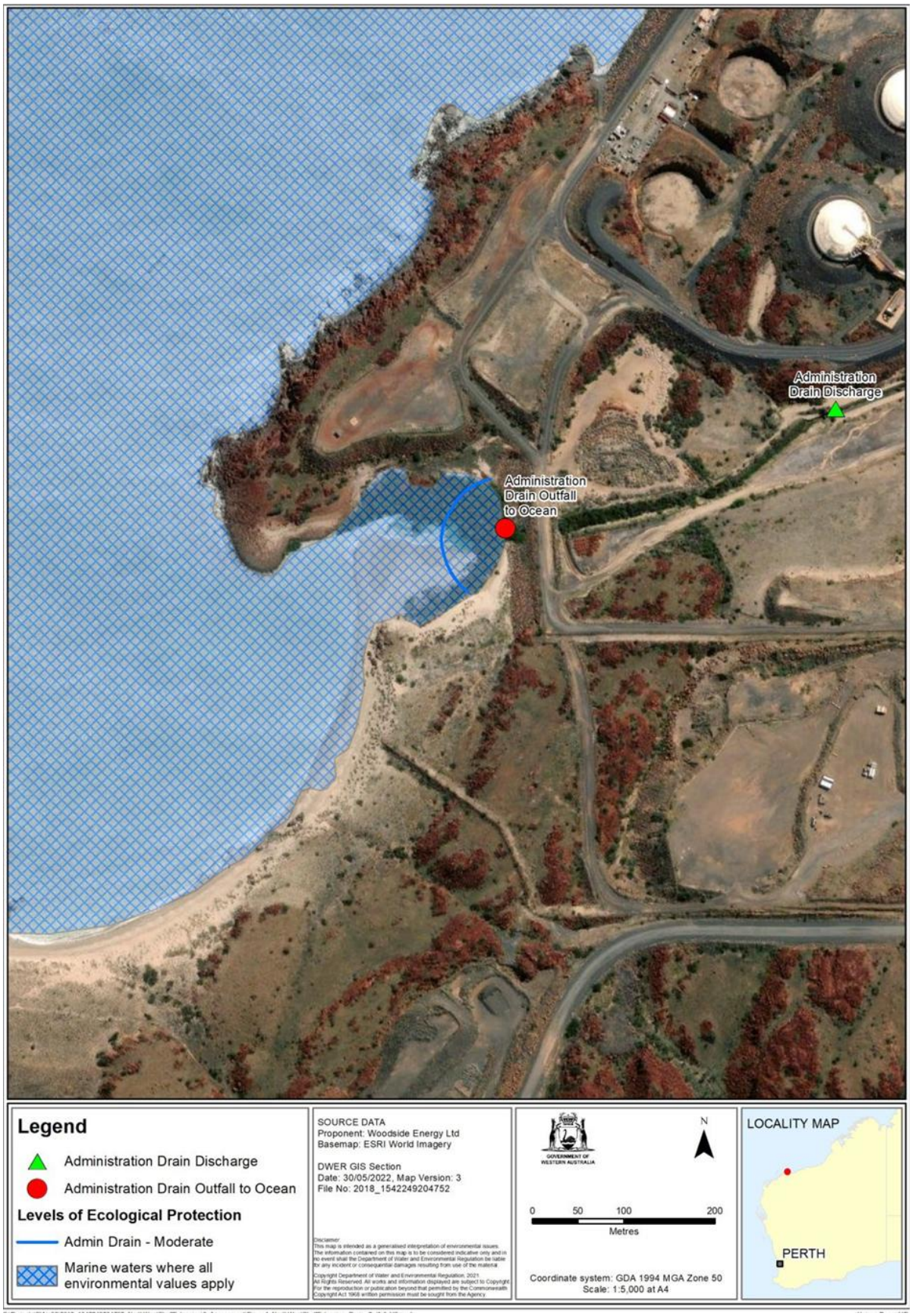


Figure 1-4 Admin Drain Levels of Ecological Protection (taken from Ministerial Statement 1233)

1.6 Scope of work

Worley Consulting was commissioned by Woodside to carry out the following scope of works:

- Complete chemical characterisation and WET testing of KGP effluent discharge samples per below:
  - Jetty Outfall (from basin T6701) – 1 sample
  - Admin Drain – 1 sample.
- Toxicity testing and chemical analysis is to be consistent and comparable with the 2018 WET testing and chemical characterisation assessment, whilst also adhering to current practices and regulatory guidance.
- Provide comparison of 2025 chemical characterisation and toxicity results against historical data (2018).
- Assess and report on the results of the 2025 WET testing including, where applicable, use of the shinyssdtools program to determine dilutions required to meet the 99% and 95% species protection levels, should toxicity be measured. An output (including confidence intervals) for the SSD using Burrlioz 2.0 shall be included for a comparison against shinyssdtools in a separate memorandum
- Provide an evaluation of the potential risks to the marine environment associated with the marine discharge, including specifying the elements of the treated wastewater likely to govern toxicity and determining the number of dilutions required to meet a high level of ecological protection.

2. Methods

2.1 Sample collection

Effluent samples were collected by Woodside personnel using the KGP Sampling Procedure and pre-prepared sampling containers supplied by each laboratory (Appendix A).

For the Jetty Outfall discharge, a sample was collected from final holding basin T6701. The wastewater in T6701 was recirculated within the basin prior to sampling, to ensure that a representative and well-mixed sample was taken of the discharge.

For the Admin Drain discharge, sampling was undertaken at the end of the Admin Drain where it enters No Name Creek (illustrated by the green triangle in the upper right quadrant of Figure 1-4).

Prior to sampling, sample containers and bottles were "field-rinsed" by partially filling the container with the source water, capping it, shaking it, and discarding it three times. Samples were then taken from source water and filled completely with no air space to minimise oxidation.

Following collection, samples were placed in insulated containers (eskies) with ice bricks and packing material and maintained at approximately 4°C. Chain-of-custody (CoC) procedures were implemented throughout sample handling, storage, and transport. Field sheets and tracking logs were used to verify that all samples were correctly labelled, preserved, and delivered to the laboratories within recommended holding times.

All samples were submitted to National Association of Testing Authorities (NATA) accredited laboratories, with chemical characterisation undertaken by ChemCentre and ecotoxicological testing conducted by Intertek.

2.2 Field quality assurance and quality control (QA/QC)

Quality control samples were collected to identify and assess potential sources of contamination introduced during sampling, handling, and transport.

Field blanks (equipment blanks) were used to assess potential contamination arising from field sampling activities, including cross-contamination between samples. Field blanks were prepared following the same procedure as primary samples, with laboratory-supplied deionised water poured over or through decontaminated sampling equipment and collected in the relevant sample containers.

Transport blanks were used to assess potential contamination during sample transport and handling. Transport blank containers were pre-filled with deionised water by the supplying laboratory, sealed prior to delivery, and transported alongside field samples. These containers remained unopened in the field and throughout transport.

2.3 Chemical characterisation

Annual full-suite chemical characterisation is undertaken for the KGP Jetty Outfall discharge to provide a comprehensive assessment of all potential contaminants and verify discharge composition. This process supports the detection of changes in contaminant profiles, including the presence of new constituents or elevated concentrations, with outcomes informing the review of the MEQMP to maintain a targeted and representative monitoring regime.

The parameters in Table 2-1 were analysed by ChemCentre, which are aligned with Table 8-1 of the MEQMP.

Table 2-1 Parameters for chemical characterisation

Parameters for chemical characterisation	
Physical parameters	
Electrical conductivity	Total suspended solids (TSS)
Total dissolved solids (TDS)	Total organic carbon (TOC)
Dissolved organic carbon (DOC)	Biological oxygen demand (BOD)
Ammonia	Hydrogen sulphide
Enterococci	
Metals and metalloids (total)	
Silver (Ag)	Aluminium (Al)
Arsenic (As)	Barium (Ba)
Calcium (Ca)	Cadmium (Cd)
Cobalt (Co)	Total chromium (Cr)
Chromium VI	Copper (Cu)
Iron (Fe)	Mercury (Hg)
Manganese (Mn)	Nickel (Ni)
Lead (Pb)	Selenium (Se)
Vanadium (V)	Zinc (Zn)
Metals and metalloids (dissolved)	
Silver (Ag),	Aluminium (Al)
Arsenic (As)	Arsenic III
Barium (Ba)	Calcium (Ca)
Cadmium (Cd)	Cobalt (Co)
Total chromium (Cr)	Chromium VI
Copper (Cu)	Iron (Fe)
Mercury (Hg)	Manganese (Mn)
Nickel (Ni)	Lead (Pb)
Selenium (Se)	Vanadium (V)
Zinc (Zn)	
Organic compounds	
BTEX (benzene, toluene, ethylbenzene, and xylenes)	Total recoverable hydrocarbons (TRH) C6–C36 fractions
Total petroleum hydrocarbons (TPH)	
volatile fatty acids	

Parameters for chemical characterisation	
Acetic acid	Propionic acid
Butyric acid	Valeric acid
Hexanoic acid	Heptanoic acid
Phenols	
Cresols	Chlorophenols
Nitrophenols	Trichlorophenols
Pentachlorophenol	
polycyclic aromatic hydrocarbons (PAHs)	
Naphthalene	Fluorene,
Phenanthrene	Anthracene
Fluoranthene	Pyrene
Benzo[a]anthracene	Benzo[b]fluoranthene
Benzo[k]fluoranthene	Benzo[a]pyrene
Dibenzo[a,h]anthracene	Benzo[ghi]perylene
Chrysene	Indeno[1,2,3 cd]pyrene

2.3.1.1 Assessment of contaminants

All analyte results were compared against Australian and New Zealand Guidelines (ANZG 2018, 2026) for marine water, where available, and also assessed against the EQGs defined in the MEQMP (Woodside 2021). ANZG (2018) values were sourced from the online ANZG Toxicant Default Guideline Values master table, current as of June 2026 (ANZG 2026).

EQGs represent site-specific trigger values for key contaminants of concern, derived from ANZG (2018) 90% or 99% species protection levels (current at the time of Revision 4 MEQMP) or internally derived limits where guideline values are unavailable. These EQGs account for background concentrations and dilution following discharge (Woodside 2021).

2.4 Whole effluent toxicity (WET) testing

The ecotoxicity tests were undertaken alongside chemical characterisation to provide a complementary line of evidence on effluent toxicity. The testing uses a range of marine species, as outlined in the Australian and New Zealand Guidelines (ANZG 2018) (Table 2-2). The toxicity bioassays used to derive the 2025 WET testing were selected in accordance with the marine ecotoxicity test suite specified by Woodside.

Samples were collected from the Jetty Outfall and Admin Drain. Both of the discharge samples were adjusted in the laboratory to a salinity of 35 ± 1‰ using artificial sea salts. The samples were then serially diluted with clean filtered seawater to achieve the effluent test concentrations (100%, 50%, 25%, 12.5%, 6.3%, 3.1% 1.6%, and 0.8%). Filtered seawater controls were tested concurrently with each sample, and all controls and sample concentrations were run in triplicate or quadruplicate. In addition, pH/salinity controls were included to match the pH and salinity of the higher dilutions.

The toxicity test data are presented in several ways. Firstly, the concentration at which no observed effects (NOEC) are demonstrated is generally used as the most conservative measure of toxicity, in that it is the lowest concentration at which no test organisms are

affected. The lowest observed effects concentration (LOEC) is the concentration where the first statistically discernible toxicity is observed. The concentration that will cause a sub-lethal effect in 50% of the test organisms in the prescribed test duration or that inhibits growth or reproduction of 50% of the test organisms in the prescribed test duration (EC50), is statistically calculated. In addition, the concentration that causes a sub-lethal effect by inhibiting growth or reproduction in 10% of the test organisms in the prescribed test duration is called EC10.

An ecotoxicity suite of eight chronic toxicity tests were undertaken using eight different species (tropical or sub-tropical species) from at least four different taxonomic groups to reliably determine effluent toxicity (Warne et al. 2025). This suite was used in 2018 for the WET testing the discharge at Jetty Outfall (Jacobs 2018), with the addition of *E. radiata*.

The planned suite also included an acute 96-hour tiger prawn survival bioassay using the tropical tiger prawn (*Penaeus monodon*). This test was not completed as suitable test organisms were unavailable from hatcheries at the time of testing. Hatcheries advised that the tiger prawn season concluded in October and would not recommence until approximately mid-June. Despite attempts to source organisms, the test could not be undertaken within the project schedule.

The eight chronic species tested and used for SSD derivation are provided in Table 2-2. This exceeds the minimum dataset requirement for SSD development, which requires chronic toxicity data from at least six species across four taxonomic groups (Warne et al. 2025).

An additional toxicity test for Microtox® (*Allivibrio fischeri* -5 and 15 minute) were completed for historical comparison (Jacobs 2018) but is not appropriate to be included in SSD (Warne et al. 2025). This test measures the decrease in light output of the marine bacterium *A. fischeri* after exposure to the discharge sample for 5 and 15 minutes. The lower the EC50, the more toxic the sample. These ecotoxicity tests are mainly focused on the early life stages of test organisms, given this is typically when organisms are most sensitive to contaminants.

Toxicity data from the Microtox® system are not recommended for inclusion in guideline derivation. Only toxicity data with immobilisation, lethality, and growth or reproduction endpoints should be used (Warne et al. 2025).

Table 2-2 Whole effluent toxicity testing taxa for the Jetty Outfall and Admin Drain discharge samples as aligned to current Australian and New Zealand Guidelines

Test species	Bioassay	Test Type	Taxonomic Group	Protocol
Allivibrio fischeri	Microtox® - 5 min	Acute	Microtox®	WIECX-17
Allivibrio fischeri	Microtox® -15 min	Acute	Microtox®	WIECX-17
Cylindrotheca closterium	Microalgae Growth	Chronic	Microalgae	WIECX-06
Ecklonia radiata	Macroalgae Zoospore Germination	Chronic	Macroalgae	WIECX-08
Exaiptasia diaphana	Sea Anemone Pedal Lacerate	Chronic	Macroinvertebrate (cnidaria)	WIECX-30

Saccostrea scyphophilla	Mollusc Larvae Development	Chronic	Macroinvertebrate (mollusc)	ESA 106
Heliocidaris tuberculata	Sea Urchin Development	Chronic	Macroinvertebrate (sea urchin)	ESA 105
Echinometra mathaei	Sea Urchin Development	Chronic	Macroinvertebrate (sea urchin)	WIECX-25
Gladioferens imparipes	Copepod Larval Development	Chronic	Micro invertebrate (copepod)	WIECX-26
Seriola lalandi	Fish Larvae Development	Chronic	Macroinvertebrate (fish)	WIECX-16

Notes:

1. Microtox® excluded from species sensitivity distribution (Warne et al. 2025).

2.4.1 Data analysis

2.4.1.1 Species sensitivity distribution and derivation of safe dilutions

The SSD methodology is used in ecotoxicology to systematically analyse and quantify the responses of multiple species to an environmental stressor. Shinyssdtools statistical software package was used for fitting SSD data (Thorley & Schwarz 2018). This program uses a model-averaging approach that automatically selects and averages the most appropriate distributions to provide a more robust and realistic fit to the data, overcoming the limitations observed in Burrlioz 2.0 which was used in 2018 for SSD on WET test data for the Jetty Outfall samples (Jacobs 2018). This method is supported by CSIRO and provides a more reliable and comprehensive estimation of toxicity guideline values.

The shinyssdtools utilises an extensive range of statistical models to analyse toxicity data and generate SSDs. The program calculates the concentration that protects a specified percentage of species (PCx values) at 80%, 90%, 95%, and 99% confidence levels (PC80(50), PC90(50), PC95(50), and PC99(50)), where '(50)' denotes the median (50th percentile) estimate of each PCx value.

For the SSD analysis, only species sensitivity data with appropriate endpoints (immobilisation, lethality, growth, or reproduction) are used. Data that do not meet these criteria, such as toxicity data from the Microtox® system (biochemical effect endpoint), are excluded, as per guidelines provided by Warne et al. (2025).

The shinyssdtools program does not support right-censored toxicity data (i.e. values reported as greater than [>]). Warne et al. (2025) advise that greater-than values may be used in SSD derivation, subject to professional judgement regarding whether they fall well outside the dataset range or unduly influence the derived guideline value. Where these conditions are not met, the reported threshold concentration should be entered for modelling purposes (e.g. >20 µg/L entered as 20 µg/L).

EC10 values reported as >100% were entered as 100%. These represent right-censored endpoints (true effect concentrations exceed the highest concentration tested) and are considered unlikely to influence the lower tail of the distribution.

The 2018 SSD included a converted Microtox® bioassay (*A. fischeri*). This test was not included in the 2025 SSD (Warne et al. 2025), and so a direct comparison of SSD outputs between years cannot be made.

Shinyssdtools also supports the calculation of the equivalent safe dilutions of Produced Water (PW) by dividing 100 by the PCx value. As this is the first sampling event for the facility, moving ranges and control charts cannot be generated. The shinyssdtools output is attached as Appendix D.

2.5 Ecotoxicity quality assurance and quality control

Specific quality assurance and quality control (QA/QC) procedures for undertaking ecotoxicity testing, procurement and culturing of test organisms, maintenance and calibration of instruments, cleaning, chain of custody and sample handling procedures, were in accordance with Intertek standard laboratory procedures and the National Association of Testing Authorities (NATA).

Each ecotoxicology test includes test acceptability criteria for the control response (negative control) and reference toxicant (positive control). Reference toxicants generally include ammonia for the fish test and copper (as copper sulphate or copper chloride) for all other tests. The control response and reference toxicant response must fall within acceptable criteria for the bioassay to be deemed valid (Appendix C).

3. Results

3.1 Chemical characterisation

3.1.1 Physical parameters

Physico-chemical data from both Admin Drain and Jetty Outfall discharges show they are significantly different to that of the receiving water.

Conductivity for both discharges was equivalent to brackish or heavily mineralised ground water, and within the range of previous years' sampling (Woodside 2021). The receiving water is marine sea water, which would have higher salinity, conductivity, sulphate and total dissolved solids in comparison to fresh or low salinity water (Searle 2012).

Biochemical oxygen demand (BOD) was low in both discharges (6 mg/L for Admin Drain, and <5 mg/L in Jetty Outfall), indicating minimal readily degradable organic load.

Total suspended solids (TSS) were moderate but not excessive in both streams (30 mg/L in the Admin Drain, 22 mg/L in the Jetty Outfall). Total dissolved solids were similar (~770 mg/L in both) and within expected ranges for industrial wastewater.

3.1.2 Microbiological indicators

The Admin Drain discharge had very high enterococci counts (>24,000 MPN/100 mL), consistent with stormwater runoff and/or domestic wastewater inflows, whereas the Jetty Outfall showed essentially no faecal indicator bacteria (10 MPN/100 mL).

While enterococci counts were elevated in comparison to 2014 -2018 averages, they were below the derived EQG of 300,000 CFU/100mL (equivalent to 300,000 MPN/100ml) (Woodside 2021).

3.1.3 Non-metallic inorganic compounds

The Admin Drain, which receives treated domestic wastewater, demineralisation water plant effluent and stormwater runoff, contained elevated ammonia concentrations (26 mg/L as N), whereas ammonia in the Jetty Outfall was below the limit of reporting.

The measured value of 26 mg/L at the Admin Drain exceeds the derived MEQMP EQG for ammonia, and warrants further assessment against the EQS, incorporating the results of WET Testing (Section 2.4). Hydrogen sulphide concentrations were at or below the limit of reporting at both discharge locations.

3.1.4 Organic compounds

3.1.4.1 Hydrocarbons

Both discharges contained low concentrations of total recoverable hydrocarbons (TRH) and total petroleum hydrocarbons (TPH). Hydrocarbon detections were dominated by heavier

fractions, with no volatile hydrocarbons (BTEX or C6–C9 fractions) detected in either discharge, potentially indicating the presence of weathered petroleum residues rather than fresh hydrocarbon inputs.

The Jetty Outfall contained a greater proportion of heavier hydrocarbons, with TRH >C16–C34 concentrations of approximately 410 µg/L. In contrast, the Admin Drain contained a broader distribution of hydrocarbon fractions, including detectable medium-chain hydrocarbons (TPH C10–C14; approximately 70 µg/L). Total TRH and TPH concentrations were low and comparable between the two discharge streams.

Overall, the hydrocarbon profile was consistent with historical wastewater characterisation data and did not indicate the presence of elevated petroleum contamination or any new hydrocarbon constituents of concern. Furthermore, when expected receiving-water dilutions were considered, hydrocarbon concentrations were below the relevant EQG values established under the MEQMP.

3.1.4.2 Other organic contaminants

All measured priority organic compounds, including polycyclic aromatic hydrocarbons (PAHs), phenols, and chlorophenols, were below detection limits in both discharges. This indicates no significant presence of these potential toxic organics (Table 3-1).

3.1.5 Metals and metalloids

Key heavy metals of concern, including arsenic, cadmium, selenium and mercury, were below analytical detection limits in both the Admin Drain and Jetty Outfall discharges (Table 3-1). Copper and zinc concentrations exceeded the 99% species protection DGVs at the point of discharge for both outfalls; however, concentrations were substantially below the applicable EQG values when dilution at the relevant mixing zone boundaries was considered.

Total iron exceeded the 99% species protection DGV at the Admin Drain. Total nickel concentrations exceeded the guideline values at both locations, and dissolved nickel exceeded the guideline value at Jetty Outfall. Chromium VI exceeded the guideline value at the Admin Drain. The values for chromium VI, iron and aluminium were present predominantly in particulate form, and dissolved values for all were below the 99% DGV.

Concentrations were below the applicable EQG after incorporating modelled dilution. The LOR for dissolved copper, and chromium VI was greater than the DGV for Jetty Outfall.

While some variability in metal concentrations was evident relative to historical characterisation data, the overall metal profile was consistent with previous monitoring and did not indicate the presence of any new or emerging contaminants of concern (Woodside 2021).

Table 3-1 Summary of chemical analysis results. Grey shading denotes below LOR.

Parameter	Units	DGV 99% ANZG (reliability)[a]	LOR	MEQMP EQGs *		Results		Results adjusted for expected dilution at MEPA boundary	
				Admin Drain	Jetty Outfall	Admin Drain	Jetty Outfall	Admin Drain (1:14 dilutions)	Jetty Outfall (1:400 dilutions)
Physical									
Biochemical Oxygen Demand	mg/L	-	<5	-	-	6	<5	0.43	<5
Dissolved Organic Carbon	mg/L	-	<1	-	-	9.7	9.5	0.69	0.02
Conductivity	mS/m	-	<0.2	-	-	160	159	11.43	0.40
Total Dissolved Solids	mg/L	-	<10	-	-	770	770	55.00	1.93
Total Organic Carbon	mg/L	-	<1	-	-	9.9	10	0.71	0.03
Total Suspended Solids	mg/L	-	<1	-	-	30	22	2.14	0.06
Biological									
Enterococci	MPN100mL	-	<1	300,000[#]	-	24,000	10	1714.00	0.025
Non-Metallic Inorganic									
Hydrogen Sulphide	mg/L	-	<0.01	1	1	<0.01	0.01	<0.01	0.000025
Nitrogen, ammonia	mg/L	0.5 (moderate)	<0.01	7	119	26	<0.01	1.857	<0.01
Organic Compounds									
Phenols	ug/L	270 (low)	<17	-	-	<17	<17	<17	<17
Acetic Acid	mg/L	-	<5	-	-	<5	<5	<5	<5
Propionic Acid	mg/L	-	<5	-	-	<5	<5	<5	<5
Heptanoic Acid	mg/L	-	<5	-	-	<5	<5	<5	<5
Hexanoic Acid	mg/L	-	<5	-	-	<5	<5	<5	<5
Butyric Acid	mg/L	-	<5	-	-	<5	<5	<5	<5
Valeric Acid	mg/L	-	<5	-	-	<5	<5	<5	<5
Benzene	ug/L	500 (moderate)	<1	-	-	<1	<1	<1	<1
Toluene	ug/L	110 (unknown)	<1	-	-	<1	<1	<1	<1
Ethylbenzene	ug/L	50 (unknown)	<1	-	-	<1	<1	<1	<1
m,p-Xylene	ug/L	-	<2	-	-	<2	<2	<2	<2
o-Xylene	ug/L	-	<1	-	-	<1	<1	<1	<1
C6-C10	ug/L	-	<25	-	-	<25	<25	<25	<25
>C10-C16	ug/L	-	<25	-	-	94	44	6.714	0.11
>C16-C34	ug/L	-	<100	-	-	230	410	16.429	1.03
>C34-C40	ug/L	-	<100	-	-	<100	<100	<100	<100
Total TRH	ug/L	-	<250	-	-	320	450	22.857	1.13
C6-C9	ug/L	-	<25	-	-	<25	<25	<25	<25
C10-C14	ug/L	-	<25	-	-	70	<25	5.000	<25
C15-C28	ug/L	-	<100	-	-	230	390	16.429	0.98
C29-C36	ug/L	-	<100	-	-	<100	<100	<100	<100
Total TPH	ug/L	-	<250	10000	10000	300	390	21.429	0.98
Acenaphthene	ug/L	-	<0.1	-	-	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	ug/L	-	<0.1	-	-	<0.1	<0.1	<0.1	<0.1
Anthracene	ug/L	0.01 (unknown)	<0.1	-	-	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	ug/L	-	<0.1	-	-	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene	ug/L	0.01 (unknown)	<0.1	-	-	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	ug/L	-	<0.1	-	-	<0.1	<0.1	<0.1	<0.1
Benzo(b)fluoranthene	ug/L	-	<0.1	-	-	<0.1	<0.1	<0.1	<0.1
Benzo(k)fluoranthene	ug/L	-	<0.1	-		<0.1	<0.1	<0.1	<0.1
Chrysene	ug/L	-	<0.1	-		<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	ug/L	-	<0.1	-		<0.1	<0.1	<0.1	<0.1
Fluoranthene	ug/L	-	<0.1	-		<0.1	<0.1	<0.1	<0.1
Fluorene	ug/L	-	<0.1	-		<0.1	<0.1	<0.1	<0.1
Indeno(1,2,3-cd)pyrene	ug/L	-	<0.1	-		<0.1	<0.1	<0.1	<0.1
Naphthalene	ug/L	50 (moderate)	<0.1	-		<0.1	<0.1	<0.1	<0.1
Phenanthrene	ug/L	0.6 (unknown)	<0.1	-		<0.1	<0.1	<0.1	<0.1
Pyrene	ug/L	-	<0.1	-		<0.1	<0.1	<0.1	<0.1
2,3,4,6-Tetrachlorophenol	ug/L	10[FW](moderate)	<1	-		<1	<1	<1	<1
2,4,5-Trichlorophenol	ug/L	-	<1	-		<1	<1	<1	<1
2,4,6-Trichlorophenol	ug/L	3[FW] (moderate)	<1	-		<1	<1	<1	<1
2,4-Dichlorophenol	ug/L	-	<1	-		<1	<1	<1	<1
2,4-Dimethylphenol	ug/L	-	<1	-		<1	<1	<1	<1
2,4-Dinitrophenol	ug/L	-	<1	-		<1	<1	<1	<1
2,6-Dichlorophenol	ug/L	-	<1	-		<1	<1	<1	<1
2-Chlorophenol	ug/L	-.	<1	-		<1	<1	<1	<1

Parameter	Units	DGV 99% ANZG (reliability)[a]	LOR	MEQMP EQGs *		Results		Results adjusted for expected dilution at MEPA boundary	
				Admin Drain	Jetty Outfall	Admin Drain	Jetty Outfall	Admin Drain (1:14 dilutions)	Jetty Outfall (1:400 dilutions)
2 methylphenol	ug/L	-	<1	-		<1	<1	<1	<1
2-Nitrophenol	ug/L	-	<1	-		<1	<1	<1	<1
3 & 4 Methylphenol	ug/L	-	<1	-		<1	<1	<1	<1
4,6-Dinitro-2-methylphenol	ug/L	-	<1	-		<1	<1	<1	<1
4-Chloro-3-methylphenol	ug/L	-	<1	-		<1	<1	<1	<1
4-Nitrophenol	ug/L	-	<1	-		<1	<1	<1	<1
Dinoseb	ug/L	-	<1	-		<1	<1	<1	<1
Pentachlorophenol	ug/L	11 (moderate)	<1	-		<1	<1	<1	<1
Phenol	ug/L	270 (moderate)	<1	-		<1	<1	<1	<1
Metals and Metalloids (Dissolved)									
Silver	µg/L	0.8 (moderate)	<0.1	-		<0.1	<0.1	<0.1	<0.1
Aluminium	µg/L	9 (very high)	<5	-	-	<5	<5	<5	<5
Arsenic	µg/L	-	<1	-	-	<1	<1	<1	<1
Arsenic (III)	µg/L	-	<1	-	-	<1	<1	<1	<1
Arsenic (V)	µg/L	-	<1	-	-	<1	<1	<1	<1
Barium	µg/L	-	<2	-	-	24	120	1.7	0.30
Calcium	µg/L	-	<100	-	-	50500	18200	3607	45.50
Cadmium	µg/L	0.7 (very high)	<0.1	36^	36^	<0.1	<0.1	<0.1	<0.1
Chromium	µg/L	-	<1	-	-	<1	<1	<1	<1
Chromium (III)	µg/L	7.7 (low)	<1	-	-	<1	<1	<1	<1
Chromium (VI)	µg/L	0.14 (very high)	<1	-	-	<1	<1	<1	<1
Cobalt	µg/L	1.6 (very high)	<0.5	-	-	<0.5	<0.5	<0.5	<0.5
Copper	µg/L	0.2 (very high)	<0.3	2	280	0.6	<0.3	0.04	<0.3
Iron	µg/L	410 (moderate)	<5	-	-	31	<5	2.2	<5
Mercury	µg/L	0.1 (very high)	<0.1	1.4^	1.4^	<0.1	<0.1	<0.1	<0.1
Magnesium	µg/L	-	<100	-	-	32300	33100	2307	82.7
Manganese	µg/L	190 (moderate)	<0.5	-	-	1.3	1	0.093	0.0025
Nickel	µg/L	1.4 (very high)	<0.5	-	-	1.1	4.2	0.079	0.0105
Lead	µg/L	2.2 (low)	<0.1	30	610	0.3	<0.1	0.021	<0.1
Selenium	µg/L	-	<1	-	-	<1	<1	<1	<1
Vanadium	µg/L	50 (high)	<0.1	-	-	1.2	1	0.09	0.0025
Zinc	µg/L	3.3 (very high)	<3	100	1900	19	<3	1.36	<3
Metals and Metalloids (Total)									
Silver, total	µg/L	0.8 (moderate)	<0.1	-	-	<0.1	<0.1	<0.1	<0.1
Aluminium, total	µg/L	9 (very high)	<10	-	-	210	20	15	0.05
Arsenic, total	µg/L	-	<1	-	-	<1	<1	<1	<1
Barium, total	µg/L	-	<2	-	-	25	120	1.8	0.30
Calcium, total	µg/L	-	<500	-	-	49400	17900	3528.6	44.75
Cadmium, total	µg/L	0.7 (very high)	<0.1	-	-	<0.1	<0.1	<0.1	<0.1
Chromium (III), total	µg/L	7.7 (low)	<1	-	-	<1	<1	<1	<1
Chromium (VI), total	µg/L	0.14 (very high)	<1	-	-	3	<1	0.21	<1
Chromium, total	µg/L	-	<1	-	-	3	<1	0.21	<1
Cobalt, total	µg/L	1.6 (very high)	<0.5	-	-	<0.5	<0.5	<0.5	<0.5
Copper, total	µg/L	0.2 (very high)	<0.3	-	-	1.7	1.9	0.12	0.0048
Iron, total	µg/L	410 (moderate)	<10	-	-	820	280	58.6	0.70
Mercury, total	µg/L	0.1 (very high)	<0.1	-	-	<0.1	<0.1	<0.1	<0.1
Magnesium, total	µg/L	-	<100	-	-	30200	30300	2157	75.75
Manganese, total	µg/L	190 (moderate)	<0.5	-	-	13	30	0.93	0.075
Nickel, total	µg/L	1.4 (very high)	<0.5	-	-	3	5.3	0.2	0.014
Lead, total	µg/L	2.2 (low)	<0.1	-	-	1.1	0.5	0.08	0.001
Selenium, total	µg/L	-	<1	-	-	<1	<1	<1	<1
Vanadium, total	µg/L	50 (high)	<1	-	-	3	2	0.20	0.005
Zinc, total	µg/L	3.3 (very high)	<3	-	-	80	12	5.7	0.030

Notes:

** MEQMP EQGs are derived from ANZG (2018) where available, for key contaminants of concern, incorporating background concentration and predicted dilution within defined mixing zones. MEQMP EQGs are applicable to bioavailable metal concentrations in the discharge stream, i.e., the dissolved component.*

[a] ANZG (2018) guideline rankings of unknown, very low, low, moderate, high, and very high reliability are shown in parenthesis.

[unk.] Unknown level of species protection

[FW] Freshwater DGV currently recommended for use in the marine environment for this analyte (ANZG, 2018)

#Admin Drain EQG for Enterococci spp. is in CFU/100ml. 1 MPN is considered equivalent to 1 CFU when estimating overall bacterial presence (AWQC, 2026)

^ 80% species protection guideline for bioaccumulating toxicants of concern (ANZG 2018)

3.1.6 Field quality assurance and quality control results

The transport blank returned no detectable contamination, with all analytes below laboratory limits of reporting (LOR). Field blanks, however, recorded detectable concentrations of middle distillate (>C10–C16) hydrocarbons in both samples, with 47 µg/L detected in the Admin Drain field blank and 48 µg/L in the Jetty Outfall field blank.

Given that higher concentrations of >C10–C16 and >C16–C34 hydrocarbon fractions were measured in the corresponding environmental samples, the most likely explanation is cross-contamination of the field blank rinsate resulting from insufficient decontamination of the sampling equipment.

Accordingly, confidence in the TRH/TPH dataset is reduced, particularly for low-level detections where concentrations fall within the range observed in the field blanks and may be attributable to cross-contamination. That said, the dataset remains suitable for screening against EQGs, as it provides an indicative measure of hydrocarbon presence. In this context, any bias introduced by cross-contamination would be conservative in nature i.e. manifest as potential false exceedance of EQGs, and prompt additional investigation rather than masking contamination.

3.2 Whole effluent toxicity (WET) testing

All toxicity tests met their individual acceptable criteria for the positive control (reference toxicant) and negative control (control treatment). Ecotoxicity laboratory reports are provided in Appendix C. All the toxicity tests were initiated within six weeks of receipt of the samples.

3.2.1 Toxicity tests

Concentrations of diluted effluent that returned EC10, EC50, NOEC and LOEC values are presented in Table 3-2. The values represent the percentage of effluent required to experience the relevant effect size tested for.

Across both discharge samples, the 5 and 15-minute Microtox® bioassay (*A. fischeri*), test required a >90.9% concentration of PW to have a 50% inhibition in bacterial light output (EC50) for the bacteria (Table 3-2).

For the Jetty Outfall, five of the eight species (*C. closterium, E. diaphana, S. scyphophilla, H. tuberculata, E. mathaei)* experienced no response to the effluent sample at full concentration (EC10 >100%). Toxic effects were observed for the remaining three species, with EC10 values of 28.8% for *E. radiata*, 7.21% for *G. imparipes,* and 29.5% for *S. lalandi*, indicating greater sensitivity of the microinvertebrate and moderate sensitivity of the macroalgae and fish endpoints.

All eight test species exhibited measurable responses to the Admin Drain sample, with EC10 values ranging from 2.58% to 24.8%. The most sensitive species were the macroinvertebrates (*E. diaphana, H. tuberculata,* and *S. scyphophilla*), with EC10 values between 2.58% and 3.20%, indicating comparatively higher toxicity of this discharge stream across multiple taxonomic groups.

Table 3-2 Summary of the statistical effects data from the ecotoxicology testing in 2018 and 2025 at Jetty Outfall, and 2025 at Admin Drain

Year		2018				2025				2025			
Discharge sample		Jetty Outfall				Jetty Outfall				Admin Drain			
Test species	Bioassay	EC10 (%)[1]	EC50 (%)[2]	NOEC (%)[3]	LOEC (%)[4]	EC10 (%)[1]	EC50 (%)[2]	NOEC (%)[3]	LOEC (%)[4]	EC10 (%)[1]	EC50 (%)[2]	NOEC (%)[3]	LOEC (%)[4]
Allivibrio fischeri	Microtox® -5 min	22	65	18	22	60.3	>90.9	45.5	90.9	>90.9	>90.9	90.9	>90.9
Allivibrio fischeri	Microtox® -15 min	-	-	-	-	36.8	>90.9	22.7	45.5	79.1	>90.9	45.5	90.9
Cylindrotheca closterium	Microalgae Growth	32	43	22	33	>100	>100	100	<100	24.8	38.2	12.5	25
Ecklonia radiata	Macroalgae Zoospore Germination	-	-	-	-	28.8	64.3	12.5	25	7.66	17.8	<6.3	6.3
Exaiptasia diaphana	Sea Anemone Pedal Lacerate	22	25	22	23	>100	>100	100	>100	2.58	8.89	3.1	6.3
Saccostrea scyphophilla	Mollusc Larvae Development	13	21	11	22	>100	>100	100	>100	3.2	4.2	3.1	6.3
Heliocidaris tuberculata	Sea Urchin Development	1.9	12	0.41	1.2	>100	>100	100	>100	2.7	4	1.6	3.1
Echinometra mathaei	Sea Urchin Development	15	18	11	22	>100	>100	100	>100	7.85	12.7	3.1	6.3
Gladioferens imparipes	Copepod Larval Development	34	45	33	50	7.21	34.8	6.3	12.5	22.3	33.1	12.5	25
Seriola lalandi	Fish Larvae Development	9.6	12	3.7	11	29.5	>100	25	50	13.1	21.8	12.5	25

Table Notes:
1. The effective concentration where a 10% effect is observed compared to the control group
2. The effective concentration where a 50% effect is observed compared to the control group
3. No observed effect concentration
4. Lowest observed effect concentration

3.2.2 Species sensitivity distribution

The WET testing statistical effects data presented in Table 3-2 were used to calculate the SSD. The SSD report of results and input data from shinyssdtools is provided in Appendix D.

The number of dilutions required to achieve high and moderate levels of ecological protection were derived by assessing the SSD and applying Warne et al. (2025) protocols. Species protection DGVs of 90, 95 and 99% were derived from the SSD and calculated the number of dilutions required to achieve each level of protection.

For the Jetty Outfall, guideline values calculated from the SSD require dilutions of 1:19 of discharge sample with background seawater to achieve a high level (99% species protection) of ecological protection, 1:8 dilutions for 95% ecological protection, and 1:6 dilutions for 90% ecological protection (Table 3-3). All dilutions are well within the predicted dilutions (1:400) expected at the boundary of the Jetty Outfall MEPA at worst case conditions.

For the Admin Drain, guideline values calculated from the SSD, requires dilutions of 1:150 of discharge sample with background seawater to achieve a high level (99% species protection) of ecological protection, 1:59 dilutions for 95% ecological protection, and 1:42 dilutions for 90% ecological protection (Table 3-3). These dilutions are greater than the minimum dilutions (1:14) expected at the boundary of the Admin Drain MEPA at worst case conditions, warranting further investigation to determine if the Marine Objective, as per Ministerial Statement 1233, has been achieved.

Warne et al. (2025) identifies that the reliability of the calculated guideline value should be based on the acceptability of data, sample size, and a visual assessment of SSD fit, with toxicity data for ≥ 6 species that belong to ≥ 4 taxonomic groups. The toxicity data and sample size utilised in this report meets the minimum requirements and are adequate for use in the SSD.

Table 3-3 DGVs and safe dilution targets from the ecotoxicity testing in 2018 and 2025 at Jetty Outfall, and 2025 at Admin Drain

Species Protection level (%)	DGVs (% PW)	Lower/Upper 95% CI (% PW)	Dilutions required to maintain the level of ecological protection
2018 Jetty Outfall			
99	0.36	-	280
95	1.7	-	59
2025 Jetty Outfall			
99	5.348	1.049-28.796	19
95	12.749	4.292-43.629	8
90	19.102	7.956-53.253	6
2025 Admin Drain			
99	0.670	0.104-3.712	150
95	1.695	0.472-5.040	59

Species Protection level (%)	DGVs (% PW)	Lower/Upper 95% CI (% PW)	Dilutions required to maintain the level of ecological protection
90	2.415	0.897-6.063	42

The SSDs for the Jetty Outfall and Admin Drain did not show a strong S-shaped fit reflecting the limited spread in species responses to discharges (Figure 3-1). Several species showed no effect at 100% concentration (Jetty Outfall), resulting in clustering of data and poor definition of the distribution tails. Consistent with the fit categorisation described in Warne et al. (2025), this represents a reduced confidence fit for the Jetty Outfall. The Admin Drain SSD shows a more coherent distribution and improved fit. Both SSDs broadly represent the data. However, the Jetty Outfall 95% species protection value should be interpreted with greater caution.

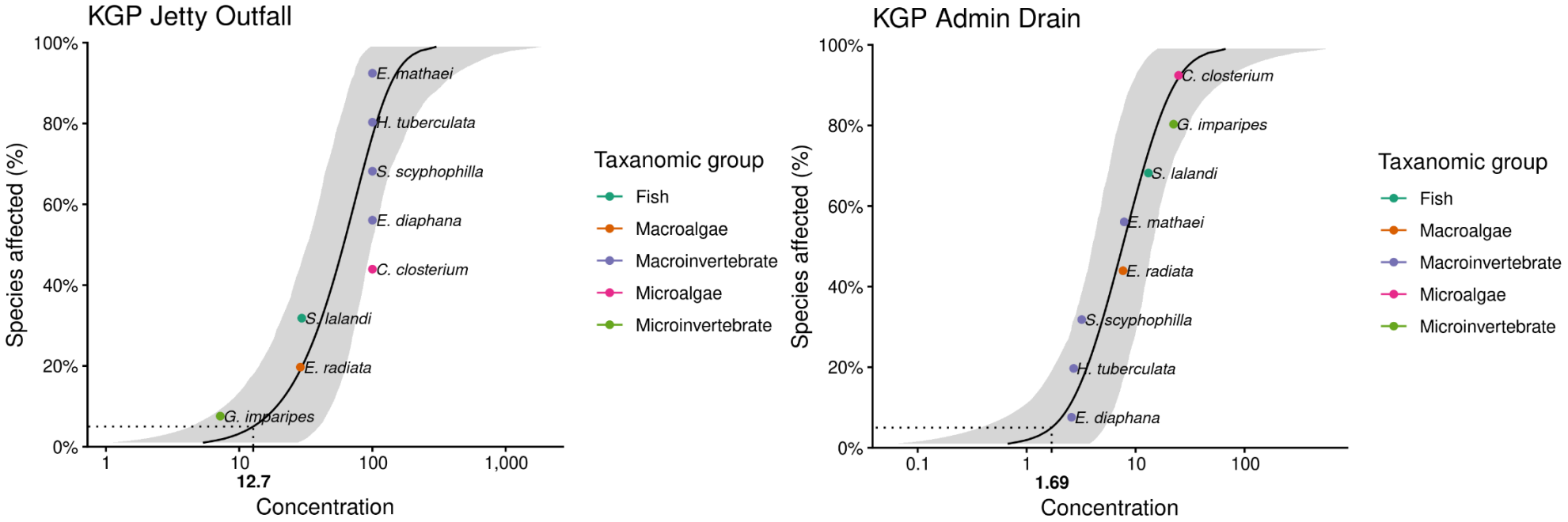


Figure 3-1 Species sensitivity distribution 95% species protection for the Jetty Outfall (left) and Admin Drain (right)

3.2.3 Toxicity change over time (Jetty Outfall)

Toxicity testing of the discharge from the Jetty Outfall in 2025 was compared to 2018 data (Table 3-4). Overall, toxicity was lower in 2025 compared to 2018. In 2018, multiple species showed effects at low PW concentrations (e.g. low EC10 = 1.9%). In 2025, six of nine species (*C. closterium*, *E. diaphana*, *S. scyphophilla*, *H. tuberculata, E. mathaei*) showed no effect at 100% PW (EC10 and EC50 >100%).

Some species remained sensitive to the discharge. *G. imparipes* showed a lower EC10 in 2025 (7.21%) than 2018 (34.0%). *S. lalandi* exhibited effects in both years, although with a higher EC50 (>100%) in 2025.

The *A. fischeri* (Microtox®) test also showed a reduction in toxicity in 2025, with EC50 values increasing from 65% (2018) to >90.9%. The 2025 results for Jetty Outfall indicate a general reduction in toxicity relative to 2018, although some variability remains among species.

Table 3-4 Summary of statistical effects data for Jetty Outfall from 2018 and 2025

Statistical effects data				
Year	**2018**		**2025**	
Bioassay / Test	**EC10(%)**	**EC50(%)**	**EC10(%)**	**EC50(%)**
A. fischeri (5 minute) [1]	22.0	65.0	60.3	>90.9
A. fischeri (15 minute) [1]	-	-	36.8	>90.9
C. closterium	32.0	43.0	>100	>100
E. radiata	-	-	28.8	64.3
E. diaphana	22.0	25.0	>100	>100
S. scyphophilla	13.0	21.0	>100	>100
H. tuberculata	1.9	12.0	>100	>100
E. mathaei	15.0	18.0	>100	>100
G. imparipes	34.0	45.0	7.21	34.8
S. lalandi	9.6	12.0	29.5	>100

Notes:

1. Microtox® excluded from species sensitivity distribution (Warne et al. 2025).

4. Conclusions and recommendations

Chemical characterisation and WET testing was undertaken for treated wastewater discharges from the KGP Jetty Outfall and Admin Drain to provide a comprehensive assessment of effluent quality and potential ecological risk under current operating conditions.

Chemical analysis demonstrated that, for both discharge locations, the majority of analytes were below laboratory LORs, including all measured priority organic compounds (PAHs, phenols, chlorophenols, and BTEX). Where organic compounds were detected, these were limited to hydrocarbons, with TRH and TPH present at both discharge points. Hydrocarbon profiles were dominated by heavier fractions, indicative of weathered petroleum products. These compounds are rapidly diluted upon discharge and do not persist beyond the defined mixing zones. Potential cross-contamination identified in the field blank reduces confidence in low-level TPH/TRH detections; however, the contamination does not materially alter the overall conclusions regarding hydrocarbon risk or compliance with MEQMP EQC.

For the Admin Drain, dissolved copper and zinc, and total aluminium, chromium VI, copper, iron, nickel, and zinc exceeded the ANZG 2018 99% species protection default guideline value at the point of discharge. For the Jetty Outfall, dissolved nickel and total aluminium, copper, nickel, and zinc exceeded the ANZG (2018) 99% species protection default guideline value at the point of discharge. When applying expected dilutions, all concentrations of bioavailable (i.e. dissolved component) metals were below ANZG (2018) 99% species protection default guideline values at the boundary of the Admin Drain and Jetty Outfall MEPAs. Key heavy metals of concern such as arsenic, cadmium, selenium, and mercury were all below detection in both Admin Drain and Jetty Outfall discharges.

Ammonia concentration in the Admin Drain discharge sample exceeded the ANZG (2018) 99% species protection default guideline value, and the derived MEQMP EQG. When applying the expected dilution, ammonia concentration remained above the ANZG (2018) 99% species protection default guideline value at the Admin Drain MEPA boundary. Exceedance of an EQG does not demonstrate that the EQO has not been achieved. Rather, it triggers further assessment, including assessment against the relevant EQSs, to determine whether additional monitoring and/or management actions are required, in accordance with the framework set out in the MEQMP (Woodside 2021).

WET testing demonstrated that treated effluent from the Jetty Outfall exhibited generally low toxicity. Five of eight chronic test species showed no observable effects at 100% effluent concentration, and comparison with historical data indicates a reduction in toxicity relative to 2018.

The Admin Drain discharge exhibited greater toxicity across all test species, with the most sensitive responses observed in macroinvertebrate taxa.

SSD derived from WET testing data indicates that the Jetty Outfall requires a dilution of approximately 1:19 to achieve a high level of ecological protection (99% species protection), substantially less than the minimum dilution predicted (1:400) at the boundary of the MEPA.

For the Admin Drain, a dilution of approximately 1:150 was derived from WET testing data to achieve the same level of protection (99% species protection), which is greater than the minimum dilutions expected (1:14) at the MEPA boundary.

5. References

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

ANZG (2026) Default Guideline Values Accessed 21/6/2026. https://www.waterquality.gov.au/anz-guidelines/guideline-values/default

DoE (2006) Pilbara Coastal Water Quality Consultation Outcomes – Environmental Values and Environmental Quality Objectives Marine Series. Department of Environment

Jacobs (2018) Karratha Gas Plant. Whole Effluent Toxicity (WET) Testing, Microtox Testing and Chemical Characterisation Assessment - 2018.

Phillips R (2019) Karratha Gas Plant Wastewater Discharge Modelling. Rob Phillips Consulting Pty Ltd, North Fremantle, Western Australia

Searle JA (2012) Groundwater resource review, Dampier Peninsula. Hydrogeological record series. Department of Water, Perth, Western Australia

Thorley JE, Schwarz C (2018) ssdtools: An R package to fit Species Sensitivity Distributions.1082

Warne M, Batley G, van Dam R, Chapman J, Fox D, Hickey C, Stauber J, Fisher R (2025) Method for deriving Australian and New Zealand water quality guideline values for protecting aquatic ecosystems from toxicants – update of 2018 version. Prepared for the Australian and New Zealand Guidelines for Fresh and Marine Water Quality Australian and New Zealand Governments and Australian state and territory governments, Canberra

Woodside (2021) Marine Environmental Quality Management Plan. Book Appendix D North West Shelf Project Extension, Perth, Western Australia

Appendix A. Sampling protocol for Karratha Gas Plant (KGP) 2025

Sampling Protocol for KGP Effluent (Admin Drain & T6701) - Whole Effluent Toxicity (WET) Assessment Study

Purpose

The purpose of this procedure is to ensure that the effluent samples are collected and handled in the manner required by the analytical laboratories so that accurate test results can be achieved. It is important that these procedures are followed to minimise the chances of sample contamination or spoiling.

Minimum Holding Times and Sample Collection Timing

Sample collection should be scheduled on a day and time to ensure that samples arrive at the laboratory no later 24 hours after sampling occurs.

Sample Locations

One sample is to be collected from Admin Drain (same location as monthly Licence sample/monitoring) and one sample is to be collected from basin T6701 (same location as pre-discharge sampling).

Equipment

It is important that all eskies are stored in a clean and dry location, once received at the plant to minimise the chances of sample contamination. The sampling kit will include:

From Intertek

Intertek Esky

6 x esky (w x h x l, 40 x 50 x 55) @ 8kg
16 x 2.5L amber glass Winchester @ 1.3kg – all unfiltered fill to top without headspace

From Chemcentre

4 x esky (w x h x l, 29 x 38 x 53) @ 5kg with empty bottles
4 x Ice bricks
1 x chain-of-custody form
1 x return address label
All bottles are already labelled.

Collection of Samples

1) Personal Protective Equipment as required by Site operations must be worn at all times. If not already required for the location, then the additional following items must also be worn: gloves and safety goggles.
2) Prior to day of sampling, collect the sampling kits previously shipped out to site. **Place ice bricks in freezer 24 hours prior to time of sampling.**

3) **The time of sampling on agreed date should be scheduled with enough time so that the samples arrive at the laboratory no later 24 hours after sampling occurs.**

4) On the morning of sampling, take the sampling kits to the inspection tanks. Label each bottle with sample labels provided in the sampling kits. Remove paperwork out of the esky and keep in a safe place for subsequent retrieval.

5) The inspection tanks need to be filled and emptied in line with plant operation batch and fill discharge procedures. Ideally this should occur three times.

6) Immediately prior to filling sample bottles, rinse out each bottle three times with effluent by half filling the bottle with effluent, capping it, then giving it a good shake and emptying it.

7) Next, **fill each of the Intertek glass bottles (9 x 2.5 L) and the unfiltered Chemcentre bottles overflowing and immediately place cap on bottle ensuring *no head (air) space*.**

8) Once all unfiltered sample bottles have been filled, keep chilled in the fridge prior to shipping.

Dispatching Eskies

9) Immediately prior to departure place all bottles in the esky they came in. Pack ice-bricks in with the bottles to keep samples cool.

10) Complete chain-of-custody form (COC to be placed in the zip lock bag provided) and put in esky. Place supplied delivery labels on outside of esky, tape everything up securely and ensure fast delivery (within 24 h of collection).

ATTACHMENT 1 - DEILIVERY ADDRESSES

Delivery address for Intertek (6 x eskies):
Attention Tristan Stringer
Intertek Exploration and Production
311 Kenwick Road
Maddington WA 6109
Opening times: (9 am to 5 pm weekdays)

Delivery address for Chemcentre (4 eskies):
Scientific Services Division
Building 500
Resources and Chemistry Precinct
Cnr Manning Rd and Townsing Drive, off Conlon Street
Bentley WA 6102
Opening times (9 am to 5 pm weekdays)

Appendix B. ChemCentre Certificate of Analysis (CoA) and raw results

ChemCentre
Scientific Services Division
Report of Examination

Resources and Chemistry Precinct
Cnr Manning Road and Townsing Drive
Bentley
WA 6102
T +61 8 9422 9800
F +61 8 9422 9801
www.chemcentre.wa.gov.au
ABN 40 991 885 705

WORLD RECOGNISED ACCREDITATION
Accredited for compliance with ISO/IEC 17025 - Testing, Accreditation No. 8

Purchase Order: None

ChemCentre Reference: 25S3432 R0

Advisian (Worley Services Pty Ltd)
Level 14
240 St George's Terrace
PERTH WA 6000
Attention: Ellie Smith

Report on: 6 samples received on 09/12/2025

LAB ID	Material	Client ID and Description
25S3432 / 001	water	Admin drain (277378)
25S3432 / 002	water	T6701 (277377)
25S3432 / 003	water	Admin drain_FIELDBLANK
25S3432 / 004	water	T6701_FIELDBLANK
25S3432 / 005	water	Admin drain_BLANK
25S3432 / 006	water	T6701_BLANK

LAB ID			001	002	003	004
Client ID^			Admin drain (277378)	T6701 (277377)	Admin drain_FIELDBLANK	T6701_FIELDBLANK
Sampled^			08/12/2025	08/12/2025	08/12/2025	08/12/2025
Analyte	**Method**	**Unit**				
Biochemical Oxygen Demand	iBOD1WR	mg/L	6	<5	<5	<5
Dissolved organic carbon	iCTO1WDCO	mg/L	9.7	9.5	<1.0	<1.0
Electrical Conductivity	iEC1WZSE	mS/m	160	159	<0.2	<0.2
Enterococci*	ePATHCENTR	MPN100r	>24000	10	<10	<10
Hydrogen sulphide*	iSD1WSCA	mg/L	<0.01	0.01	<0.01	<0.01
Nitrogen, ammonia	iAMMN1WFIA	mg/L	26	<0.01	<0.01	<0.01
Phenols - Total*	ORG100WPhenC	ug/L	<17	<17	<17	<17
Total dissolved solids(grav)	iSOL1WDGR	mg/L	770	770	<10	<10
Total Organic Carbon	iCTO1WTCO	mg/L	9.9	10	<1.0	<1.0
Total suspended solids	iSOL1WPGR	mg/L	30	22	<1	<1
Aluminium	iMET1WCICP	mg/L	<0.005	<0.005	<0.005	<0.005
Aluminium, total	iMET1WTICP	mg/L	0.21	0.02	<0.01	<0.01
Arsenic	iMET1WCMSHMI	mg/L	<0.001	<0.001	<0.001	<0.001
Arsenic (III) Species*	iASSPEC1VG	mg/L	<0.001	<0.001	<0.001	<0.001
Arsenic (V) Species*	iASSPEC1VG	mg/L	<0.001	<0.001	<0.001	<0.001
Arsenic, total	iMET1WTMSHMI	mg/L	<0.001	<0.001	<0.001	<0.001
Barium	iMET1WCICP	mg/L	0.024	0.12	<0.002	<0.002
Barium, total	iMET1WTICP	mg/L	0.025	0.12	<0.002	<0.002
Cadmium	iMET1WCMSHMI	mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Cadmium, total	iMET1WTMSHMI	mg/L	<0.0001	<0.0001	<0.0001	<0.0001

LAB ID			001	002	003	004
Client ID^			Admin drain (277378)	T6701 (277377)	Admin drain_FIELDBLANK	T6701_FIELDBLANK
Sampled^			08/12/2025	08/12/2025	08/12/2025	08/12/2025
Analyte	**Method**	**Unit**				
Calcium	iMET1WCICP	mg/L	50.5	18.2	<0.1	<0.1
Calcium, total	iMET1WTICP	mg/L	49.4	17.9	<0.5	<0.5
Chromium	iMET1WCICP	mg/L	<0.001	<0.001	<0.001	<0.001
Chromium(III)*	iCR3+1WCCAL	mg/L	<0.001	<0.001	<0.001	<0.001
Chromium(III), total*	iCR3+1WCCAL	mg/L	<0.001	<0.001	<0.001	<0.001
Chromium(VI)	iCO1WCDAL	mg/L	<0.001	<0.001	<0.001	<0.001
Chromium(VI), total	iCO1WCDAL	mg/L	0.003	<0.001	<0.001	<0.001
Chromium, total	iMET1WTICP	mg/L	0.003	<0.001	<0.001	<0.001
Cobalt	iMET1WCMSHMI	mg/L	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt, total	iMET1WTMSHMI	mg/L	<0.0005	<0.0005	<0.0005	<0.0005
Copper	iMET1WCMSHMI	mg/L	0.0006	<0.0003	<0.0003	<0.0003
Copper, total	iMET1WTMSHMI	mg/L	0.0017	0.0019	<0.0003	<0.0003
Iron	iMET1WCICP	mg/L	0.031	<0.005	<0.005	<0.005
Iron, total	iMET1WTICP	mg/L	0.82	0.28	<0.01	<0.01
Lead	iMET1WCMSHMI	mg/L	0.0003	<0.0001	<0.0001	<0.0001
Lead, total	iMET1WTMSHMI	mg/L	0.0011	0.0005	<0.0001	<0.0001
Magnesium	iMET1WCICP	mg/L	32.3	33.1	<0.1	<0.1
Magnesium, total	iMET1WTICP	mg/L	30.2	30.3	<0.1	<0.1
Manganese	iMET1WCMSHMI	mg/L	0.0013	0.0010	<0.0005	<0.0005
Manganese, total	iMET1WTMSHMI	mg/L	0.013	0.030	<0.0005	<0.0005
Mercury	iHG1WCVG	mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Mercury, total	iHG1WTVG	mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Nickel	iMET1WCMSHMI	mg/L	0.0011	0.0042	<0.0005	<0.0005
Nickel, total	iMET1WTMSHMI	mg/L	0.0030	0.0053	<0.0005	<0.0005
Selenium	iMET1WCMS	mg/L	<0.001	<0.001	<0.001	<0.001
Selenium, total	iMET1WTMS	mg/L	<0.001	<0.001	<0.001	<0.001
Silver	iMET1WCMSHMI	mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Silver, total	iMET1WTMSHMI	mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Vanadium	iMET1WCMS	mg/L	0.0012	0.0010	<0.0001	<0.0001
Vanadium, total	iMET1WTMS	mg/L	0.003	0.002	<0.001	<0.001
Zinc	iMET1WCMSHMI	mg/L	0.019	<0.003	<0.003	<0.003
Zinc, total	iMET1WTICP	mg/L	0.08			
Zinc, total	iMET1WTMSHMI	mg/L		0.012	<0.003	<0.003
Acetic acid*	ORG091W	mg/L	<5	<5	<5	<5
Butyric acid*	ORG091W	mg/L	<5	<5	<5	<5
Heptanoic acid*	ORG091W	mg/L	<5	<5	<5	<5
Hexanoic acid*	ORG091W	mg/L	<5	<5	<5	<5
Propionic acid*	ORG091W	mg/L	<5	<5	<5	<5
Valeric acid*	ORG091W	mg/L	<5	<5	<5	<5
Benzene	ORG015W	ug/L	<1	<1	<1	<1

LAB ID			001	002	003	004
Client ID^			Admin drain (277378)	T6701 (277377)	Admin drain_FIELDBLANK	T6701_FIELDBLANK
Sampled^			08/12/2025	08/12/2025	08/12/2025	08/12/2025
Analyte	**Method**	**Unit**				
Toluene	ORG015W	ug/L	<1	<1	<1	<1
Ethylbenzene	ORG015W	ug/L	<1	<1	<1	<1
m,p-Xylene	ORG015W	ug/L	<2	<2	<2	<2
o-Xylene	ORG015W	ug/L	<1	<1	<1	<1
TRH >C10-C16	ORG007W	ug/L	94	44	<25	<25
TRH >C16-C34	ORG007W	ug/L	230	410	<100	<100
TRH >C34-C40	ORG007W	ug/L	<100	<100	<100	<100
TRH C6-C10	ORG015W	ug/L	<25	<25	<25	<25
Total TRHs	ORG007WPTC	ug/L	320	450	<250	<250
TPH C6-C9	ORG015W	ug/L	<25	<25	<25	<25
TPH C10-C14	ORG007W	ug/L	70	<25	<25	<25
TPH C15-C28	ORG007W	ug/L	230	390	<100	<100
TPH C29-C36	ORG007W	ug/L	<100	<100	<100	<100
Total TPHs	ORG007WPTC	ug/L	300	390	<250	<250
Acenaphthene	ORG100W	ug/L	<0.1	<0.1		
Acenaphthylene	ORG100W	ug/L	<0.1	<0.1		
Anthracene	ORG100W	ug/L	<0.1	<0.1		
Benz(a)anthracene	ORG100W	ug/L	<0.1	<0.1		
Benzo(a)pyrene	ORG100W	ug/L	<0.1	<0.1		
Benzo(b)fluoranthene	ORG100W	ug/L	<0.1	<0.1		
Benzo(g,h,i)perylene	ORG100W	ug/L	<0.1	<0.1		
Benzo(k)fluoranthene	ORG100W	ug/L	<0.1	<0.1		
Chrysene	ORG100W	ug/L	<0.1	<0.1		
Dibenzo(a,h)anthracene	ORG100W	ug/L	<0.1	<0.1		
Fluoranthene	ORG100W	ug/L	<0.1	<0.1		
Fluorene	ORG100W	ug/L	<0.1	<0.1		
Indeno(1,2,3-cd)pyrene	ORG100W	ug/L	<0.1	<0.1		
Naphthalene	ORG100W	ug/L	<0.1	<0.1		
Phenanthrene	ORG100W	ug/L	<0.1	<0.1		
Pyrene	ORG100W	ug/L	<0.1	<0.1	<0.1	<0.1
2 methylphenol	ORG100W	ug/L	<1	<1	<1	<1
2,3,4,6-Tetrachlorophenol	ORG100W	ug/L	<1	<1	<1	<1
2,4,5-Trichlorophenol	ORG100W	ug/L	<1	<1	<1	<1
2,4,6-Trichlorophenol	ORG100W	ug/L	<1	<1	<1	<1
2,4-Dichlorophenol	ORG100W	ug/L	<1	<1	<1	<1
2,4-Dimethylphenol	ORG100W	ug/L	<1	<1	<1	<1
2,4-Dinitrophenol	ORG100W	ug/L	<1	<1	<1	<1
2,6-Dichlorophenol	ORG100W	ug/L	<1	<1	<1	<1
2-Chlorophenol	ORG100W	ug/L	<1	<1	<1	<1
2-Nitrophenol	ORG100W	ug/L	<1	<1	<1	<1
3 & 4 Methylphenol	ORG100W	ug/L	<1	<1	<1	<1
4,6-Dinitro-2-methylphenol	ORG100W	ug/L	<1	<1	<1	<1
4-Chloro-3-methylphenol	ORG100W	ug/L	<1	<1	<1	<1
4-Nitrophenol	ORG100W	ug/L	<1	<1	<1	<1
Dinoseb	ORG100W	ug/L	<1	<1	<1	<1
Pentachlorophenol	ORG100W	ug/L	<1	<1	<1	<1
Phenol	ORG100W	ug/L	<1	<1	<1	<1

LAB ID			001	002	003	004
Client ID^						
Sampled^						
Analyte	**Method**	**Unit**				
Date Analysed	ePATHCENTR		11/12/2025	11/12/2025	11/12/2025	11/12/2025
	iAMMN1WFIA		12/12/2025	12/12/2025	12/12/2025	12/12/2025
	iASSPEC1VG		22/12/2025	22/12/2025	22/12/2025	22/12/2025
	iBOD1WR		12/12/2025	12/12/2025	12/12/2025	12/12/2025
	iCO1WCDAL		24/12/2025	10/12/2025	10/12/2025	10/12/2025
	iCR3+1WCCAL		19/12/2025	19/12/2025	23/12/2025	23/12/2025
	iCTO1WDCO		15/12/2025	15/12/2025	15/12/2025	15/12/2025
	iCTO1WTCO		15/12/2025	15/12/2025	15/12/2025	15/12/2025
	iEC1WZSE		10/12/2025	10/12/2025	10/12/2025	10/12/2025
	iHG1WCVG		15/12/2025	15/12/2025	15/12/2025	15/12/2025
	iHG1WTVG		15/12/2025	15/12/2025	15/12/2025	15/12/2025
	iMET1WCICP		17/12/2025	17/12/2025	17/12/2025	17/12/2025
	iMET1WCMS		16/12/2025	16/12/2025	16/12/2025	16/12/2025
	iMET1WCMSHMI		16/12/2025	16/12/2025	16/12/2025	16/12/2025
	iMET1WTICP		19/12/2025	19/12/2025	23/12/2025	23/12/2025
	iMET1WTMS		18/12/2025	18/12/2025	16/12/2025	16/12/2025
	iMET1WTMSHMI		17/12/2025	17/12/2025	16/12/2025	16/12/2025
	iSD1WSCA		12/12/2025	12/12/2025	12/12/2025	12/12/2025
	iSOL1WDGR		15/12/2025	15/12/2025	15/12/2025	15/12/2025
	iSOL1WPGR		16/12/2025	16/12/2025	16/12/2025	16/12/2025
	ORG007W		16/12/2025	16/12/2025	16/12/2025	16/12/2025
	ORG007WPTC		24/12/2025	24/12/2025	24/12/2025	24/12/2025
	ORG015W		15/12/2025	15/12/2025	15/12/2025	15/12/2025
	ORG091W		18/12/2025	18/12/2025	18/12/2025	18/12/2025
	ORG100W		23/12/2025	23/12/2025	23/12/2025	23/12/2025
	ORG100WPhenC		22/12/2025	22/12/2025	22/12/2025	22/12/2025
Sample Condition			Cold	Cold	Cold	Cold

LAB ID			005	006
Client ID^			Admin drain_BLANK	T6701_BLANK
Sampled^			08/12/2025	08/12/2025
Analyte	**Method**	**Unit**		
Biochemical Oxygen Demand	iBOD1WR	mg/L	<5	<5
Dissolved organic carbon	iCTO1WDCO	mg/L	<1.0	<1.0
Electrical Conductivity	iEC1WZSE	mS/m	<0.2	<0.2
Enterococci*	ePATHCENTR	MPN100r	<10	<10
Hydrogen sulphide*	iSD1WSCA	mg/L	<0.01	<0.01
Nitrogen, ammonia	iAMMN1WFIA	mg/L	<0.01	<0.01
Phenols - Total*	ORG100WPhenC	ug/L	<17	<17
Total dissolved solids(grav)	iSOL1WDGR	mg/L	<10	<10
Total Organic Carbon	iCTO1WTCO	mg/L	<1.0	<1.0
Total suspended solids	iSOL1WPGR	mg/L	<1	<1
Aluminium	iMET1WCICP	mg/L	<0.005	<0.005
Aluminium, total	iMET1WTICP	mg/L	<0.01	<0.01
Arsenic	iMET1WCMSHMI	mg/L	<0.001	<0.001
Arsenic (III) Species*	iASSPEC1VG	mg/L	<0.001	<0.001
Arsenic (V) Species*	iASSPEC1VG	mg/L	<0.001	<0.001
Arsenic, total	iMET1WTMSHMI	mg/L	<0.001	<0.001

LAB ID			005	006
Client ID^			Admin drain_BLANK	T6701_BLANK
Sampled^			08/12/2025	08/12/2025
Analyte	**Method**	**Unit**		
Barium	iMET1WCICP	mg/L	<0.002	<0.002
Barium, total	iMET1WTICP	mg/L	<0.002	<0.002
Cadmium	iMET1WCMSHMI	mg/L	<0.0001	<0.0001
Cadmium, total	iMET1WTMSHMI	mg/L	<0.0001	<0.0001
Calcium	iMET1WCICP	mg/L	<0.1	<0.1
Calcium, total	iMET1WTICP	mg/L	<0.5	<0.5
Chromium	iMET1WCICP	mg/L	<0.001	<0.001
Chromium(III)*	iCR3+1WCCAL	mg/L	<0.001	<0.001
Chromium(III), total*	iCR3+1WCCAL	mg/L	<0.001	<0.001
Chromium(VI)	iCO1WCDAL	mg/L	<0.001	<0.001
Chromium(VI), total	iCO1WCDAL	mg/L	<0.001	<0.001
Chromium, total	iMET1WTICP	mg/L	<0.001	<0.001
Cobalt	iMET1WCMSHMI	mg/L	<0.0005	<0.0005
Cobalt, total	iMET1WTMSHMI	mg/L	<0.0005	<0.0005
Copper	iMET1WCMSHMI	mg/L	<0.0003	<0.0003
Copper, total	iMET1WTMSHMI	mg/L	<0.0003	<0.0003
Iron	iMET1WCICP	mg/L	<0.005	<0.005
Iron, total	iMET1WTICP	mg/L	<0.01	<0.01
Lead	iMET1WCMSHMI	mg/L	<0.0001	<0.0001
Lead, total	iMET1WTMSHMI	mg/L	<0.0001	<0.0001
Magnesium	iMET1WCICP	mg/L	<0.1	<0.1
Magnesium, total	iMET1WTICP	mg/L	<0.1	<0.1
Manganese	iMET1WCMSHMI	mg/L	<0.0005	<0.0005
Manganese, total	iMET1WTMSHMI	mg/L	<0.0005	<0.0005
Mercury	iHG1WCVG	mg/L	<0.0001	<0.0001
Mercury, total	iHG1WTVG	mg/L	<0.0001	<0.0001
Nickel	iMET1WCMSHMI	mg/L	<0.0005	<0.0005
Nickel, total	iMET1WTMSHMI	mg/L	<0.0005	<0.0005
Selenium	iMET1WCMS	mg/L	<0.001	<0.001
Selenium, total	iMET1WTMS	mg/L	<0.001	<0.001
Silver	iMET1WCMSHMI	mg/L	<0.0001	<0.0001
Silver, total	iMET1WTMSHMI	mg/L	<0.0001	<0.0001
Vanadium	iMET1WCMS	mg/L	<0.0001	<0.0001
Vanadium, total	iMET1WTMS	mg/L	<0.001	<0.001
Zinc	iMET1WCMSHMI	mg/L	<0.003	<0.003
Zinc, total	iMET1WTMSHMI	mg/L	<0.003	<0.003
Acetic acid*	ORG091W	mg/L	<5	<5
Butyric acid*	ORG091W	mg/L	<5	<5
Heptanoic acid*	ORG091W	mg/L	<5	<5
Hexanoic acid*	ORG091W	mg/L	<5	<5

LAB ID			005	006
Client ID^			Admin drain_BLANK	T6701_BLANK
Sampled^			08/12/2025	08/12/2025
Analyte	**Method**	**Unit**		
Propionic acid*	ORG091W	mg/L	<5	<5
Valeric acid*	ORG091W	mg/L	<5	<5
Benzene	ORG015W	ug/L	<1	<1
Toluene	ORG015W	ug/L	<1	<1
Ethylbenzene	ORG015W	ug/L	<1	<1
m,p-Xylene	ORG015W	ug/L	<2	<2
o-Xylene	ORG015W	ug/L	<1	<1
TRH >C10-C16	ORG007W	ug/L	47	48
TRH >C16-C34	ORG007W	ug/L	<100	<100
TRH >C34-C40	ORG007W	ug/L	<100	<100
TRH C6-C10	ORG015W	ug/L	<25	<25
Total TRHs	ORG007WPTC	ug/L	<250	<250
TPH C6-C9	ORG015W	ug/L	<25	<25
TPH C10-C14	ORG007W	ug/L	<25	<25
TPH C15-C28	ORG007W	ug/L	<100	<100
TPH C29-C36	ORG007W	ug/L	<100	<100
Total TPHs	ORG007WPTC	ug/L	<250	<250
Acenaphthene	ORG100W	ug/L	<0.1	<0.1
Acenaphthylene	ORG100W	ug/L	<0.1	<0.1
Anthracene	ORG100W	ug/L	<0.1	<0.1
Benz(a)anthracene	ORG100W	ug/L	<0.1	<0.1
Benzo(a)pyrene	ORG100W	ug/L	<0.1	<0.1
Benzo(b)fluoranthene	ORG100W	ug/L	<0.1	<0.1
Benzo(g,h,i)perylene	ORG100W	ug/L	<0.1	<0.1
Benzo(k)fluoranthene	ORG100W	ug/L	<0.1	<0.1
Chrysene	ORG100W	ug/L	<0.1	<0.1
Dibenzo(a,h)anthracene	ORG100W	ug/L	<0.1	<0.1
Fluoranthene	ORG100W	ug/L	<0.1	<0.1
Fluorene	ORG100W	ug/L	<0.1	<0.1
Indeno(1,2,3-cd)pyrene	ORG100W	ug/L	<0.1	<0.1
Naphthalene	ORG100W	ug/L	<0.1	<0.1
Phenanthrene	ORG100W	ug/L	<0.1	<0.1
Pyrene	ORG100W	ug/L	<0.1	<0.1
2 methylphenol	ORG100W	ug/L	<1	<1
2,3,4,6-Tetrachlorophenol	ORG100W	ug/L	<1	<1
2,4,5-Trichlorophenol	ORG100W	ug/L	<1	<1
2,4,6-Trichlorophenol	ORG100W	ug/L	<1	<1
2,4-Dichlorophenol	ORG100W	ug/L	<1	<1
2,4-Dimethylphenol	ORG100W	ug/L	<1	<1
2,4-Dinitrophenol	ORG100W	ug/L	<1	<1
2,6-Dichlorophenol	ORG100W	ug/L	<1	<1
2-Chlorophenol	ORG100W	ug/L	<1	<1
2-Nitrophenol	ORG100W	ug/L	<1	<1
3 & 4 Methylphenol	ORG100W	ug/L	<1	<1
4,6-Dinitro-2-methylphenol	ORG100W	ug/L	<1	<1
4-Chloro-3-methylphenol	ORG100W	ug/L	<1	<1
4-Nitrophenol	ORG100W	ug/L	<1	<1

LAB ID			005	006
Client ID^			Admin drain_BLANK	T6701_BLANK
Sampled^			08/12/2025	08/12/2025
Analyte	**Method**	**Unit**		
Dinoseb	ORG100W	ug/L	<1	<1
Pentachlorophenol	ORG100W	ug/L	<1	<1
Phenol	ORG100W	ug/L	<1	<1
Date Analysed	ePATHCENTR		11/12/2025	11/12/2025
	iAMMN1WFIA		12/12/2025	12/12/2025
	iASSPEC1VG		22/12/2025	22/12/2025
	iBOD1WR		12/12/2025	12/12/2025
	iCO1WCDAL		10/12/2025	10/12/2025
	iCR3+1WCCAL		23/12/2025	23/12/2025
	iCTO1WDCO		15/12/2025	15/12/2025
	iCTO1WTCO		15/12/2025	15/12/2025
	iEC1WZSE		10/12/2025	10/12/2025
	iHG1WCVG		15/12/2025	15/12/2025
	iHG1WTVG		15/12/2025	15/12/2025
	iMET1WCICP		17/12/2025	17/12/2025
	iMET1WCMS		16/12/2025	16/12/2025
	iMET1WCMSHMI		16/12/2025	16/12/2025
	iMET1WTICP		23/12/2025	23/12/2025
	iMET1WTMS		16/12/2025	16/12/2025
	iMET1WTMSHMI		16/12/2025	16/12/2025
	iSD1WSCA		12/12/2025	12/12/2025
	iSOL1WDGR		15/12/2025	15/12/2025
	iSOL1WPGR		16/12/2025	16/12/2025
	ORG007W		16/12/2025	16/12/2025
	ORG007WPTC		24/12/2025	24/12/2025
	ORG015W		15/12/2025	15/12/2025
	ORG091W		18/12/2025	18/12/2025
	ORG100W		23/12/2025	23/12/2025
	ORG100WPhenC		22/12/2025	22/12/2025
Sample Condition			Cold	Cold

Method	**Method Description**
ePATHCENTR	Microbiological analysis as performed by PathWest - refer to their report attached.
iAMMN1WFIA	Ammonia expressed as Nitrogen by FIA.
iASSPEC1VG	Inorganic Arsenic Speciation by Hydride Generation AAS
iBOD1WR	Biochemical Oxygen Demand.
iCO1WCDAL	Colourimetric analysis by DA (Discrete Autoanalyser).
iCR3+1WCCAL	Chromium (III) species by calculation (Cr minus Cr(VI)).
iCTO1WDCO	Dissolved Organic Carbon (DOC), Dissolved Non Purgeable Organic Carbon (DNPOC) or Total Dissolved Carbon (DTC) by combustion.
iCTO1WTCO	Total Organic Carbon (TOC) , Non Purgeable Organic Carbon (NPOC) or Total Carbon (TC) by combustion.
iEC1WZSE	Electrical conductivity in water compensated to 25C.
iHG1WCVG	Dissolved mercury in water by CV-AAS.
iHG1WTVG	Mercury (unfiltered) in water by CV-AAS.
iMET1WCICP	Total dissolved metals by ICPAES.
iMET1WCMS	Total dissolved metals by ICPMS.
iMET1WCMSHMI	Total dissolved metals by ICPMS.
iMET1WTICP	Total metals by microwave digestion and ICPAES.
iMET1WTMS	Total metals by microwave digestion and ICPMS.
iMET1WTMSHMI	Total metals by ICPMS.
iSD1WSCA	Hydrogen Sulphide in water calculated from sulphide by colourimetry.
iSOL1WDGR	Total dissolved solids (TDS) by gravimetry, dried at 178 - 182 C.
iSOL1WPGR	Suspended Solids dried at 103 -105 C and Volatile Suspended Solids ignited at 550C.
ORG007W	Total Recoverable Hydrocarbons in Water
ORG007WPTC	Sum of TRHs in Water with C6-C10 by Purge and Trap
ORG015W	BTEXN, MTBE and vTRH in water by PT GC-MS

Method	Method Description
ORG091W	Volatile fatty acids in water by GCFID
ORG100W	Semi-Volatile organic compounds in water by GC-MS
ORG100WPhenC	Total Phenols in Water by summation of 17 selected speciated phenols

A quality assurance report is attached.

Analysis of the pH was outside the holding time of six hours. The results should be used as reference only.

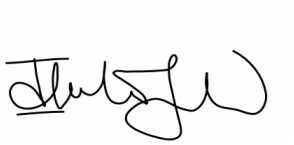
The BOD / cBOD should be analysed within 48 hours of sample collection (APHA Method 5210 B, 2017). The sample(s) was analysed outside this timeframe and results may be impacted by the delay.

The microbiological analysis was outsourced to PathWest (NATA Accreditation No 2851). A copy of their report is attached.

These results apply only to the sample(s) as received. Unless arrangements are made to the contrary, these samples will be disposed of after 30 days of the issue of this report.
This report may only be reproduced in full.

*Analysis not covered by scope of ChemCentre's NATA accreditation.
^Information provided by client, unless otherwise stated.

Tavish Shankar
Chemist
SSD Inorganic Chemistry
24-Dec-2025



Ibrahim Jambol
Team Leader
SSD Organic Chemistry

Appendix C. Intertek whole effluent toxicity (WET) test reports

ECOTOXICOLOGY LABORATORY
TEST REPORT

CLIENT	STEPHANIE WATTS & ELEANOR SMITH WORLEY CONSULTING LEVEL 14 240 ST GEORGE'S TERRACE PERTH, WA 6000 AUSTRALIA

JOB INFORMATION			
	JOB REFERENCE	:	2025-MDTN-001089
	SAMPLE REFERENCE	:	002
	CLIENT ORDER NO.	:	411012-01338-100901-1054
	PROJECT	:	KGP
	DATE SAMPLED	:	08/12/2025
	DATE RECEIVED	:	09/12/2025
	DATE REPORTED	:	28/01/2026

REPORT NOTES	
	Sample received in good condition at a temperature of 12.5°C [1].

TESTED BY

Intertek Ecotoxicology Laboratory
Intertek Geotech
544 Bickley Road
Maddington, Western Australia 6109

Tel: +61 8 9263 0263
Tristan.Stringer@Intertek.com

COMPANY APPROVED SIGNATORY

DR TRISTAN STRINGER
PRINCIPAL ECOTOXICOLOGIST

NATA Accreditation Number: 5646
Accredited for compliance with ISO/IEC 17025 – Testing

LIST OF REVISIONS

REV.	DATE	REVISION DETAILS	AUTHOR	ISSUE
0	28/01/2026	Document prepared	Dr Tristan Stringer	Dr Tristan Stringer

This document replaces and supersedes all previous versions.

SAMPLE INFORMATION

SAMPLE REFERENCE	SAMPLE DATE	MATRIX	PRESERVATION	INTERTEK REFERENCE
T6701 277377 (KGP1)	08/12/2025	Water	Chilled	2025-MDTN-001089 - 002

ADDITIONAL SAMPLE INFORMATION

One (1) seawater sample was received on 09/12/2025 for testing as per quote QU25625 ECX WORLEY Rev 0.

METHODOLOGY

Following the protocol outlined in ANZECC/ARMCANZ (2000) and ANZG (2018), a suite of bioassays was used to assess the toxicity of one seawater.

For quality assurance purposes reference toxicant) bioassays were tested simultaneously. Statistically calculated effect concentrations (EC_{10}, EC_{50}, NOEC and LOEC) have been reported the samples and reference toxicants.

Sample is characterised with low salinity which can be toxic for marine species.

To exclude adverse effect of low salinity original sample was adjusted using artificial GP-2 Salts to match the salinity of Filtered Sea Water (FSW) - 35‰. GP-2 Salts Control was tested in each bioassay.

For Microtox Bioassay Osmotic Adjustment Solution (OAS) was used to adjust the salinity of the sample to approximately 2% NaCl. 2 mL of OAS was added to 20 mL of 100% samples and then serially diluted with filtered sea water. The highest tested concentration for Microtox Bioassay was 90.9%.

BIOASSAY DETAILS

BIOASSAY	PROTOCOL	TEST SPECIES	TEMP.
5-min Acute Microtox Bioassay	WIECX-17	*Allivibrio fischeri* [2]	15°C
15-min Acute Microtox Bioassay	WIECX-17	*Allivibrio fischeri* [2]	15°C
72-hour Microalgal Growth Bioassay	WIECX-06	*Cylindrotheca closterium* [3]	22°C
72-hour Macroalgal Zoospore Germination Bioassay	WIECX-08	*Ecklonia radiata*	22°C
8-day Sea Anemone Pedal Lacerate Development [1]	WIECX-30	*Exaiptasia diaphana* [4]	25°C
48-hr Mollusc Larval Development Bioassay [5]	ESA 106	*Saccostrea scyphophilla* [6]	29°C
72-hr Sea Urchin Larval Development Bioassay [5]	ESA 105	*Heliocidaris tuberculata*	20°C
72-hr Sea Urchin Larval Development Bioassay	WIECX-25	*Echinometra mathaei*	25°C
5-7 day Copepod Larval Development Bioassay [1]	WIECX-26	*Gladioferens imparipes*	22°C
7-day Fish Larval Development Bioassay	WIECX-16	*Seriola lalandi*	22°C

Note [1] – Non-NATA Accredited Method
Note [2] – Previously referred to as *Vibrio fischeri*
Note [3] – Previously referred to as *Nitzschia closterium*, Coral Sea isolate
Note [4] – Previously referred to as *Aiptasia pulchella*
Note [5] – Subcontracted to Ecotox Services Australia
Note [6] – Previously referred to as *Saccostrea glomerata*

RESULTS

SAMPLE INFORMATION

SAMPLE REFERENCE	INTERTEK REFERENCE
T6701 277377 (KGP1)	2025-MDTN-001089 - 002

PHYSICOCHEMISTRY

PARAMETER	CONTROL	GP-2 SALTS	0.8%	1.6%	3.1%	6.3%
pH [1]	8.10	8.12	8.11	8.11	8.12	8.14
Salinity (‰) [1]	35.0	35.0	35.0	35.0	35.0	35.0
DO (%) [1]	100	100	100	100	100	100

PARAMETER	12.5%	25%	50%	100%	100% AS RECEIVED
pH [1]	8.17	8.22	8.30	8.40	9.45
Salinity (‰) [1]	35.0	35.0	35.0	35.0	0.8
DO (%) [1]	100	100	100	100	98

Note [1] – Non-NATA Accredited Method

Results on the following pages

CONCENTRATION-RESPONSE DATA

BIOASSAY (% CONTROL)	CONTROL	0.71%	1.42%	2.84%	5.68%	11.4%	22.7%	45.5%	90.9%
Microtox – 5 min	100 ± 2	105 ± 5	106 ± 7	102 ± 16	115 ± 0	113 ± 4	114 ± 4	105 ± 19	76 ± 7
Microtox – 15 min	100 ± 1	95 ± 7	95 ± 6	96 ± 1	96 ± 2	97 ± 1	93 ± 1	80 ± 15	51 ± 6

BIOASSAY (% CONTROL)	CONTROL	GP-2 SALTS	0.8%	1.6%	3.1%	6.3%	12.5%	25%	50%	100%
Microalgae Growth	100 ± 2	101 ± 8	-	-	-	126 ± 8	143 ± 2	166 ± 5	132 ± 6	209 ± 35
Macroalgae Zoospore Germination	100 ± 2	103 ± 2	-	-	-	98 ± 3	100 ± 2	85 ± 3	77 ± 3	18 ± 10
Sea Anemone Pedal Lacerate Development [1]	100 ± 0	100 ± 0	-	-	100 ± 0	100 ± 0	95 ± 10	100 ± 0	100 ± 0	95 ± 10
Mollusc Larvae Development [5]	102 ± 3	100 ± 5	100 ± 4	106 ± 7	109 ± 4	106 ± 4	105 ± 6	104 ± 6	101 ± 3	100 ± 9
Sea Urchin Development (*H. tuberculata*) [5]	100 ± 3	100 ± 3	100 ± 3	99 ± 2	99 ± 2	101 ± 2	101 ± 3	100 ± 1	100 ± 2	98 ± 3
Sea Urchin Development (*E. mathaei*)	100 ± 2	100 ± 2	-	-	-	101 ± 2	100 ± 2	99 ± 2	101 ± 0	102 ±1
Copepod Larval Development [1]	100 ± 11	107 ± 5	-	-	103 ± 3	92 ± 19	70 ± 8	51 ± 25	25 ± 10	6 ± 1
Fish Larvae Development	100 ± 3	108 ± 0	-	-	98 ± 7	96 ± 6	94 ± 7	90 ± 6	84 ± 6	78 ± 10

Note [1] – Non-NATA Accredited Method
Note [5] – Subcontracted to Ecotox Services Australia

STATISTICAL EFFECTS DATA

BIOASSAY	EC_{10} (%)	EC_{50} (%)	NOEC (%)	LOEC (%)
Microtox – 5 min	60.3	>90.9	45.5	90.9
Microtox – 15 min	36.8	>90.9	22.7	45.5
Microalgae Growth	>100	>100	100	>100
Macroalgae Zoospore Germination	28.8	64.3	12.5	25
Sea Anemone Pedal Lacerate Development [1]	>100	>100	100	>100
Mollusc Larvae Development [5]	>100	>100	100	>100
Sea Urchin Development (*H. tuberculata*) [5]	>100	>100	100	>100
Sea Urchin Development (*E. mathaei*)	>100	>100	100	>100
Copepod Larval Development [1]	7.21	24.8	6.3	12.5
Fish Larvae Development	29.5	>100	25	50

Note [1] – Non-NATA Accredited Method
Note [5] – Subcontracted to Ecotox Services Australia
EC_{10} - The effective concentration where a 10% effect is observed compared to the control group.
EC_{50} - The effective concentration where a 50% effect is observed compared to the control group.
NOEC- No observed effect concentration
LOEC - Lowest observed effect concentration

QUALITY ASSURANCE LIMITS

BIOASSAY	REFERENCE TOXICANT	OBSERVED EC_{50}	CUSUM CHART LIMITS	COEFFICIENT OF VARIANCE	CONTROL RESPONSE	TEST ACCEPTABILITY
Microtox	Phenol	20.4 mg/L	15.8 – 24.9 mg/L	11.3%	> 90%	PASS
Microalgae Growth	Copper	118 µg/L	50.9 – 125 µg/L	22.8%	> 3 x cell divisions	PASS
Macroalgae Zoospore Germination	Copper	150 µg/L	116 – 196 µg/L	13.4%	>80% Germination	PASS
Sea Anemone Pedal Lacerate Development [1]	Copper	21.6 µg/L	17.6 – 31.1 µg/L	14.3%	>90% Unaffected	PASS
Mollusc Larvae Development [5]	Copper	15.5 µg/L	14.1 – 16.6 µg/L	N/A	>70% Development	PASS
Sea Urchin Development (*H. tuberculata*) [5]	Copper	11.1 µg/L	10.6 – 11.6 µg/L	N/A	>70% Development	PASS
Sea Urchin Development (*E. mathaei*)	Copper	11.1 µg/L	10.5 – 16.1 µg/L	10.9%	>80% Development	PASS
Copepod Larval Development [1]	Copper	12.1 µg/L	9.0 – 24.8 µg/L	26.1%	60-90% Development	PASS
Fish Larvae Development	Copper	39.9 µg/L	27.7 – 53.3 µg/L	16.4%	>80% Development	PASS

Note [1] – Non-NATA Accredited Method
Note [5] – Subcontracted to Ecotox Services Australia

GENERAL COMMENTS

Quality assurance and quality control criteria were within acceptable limits for all bioassays.

REFERENCES

BIOASSAY PROTOCOL	REFERENCE
WIECX-06	Stauber, J.L., Tsai, J., Vaughan, G., Peterson, S.M. and Brockbank, C.I. (1994). Algae as indicators of toxicity of BEKM effluents. National Pulp Mills Research Program Technical Report Series No. 3, Canberra: CSIRO, pp. 1-82.
WIECX-08	Burridge, T.R., Karistianos, M., Bidwell, J. (1999) The use of aquatic macrophyte ecotoxicological assays in monitoring coastal effluent discharges in Southern Australia. Marine Pollution Bulletin 39 (1-12):89-96.
WIECX-16	U.S. Environmental Protection Agency. 2002. Method 1005.0: Sheepshead Minnow, Cyprinodon variegatus, Embryo-Larval Survival and Teratogenicity Test, Chronic Toxicity. Third edition. Environmental Monitoring Systems Laboratory, U. S. Environmental Protection Agency, Cincinnati, OH EPA-821-R-02-014.
WIECX-17	Microbics 1992 & Modern Water Microtox® LX Analyser User Manual
WIECX-25	ASTM Standard E1563-21a (2021) Standard Guide for Conducting Short-Term Chronic Toxicity Tests with Echinoid Embryos. ASTM International, West Conshohocken, PA.
WIECX-26	International Organization for Standardization. (2015) Water quality — Calanoid copepod early-life stage test with Acartia tonsa (ISO standard No. 16778:2015)
WIECX-30	Howe P., Reichelt-Brushett A., Clark M. (2014) Development of a chronic, early life-stage sub-lethal toxicity test and recovery assessment for the tropical zooxanthellate sea anemone Aiptasia pulchella, Ecotoxicology and Environmental Safety 100: 138-147

APPENDIX A

Statistical Data

MICROTOX – 5 MIN

Start Date:	11/12/2025	Test ID:	AF251211	Sample ID:	2025-MDTN-001089-001
End Date:	11/12/2025	Lab ID:	ECOTOX-Intertek Geotech	Sample Type:	Admin Drain 277378 (KGP2)
Sample Date:	8/12/2025	Protocol:	WIECX-17-Microtox	Test Species:	MICROTOX-Allivibrio fischeri
Comments:	t=5 min				

Conc-%	1	2	3
B-Control	1.0000	0.9400	1.0000
0.71	0.9800	1.0000	1.0000
1.42	1.0000	1.0000	1.0000
2.84	1.0000	1.0000	1.0000
5.68	1.0000	1.0000	1.0000
11.4	1.0000	1.0000	1.0000
22.7	1.0000	1.0000	1.0000
45.5	1.0000	1.0000	1.0000
90.9	1.0000	1.0000	1.0000

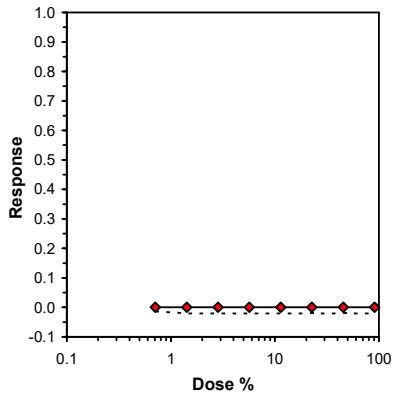
			Transform: Arcsin Square Root					1-Tailed			Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
B-Control	0.9800	1.0000	1.4550	1.3233	1.5208	7.835	3				0.9970	1.0000
0.71	0.9933	1.0136	1.4902	1.4289	1.5208	3.560	3	-1.028	2.580	0.0883	0.9970	1.0000
1.42	1.0000	1.0204	1.5208	1.5208	1.5208	0.000	3	-1.923	2.580	0.0883	0.9970	1.0000
2.84	1.0000	1.0204	1.5208	1.5208	1.5208	0.000	3	-1.923	2.580	0.0883	0.9970	1.0000
5.68	1.0000	1.0204	1.5208	1.5208	1.5208	0.000	3	-1.923	2.580	0.0883	0.9970	1.0000
11.4	1.0000	1.0204	1.5208	1.5208	1.5208	0.000	3	-1.923	2.580	0.0883	0.9970	1.0000
22.7	1.0000	1.0204	1.5208	1.5208	1.5208	0.000	3	-1.923	2.580	0.0883	0.9970	1.0000
45.5	1.0000	1.0204	1.5208	1.5208	1.5208	0.000	3	-1.923	2.580	0.0883	0.9970	1.0000
90.9	1.0000	1.0204	1.5208	1.5208	1.5208	0.000	3	-1.923	2.580	0.0883	0.9970	1.0000

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.60992	0.894	-1.8444	8.20697
Equality of variance cannot be confirmed				

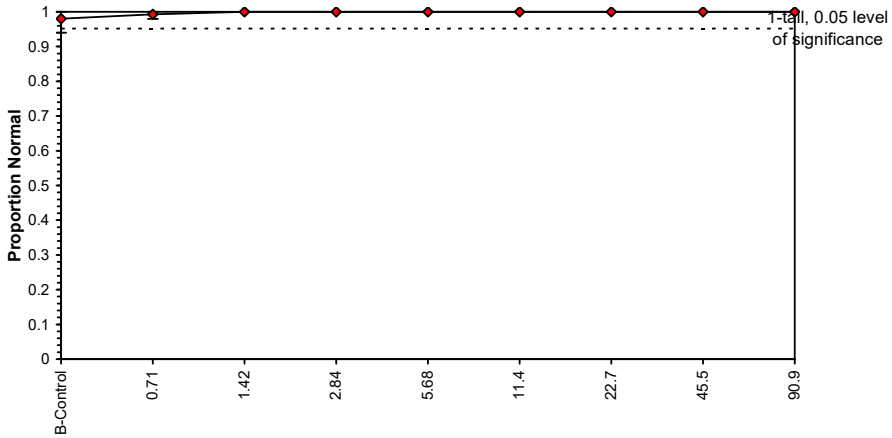
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	90.9	>90.9		1.10011	0.02773	0.02811	0.00159	0.00176	0.53382	8, 18

Log-Logit Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)	Skew
IC05	>90.9			
IC10	>90.9			
IC15	>90.9			
IC20	>90.9			
IC25	>90.9			
IC40	>90.9			
IC50	>90.9			



Dose-Response Plot



MICROTOX – 15 MIN

Start Date:	11/12/2025	Test ID:	AF251211	Sample ID:	2025-MDTN-001089-001
End Date:	11/12/2025	Lab ID:	ECOTOX-Intertek Geotech	Sample Type:	Admin Drain 277378 (KGP2)
Sample Date:	8/12/2025	Protocol:	WIECX-17-Microtox	Test Species:	MICROTOX-Allivibrio fischeri
Comments:	t=15 min				

Conc-%	1	2	3
B-Control	1.0000	0.9600	0.9900
0.71	0.9400	1.0000	1.0000
1.42	1.0000	1.0000	1.0000
2.84	1.0000	1.0000	1.0000
5.68	1.0000	1.0000	1.0000
11.4	1.0000	0.9600	1.0000
22.7	0.9700	0.9600	0.9600
45.5	1.0000	1.0000	1.0000
90.9	0.7900	0.8700	0.8600

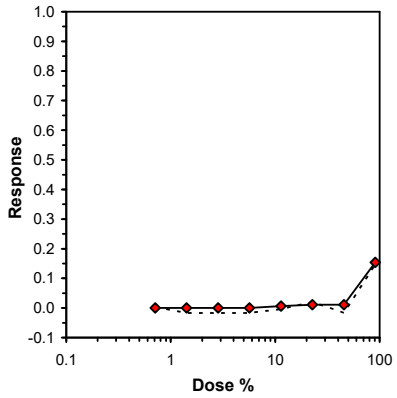
			Transform: Arcsin Square Root					1-Tailed			Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
B-Control	0.9833	1.0000	1.4536	1.3694	1.5208	5.303	3				0.9927	1.0000
0.71	0.9800	0.9966	1.4550	1.3233	1.5208	7.835	3	-0.028	2.580	0.1220	0.9927	1.0000
1.42	1.0000	1.0169	1.5208	1.5208	1.5208	0.000	3	-1.420	2.580	0.1220	0.9927	1.0000
2.84	1.0000	1.0169	1.5208	1.5208	1.5208	0.000	3	-1.420	2.580	0.1220	0.9927	1.0000
5.68	1.0000	1.0169	1.5208	1.5208	1.5208	0.000	3	-1.420	2.580	0.1220	0.9927	1.0000
11.4	0.9867	1.0034	1.4703	1.3694	1.5208	5.943	3	-0.353	2.580	0.1220	0.9867	0.9940
22.7	0.9633	0.9797	1.3785	1.3694	1.3967	1.142	3	1.588	2.580	0.1220	0.9817	0.9889
45.5	1.0000	1.0169	1.5208	1.5208	1.5208	0.000	3	-1.420	2.580	0.1220	0.9817	0.9889
*90.9	0.8400	0.8542	1.1613	1.0948	1.2019	5.004	3	6.180	2.580	0.1220	0.8400	0.8462

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.84649	0.894	-1.104	1.54072
Equality of variance cannot be confirmed				

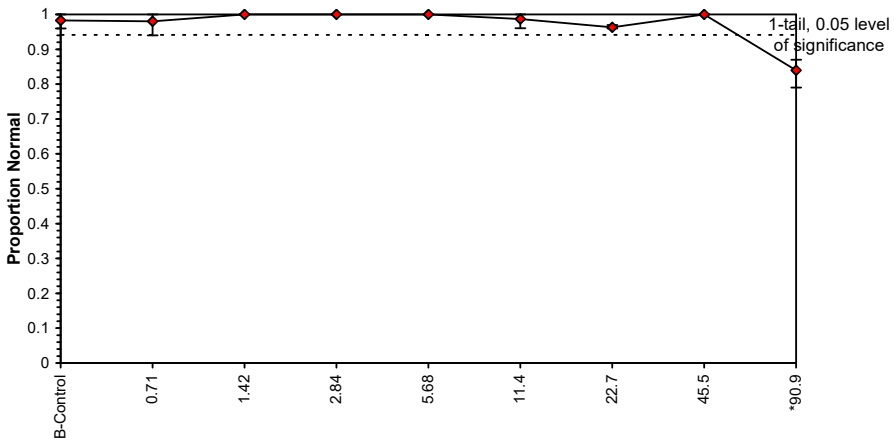
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	45.5	90.9	64.3114	2.1978	0.04247	0.04305	0.04075	0.00336	7.8E-06	8, 18

Log-Logit Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew
IC05	64.616	2.261	54.917	72.666	0.1075
IC10	79.117	3.227	67.719	90.911	0.1818
IC15	90.140				
IC20	>90.9				
IC25	>90.9				
IC40	>90.9				
IC50	>90.9				



Dose-Response Plot



MICROALGAE GROWTH

Start Date:	16/12/2025	Test ID:	CC251216	Sample ID:	2025-MDTN-001089-001
End Date:	19/12/2025	Lab ID:	ECOTOX-Intertek Geotech	Sample Type:	Admin Drain 277378 (KGP2)
Sample Date:	8/12/2025	Protocol:	WIECX-06-Marine Microalgae	Test Species:	CC-Cylindrotheca closterium
Comments:					

Conc-%	1	2	3
B-Control	0.9800	1.0000	1.0000
6.3	1.0000	1.0000	1.0000
12.5	1.0000	1.0000	1.0000
25	0.8300	0.8300	0.9800
50	0.2100	0.2100	0.2400
100	0.0000	0.0000	0.0000

			Transform: Arcsin Square Root						1-Tailed		Number	Total
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Resp	Number
B-Control	0.9933	1.0000	1.4902	1.4289	1.5208	3.560	3				2	300
6.3	1.0000	1.0067	1.5208	1.5208	1.5208	0.000	3	-0.531	2.500	0.1442	0	300
12.5	1.0000	1.0067	1.5208	1.5208	1.5208	0.000	3	-0.531	2.500	0.1442	0	300
*25	0.8800	0.8859	1.2402	1.1458	1.4289	13.179	3	4.333	2.500	0.1442	36	300
*50	0.2200	0.2215	0.4880	0.4760	0.5120	4.252	3	17.370	2.500	0.1442	234	300
*100	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	3	24.961	2.500	0.1442	300	300

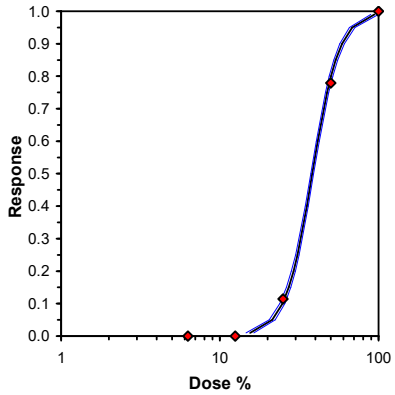
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.74743	0.858	1.54329	6.12797
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	12.5	25	17.6777	8	0.04324	0.04352	1.19336	0.00499	1.4E-11	5, 12

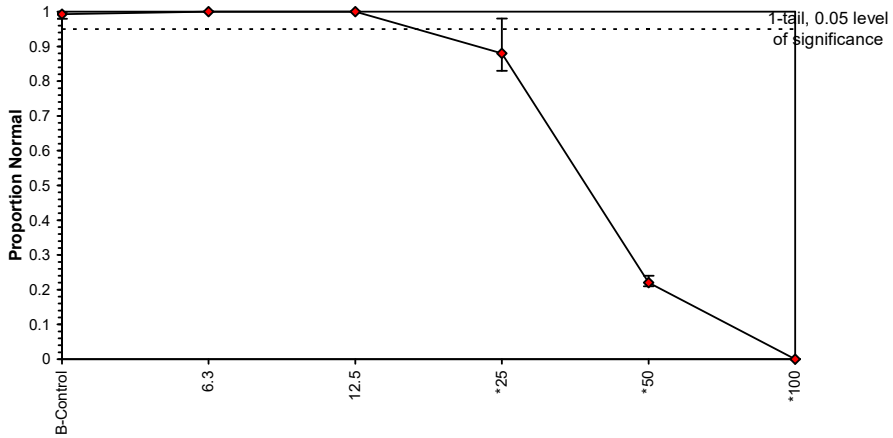
Maximum Likelihood-Logit

Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	11.7328	0.35199	11.0429	12.4227	0.00667	5.92526	7.81473	0.12			7
Intercept	-18.562	0.56543	-19.67	-17.454							
TSCR	0.00232	0.00184	-0.0013	0.00593							

Point	Logits	%	95% Fiducial Limits	
EC01	-4.595	15.5037	14.5535	16.408
EC05	-2.944	21.4351	20.4939	22.3231
EC10	-2.197	24.8206	23.9132	25.6775
EC15	-1.735	27.1796	26.3005	28.0131
EC20	-1.386	29.1024	28.2459	29.9191
EC25	-1.099	30.7928	29.9535	31.5985
EC40	-0.405	35.2799	34.46	36.0881
EC50	0.000	38.2019	37.3631	39.0475
EC60	0.405	41.366	40.4712	42.2909
EC75	1.099	47.3938	46.2923	48.5792
EC80	1.386	50.1466	48.9136	51.4919
EC85	1.735	53.6943	52.265	55.276
EC90	2.197	58.7974	57.0435	60.7681
EC95	2.944	68.0839	65.6442	70.876
EC99	4.595	94.1313	89.3482	99.7623



Dose-Response Plot



MACROALGAE ZOOSPORE GERMINATION

Start Date:	16/12/2025	Test ID:	ER251216	Sample ID:	2025-MDTN-001089-001
End Date:	19/12/2025	Lab ID:	ECOTOX-Intertek Geotech	Sample Type:	Admin Drain 277378 (KGP2)
Sample Date:	8/12/2025	Protocol:	WIECX-08-Macroalgae Germ	Test Species:	EK-Ecklonia radiata
Comments:					

Conc-%	1	2	3
B-Control	0.9900	1.0000	0.9900
6.3	0.9000	0.8700	1.0000
12.5	0.6400	0.6200	0.6400
25	0.3700	0.4900	0.5100
50	0.0000	0.0000	0.0000
100	0.0000	0.0000	0.0000

			Transform: Arcsin Square Root						1-Tailed		Number	Total
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Resp	Number
B-Control	0.9933	1.0000	1.4706	1.4706	1.5208	1.947	3				2	300
*6.3	0.9233	0.9295	1.3239	1.2019	1.5208	13.000	3	2.567	2.500	0.1591	23	300
*12.5	0.6333	0.6376	0.9204	0.9066	0.9273	1.299	3	8.907	2.500	0.1591	110	300
*25	0.4567	0.4597	0.7416	0.6539	0.7954	10.327	3	11.716	2.500	0.1591	163	300
*50	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	3	22.580	2.500	0.1591	300	300
*100	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	3	22.580	2.500	0.1591	300	300

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.82954	0.858	1.16359	4.69872
Equality of variance cannot be confirmed				

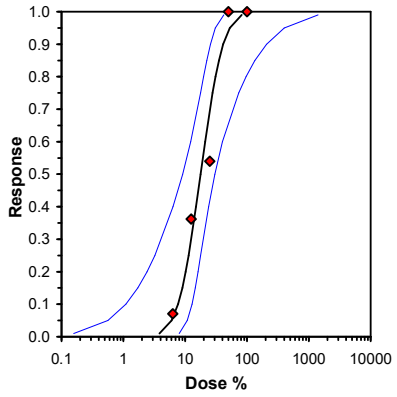
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	<6.3	6.3			0.05075	0.05111	1.12873	0.00608	6.2E-11	5, 12

Maximum Likelihood-Probit

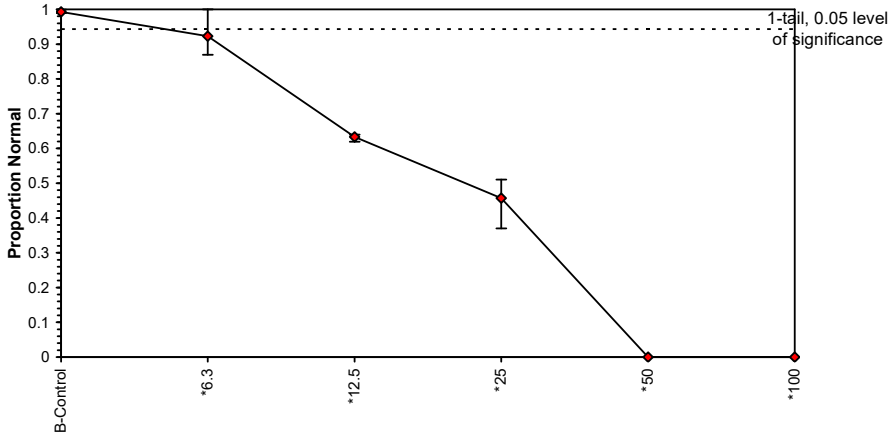
Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	3.50431	0.72315	1.20292	5.80571	0.00667	61.5449	7.81473	2.8E-13	1.24969	0.28536	6
Intercept	0.62068	0.94597	-2.3898	3.63117							
TSCR	0.00861	0.02378	-0.0671	0.08428							

Point	Probits	%	95% Fiducial Limits	
EC01	2.674	3.85338	0.15796	8.02033
EC05	3.355	6.02997	0.56402	10.8483
EC10	3.718	7.65575	1.0999	12.8794
EC15	3.964	8.99364	1.71292	14.5714
EC20	4.158	10.2218	2.41919	16.1835
EC25	4.326	11.4083	3.23061	17.8313
EC40	4.747	15.0452	6.38395	23.8791
EC50	5.000	17.7703	9.10828	30.0552
EC60	5.253	20.9889	12.2556	40.1116
EC75	5.674	27.6802	17.6973	73.5081
EC80	5.842	30.8931	19.8417	96.4693
EC85	6.036	35.1119	22.3556	134.303
EC90	6.282	41.2479	25.5994	206.648
EC95	6.645	52.369	30.7203	398.685
EC99	7.326	81.9497	41.9548	1409.91

Significant heterogeneity detected (p = 2.75E-13)



Dose-Response Plot



SEA ANEMONE PEDAL LACERATE DEVELOPMENT

Start Date:	16/12/2025	Test ID:	EDD251216	Sample ID:	2025-MDTN-001089-001
End Date:	24/12/2025	Lab ID:	ECOTOX-Intertek Geotech	Sample Type:	Admin Drain 277378 (KGP2)
Sample Date:	8/12/2025	Protocol:	WIECX-30-Sea Anemone De	Test Species:	ED-Exaiptasia diaphana
Comments:					

Conc-%	1	2	3	4
B-Control	1.0000	1.0000	0.8400	1.0000
1.6	1.0000	0.6300	1.0000	1.0000
3.1	0.6300	0.8400	0.8400	0.8400
6.3	0.6300	0.6300	0.6300	0.4200
12.5	0.6300	0.4200	0.2100	0.4200
25	0.0000	0.0000	0.0000	0.0000

			Transform: Arcsin Square Root					Rank	1-Tailed	Number	Total
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Resp	Number
B-Control	0.9600	1.0000	1.4304	1.1593	1.5208	12.636	4			16	400
1.6	0.9075	0.9453	1.3698	0.9169	1.5208	22.042	4	17.50	10.00	37	400
3.1	0.7875	0.8203	1.0987	0.9169	1.1593	11.030	4	11.50	10.00	85	400
*6.3	0.5775	0.6016	0.8639	0.7051	0.9169	12.261	4	10.00	10.00	169	400
*12.5	0.4200	0.4375	0.7008	0.4760	0.9169	25.694	4	10.00	10.00	232	400
*25	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4	10.00	10.00	400	400

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.85592	0.884	-1.4304	2.14225
Equality of variance cannot be confirmed				

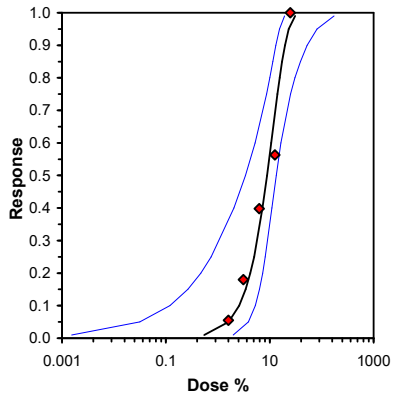
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	3.1	6.3	4.41928	32.2581

Maximum Likelihood-Weibull

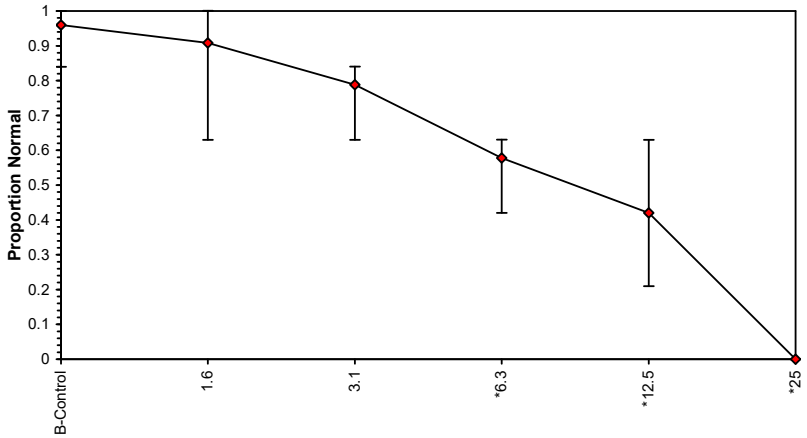
Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	3.50468	0.71458	1.23057	5.7788	0.04	52.4047	7.81473	2.5E-11			6
Intercept	-3.6915	0.78381	-6.186	-1.1971							
TSCR	0.04928	0.04081	-0.0806	0.17916							

Point	Weibull	%	95% Fiducial Limits	
EC01	-4.600	0.55047	0.00153	1.9883
EC05	-2.970	1.60626	0.0316	3.881
EC10	-2.250	2.57754	0.11955	5.25524
EC15	-1.817	3.42666	0.265	6.34029
EC20	-1.500	4.22014	0.4723	7.30494
EC25	-1.246	4.98669	0.74734	8.21704
EC40	-0.672	7.27181	2.05395	11.0051
EC50	-0.367	8.88649	3.41021	13.2509
EC60	-0.087	10.6749	5.21309	16.3315
EC75	0.327	14.0122	8.67974	25.104
EC80	0.476	15.4559	10.0049	30.5596
EC85	0.640	17.2194	11.4472	38.7938
EC90	0.834	19.5562	13.1165	52.5488
EC95	1.097	23.2473	15.3755	81.4593
EC99	1.527	30.8363	19.2305	172.827

Significant heterogeneity detected (p = 2.46E-11)



Dose-Response Plot



SEA URCHIN DEVELOPMENT (*E. MATHAEI*)

Start Date:	19/12/2025	Test ID:	SD251219	Sample ID:	2025-MDTN-001089-001
End Date:	22/12/2025	Lab ID:	ECOTOX-Intertek Geotech	Sample Type:	Admin Drain 277378 (KGP2)
Sample Date:	8/12/2025	Protocol:	WIECX-25-Sea Urchin Larval	Test Species:	EM-Echinometra mathaei
Comments:					

Conc-%	1	2	3
B-Control	1.0000	0.9900	0.9900
1.6	1.0000	1.0000	0.9600
3.1	0.9700	0.9400	1.0000
6.3	0.9700	0.9300	0.9400
12.5	0.5400	0.5000	0.5100
25	0.0000	0.0000	0.0000

			Transform: Arcsin Square Root						1-Tailed		Number	Total
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Resp	Number
B-Control	0.9933	1.0000	1.4873	1.4706	1.5208	1.947	3				2	300
1.6	0.9867	0.9933	1.4703	1.3694	1.5208	5.943	3	0.350	2.500	0.1216	4	300
3.1	0.9700	0.9765	1.4136	1.3233	1.5208	7.060	3	1.516	2.500	0.1216	9	300
*6.3	0.9467	0.9530	1.3410	1.3030	1.3967	3.675	3	3.008	2.500	0.1216	16	300
*12.5	0.5167	0.5201	0.8021	0.7854	0.8254	2.598	3	14.087	2.500	0.1216	145	300
*25	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	3	29.548	2.500	0.1216	300	300

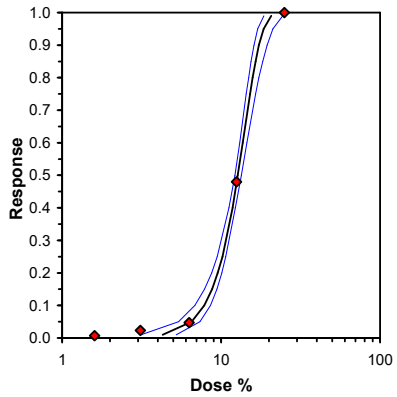
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.94526	0.858	-0.0695	0.77506
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	3.1	6.3	4.41928	32.2581	0.03452	0.03476	0.98077	0.00355	5.9E-12	5, 12

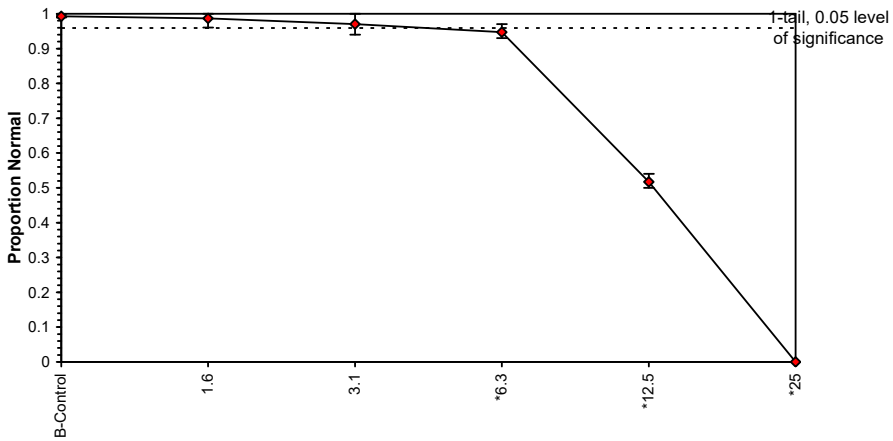
Maximum Likelihood-Weibull

Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	8.96301	1.04404	6.91669	11.0093	0.00667	2.95792	7.81473	0.4			10
Intercept	-10.271	1.13088	-12.487	-8.0543							
TSCR	0.01463	0.00428	0.00624	0.02303							

Point	Weibull	%	95% Fiducial Limits	
EC01	-4.600	4.2922	3.1421	5.22861
EC05	-2.970	6.52429	5.39287	7.37045
EC10	-2.250	7.84954	6.83651	8.58883
EC15	-1.817	8.77403	7.87707	9.42826
EC20	-1.500	9.51851	8.7271	10.1055
EC25	-1.246	10.1604	9.46155	10.6971
EC40	-0.672	11.7753	11.2467	12.2849
EC50	-0.367	12.7358	12.2082	13.3535
EC60	-0.087	13.6824	13.0751	14.5045
EC75	0.327	15.2181	14.3755	16.5119
EC80	0.476	15.8129	14.8584	17.3214
EC85	0.640	16.4953	15.4028	18.267
EC90	0.834	17.3368	16.0634	19.4549
EC95	1.097	18.5494	16.9982	21.2038
EC99	1.527	20.7159	18.63	24.4246



Dose-Response Plot



COPEPOD LARVAL DEVELOPMENT

Start Date:	12/12/2025	Test ID:	GI251212	Sample ID:	2025-MDTN-001089-001
End Date:	19/12/2025	Lab ID:	ECOTOX-Intertek Geotech	Sample Type:	Admin Drain 277378 (KGP2)
Sample Date:	8/12/2025	Protocol:	WIECX-26-Copepod Larval D	Test Species:	GI-Gladioferens Imparipes
Comments:					

Conc-%	1	2	3	4
B-Control	0.9300	1.0000	1.0000	0.8900
6.3	0.9300	1.0000	0.9500	
12.5	1.0000	1.0000	1.0000	
25	0.8400	0.8000	0.7500	
50	0.1100	0.0900	0.0500	
100	0.0000	0.0200	0.0000	

			Transform: Arcsin Square Root						1-Tailed		Number	Total
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Resp	Number
B-Control	0.9550	1.0000	1.3943	1.2327	1.5208	10.672	4				18	400
6.3	0.9600	1.0052	1.3897	1.3030	1.5208	8.309	3	0.065	2.650	0.1876	12	300
12.5	1.0000	1.0471	1.5208	1.5208	1.5208	0.000	3	-1.786	2.650	0.1876	0	300
*25	0.7967	0.8342	1.1045	1.0472	1.1593	5.078	3	4.093	2.650	0.1876	61	300
*50	0.0833	0.0873	0.2894	0.2255	0.3381	19.974	3	15.607	2.650	0.1876	275	300
*100	0.0067	0.0070	0.0806	0.0500	0.1419	65.775	3	18.556	2.650	0.1876	298	300

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.96305	0.863	0.07388	-0.1949
Equality of variance cannot be confirmed				

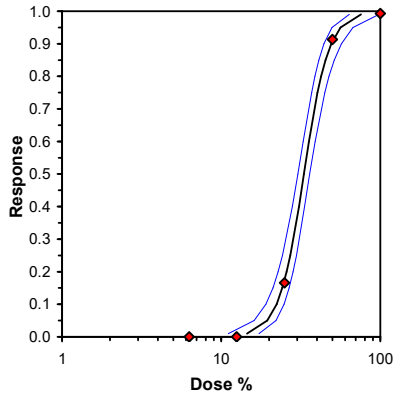
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Bonferroni t Test	12.5	25	17.6777	8	0.09599	0.09904	1.19412	0.00859	8.2E-11	5, 13

Maximum Likelihood-Logit

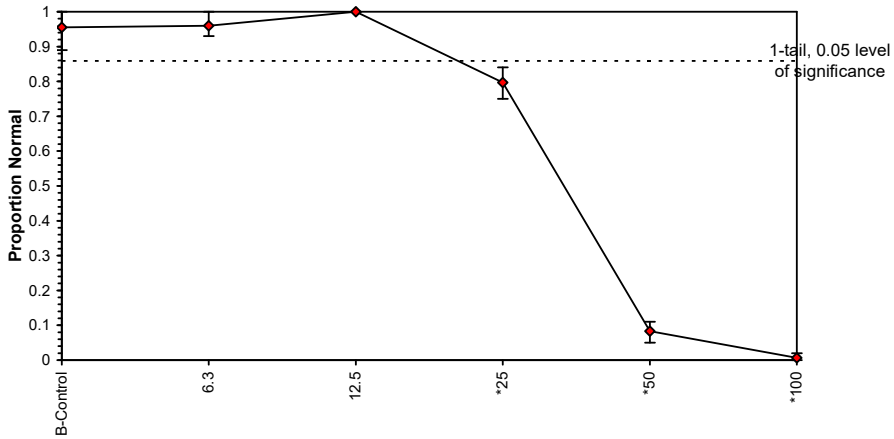
Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	12.821	0.92939	9.86326	15.7787	0.045	14.9298	7.81473	1.9E-03			8
Intercept	-19.483	1.42129	-24.006	-14.96							
TSCR	0.03019	0.01251	-0.0096	0.06999							

Point	Logits	%	95% Fiducial Limits	
EC01	-4.595	14.4943	11.0713	17.2627
EC05	-2.944	19.496	16.1466	22.141
EC10	-2.197	22.296	19.1015	24.8498
EC15	-1.735	24.2276	21.1617	26.7339
EC20	-1.386	25.7915	22.8306	28.2803
EC25	-1.099	27.1591	24.2828	29.6552
EC40	-0.405	30.7595	28.0267	33.4221
EC50	0.000	33.0829	30.347	35.9994
EC60	0.405	35.5819	32.7401	38.9168
EC75	1.099	40.2988	36.9831	44.8144
EC80	1.386	42.4356	38.8085	47.6315
EC85	1.735	45.1749	41.0811	51.3531
EC90	2.197	49.0886	44.2253	56.854
EC95	2.944	56.1386	49.6699	67.2128
EC99	4.595	75.5109	63.7501	97.957

Significant heterogeneity detected (p = 1.88E-03)



Dose-Response Plot



FISH LARVAE DEVELOPMENT

Start Date:	18/12/2025	Test ID:	SL251218	Sample ID:	2025-MDTN-001089-001
End Date:	25/12/2025	Lab ID:	ECOTOX-Intertek Geotech	Sample Type:	Admin Drain 277378 (KGP2)
Sample Date:	8/12/2025	Protocol:	WIECX-16-Fish Developmen	Test Species:	SL-Seriola lalandi
Comments:					

Conc-%	1	2	3
B-Control	1.0000	1.0000	0.9600
3.1	0.9000	1.0000	0.9000
6.3	1.0000	0.7800	1.0000
12.5	0.7800	0.9600	0.9000
25	0.1200	0.3000	0.4800
50	0.0000	0.0000	0.0000

			Transform: Arcsin Square Root						1-Tailed		Number	Total
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Resp	Number
B-Control	0.9867	1.0000	1.4703	1.3694	1.5208	5.943	3				4	300
3.1	0.9333	0.9459	1.3396	1.2490	1.5208	11.711	3	0.982	2.500	0.3328	20	300
6.3	0.9267	0.9392	1.3747	1.0826	1.5208	18.403	3	0.718	2.500	0.3328	22	300
12.5	0.8800	0.8919	1.2337	1.0826	1.3694	11.675	3	1.778	2.500	0.3328	36	300
*25	0.3000	0.3041	0.5663	0.3537	0.7654	36.406	3	6.791	2.500	0.3328	210	300
*50	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	3	10.669	2.500	0.3328	300	300

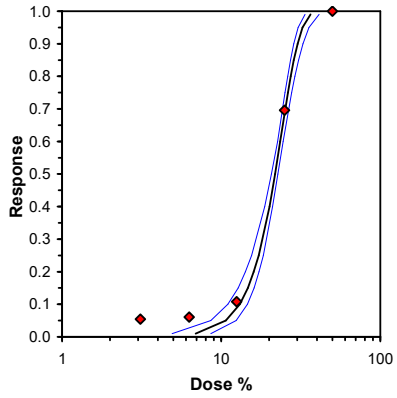
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.95526	0.858	-0.4545	-0.2809
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	12.5	25	17.6777	8	0.16621	0.1679	0.97318	0.02658	7.3E-07	5, 12

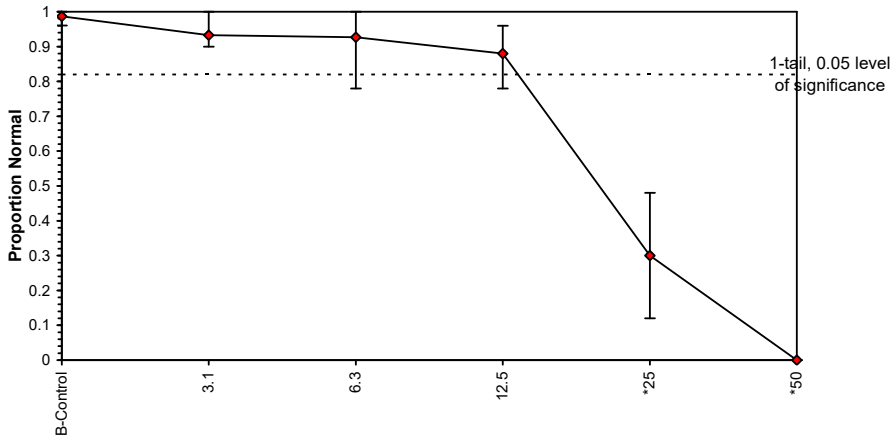
Maximum Likelihood-Weibull

Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	8.4768	0.91908	6.67541	10.2782	0.01333	5.02093	7.81473	0.17			10
Intercept	-11.71	1.26219	-14.184	-9.2365							
TSCR	0.04677	0.00767	0.03173	0.0618							

Point	Weibull	%	95% Fiducial Limits	
EC01	-4.600	6.89898	4.91934	8.60256
EC05	-2.970	10.7416	8.61758	12.4138
EC10	-2.250	13.0613	11.0307	14.6068
EC15	-1.817	14.6932	12.792	16.1181
EC20	-1.500	16.0145	14.2495	17.3295
EC25	-1.246	17.1586	15.5294	18.374
EC40	-0.672	20.0547	18.8019	21.0394
EC50	-0.367	21.7883	20.7304	22.701
EC60	-0.087	23.5043	22.5503	24.4604
EC75	0.327	26.3022	25.2397	27.6594
EC80	0.476	27.3905	26.2072	28.9991
EC85	0.640	28.6418	27.2839	30.5869
EC90	0.834	30.1891	28.5773	32.6049
EC95	1.097	32.4261	30.3961	35.605
EC99	1.527	36.4435	33.5635	41.1823



Dose-Response Plot



APPENDIX B

Ecotox Services Australia Report

Toxicity Assessment of 2025-MDTN-001089-1 and -2

Intertek

Test Report

December 2025

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Unit 27, 2 Chaplin Drive
Lane Cove NSW 2066 Australia
www.ecotox.com.au
ECOTOX SERVICES AUSTRALIA PTY LIMITED
ABN 95 619 426 201

Toxicity Test Report: TR2393/1

Accredited for compliance with ISO/IEC 17025 - Testing

Client:	Intertek 311 Kenwick RD Maddington WA 6109	**ESA Job #:** **Date Sampled:** **Date Received:**	PR2393 09 December 2025 11 December 2025
Attention:	Tristan Stringer	**Sampled By:**	Client
Client Ref:	AUS05-0000153435	**ESA Quote #:**	PL2393_q01

Lab ID No.:	**Sample Name:**	**Sample Description:**
12283	2025-MDTN-001089-1	Aqueous sample, pH 8.5*, salinity 0.8‰*, total ammonia <2.0mg/L*. Sample received at 12ºC* in apparent good condition.

*NATA accreditation does not cover the performance of this service

Test Performed:	48-hr larval development test using the milky oyster *Saccostrea scyphophilla*
Test Protocol:	ESA SOP 106 (ESA 2016), based on APHA (1998) and Krassoi (1995)
Test Temperature:	The test was performed at 29±1°C.
Deviations from Protocol:	Nil
Comments on Solution Preparation:	The sample was adjusted to a salinity of 35±1‰ with modified GP2 artificial sea salts prior to testing. The sample was serially diluted with filtered seawater (FSW) to achieve the test concentrations. A FSW control and an artificial seawater (ASW) control were tested concurrently with the sample.
Source of Test Organisms:	Field collected from Mackay, QLD.
Test Initiated:	12 December 2025 at 1945h

Sample 12283: *2025-MDTN-001089-1* **Concentration (%)**	**% Normal larvae (Mean ± SD)**	*Vacant*	*Vacant*
FSW Control	72.0 ± 2.9		
ASW Control	70.8 ± 4.8		
0.8	72.3 ± 3.5		
1.6	79.0 ± 4.2		
3.1	68.0 ± 2.5		
6.3	0.0 ± 0.0		
12.5	0.0 ± 0.0		
25	0.0 ± 0.0		
50	0.0 ± 0.0		
100	0.0 ± 0.0		
48-hr IC10 = 3.2 (2.82-3.36)% **48-hr EC50 = 4.2 (4.10-4.26)%** **NOEC = 3.1%** **LOEC = 6.3%**			

QA/QC Parameter	**Criterion**	**This Test**	**Criterion met?**
FSW Control mean % normal	≥70%	72.0%	Yes
Reference Toxicant within cusum chart limits	14.1-16.6µg Cu/L	15.5µg Cu/L	Yes

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Test Report Authorised by: Dr Rick Krassoi, Director on 21 December 2025

Results are based on the samples in the condition as received by ESA.

NATA Accredited Laboratory Number: 14709

Citations:

APHA (1998) Standard Methods for the Examination of Water and Wastewater. 20th Ed. American Public Health Association, American Water Works Association and the Water Environment Federation, Washington, DC.

ESA (2016) SOP 106 – *Bivalve Larval Development Test*. Issue No. 15. Ecotox Services Australasia, Sydney, NSW.

Krassoi, R (1995) Salinity adjustment of effluents for use with marine bioassays: effects on the larvae of the doughboy scallop Chlamys asperrimus and the Sydney rock oyster *Saccostrea commercialis*. *Australasian Journal of Ecotoxicology*, 1: 143-148.

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ABN 95 619 426 201

Toxicity Test Report: TR2393/2

Accredited for compliance with ISO/IEC 17025 - Testing

Client:	Intertek 311 Kenwick RD Maddington WA 6109	**ESA Job #:** **Date Sampled:** **Date Received:**	PR2393 09 December 2025 11 December 2025
Attention:	Tristan Stringer	**Sampled By:**	Client
Client Ref:	AUS05-0000153435	**ESA Quote #:**	PL2393_q01

Lab ID No.:	Sample Name:	Sample Description:
12284	2025-MDTN-001089-2	Aqueous sample, pH 9.2*, salinity 0.8‰*, total ammonia <2.0mg/L*. Sample received at 12ºC* in apparent good condition.

*NATA accreditation does not cover the performance of this service

Test Performed:	48-hr larval development test using the milky oyster *Saccostrea scyphophilla*
Test Protocol:	ESA SOP 106 (ESA 2016), based on APHA (1998) and Krassoi (1995)
Test Temperature:	The test was performed at 29±1°C.
Deviations from Protocol:	Nil
Comments on Solution Preparation:	The sample was adjusted to a salinity of 35±1‰ with modified GP2 artificial sea salts prior to testing. The sample was serially diluted with filtered seawater (FSW) to achieve the test concentrations. A FSW control and an artificial seawater (ASW) control were tested concurrently with the sample.
Source of Test Organisms:	Field collected from Mackay, QLD.
Test Initiated:	12 December 2025 at 1945h

Sample 12283: *2025-MDTN-001089-1* **Concentration (%)**	**% Normal larvae (Mean ± SD)**	*Vacant*	*Vacant*
FSW Control	72.0 ± 2.9		
ASW Control	70.8 ± 4.8		
0.8	70.5 ± 4.0		
1.6	75.0 ± 7.2		
3.1	77.3 ± 4.1		
6.3	75.0 ± 3.3		
12.5	74.3 ± 6.2		
25	73.3 ± 6.4		
50	71.8 ± 3.4		
100	70.5 ± 8.6		
48-hr IC10 = >100% **48-hr EC50 = >100%** **NOEC = 100%** **LOEC = >100%**			

QA/QC Parameter	Criterion	This Test	Criterion met?
FSW Control mean % normal	≥70%	72.0%	Yes
Reference Toxicant within cusum chart limits	14.1-16.6µg Cu/L	15.5µg Cu/L	Yes

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Test Report Authorised by: Dr Rick Krassoi, Director on 21 December 2025

Results are based on the samples in the condition as received by ESA.

NATA Accredited Laboratory Number: 14709

Citations:

APHA (1998) Standard Methods for the Examination of Water and Wastewater. 20th Ed. American Public Health Association, American Water Works Association and the Water Environment Federation, Washington, DC.

ESA (2016) SOP 106 – *Bivalve Larval Development Test*. Issue No. 15. Ecotox Services Australasia, Sydney, NSW.

Krassoi, R (1995) Salinity adjustment of effluents for use with marine bioassays: effects on the larvae of the doughboy scallop Chlamys asperrimus and the Sydney rock oyster *Saccostrea commercialis*. *Australasian Journal of Ecotoxicology*, 1: 143-148.

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Toxicity Test Report: TR2393/3

Accredited for compliance with ISO/IEC 17025 - Testing

Client:	Intertek 311 Kenwick RD Maddington WA 6109	**ESA Job #:** **Date Sampled:** **Date Received:**	PR2393 09 December 2025 11 December 2025
Attention:	Tristan Stringer	**Sampled By:**	Client
Client Ref:	AUS05-0000153435	**ESA Quote #:**	PL2393_q01

Lab ID No.:	Sample Name:	Sample Description:
12283	2025-MDTN-001089-1	Aqueous sample, pH 8.5*, salinity 0.8‰*, total ammonia <2.0mg/L*. Sample received at 12ºC* in apparent good condition.

*NATA accreditation does not cover the performance of this service

Test Performed:	72-hr sea urchin larval development test using *Heliocidaris tuberculata*
Test Protocol:	ESA SOP 105 (ESA 2016), based on APHA (1998), Simon and Laginestra (1996) and Doyle *et al*. (2003)
Test Temperature:	The test was performed at 20±1°C.
Deviations from Protocol:	Nil
Comments on Solution Preparation:	The sample was adjusted to a salinity of 35±1‰ with modified GP2 artificial sea salts prior to testing. The sample was serially diluted with filtered seawater (FSW) to achieve the test concentrations. A FSW control and an artificial seawater (ASW) control were tested concurrently with the sample.
Source of Test Organisms:	Field collected from South Maroubra, NSW.
Test Initiated:	12 December 2025 at 1930h

Sample 12283: *2025-MDTN-001089-1* **Concentration (%)**	**% Normal larvae (Mean ± SD)**	*Vacant*	*Vacant*
FSW Control	94.8 ± 2.8		
ASW Control	94.8 ± 2.6		
0.8	96.5 ± 1.3		
1.6	96.0 ± 0.8		
3.1	82.0 ± 2.9 *		
6.3	0.0 ± 0.0		
12.5	0.0 ± 0.0		
25	0.0 ± 0.0		
50	0.0 ± 0.0		
100	0.0 ± 0.0		
72-hr IC10 = 2.7 (2.55-3.06)% **72-hr EC50 = 4.0 (3.91-4.10)%** **NOEC = 1.6%** **LOEC = 3.1%**			

*Significantly lower percentage of normally developed larvae compared with the ASW Control (Dunnett's Test, 1-tailed, P=0.05)

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Toxicity Test Report: TR2393/3

QA/QC Parameter	Criterion	This Test	Criterion met?
Control mean % normal larvae	≥70.0%	94.8%	Yes
Reference Toxicant within cusum chart limits	10.6-11.6µg Cu/L	11.1µg Cu/L	Yes

Test Report Authorised by: Dr Rick Krassoi, Director on 21 December 2025

Results are based on the samples in the condition as received by ESA.

NATA Accredited Laboratory Number: 14709

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Citations:

APHA (1998) Method 8810 D. Echinoderm Embryo Development Test. In Standard Methods for the Examination of Water and Wastewater, 20th Ed. American Public Health Association, American Water Works Association and the Water Environment Federation, USA.

Doyle, C.J., Pablo, F., Lim, R.P. and Hyne, R.V. (2003) Assessment of metal toxicity in sediment pore water from Lake Macquarie, Australia. *Arch. Environ. Contam. Toxicology*, 44(3): 343-350.

ESA (2016) *ESA SOP 105 - Sea Urchin Larval Development Test*. Issue No. 11. Ecotox Services Australasia, Sydney NSW.

Simon, J. and Laginestra, E.(1997) Bioassay for testing sublethal toxicity in effluents, using gametes of sea urchin *Heliocidaris tuberculata*. National Pulp Mills Research Program Technical Report No. 20. CSIRO, Canberra, ACT.

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Toxicity Test Report: TR2393/4

Accredited for compliance with ISO/IEC 17025 - Testing

Client:	Intertek 311 Kenwick RD Maddington WA 6109	**ESA Job #:** **Date Sampled:** **Date Received:**	PR2393 09 December 2025 11 December 2025
Attention:	Tristan Stringer	**Sampled By:**	Client
Client Ref:	AUS05-0000153435	**ESA Quote #:**	PL2393_q01

Lab ID No.:	**Sample Name:**	**Sample Description:**
12284	2025-MDTN-001089-2	Aqueous sample, pH 9.2*, salinity 0.8‰*, total ammonia <2.0mg/L*. Sample received at 12ºC* in apparent good condition.

*NATA accreditation does not cover the performance of this service

Test Performed:	72-hr sea urchin larval development test using *Heliocidaris tuberculata*
Test Protocol:	ESA SOP 105 (ESA 2016), based on APHA (1998), Simon and Laginestra (1996) and Doyle *et al*. (2003)
Test Temperature:	The test was performed at 20±1°C.
Deviations from Protocol:	Nil
Comments on Solution Preparation:	The sample was adjusted to a salinity of 35±1‰ with modified GP2 artificial sea salts prior to testing. The sample was serially diluted with filtered seawater (FSW) to achieve the test concentrations. A FSW control and an artificial seawater (ASW) control were tested concurrently with the sample.
Source of Test Organisms:	Field collected from South Maroubra, NSW.
Test Initiated:	12 December 2025 at 1930h

Sample 12284: *2025-MDTN-001089-2* **Concentration (%)**	**% Normal larvae (Mean ± SD)**	*Vacant*	*Vacant*
FSW Control	94.8 ± 2.8		
ASW Control	94.8 ± 2.6		
0.8	95.0 ± 2.9		
1.6	93.5 ± 1.9		
3.1	93.3 ± 2.1		
6.3	95.3 ± 1.7		
12.5	95.3 ± 2.5		
25	94.5 ± 1.3		
50	94.8 ± 2.2		
100	92.5 ± 2.7		
72-hr IC10 = >100% **72-hr EC50 = >100%** **NOEC = 100%** **LOEC = >100%**			

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Toxicity Test Report: TR2393/4

QA/QC Parameter	Criterion	This Test	Criterion met?
Control mean % normal larvae	≥70.0%	94.8%	Yes
Reference Toxicant within cusum chart limits	10.6-11.6µg Cu/L	11.1µg Cu/L	Yes

Test Report Authorised by: Dr Rick Krassoi, Director on 21 December 2025

Results are based on the samples in the condition as received by ESA.

NATA Accredited Laboratory Number: 14709

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Citations:

APHA (1998) Method 8810 D. Echinoderm Embryo Development Test. In Standard Methods for the Examination of Water and Wastewater, 20th Ed. American Public Health Association, American Water Works Association and the Water Environment Federation, USA.

Doyle, C.J., Pablo, F., Lim, R.P. and Hyne, R.V. (2003) Assessment of metal toxicity in sediment pore water from Lake Macquarie, Australia. *Arch. Environ. Contam. Toxicology*, 44(3): 343-350.

ESA (2016) *ESA SOP 105 - Sea Urchin Larval Development Test*. Issue No. 11. Ecotox Services Australasia, Sydney NSW.

Simon, J. and Laginestra, E.(1997) Bioassay for testing sublethal toxicity in effluents, using gametes of sea urchin *Heliocidaris tuberculata*. National Pulp Mills Research Program Technical Report No. 20. CSIRO, Canberra, ACT.

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Chain-of-Custody Documentation

Datasheet ID: 601.2
Last Revised: 21 September 2018

Sample Receipt Notification

Attention : Tristan Stringer

Client : Intertek
1 Fleet Street
Fremantle WA 6160

Email : tristan.stringer@intertek.com
Telephone : 08 9336 5071
Facsimile :

Date : 17/12/2025

Re : Receipt of Samples **Pages : 2**

ESA Project : PR2393 ☑ For Review ☐ Additional Documentation Required - Please Respond

Sample Delivery Details

Completed Chain of Custody accompanied samples: YES
Samples received in apparent good condition and correctly bottled: YES
Security seals on sample bottles and esky intact: YES

Date samples received : 11/12/2025
Time samples received : 14:30
No. of samples received : 2
Sample matrix : Aqueous
Sample temperature : 11-15°C

Comments : 1 x 2.5L of each sample received at 12 degrees C in apparent good condition

Contact Details

Projects Manager : Dr Rick Krassoi
Telephone : 61 2 9420 9481
Facsimile : 61 2 9420 9484
Email : rkrassoi@ecotox.com.au

Please contact customer services officer for all queries or issues regarding samples

Note that the chain-of-custody provides definitive information on the tests to be performed

Ecotox Services Australia
ABN 95619426201
Unit 27, 2 Chaplin Drive
Lane Cove NSW 2066 Australia

Phone : 61 2 9420 9481
Fax : 61 2 9420 9484
Email : info@ecotox.com.au

Chain-of-Custody / Service Request Form

Datasheet ID: 601.1
Last Revised: 20 September 2018

Customer: Intertek Geotech
Contact Name: Tristan Stringer
Phone: 0448161528 Email: tristan.stringer@intertek.com (please provide an email address for sample receipt notification)
Sampled by:

Ship To: ESA
Attention: Rick Krassoi

12°C

Sample Date (day/month /year)	Sample Time	Sample Name (exactly as written on the sample vessel)	Sample Method (eg. Grab, composite etc.)	Number and Volume of Containers (eg 2 x 1L)	Tests Requested (See reverse for guidance)						Comments / Instructions
					SU larval Dev. (H. tuberculata)	Milky Oyster Development (S. echinata)	7-D Fish imbalance & Biomass (L. calcarifer)	96-hr Prawn survival			**Note that testing will be delayed if an incomplete chain of custody is received** • Additional treatment of samples (i.e. spiking) • Sub-contracted services (i.e. chemical analyses) • Dilutions required (if different than 100% down to 6.25%) • Sample holding time restriction (if applicable) • Sample used for litigation (if applicable) *Note: An MSDS must be attached if Available* **ESA Project Number: PR** 2393
12283 9/12/2025	-	2025-MDTN-001089-1	Sub	1 x 2.5L	x	x					TBC
12284 9/12/2025	-	2025-MDTN-001089-2	Sub	1 x 2.5L	x	x					TBC
9/12/2025	-	2025-MDTN-001088	Sub	5 x 2.5 L	x	x	x	x			TBC
9/12/2025	-	2025-MDTN-001062	Sub	1 x 1L		x					1.6 - 100%
		Note: Please report as Three reports									

1) Released By:	Date:	2) Received By:	Date: 11/12/25	3) Released By:	Date:	4) Received By:	Date:
Of:	Time:	Of: ESA	Time: 1430	Of:	Time:	Of:	Time:

Note that the chain-of-custody documentation will provide definitive information on the tests to be performed.

Ecotox Services Australia . Unit 27, 2 Chaplin Drive, Lane Cove NSW 2066 AUSTRALIA
Phone: 61 2 9420-9481 Fax 61 2 9420-9484 info@ecotox.com.au

Statistical Printouts for the Sea Urchin Larval Development Test

Sea Urchin Larval Development Test-Proportion Normal

Start Date:	12/12/2025 19:30	Test ID:	PR2393/02	Sample ID:	2028-MDTN-001089-1
End Date:	15/12/2025 19:30	Lab ID:	12283	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 106	Test Species:	HT-Heliocidaris tuberculata
Comments:					

Conc-%	1	2	3	4
FSW Control	0.9800	0.9600	0.9300	0.9200
ASW Control	0.9700	0.9500	0.9100	0.9600
0.8	0.9800	0.9600	0.9500	0.9700
1.6	0.9600	0.9500	0.9700	0.9600
3.1	0.8100	0.7900	0.8600	0.8200
6.3	0.0000	0.0000	0.0000	0.0000
12.5	0.0000	0.0000	0.0000	0.0000
25	0.0000	0.0000	0.0000	0.0000
50	0.0000	0.0000	0.0000	0.0000
100	0.0000	0.0000	0.0000	0.0000

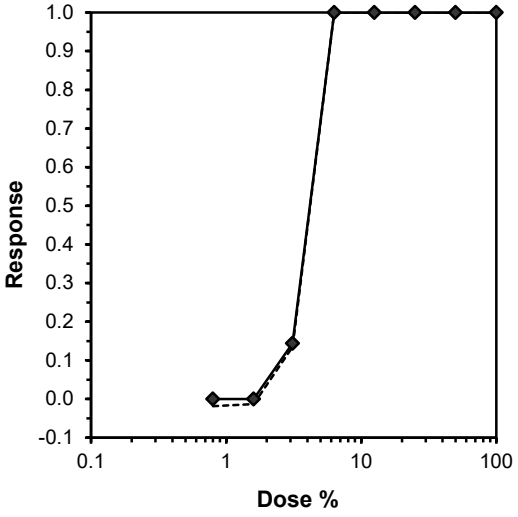
			Transform: Arcsin Square Root					1-Tailed			Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
FSW Control	0.9475	1.0000	1.3464	1.2840	1.4289	4.909	4					
ASW Control	0.9475	1.0000	1.3444	1.2661	1.3967	4.185	4	*			0.9575	1.0000
0.8	0.9650	1.0185	1.3851	1.3453	1.4289	2.598	4	-1.436	2.290	0.0649	0.9575	1.0000
1.6	0.9600	1.0132	1.3702	1.3453	1.3967	1.534	4	-0.911	2.290	0.0649	0.9575	1.0000
*3.1	0.8200	0.8654	1.1336	1.0948	1.1873	3.448	4	7.435	2.290	0.0649	0.8200	0.8564
6.3	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				0.0000	0.0000
12.5	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				0.0000	0.0000
25	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				0.0000	0.0000
50	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				0.0000	0.0000
100	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				0.0000	0.0000

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.964667	0.887	-0.33943	0.100551
Bartlett's Test indicates equal variances (p = 0.51)	2.32101	11.34487		
The control means are not significantly different (p = 0.97)	0.045348	2.446912		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	1.6	3.1	2.227106	62.5	0.032107	0.033811	0.055393	0.001607	3.5E-06	3, 12
Treatments vs ASW Control										

Log-Logit Interpolation (200 Resamples)

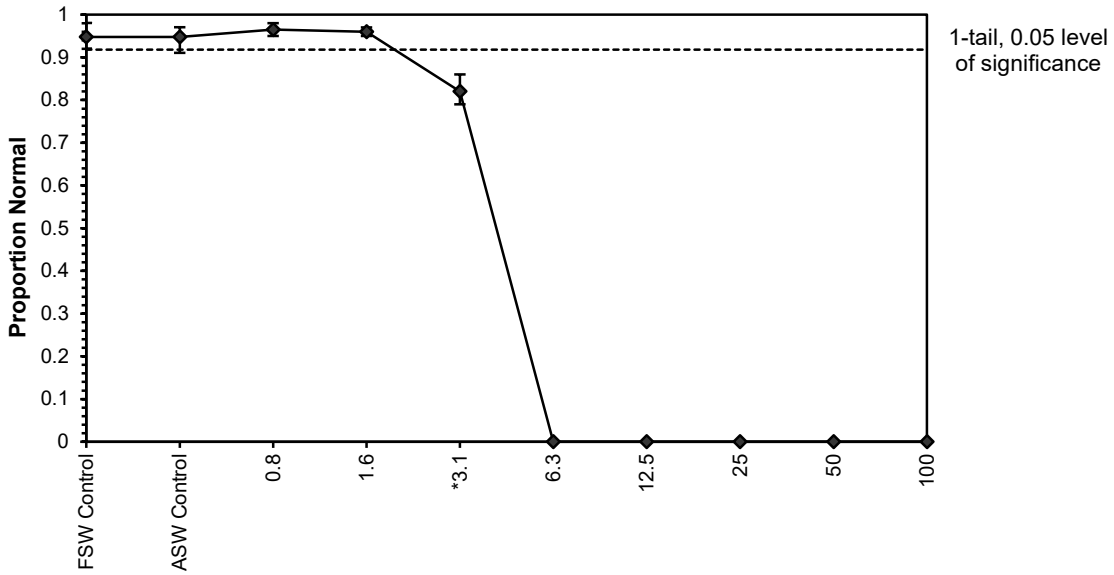
Point	%	SD	95% CL(Exp)		Skew
IC05	2.2710	0.0532	2.1027	2.4416	0.2220
IC10	2.7496	0.0851	2.5531	3.0620	0.8389
IC15	3.1090	0.0440	2.9176	3.1767	-1.1279
IC20	3.1735	0.0195	3.1223	3.2405	0.3718
IC25	3.2302	0.0191	3.1799	3.2963	0.3616
IC40	3.3771	0.0183	3.3295	3.4419	0.3426
IC50	3.4688	0.0179	3.4219	3.5323	0.3352



Sea Urchin Larval Development Test-Proportion Normal

Start Date:	12/12/2025 19:30	Test ID:	PR2393/02	Sample ID:	2028-MDTN-001089-1
End Date:	15/12/2025 19:30	Lab ID:	12283	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 106	Test Species:	HT-Heliocidaris tuberculata
Comments:					

Dose-Response Plot



Sea Urchin Larval Development Test-Proportion Normal

Start Date:	12/12/2025 19:30	Test ID:	PR2393/02	Sample ID:	2028-MDTN-001089-1
End Date:	15/12/2025 19:30	Lab ID:	12283	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 106	Test Species:	HT-Heliocidaris tuberculata
Comments:					

		Auxiliary Data Summary					
Conc-%	**Parameter**	**Mean**	**Min**	**Max**	**SD**	**CV%**	**N**
FSW Control	% Normal	94.75	92.00	98.00	2.75	1.75	4
ASW Control		94.75	91.00	97.00	2.63	1.71	4
0.8		96.50	95.00	98.00	1.29	1.18	4
1.6		96.00	95.00	97.00	0.82	0.94	4
3.1		82.00	79.00	86.00	2.94	2.09	4
6.3		0.00	0.00	0.00	0.00		4
12.5		0.00	0.00	0.00	0.00		4
25		0.00	0.00	0.00	0.00		4
50		0.00	0.00	0.00	0.00		4
100		0.00	0.00	0.00	0.00		4
FSW Control	pH	8.20	8.20	8.20	0.00	0.00	1
ASW Control		8.20	8.20	8.20	0.00	0.00	1
0.8		8.10	8.10	8.10	0.00	0.00	1
1.6		8.10	8.10	8.10	0.00	0.00	1
3.1		8.10	8.10	8.10	0.00	0.00	1
6.3		8.10	8.10	8.10	0.00	0.00	1
12.5		8.10	8.10	8.10	0.00	0.00	1
25		8.10	8.10	8.10	0.00	0.00	1
50		8.00	8.00	8.00	0.00	0.00	1
100		7.80	7.80	7.80	0.00	0.00	1
FSW Control	Salinity ppt	35.20	35.20	35.20	0.00	0.00	1
ASW Control		34.90	34.90	34.90	0.00	0.00	1
0.8		34.90	34.90	34.90	0.00	0.00	1
1.6		34.90	34.90	34.90	0.00	0.00	1
3.1		34.90	34.90	34.90	0.00	0.00	1
6.3		34.90	34.90	34.90	0.00	0.00	1
12.5		34.80	34.80	34.80	0.00	0.00	1
25		34.80	34.80	34.80	0.00	0.00	1
50		34.60	34.60	34.60	0.00	0.00	1
100		34.40	34.40	34.40	0.00	0.00	1
FSW Control	DO %	99.60	99.60	99.60	0.00	0.00	1
ASW Control		96.80	96.80	96.80	0.00	0.00	1
0.8		101.20	101.20	101.20	0.00	0.00	1
1.6		100.50	100.50	100.50	0.00	0.00	1
3.1		100.40	100.40	100.40	0.00	0.00	1
6.3		100.30	100.30	100.30	0.00	0.00	1
12.5		100.30	100.30	100.30	0.00	0.00	1
25		100.20	100.20	100.20	0.00	0.00	1
50		99.70	99.70	99.70	0.00	0.00	1
100		97.10	97.10	97.10	0.00	0.00	1

Sea Urchin Larval Development Test-Proportion Normal

Start Date:	12/12/2025 19:30	Test ID:	PR2393/02	Sample ID:	2028-MDTN-001089-1
End Date:	15/12/2025 19:30	Lab ID:	12283	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 106	Test Species:	HT-Heliocidaris tuberculata
Comments:					

Conc-%	1	2	3	4
FSW Control	0.9800	0.9600	0.9300	0.9200
ASW Control	0.9700	0.9500	0.9100	0.9600
0.8	0.9800	0.9600	0.9500	0.9700
1.6	0.9600	0.9500	0.9700	0.9600
3.1	0.8100	0.7900	0.8600	0.8200
6.3	0.0000	0.0000	0.0000	0.0000
12.5	0.0000	0.0000	0.0000	0.0000
25	0.0000	0.0000	0.0000	0.0000
50	0.0000	0.0000	0.0000	0.0000
100	0.0000	0.0000	0.0000	0.0000

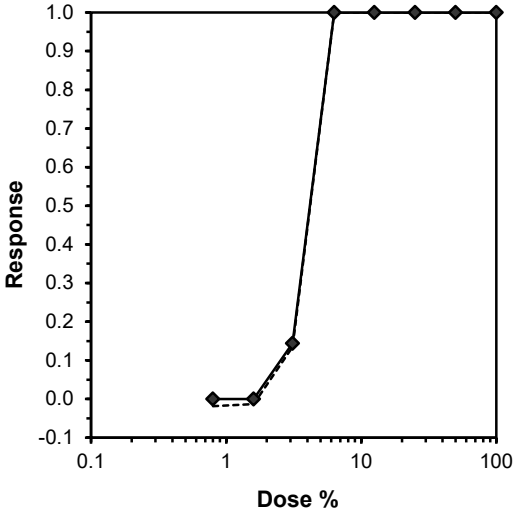
			Transform: Arcsin Square Root						1-Tailed		Number	Total
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Resp	Number
FSW Control	0.9475	1.0000	1.3464	1.2840	1.4289	4.909	4					
ASW Control	0.9475	1.0000	1.3444	1.2661	1.3967	4.185	4	*			21	400
0.8	0.9650	1.0185	1.3851	1.3453	1.4289	2.598	4	-1.436	2.290	0.0649	14	400
1.6	0.9600	1.0132	1.3702	1.3453	1.3967	1.534	4	-0.911	2.290	0.0649	16	400
*3.1	0.8200	0.8654	1.1336	1.0948	1.1873	3.448	4	7.435	2.290	0.0649	72	400
6.3	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				400	400
12.5	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				400	400
25	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				400	400
50	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				400	400
100	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				400	400

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.964667	0.887	-0.33943	0.100551
Bartlett's Test indicates equal variances (p = 0.51)	2.32101	11.34487		
The control means are not significantly different (p = 0.97)	0.045348	2.446912		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	1.6	3.1	2.227106	62.5	0.032107	0.033811	0.055393	0.001607	3.5E-06	3, 12
Treatments vs ASW Control										

Trimmed Spearman-Karber

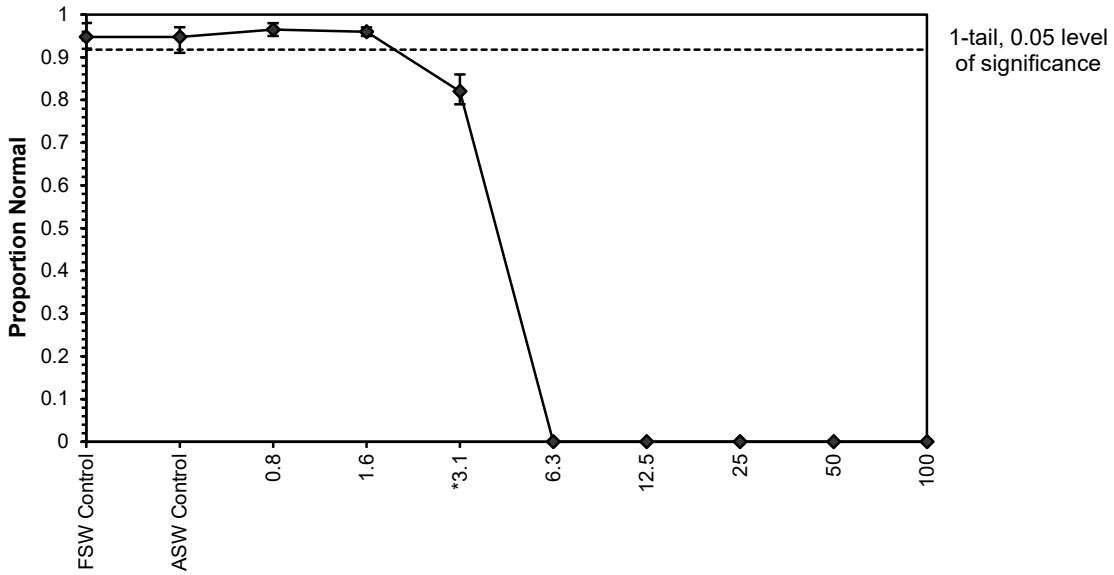
Trim Level	EC50	95% CL	
0.0%	4.0051	3.9100	4.1025
5.0%	4.0883	3.9746	4.2053
10.0%	4.1455	3.9955	4.3012
20.0%	4.1642	4.0942	4.2354
Auto-0.0%	4.0051	3.9100	4.1025



Sea Urchin Larval Development Test-Proportion Normal

Start Date:	12/12/2025 19:30	Test ID:	PR2393/02	Sample ID:	2028-MDTN-001089-1
End Date:	15/12/2025 19:30	Lab ID:	12283	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 106	Test Species:	HT-Heliocidaris tuberculata
Comments:					

Dose-Response Plot



Sea Urchin Larval Development Test-Proportion Normal

Start Date:	12/12/2025 19:30	Test ID:	PR2393/02	Sample ID:	2028-MDTN-001089-1
End Date:	15/12/2025 19:30	Lab ID:	12283	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 106	Test Species:	HT-Heliocidaris tuberculata
Comments:					

		Auxiliary Data Summary					
Conc-%	**Parameter**	**Mean**	**Min**	**Max**	**SD**	**CV%**	**N**
FSW Control	% Normal	94.75	92.00	98.00	2.75	1.75	4
ASW Control		94.75	91.00	97.00	2.63	1.71	4
0.8		96.50	95.00	98.00	1.29	1.18	4
1.6		96.00	95.00	97.00	0.82	0.94	4
3.1		82.00	79.00	86.00	2.94	2.09	4
6.3		0.00	0.00	0.00	0.00		4
12.5		0.00	0.00	0.00	0.00		4
25		0.00	0.00	0.00	0.00		4
50		0.00	0.00	0.00	0.00		4
100		0.00	0.00	0.00	0.00		4
FSW Control	pH	8.20	8.20	8.20	0.00	0.00	1
ASW Control		8.20	8.20	8.20	0.00	0.00	1
0.8		8.10	8.10	8.10	0.00	0.00	1
1.6		8.10	8.10	8.10	0.00	0.00	1
3.1		8.10	8.10	8.10	0.00	0.00	1
6.3		8.10	8.10	8.10	0.00	0.00	1
12.5		8.10	8.10	8.10	0.00	0.00	1
25		8.10	8.10	8.10	0.00	0.00	1
50		8.00	8.00	8.00	0.00	0.00	1
100		7.80	7.80	7.80	0.00	0.00	1
FSW Control	Salinity ppt	35.20	35.20	35.20	0.00	0.00	1
ASW Control		34.90	34.90	34.90	0.00	0.00	1
0.8		34.90	34.90	34.90	0.00	0.00	1
1.6		34.90	34.90	34.90	0.00	0.00	1
3.1		34.90	34.90	34.90	0.00	0.00	1
6.3		34.90	34.90	34.90	0.00	0.00	1
12.5		34.80	34.80	34.80	0.00	0.00	1
25		34.80	34.80	34.80	0.00	0.00	1
50		34.60	34.60	34.60	0.00	0.00	1
100		34.40	34.40	34.40	0.00	0.00	1
FSW Control	DO %	99.60	99.60	99.60	0.00	0.00	1
ASW Control		96.80	96.80	96.80	0.00	0.00	1
0.8		101.20	101.20	101.20	0.00	0.00	1
1.6		100.50	100.50	100.50	0.00	0.00	1
3.1		100.40	100.40	100.40	0.00	0.00	1
6.3		100.30	100.30	100.30	0.00	0.00	1
12.5		100.30	100.30	100.30	0.00	0.00	1
25		100.20	100.20	100.20	0.00	0.00	1
50		99.70	99.70	99.70	0.00	0.00	1
100		97.10	97.10	97.10	0.00	0.00	1

Sea Urchin Larval Development Test-Proportion Normal

Start Date:	12/12/2025 19:30	Test ID:	PR2393/03	Sample ID:	2028-MDTN-001089-2
End Date:	15/12/2025 19:30	Lab ID:	12284	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 106	Test Species:	HT-Heliocidaris tuberculata
Comments:					

Conc-%	1	2	3	4
FSW Control	0.9800	0.9600	0.9300	0.9200
ASW Control	0.9700	0.9500	0.9100	0.9600
0.8	0.9800	0.9600	0.9500	0.9100
1.6	0.9200	0.9200	0.9600	0.9400
3.1	0.9300	0.9100	0.9600	0.9400
6.3	0.9700	0.9600	0.9500	0.9300
12.5	0.9600	0.9500	0.9200	0.9800
25	0.9500	0.9300	0.9600	0.9400
50	0.9200	0.9700	0.9400	0.9600
100	0.9600	0.9100	0.9000	0.9300

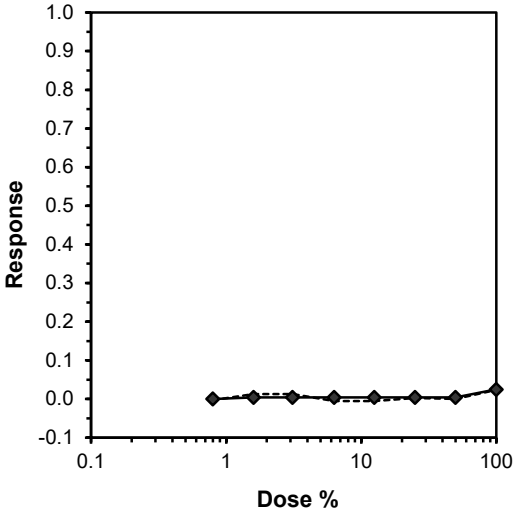
			Transform: Arcsin Square Root					1-Tailed			Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
FSW Control	0.9475	1.0000	1.3464	1.2840	1.4289	4.909	4					
ASW Control	0.9475	1.0000	1.3444	1.2661	1.3967	4.185	4	*			0.9488	1.0000
0.8	0.9500	1.0026	1.3524	1.2661	1.4289	4.986	4	-0.227	2.513	0.0889	0.9488	1.0000
1.6	0.9350	0.9868	1.3152	1.2840	1.3694	3.088	4	0.824	2.513	0.0889	0.9446	0.9956
3.1	0.9350	0.9868	1.3155	1.2661	1.3694	3.274	4	0.817	2.513	0.0889	0.9446	0.9956
6.3	0.9525	1.0053	1.3536	1.3030	1.3967	2.935	4	-0.261	2.513	0.0889	0.9446	0.9956
12.5	0.9525	1.0053	1.3569	1.2840	1.4289	4.419	4	-0.354	2.513	0.0889	0.9446	0.9956
25	0.9450	0.9974	1.3353	1.3030	1.3694	2.140	4	0.258	2.513	0.0889	0.9446	0.9956
50	0.9475	1.0000	1.3434	1.2840	1.3967	3.709	4	0.028	2.513	0.0889	0.9446	0.9956
100	0.9250	0.9763	1.2969	1.2490	1.3694	4.113	4	1.342	2.513	0.0889	0.9250	0.9750

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.968675	0.935	-0.08416	-0.70422
Bartlett's Test indicates equal variances (p = 0.96)	2.635368	20.09023		
The control means are not significantly different (p = 0.97)	0.045348	2.446912		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	100	>100		1	0.045795	0.048225	0.001756	0.002504	0.687442	8, 27
Treatments vs ASW Control										

Log-Logit Interpolation (200 Resamples)

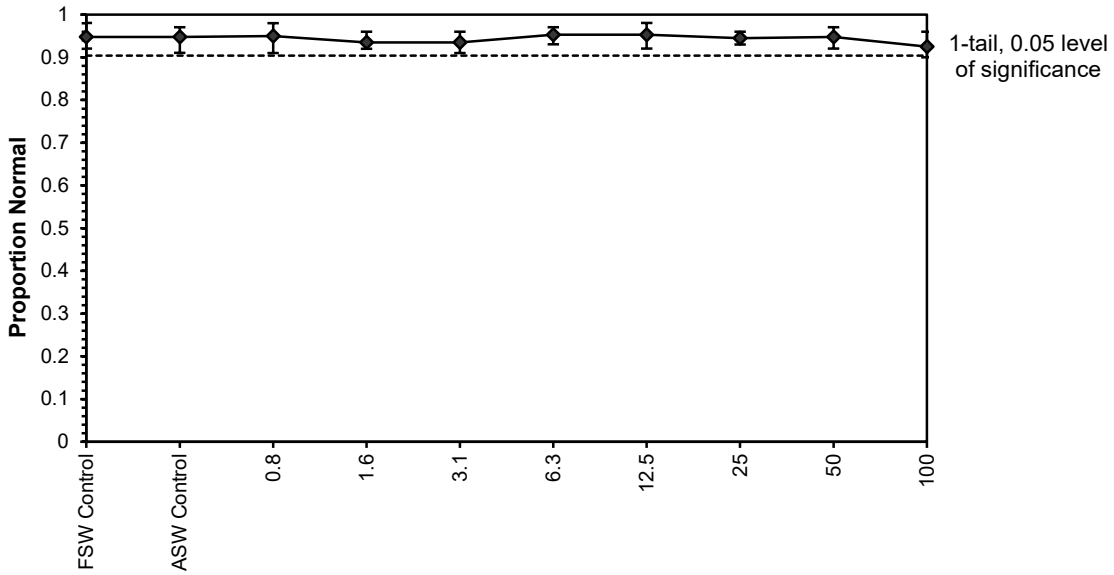
Point	%	SD	95% CL(Exp)	Skew
IC05	>100			
IC10	>100			
IC15	>100			
IC20	>100			
IC25	>100			
IC40	>100			
IC50	>100			



Sea Urchin Larval Development Test-Proportion Normal

Start Date:	12/12/2025 19:30	Test ID:	PR2393/03	Sample ID:	2028-MDTN-001089-2
End Date:	15/12/2025 19:30	Lab ID:	12284	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 106	Test Species:	HT-Heliocidaris tuberculata
Comments:					

Dose-Response Plot



Sea Urchin Larval Development Test-Proportion Normal

Start Date:	12/12/2025 19:30	Test ID:	PR2393/03	Sample ID:	2028-MDTN-001089-2
End Date:	15/12/2025 19:30	Lab ID:	12284	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 106	Test Species:	HT-Heliocidaris tuberculata
Comments:					

		Auxiliary Data Summary					
Conc-%	**Parameter**	**Mean**	**Min**	**Max**	**SD**	**CV%**	**N**
FSW Control	% Normal	94.75	92.00	98.00	2.75	1.75	4
ASW Control		94.75	91.00	97.00	2.63	1.71	4
0.8		95.00	91.00	98.00	2.94	1.81	4
1.6		93.50	92.00	96.00	1.91	1.48	4
3.1		93.50	91.00	96.00	2.08	1.54	4
6.3		95.25	93.00	97.00	1.71	1.37	4
12.5		95.25	92.00	98.00	2.50	1.66	4
25		94.50	93.00	96.00	1.29	1.20	4
50		94.75	92.00	97.00	2.22	1.57	4
100		92.50	90.00	96.00	2.65	1.76	4
FSW Control	pH	8.20	8.20	8.20	0.00	0.00	1
ASW Control		8.20	8.20	8.20	0.00	0.00	1
0.8		8.10	8.10	8.10	0.00	0.00	1
1.6		8.10	8.10	8.10	0.00	0.00	1
3.1		8.10	8.10	8.10	0.00	0.00	1
6.3		8.10	8.10	8.10	0.00	0.00	1
12.5		8.10	8.10	8.10	0.00	0.00	1
25		8.10	8.10	8.10	0.00	0.00	1
50		8.10	8.10	8.10	0.00	0.00	1
100		8.10	8.10	8.10	0.00	0.00	1
FSW Control	Salinity ppt	35.20	35.20	35.20	0.00	0.00	1
ASW Control		34.90	34.90	34.90	0.00	0.00	1
0.8		34.90	34.90	34.90	0.00	0.00	1
1.6		34.90	34.90	34.90	0.00	0.00	1
3.1		34.90	34.90	34.90	0.00	0.00	1
6.3		34.90	34.90	34.90	0.00	0.00	1
12.5		34.90	34.90	34.90	0.00	0.00	1
25		34.80	34.80	34.80	0.00	0.00	1
50		34.60	34.60	34.60	0.00	0.00	1
100		34.40	34.40	34.40	0.00	0.00	1
FSW Control	DO %	99.60	99.60	99.60	0.00	0.00	1
ASW Control		96.80	96.80	96.80	0.00	0.00	1
0.8		100.60	100.60	100.60	0.00	0.00	1
1.6		100.20	100.20	100.20	0.00	0.00	1
3.1		100.20	100.20	100.20	0.00	0.00	1
6.3		100.10	100.10	100.10	0.00	0.00	1
12.5		100.20	100.20	100.20	0.00	0.00	1
25		100.00	100.00	100.00	0.00	0.00	1
50		100.00	100.00	100.00	0.00	0.00	1
100		100.10	100.10	100.10	0.00	0.00	1

Statistical Printouts for the Milky Oyster Larval Development Tests

Bivalve Larval Development Test-Proportion Normal

Start Date:	12/12/2025 19:45	Test ID:	PR2393/05	Sample ID:	2028-MDTN-001089-1
End Date:	14/12/2025 19:00	Lab ID:	12283	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 106	Test Species:	SE-Saccostrea echinata
Comments:					

Conc-%	1	2	3	4
FSW Control	0.7300	0.6800	0.7500	0.7200
ASW Control	0.7600	0.6500	0.6900	0.7300
0.8	0.7600	0.7100	0.6800	0.7400
1.6	0.7600	0.7900	0.8500	0.7600
3.1	0.6800	0.7100	0.6800	0.6500
6.3	0.0000	0.0000	0.0000	0.0000
12.5	0.0000	0.0000	0.0000	0.0000
25	0.0000	0.0000	0.0000	0.0000
50	0.0000	0.0000	0.0000	0.0000
100	0.0000	0.0000	0.0000	0.0000

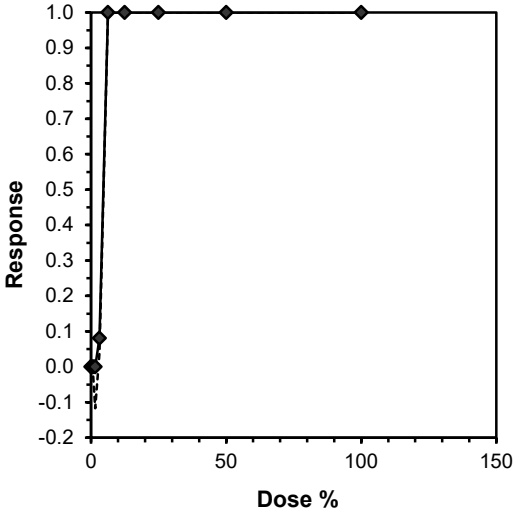
			Transform: Arcsin Square Root					1-Tailed			Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
FSW Control	0.7200	1.0177	1.0136	0.9695	1.0472	3.216	4					
ASW Control	0.7075	1.0000	1.0003	0.9377	1.0588	5.264	4	*			0.7400	1.0000
0.8	0.7225	1.0212	1.0166	0.9695	1.0588	3.841	4	-0.517	2.290	0.0719	0.7400	1.0000
1.6	0.7900	1.1166	1.0964	1.0588	1.1731	4.914	4	-3.059	2.290	0.0719	0.7400	1.0000
3.1	0.6800	0.9611	0.9697	0.9377	1.0021	2.710	4	0.974	2.290	0.0719	0.6800	0.9189
6.3	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				0.0000	0.0000
12.5	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				0.0000	0.0000
25	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				0.0000	0.0000
50	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				0.0000	0.0000
100	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				0.0000	0.0000

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.972758	0.887	0.344866	-0.64599
Bartlett's Test indicates equal variances (p = 0.68)	1.528992	11.34487		
The control means are not significantly different (p = 0.68)	0.4284	2.446912		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test Treatments vs ASW Control	3.1	6.3	4.419276	32.25806	0.067307	0.095018	0.011677	0.001973	0.010197	3, 12

Linear Interpolation (200 Resamples)

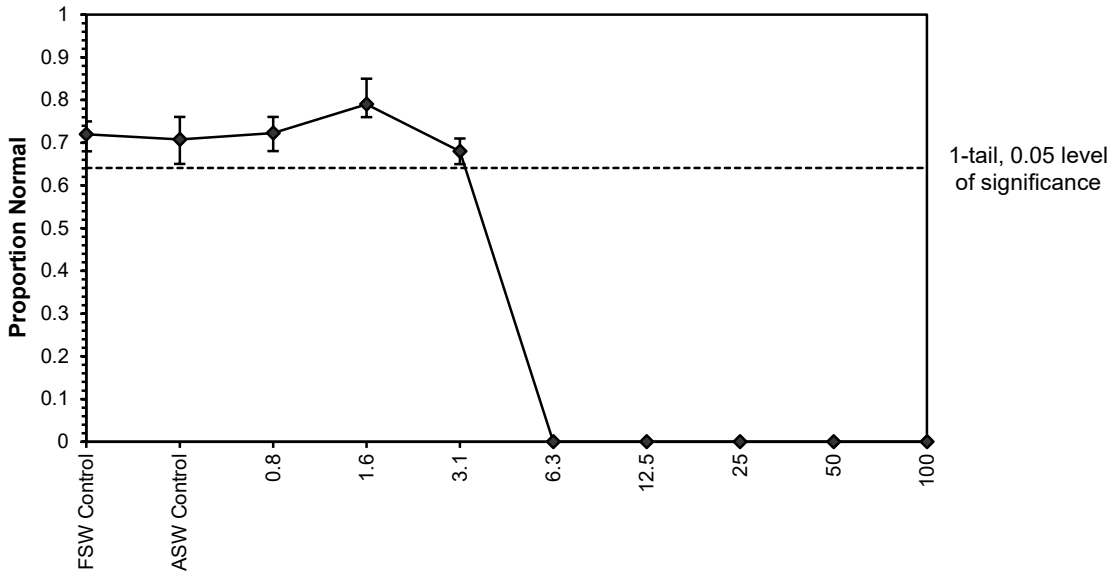
Point	%	SD	95% CL(Exp)		Skew
IC05	2.5250	0.2461	2.1226	3.4784	0.6369
IC10	3.1659	0.0897	2.8157	3.3616	-1.4276
IC15	3.3400	0.0612	3.1786	3.5248	-0.0822
IC20	3.5141	0.0576	3.3622	3.6881	-0.0822
IC25	3.6882	0.0540	3.5459	3.8513	-0.0822
IC40	4.2106	0.0432	4.0967	4.3410	-0.0822
IC50	4.5588	0.0360	4.4639	4.6675	-0.0822



Bivalve Larval Development Test-Proportion Normal

Start Date:	12/12/2025 19:45	Test ID:	PR2393/05	Sample ID:	2028-MDTN-001089-1
End Date:	14/12/2025 19:00	Lab ID:	12283	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 106	Test Species:	SE-Saccostrea echinata
Comments:					

Dose-Response Plot



Bivalve Larval Development Test-Proportion Normal

Start Date:	12/12/2025 19:45	Test ID:	PR2393/05	Sample ID:	2028-MDTN-001089-1
End Date:	14/12/2025 19:00	Lab ID:	12283	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 106	Test Species:	SE-Saccostrea echinata
Comments:					

		Auxiliary Data Summary					
Conc-%	**Parameter**	**Mean**	**Min**	**Max**	**SD**	**CV%**	**N**
FSW Control	% Normal	72.00	68.00	75.00	2.94	2.38	4
ASW Control		70.75	65.00	76.00	4.79	3.09	4
0.8		72.25	68.00	76.00	3.50	2.59	4
1.6		79.00	76.00	85.00	4.24	2.61	4
3.1		68.00	65.00	71.00	2.45	2.30	4
6.3		0.00	0.00	0.00	0.00		4
12.5		0.00	0.00	0.00	0.00		4
25		0.00	0.00	0.00	0.00		4
50		0.00	0.00	0.00	0.00		4
100		0.00	0.00	0.00	0.00		4
FSW Control	pH	8.20	8.20	8.20	0.00	0.00	1
ASW Control		8.20	8.20	8.20	0.00	0.00	1
0.8		8.10	8.10	8.10	0.00	0.00	1
1.6		8.10	8.10	8.10	0.00	0.00	1
3.1		8.10	8.10	8.10	0.00	0.00	1
6.3		8.10	8.10	8.10	0.00	0.00	1
12.5		8.10	8.10	8.10	0.00	0.00	1
25		8.10	8.10	8.10	0.00	0.00	1
50		8.00	8.00	8.00	0.00	0.00	1
100		7.80	7.80	7.80	0.00	0.00	1
FSW Control	Salinity ppt	35.20	35.20	35.20	0.00	0.00	1
ASW Control		34.90	34.90	34.90	0.00	0.00	1
0.8		34.90	34.90	34.90	0.00	0.00	1
1.6		34.90	34.90	34.90	0.00	0.00	1
3.1		34.90	34.90	34.90	0.00	0.00	1
6.3		34.90	34.90	34.90	0.00	0.00	1
12.5		34.80	34.80	34.80	0.00	0.00	1
25		34.80	34.80	34.80	0.00	0.00	1
50		34.60	34.60	34.60	0.00	0.00	1
100		34.40	34.40	34.40	0.00	0.00	1
FSW Control	DO %	99.60	99.60	99.60	0.00	0.00	1
ASW Control		96.80	96.80	96.80	0.00	0.00	1
0.8		101.20	101.20	101.20	0.00	0.00	1
1.6		100.50	100.50	100.50	0.00	0.00	1
3.1		100.40	100.40	100.40	0.00	0.00	1
6.3		100.30	100.30	100.30	0.00	0.00	1
12.5		100.30	100.30	100.30	0.00	0.00	1
25		100.20	100.20	100.20	0.00	0.00	1
50		99.70	99.70	99.70	0.00	0.00	1
100		97.10	97.10	97.10	0.00	0.00	1

Bivalve Larval Development Test-Proportion Normal

Start Date:	12/12/2025 19:45	Test ID:	PR2393/05	Sample ID:	2028-MDTN-001089-1
End Date:	14/12/2025 19:00	Lab ID:	12283	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 106	Test Species:	SE-Saccostrea echinata
Comments:					

Conc-%	1	2	3	4
FSW Control	0.7300	0.6800	0.7500	0.7200
ASW Control	0.7600	0.6500	0.6900	0.7300
0.8	0.7600	0.7100	0.6800	0.7400
1.6	0.7600	0.7900	0.8500	0.7600
3.1	0.6800	0.7100	0.6800	0.6500
6.3	0.0000	0.0000	0.0000	0.0000
12.5	0.0000	0.0000	0.0000	0.0000
25	0.0000	0.0000	0.0000	0.0000
50	0.0000	0.0000	0.0000	0.0000
100	0.0000	0.0000	0.0000	0.0000

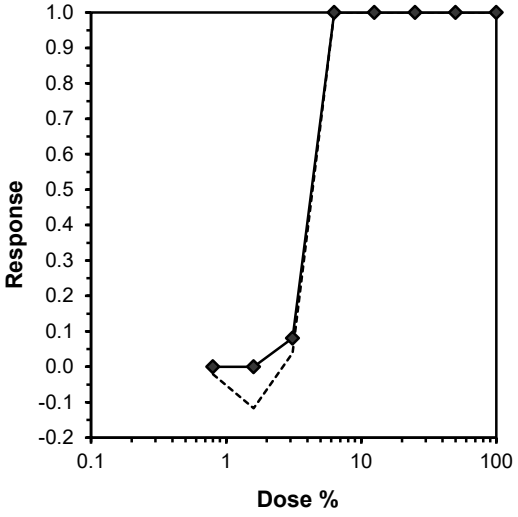
			Transform: Arcsin Square Root						1-Tailed		Number	Total
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Resp	Number
FSW Control	0.7200	1.0177	1.0136	0.9695	1.0472	3.216	4					
ASW Control	0.7075	1.0000	1.0003	0.9377	1.0588	5.264	4	*			117	400
0.8	0.7225	1.0212	1.0166	0.9695	1.0588	3.841	4	-0.517	2.290	0.0719	111	400
1.6	0.7900	1.1166	1.0964	1.0588	1.1731	4.914	4	-3.059	2.290	0.0719	84	400
3.1	0.6800	0.9611	0.9697	0.9377	1.0021	2.710	4	0.974	2.290	0.0719	128	400
6.3	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				400	400
12.5	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				400	400
25	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				400	400
50	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				400	400
100	0.0000	0.0000	0.0500	0.0500	0.0500	0.000	4				400	400

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.972758	0.887	0.344866	-0.64599
Bartlett's Test indicates equal variances (p = 0.68)	1.528992	11.34487		
The control means are not significantly different (p = 0.68)	0.4284	2.446912		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	3.1	6.3	4.419276	32.25806	0.067307	0.095018	0.011677	0.001973	0.010197	3, 12
Treatments vs ASW Control										

Trimmed Spearman-Karber

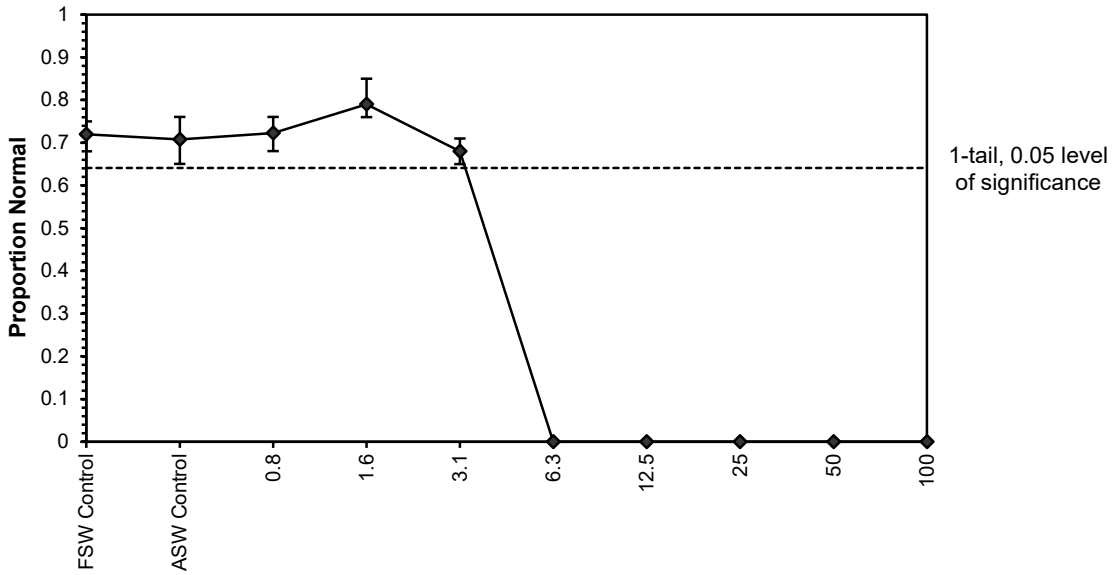
Trim Level	EC50	95% CL	
0.0%	4.1804	4.1030	4.2594
5.0%	4.2662	4.1627	4.3723
10.0%	4.2832	4.2343	4.3325
20.0%	4.2832	4.2343	4.3325
Auto-0.0%	4.1804	4.1030	4.2594



Bivalve Larval Development Test-Proportion Normal

Start Date:	12/12/2025 19:45	Test ID:	PR2393/05	Sample ID:	2028-MDTN-001089-1
End Date:	14/12/2025 19:00	Lab ID:	12283	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 106	Test Species:	SE-Saccostrea echinata
Comments:					

Dose-Response Plot



Bivalve Larval Development Test-Proportion Normal

Start Date:	12/12/2025 19:45	Test ID:	PR2393/05	Sample ID:	2028-MDTN-001089-1
End Date:	14/12/2025 19:00	Lab ID:	12283	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 106	Test Species:	SE-Saccostrea echinata
Comments:					

		Auxiliary Data Summary					
Conc-%	**Parameter**	**Mean**	**Min**	**Max**	**SD**	**CV%**	**N**
FSW Control	% Normal	72.00	68.00	75.00	2.94	2.38	4
ASW Control		70.75	65.00	76.00	4.79	3.09	4
0.8		72.25	68.00	76.00	3.50	2.59	4
1.6		79.00	76.00	85.00	4.24	2.61	4
3.1		68.00	65.00	71.00	2.45	2.30	4
6.3		0.00	0.00	0.00	0.00		4
12.5		0.00	0.00	0.00	0.00		4
25		0.00	0.00	0.00	0.00		4
50		0.00	0.00	0.00	0.00		4
100		0.00	0.00	0.00	0.00		4
FSW Control	pH	8.20	8.20	8.20	0.00	0.00	1
ASW Control		8.20	8.20	8.20	0.00	0.00	1
0.8		8.10	8.10	8.10	0.00	0.00	1
1.6		8.10	8.10	8.10	0.00	0.00	1
3.1		8.10	8.10	8.10	0.00	0.00	1
6.3		8.10	8.10	8.10	0.00	0.00	1
12.5		8.10	8.10	8.10	0.00	0.00	1
25		8.10	8.10	8.10	0.00	0.00	1
50		8.00	8.00	8.00	0.00	0.00	1
100		7.80	7.80	7.80	0.00	0.00	1
FSW Control	Salinity ppt	35.20	35.20	35.20	0.00	0.00	1
ASW Control		34.90	34.90	34.90	0.00	0.00	1
0.8		34.90	34.90	34.90	0.00	0.00	1
1.6		34.90	34.90	34.90	0.00	0.00	1
3.1		34.90	34.90	34.90	0.00	0.00	1
6.3		34.90	34.90	34.90	0.00	0.00	1
12.5		34.80	34.80	34.80	0.00	0.00	1
25		34.80	34.80	34.80	0.00	0.00	1
50		34.60	34.60	34.60	0.00	0.00	1
100		34.40	34.40	34.40	0.00	0.00	1
FSW Control	DO %	99.60	99.60	99.60	0.00	0.00	1
ASW Control		96.80	96.80	96.80	0.00	0.00	1
0.8		101.20	101.20	101.20	0.00	0.00	1
1.6		100.50	100.50	100.50	0.00	0.00	1
3.1		100.40	100.40	100.40	0.00	0.00	1
6.3		100.30	100.30	100.30	0.00	0.00	1
12.5		100.30	100.30	100.30	0.00	0.00	1
25		100.20	100.20	100.20	0.00	0.00	1
50		99.70	99.70	99.70	0.00	0.00	1
100		97.10	97.10	97.10	0.00	0.00	1

Bivalve Larval Development Test-Proportion Normal

Start Date:	12/12/2025 19:45	Test ID:	PR2393/04	Sample ID:	2028-MDTN-001089-2
End Date:	14/12/2025 19:00	Lab ID:	12284	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 106	Test Species:	SE-Saccostrea echinata
Comments:					

Conc-%	1	2	3	4
FSW Control	0.7300	0.6800	0.7500	0.7200
ASW Control	0.7600	0.6500	0.6900	0.7300
0.8	0.7600	0.7100	0.6800	0.6700
1.6	0.7400	0.6800	0.8500	0.7300
3.1	0.7200	0.8000	0.7600	0.8100
6.3	0.7300	0.7200	0.7500	0.8000
12.5	0.6900	0.8300	0.7400	0.7100
25	0.7200	0.7600	0.8000	0.6500
50	0.7300	0.7600	0.6900	0.6900
100	0.7800	0.7600	0.5900	0.6900

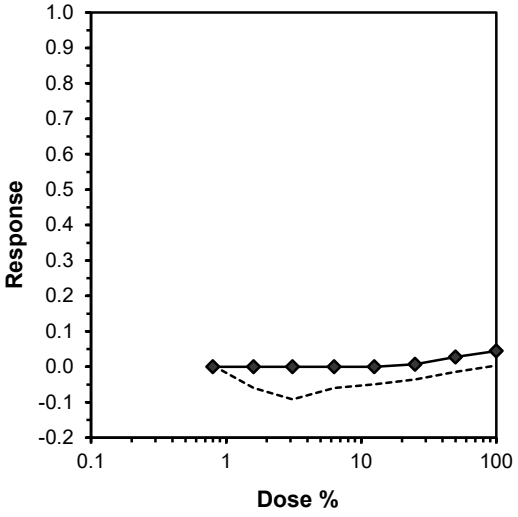
			Transform: Arcsin Square Root					1-Tailed			Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
FSW Control	0.7200	1.0177	1.0136	0.9695	1.0472	3.216	4					
ASW Control	0.7075	1.0000	1.0003	0.9377	1.0588	5.264	4	*			0.7379	1.0000
0.8	0.7050	0.9965	0.9973	0.9589	1.0588	4.505	4	0.066	2.513	0.1142	0.7379	1.0000
1.6	0.7500	1.0601	1.0507	0.9695	1.1731	8.240	4	-1.109	2.513	0.1142	0.7379	1.0000
3.1	0.7725	1.0919	1.0747	1.0132	1.1198	4.533	4	-1.638	2.513	0.1142	0.7379	1.0000
6.3	0.7500	1.0601	1.0480	1.0132	1.1071	3.998	4	-1.049	2.513	0.1142	0.7379	1.0000
12.5	0.7425	1.0495	1.0410	0.9803	1.1458	7.061	4	-0.895	2.513	0.1142	0.7379	1.0000
25	0.7325	1.0353	1.0292	0.9377	1.1071	7.000	4	-0.636	2.513	0.1142	0.7325	0.9927
50	0.7175	1.0141	1.0110	0.9803	1.0588	3.767	4	-0.234	2.513	0.1142	0.7175	0.9723
100	0.7050	0.9965	0.9994	0.8759	1.0826	9.328	4	0.020	2.513	0.1142	0.7050	0.9554

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.978448	0.935	0.165203	-0.29417
Bartlett's Test indicates equal variances (p = 0.80)	4.614032	20.09023		
The control means are not significantly different (p = 0.68)	0.4284	2.446912		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	100	>100		1	0.108306	0.152897	0.003042	0.004128	0.658594	8, 27
Treatments vs ASW Control										

Log-Logit Interpolation (200 Resamples)

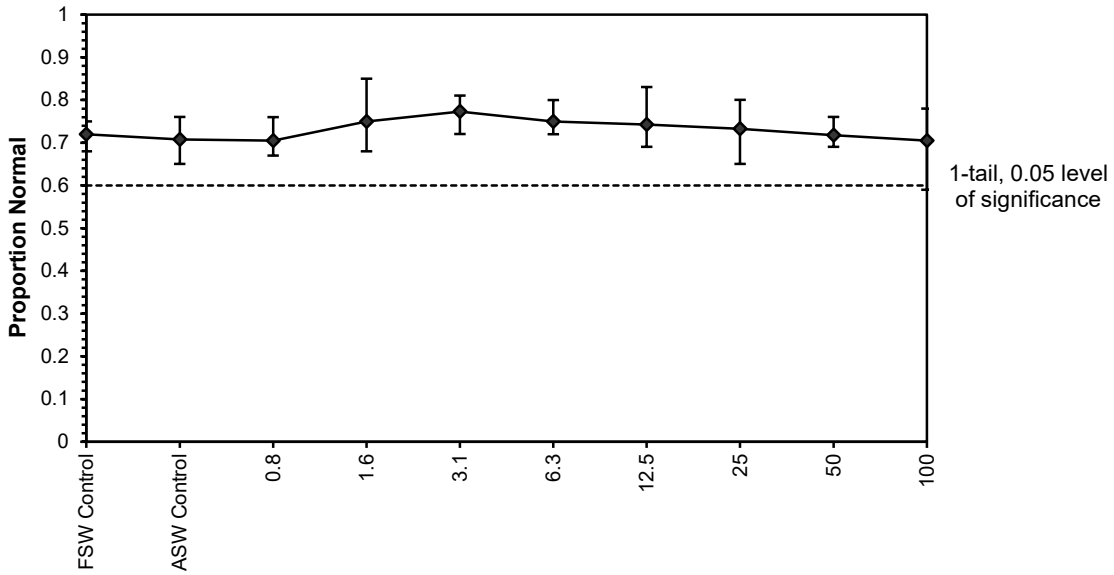
Point	%	SD	95% CL(Exp)	Skew
IC05	>100			
IC10	>100			
IC15	>100			
IC20	>100			
IC25	>100			
IC40	>100			
IC50	>100			



Bivalve Larval Development Test-Proportion Normal

Start Date:	12/12/2025 19:45	Test ID:	PR2393/04	Sample ID:	2028-MDTN-001089-2
End Date:	14/12/2025 19:00	Lab ID:	12284	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 106	Test Species:	SE-Saccostrea echinata
Comments:					

Dose-Response Plot



Bivalve Larval Development Test-Proportion Normal

Start Date:	12/12/2025 19:45	Test ID:	PR2393/04	Sample ID:	2028-MDTN-001089-2
End Date:	14/12/2025 19:00	Lab ID:	12284	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 106	Test Species:	SE-Saccostrea echinata
Comments:					

		Auxiliary Data Summary					
Conc-%	**Parameter**	**Mean**	**Min**	**Max**	**SD**	**CV%**	**N**
FSW Control	% Normal	72.00	68.00	75.00	2.94	2.38	4
ASW Control		70.75	65.00	76.00	4.79	3.09	4
0.8		70.50	67.00	76.00	4.04	2.85	4
1.6		75.00	68.00	85.00	7.16	3.57	4
3.1		77.25	72.00	81.00	4.11	2.63	4
6.3		75.00	72.00	80.00	3.56	2.52	4
12.5		74.25	69.00	83.00	6.18	3.35	4
25		73.25	65.00	80.00	6.40	3.45	4
50		71.75	69.00	76.00	3.40	2.57	4
100		70.50	59.00	78.00	8.58	4.16	4
FSW Control	pH	8.20	8.20	8.20	0.00	0.00	1
ASW Control		8.20	8.20	8.20	0.00	0.00	1
0.8		8.10	8.10	8.10	0.00	0.00	1
1.6		8.10	8.10	8.10	0.00	0.00	1
3.1		8.10	8.10	8.10	0.00	0.00	1
6.3		8.10	8.10	8.10	0.00	0.00	1
12.5		8.10	8.10	8.10	0.00	0.00	1
25		8.10	8.10	8.10	0.00	0.00	1
50		8.10	8.10	8.10	0.00	0.00	1
100		8.10	8.10	8.10	0.00	0.00	1
FSW Control	Salinity ppt	35.20	35.20	35.20	0.00	0.00	1
ASW Control		34.90	34.90	34.90	0.00	0.00	1
0.8		34.90	34.90	34.90	0.00	0.00	1
1.6		34.90	34.90	34.90	0.00	0.00	1
3.1		34.90	34.90	34.90	0.00	0.00	1
6.3		34.90	34.90	34.90	0.00	0.00	1
12.5		34.90	34.90	34.90	0.00	0.00	1
25		34.80	34.80	34.80	0.00	0.00	1
50		34.60	34.60	34.60	0.00	0.00	1
100		34.40	34.40	34.40	0.00	0.00	1
FSW Control	DO %	99.60	99.60	99.60	0.00	0.00	1
ASW Control		96.80	96.80	96.80	0.00	0.00	1
0.8		100.60	100.60	100.60	0.00	0.00	1
1.6		100.20	100.20	100.20	0.00	0.00	1
3.1		100.20	100.20	100.20	0.00	0.00	1
6.3		100.10	100.10	100.10	0.00	0.00	1
12.5		100.20	100.20	100.20	0.00	0.00	1
25		100.00	100.00	100.00	0.00	0.00	1
50		100.00	100.00	100.00	0.00	0.00	1
100		100.10	100.10	100.10	0.00	0.00	1

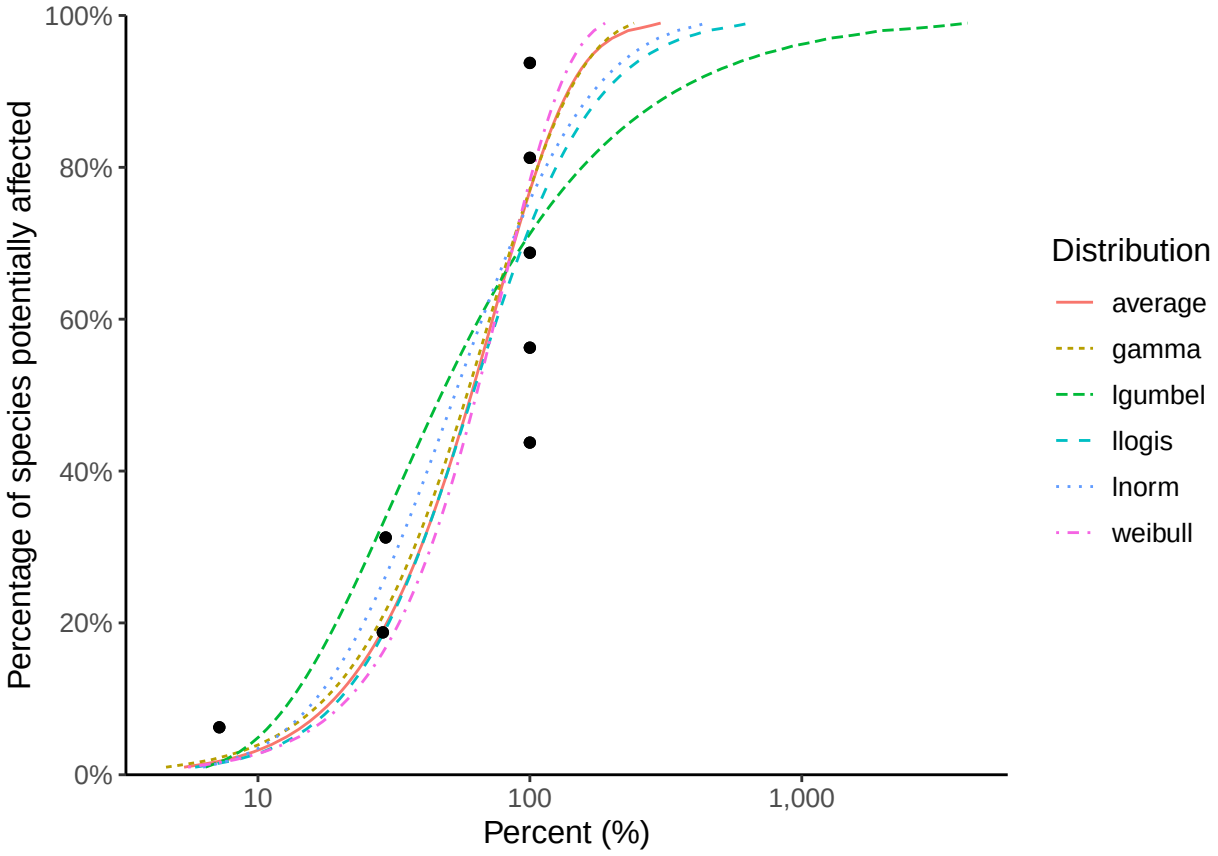
Appendix D. Shinyssdtools reports

ssdtools BCANZ Report

This report was generated through the ssdtools Shiny app which fits species sensitivity distributions to concentration data. The app is built from the R package ssdtools, and shares the same functionality.

Toxicant: KGP1 Jetty Outfall
Report created: 26/02/2026
Input distributions: gamma, lgumbel, llogis, lnorm, lnorm_lnorm, weibull
ssdtools version: 2.3.0
R version: 4.4.1 (2024-06-14)

Fit of all distributions

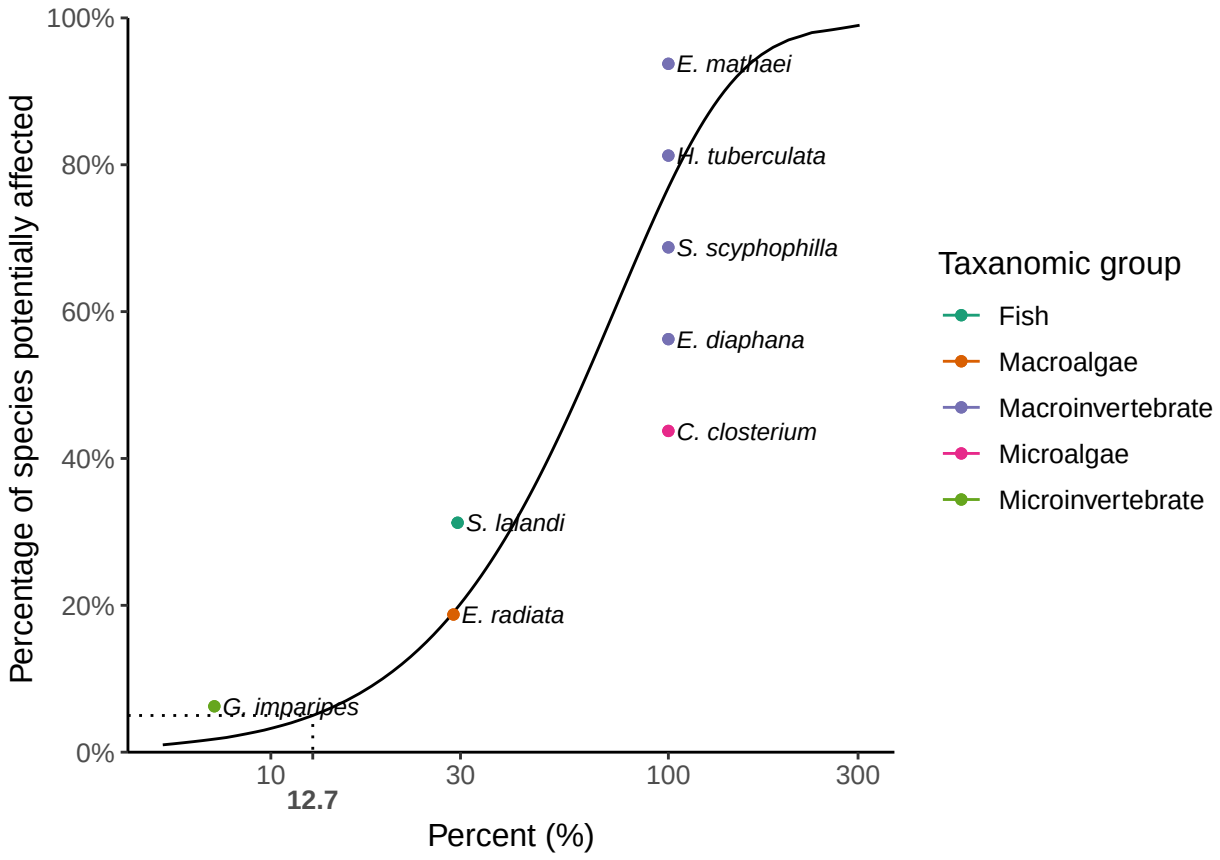


Goodness of fit table

dist	ad	ks	cvm	aic	aicc	bic	delta	weight
weibull	1.34	0.407	0.236	85.6	88.0	85.8	0.000	0.483
gamma	1.17	0.396	0.213	86.6	89.0	86.7	0.967	0.298
llogis	1.08	0.347	0.189	88.8	91.2	88.9	3.150	0.100
lnorm	1.13	0.382	0.200	88.8	91.2	88.9	3.180	0.098
lgumbel	1.08	0.337	0.193	91.9	94.3	92.1	6.340	0.020

Table 1. The goodness of fit statistics. 'dist' is the distribution name; 'ad' is the Anderson-Darling statistic; 'ks' is the Kolmogorov-Smirnov statistic; 'cvm' is the Cramer-von Mises statistic; 'aic' is the Akaike's Information Criterion; 'aicc' is the Akaike's Information Criterion corrected for sample size; 'bic' is the Bayesian Information Criterion; 'delta' is the Information Criterion differences; 'weight' is the Information Criterion weights. 'delta' and 'weight' are based on 'aic' for censored data and 'aicc' for non-censored data.

Model averaged fit



Estimated hazardous/protective concentration

HCx	PCx	est	se	lcl	ucl	nboot	pboot
1	99	5.348	6.894	1.036	25.941	1000	0.999
5	95	12.749	9.574	4.181	40.474	1000	0.999
10	90	19.102	11.089	7.565	48.925	1000	0.999
20	80	29.781	12.917	13.572	62.247	1000	0.999

Table 2. The estimated hazardous/protective concentrations. 'HCx' is the % species affected; 'PCx' is the % species protected; 'est' is the model-averaged estimate of the concentration; 'se' is the bootstrap based standard error of the estimate; 'lcl' and 'ucl' are the bootstrapped based lower and upper 95% confidence limits; 'nboot' is the number of bootstrap samples; 'pboot' is the proportion of bootstrap samples that converged. The model-averaged estimate(s) is calculated by treating the distribution as a single weighted mixture distribution. Distributions with an absolute AIC difference greater than a default delta of 9.21 (corresponding to a weight of no more than 0.01) are excluded prior to bootstrapping.

Input data

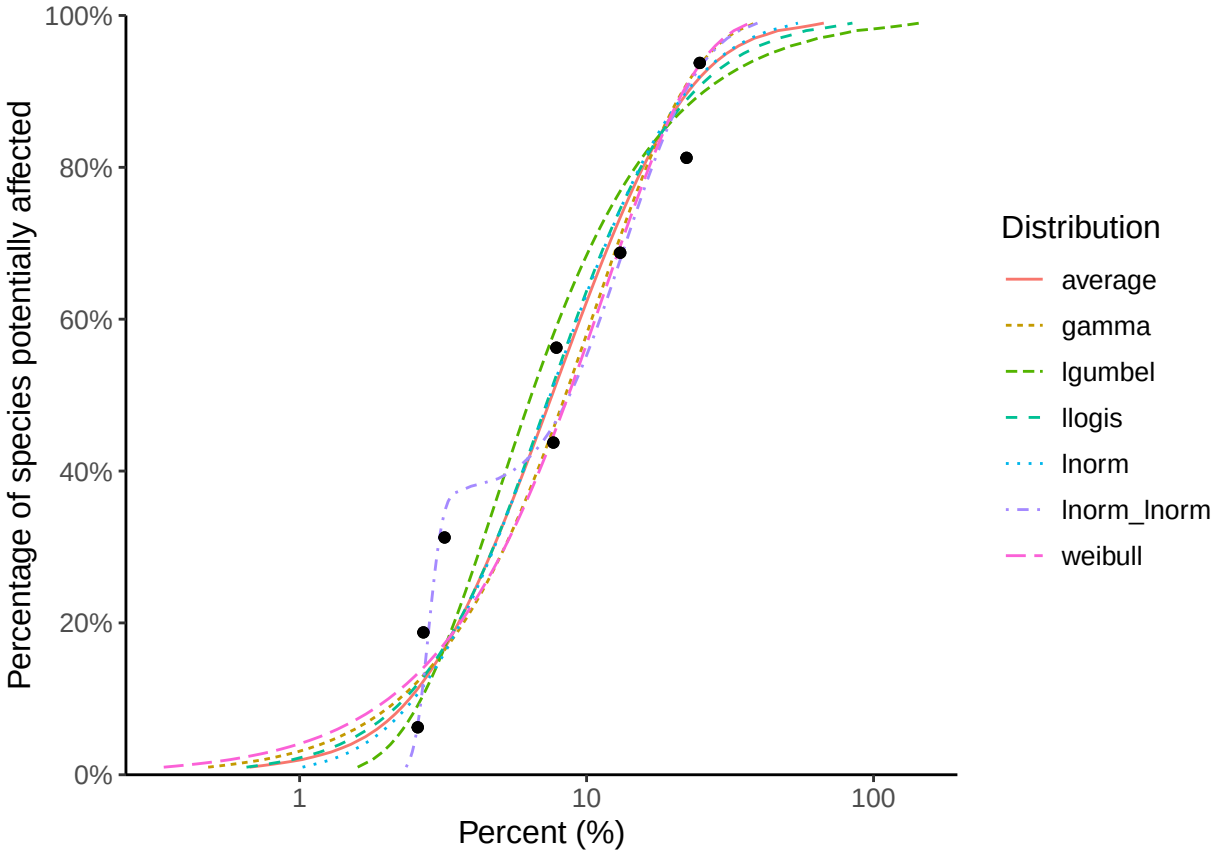
EC10...	BIOASSAY	Taxanomic.group
100.00	C. closterium	Microalgae
28.80	E. radiata	Macroalgae
100.00	E. diaphana	Macroinvertebrate
100.00	S. scyphophilla	Macroinvertebrate
100.00	H. tuberculata	Macroinvertebrate
100.00	E. mathaei	Macroinvertebrate
7.21	G. imparipes	Microinvertebrate
29.50	S. lalandi	Fish

ssdtools BCANZ Report

This report was generated through the ssdtools Shiny app which fits species sensitivity distributions to concentration data. The app is built from the R package ssdtools, and shares the same functionality.

Toxicant: Admin Drain
Report created: 26/02/2026
Input distributions: gamma, lgumbel, llogis, lnorm, lnorm_lnorm, weibull
ssdtools version: 2.3.0
R version: 4.4.1 (2024-06-14)

Fit of all distributions

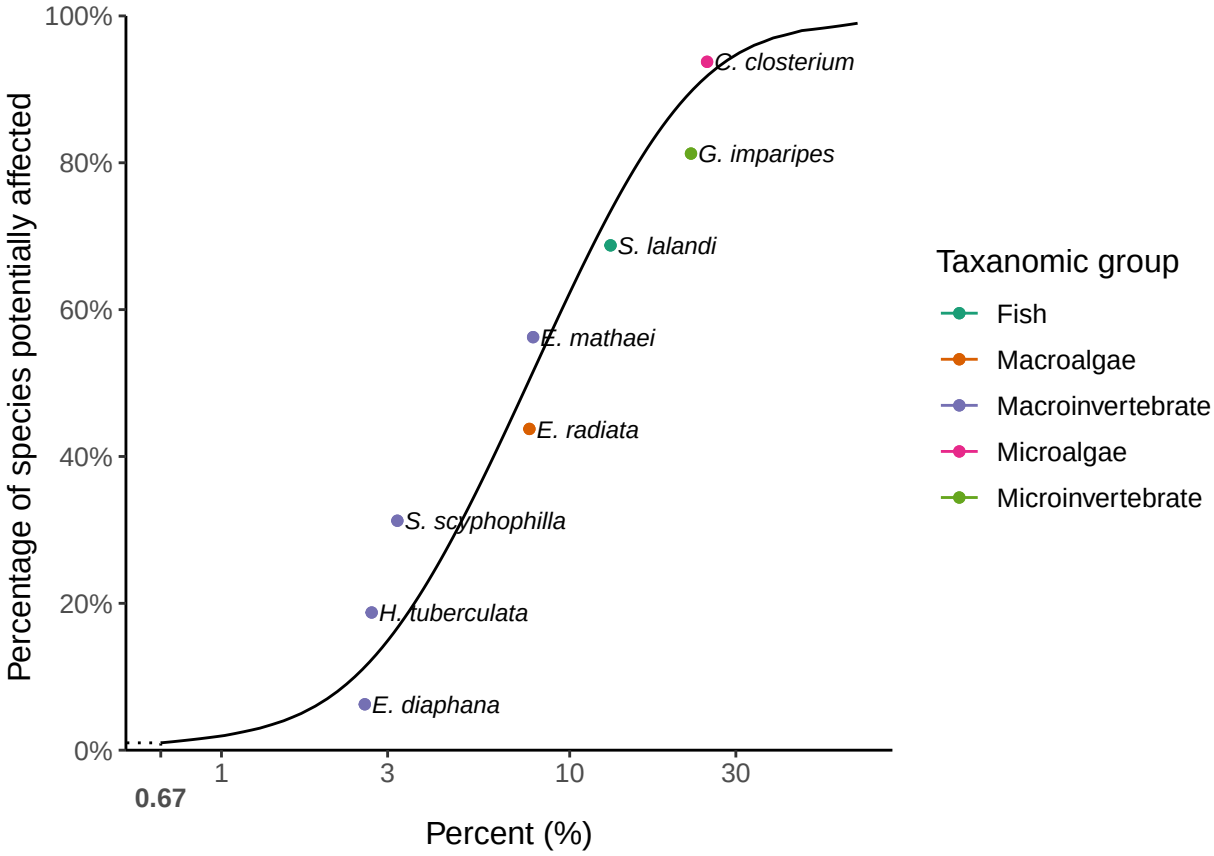


Goodness of fit table

dist	ad	ks	cvm	aic	aicc	bic	delta	weight
lnorm	0.417	0.215	0.0587	56.4	58.8	56.5	0.000	0.236
lgumbel	0.467	0.207	0.0729	56.4	58.8	56.6	0.072	0.228
gamma	0.420	0.211	0.0585	56.7	59.1	56.9	0.351	0.198
weibull	0.407	0.202	0.0575	56.8	59.2	57.0	0.485	0.185
llogis	0.386	0.206	0.0550	57.2	59.6	57.4	0.886	0.152
lnorm_lnorm	0.245	0.158	0.0337	54.2	84.2	54.6	25.400	0.000

Table 1. The goodness of fit statistics. 'dist' is the distribution name; 'ad' is the Anderson-Darling statistic; 'ks' is the Kolmogorov-Smirnov statistic; 'cvm' is the Cramer-von Mises statistic; 'aic' is the Akaike's Information Criterion; 'aicc' is the Akaike's Information Criterion corrected for sample size; 'bic' is the Bayesian Information Criterion; 'delta' is the Information Criterion differences; 'weight' is the Information Criterion weights. 'delta' and 'weight' are based on 'aic' for censored data and 'aicc' for non-censored data.

Model averaged fit



Estimated hazardous/protective concentration

HCx	PCx	est	se	lcl	ucl	nboot	pboot
1	99	0.670	0.958	0.118	3.522	1000	0.999
5	95	1.695	1.222	0.481	5.155	1000	0.999
10	90	2.415	1.412	0.930	6.439	1000	0.999
20	80	3.579	1.718	1.867	8.373	1000	0.999

Table 2. The estimated hazardous/protective concentrations. 'HCx' is the % species affected; 'PCx' is the % species protected; 'est' is the model-averaged estimate of the concentration; 'se' is the bootstrap based standard error of the estimate; 'lcl' and 'ucl' are the bootstrapped based lower and upper 95% confidence limits; 'nboot' is the number of bootstrap samples; 'pboot' is the proportion of bootstrap samples that converged. The model-averaged estimate(s) is calculated by treating the distribution as a single weighted mixture distribution. Distributions with an absolute AIC difference greater than a default delta of 9.21 (corresponding to a weight of no more than 0.01) are excluded prior to bootstrapping.

Input data

EC10...	BIOASSAY	Taxanomic.group
24.80	C. closterium	Microalgae
7.66	E. radiata	Macroalgae
2.58	E. diaphana	Macroinvertebrate
3.20	S. scyphophilla	Macroinvertebrate
2.70	H. tuberculata	Macroinvertebrate
7.85	E. mathaei	Macroinvertebrate
22.30	G. imparipes	Microinvertebrate
13.10	S. lalandi	Fish