Compliance Report 2022-2023

Kooragang Island Waste Emplacement Facility, Area 2 Closure Works

EPBC 2016/7670

Revision C

10 November 2023

Document history and status

Revision	Date	Description	By	Checked	Approved
A	24 May 2023	Draft	G. Moylan	M. Bardsley	M. Bardsley
B	10 November 2023	Draft Final	G. Moylan	M. Bardsley	M. Bardsley
C	17 November	Final	G. Moylan	M. Bardsley	M. Bardsley

NSW GOVERNMENT | Hunter & Central Coast Development Corporation

Declaration of Accuracy

In making this declaration, I am aware that sections 490 and 491 of the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) make it an offence in certain circumstances to knowingly provide false or misleading information or documents. The offence is punishable on conviction by imprisonment or a fine, or both. I declare that all the information and documentation supporting this compliance report is true and correct in every particular. I am authorised to bind the approval holder to this declaration and that I have no knowledge of that authorisation being revoked at the time of making this declaration.

Signed	
Full name (please print)	Michael Bardsley
Position (please print)	Environmental Manager
Organisation	Hunter & Central Coast Development Corporation ABN 94 688 782 063
Date	17 November 2023

Hunter & Central Coast Development Corporation

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1. Purpose of the Report

The Kooragang Island Waste Emplacement Facility (KIWEF) Area 2 Closure Works Project was undertaken by Daracon Contractors Pty Ltd (Daracon) between August 2019 and July 2020. The Hunter and Central Coast Development Corporation (HCCDC) was acting as the agent of the New South Wales (NSW) Government for the closure of KIWEF, a former landfill site that received waste from the former Broken Hill Proprietary (BHP) Company Limited Mayfield steelworks and associated operations.

KIWEF is a 179-hectare site located on the western portion of Kooragang Island, approximately 7km northwest of Newcastle's city centre. The site is bounded by Newcastle Coal Infrastructure Group to the south, the Port Waratah Coal Services – Kooragang Coal Terminal railway line to the west and north and adjacent industrial land consisting of third part waste facilities to the east. The action involves the closure of a 32-hectare portion of referred to as Area 2, shown on Figure 1.

In 2019, HCCDC completed an assessment of impact to matters of national environmental significance (MNES) under the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999*. The Department of Agriculture, Water and Environment (DAWE, previously Department of Environment and Energy) granted approval for the project (EPBC 2016/7670) under sections 130(1) and 133(1) of the EPBC Act, on 22 March 2019.

The Area 2 closure works consisted of the construction of an engineered cap over the former landfill. The site is complicated by presence of MNES including Wetlands of International Importance and listed threatened species including the *Litoria aurea*, Green and Golden Bell Frogs (GGBF) and migratory wading birds.

This report documents HCCDC's compliance with the conditions of the approval issued under the EPBC Act for the action (EPBC 2016/7670) and to satisfy Condition 15 of that approval, which states:

Annual compliance reporting

15. The approval holder must prepare a compliance report for each 12-month period following the date of the commencement of the proposed action, or as otherwise agreed to in writing by the Minister. The approval holder must:

- *a) publish each compliance report on the website within 60 business days following the relevant 12-month period;*
- *b) notify the Department by email that a compliance report has been published on the website within five business days of the date of publication;*
- *c) keep all compliance reports publicly available on the website until this approval expires;*
- *d) exclude or redact sensitive ecological data from compliance reports published on the website; and*
- *e) where any sensitive ecological data has been excluded from the version published, submit the full compliance report to the Department within five business days of publication.*

Note: The first compliance report may report a period less than 12 months so that it and subsequent compliance reports align with the similar requirement under state approval. Compliance reports may be published on the Department's website.

The action was commenced on 21 August 2019 and works on site were completed within a single reporting period. **Section 2** provides further detail on the activities completed within the current reporting period (nominally between September 2022 and September 2023. **Section 3** demonstrates the sites compliance throughout the current maintenance period, against the conditions granted under EPBC 2016/7670.

Figure 1: Project Locality

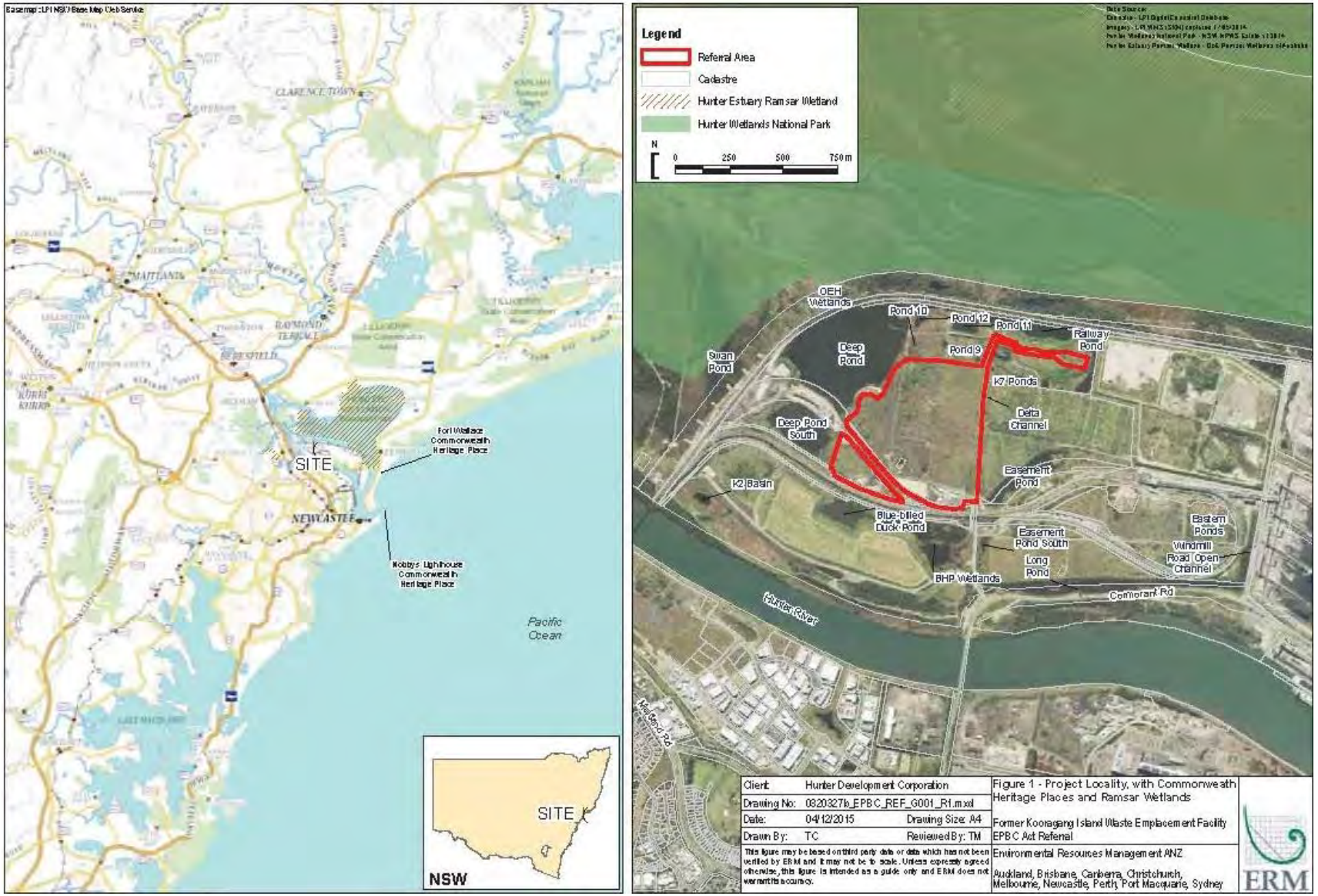

Figure 2: Footprint of the Action area

RAMBOLL

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Date 14/12/2018
Version H

Hunter Development Corporation

FIGURE 2-4 Variation Components

EPBC Referral Preliminary Documentation Package
KIWEF Area 2 Closure Works
Hunter Development Corporation

2. Description of Activities

Civil works for the controlled activity were completed by the contractor (Daracon) on 10 July 2020. Since then, the site has been managed by HCCDC to conduct the required monitoring and maintenance of the site, including establishment of vegetation, removal of weeds or vegetative species that could damage the capping layer and repair any damage caused by stormwater erosion.

A breakdown of works undertaken within Area 2 during the current period are summarised below in Table 1.

Table 1: 2022-2023 Activities

Works Undertaken	Date of Works
Annual GGBF Monitoring – A team of amphibian researchers from the University of Newcastle (UoN) undertook three complete rounds of KIWEF/Ash Island ecological surveys across 2022/2023 summer season as required by the KIWEF GGBF Management Plan and condition 3 of the EPBC 2016/7670. In addition, UoN undertook several smaller targeted surveys of selected pond areas, including around the Area 2 site (7 additional targeted surveys). The complete monitoring program includes (but is not limited to) the survey of 80 ponds (and their surrounds) across the KIWEF site and adjacent national park area in Ash Island, for the following: • Presence/absence of GGBF (and other frog species); • GGBF distribution; • Habitat utilisation; • GGBF behaviour; • GGBF size, age and gender; • Tagging/recapturing of GGBF to track movement patterns; • Presence/absence of predators including *Gambusia holbrooki*.	September 2022 to May 2023
Annual Cap Maintenance – HCCDC's contractors (Daracon) completed the rectification issues identified by the HCCDC Biannual inspection in December 2021 and June 2022. These works involved: • Removal of targeted vegetation species with roots that can impact capping layer. This was mechanical where possible with ecologists in attendance; otherwise removed individually by hand cutting and painted application of herbicide directly to the freshly cut stump. • Removal of weeds from boundaries of ponds using approved methods (no use of herbicides adjacent to watercourses).	August to October 2022
Biannual Cap Inspection – Following the completion of the cap maintenance activities in October 2022, HCCDC conducted a site walkover to inspect capped areas for signs that the cap has eroded, degraded or slumped. The inspection confirmed that all previously identified rectification issues had been satisfactorily resolved and that no new cap maintenance issues had been identified.	October 2022 and December 2022

Works Undertaken	Date of Works
Biannual Surface Water Datalogger Download – HCCDC's consultants (Robert Carr and Associates) undertook the fifth round of Continuous Datalogging as required by the Water Quality Management Plan and condition 6 of EPBC 2016/7670. The network of 13 continuous dataloggers installed within surface water bodies around the KIWEF were checked to retrieve the units and download the data. Unfortunately, prolonged very wet weather conditions over consecutive months made several of the locations inaccessible during the previous fourth round of monitoring (water levels were too high to locate the units, or made conditions unsafe for personnel to access) and several units were non-communicable and have been returned to the supplier for repairs. The resultant data from the units that was able to be collected were compared to the established salinity threshold levels for chytrid protection and showed results consistent with expectations. The Water Quality Management Plan indicated the Continuous Datalogger Monitoring would continue for 2 years post construction, which would make the previous fourth download event the final round. However due to the inaccessibility of some locations in current round, HCCDC proposed to conduct a further download round (occurred in February/March 2023). All logging units have now been retrieved and further logging is not considered necessary.	March 2023
Biannual Cap Inspection – HCCDC conducted a site walkover to inspect capped areas for signs that the cap has eroded, degraded or slumped. The inspection identified several risks to the cap or environment that may require future rectification, including: • The emergence of shrub saplings across areas of the cap cleared during maintenance activities in October 2022. Appears to be same species with root systems that may damage the capping layer, but currently vegetation is too small for removal; • Areas of weed growth identified, particularly around basins. There were no observed signs of major erosion, slumping or degradation of the cap during the inspection.	May 2023
KIWEF Annual Water Quality Monitoring – HCCDC's consultants (GHD) undertook the Annual Water Quality Monitoring as required by the Water Quality Management Plan and condition 6 of EPBC 2016/7670. The network of 50 groundwater monitoring locations and 5 surface water monitoring locations were sampled and analysed for a variety of parameters and pollutants as specified by the NSW EPA issued Surrender Notice.	Nov 2023

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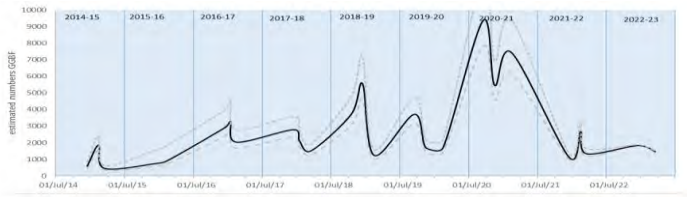
3. Approval Compliance

An assessment of the action's compliance with the conditions of the Commonwealth Approval under the EPBC Act (EPBC Ref: 2016/7670) during the 2022-2023 period is summarised in Table 2.

Table 2: Approval Conditions Compliance Table

Condition Ref	Condition	Compliance	Evidence/Comments
PART A – CONDITIONS SPECIFIC TO THE ACTION			
1.	The action must only be undertaken within the footprint.	Compliant	During the current period the only works cap maintenance works were undertaken in Area 2. As the works were limited to the extent of the cap installed during the construction phase, they are known to be within the footprint shown in Figure 2. Further survey information collected during the construction works has now been overlayed onto the Commonwealth Approval Boundary to confirm the actual works footprint was within the approved area. The below figure shows the extent of works: **KIWEF Area 2 Works Footprint** *Key: Orange – Commonwealth Approval Boundary; Pink – KIWEF Closure Works extents*

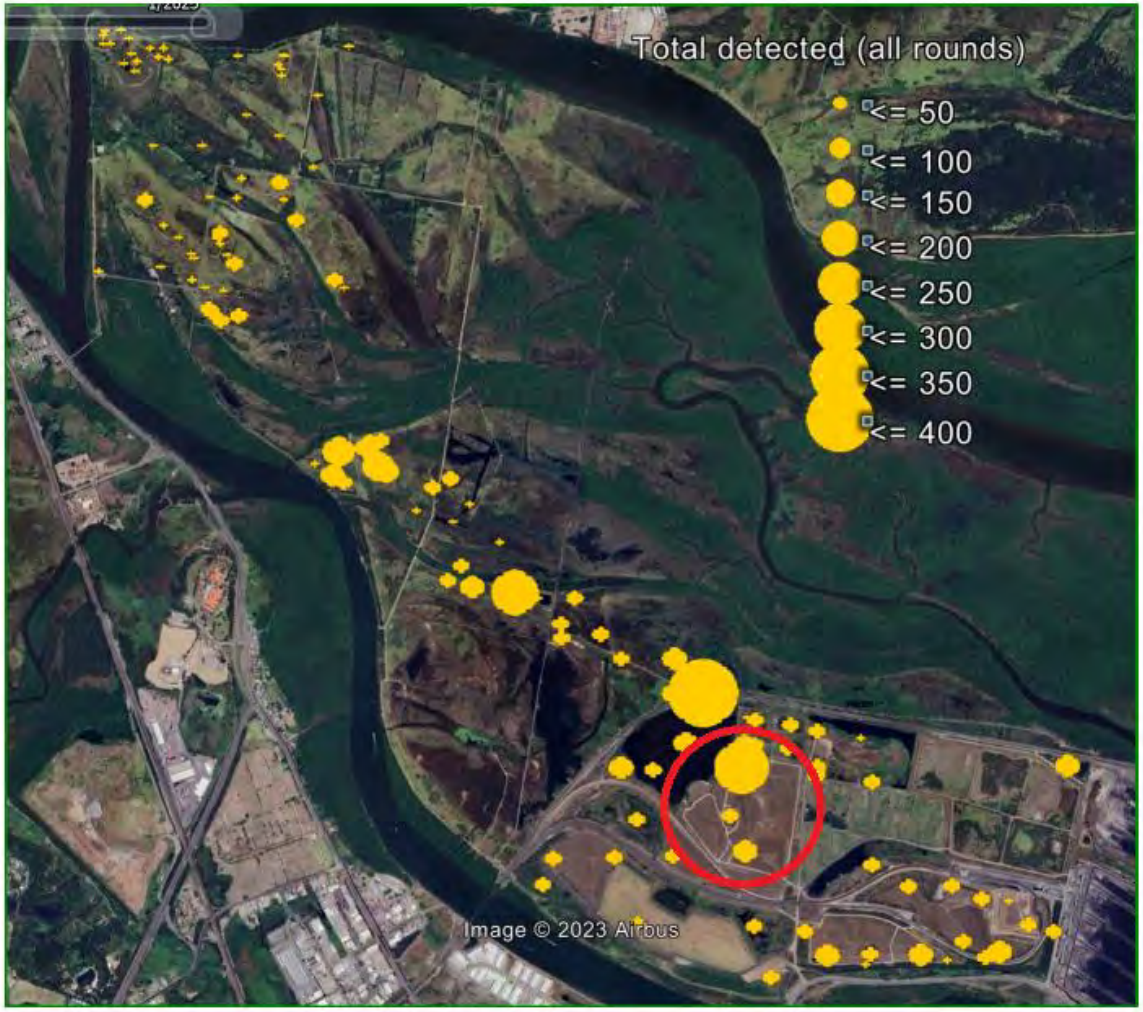
Condition Ref	Condition	Compliance	Evidence/Comments
2.	The person taking the action must implement the Green and Golden Bell Frog Management Plan to avoid and mitigate impacts on the Green and Golden Bell Frog (Litoria aurea) (GGBF) population.	Compliant	The GGBF Management Plan was implemented through the reporting period. This included monitoring of the GGBF population by the University of Newcastle (UoN) researchers on behalf of the State, and the preparation of the 2022/23 Island Wide Survey (IWS). A report of the IWS is provided in Appendix C. In addition, during maintenance works that had the potential to harm protected species, the contractor Daracon were also required to have an ecological supervision and clearances prior to undertaking and activities that could injure protected species (and other fauna). Ecological clearance reports are provided as Appendix F.
3.	GGBF monitoring must be undertaken in accordance with the Green and Golden Bell Frog Management Plan within the KIWEF Site, including the temporary basins, aligned with NCIG monitoring program.	Compliant	As described in Section 2, the annual monitoring of GGBF in accordance with the GGBF Management Plan (refer to Appendix B) was undertaken by the University of Newcastle through the spring – summer period. A copy of the 2022/23 IWS report is provided in Appendix C.
4.	GGBF monitoring data must be analysed following each round of monitoring to identify any changes to the GGBF population, as compared to the baseline data described in the Green and Golden Bell Frog Management Plan. Should a decline in population be attributed to the action, response measures must be developed and implemented in accordance with the Green and Golden Bell Frog Management Plan.	Compliant	The UoN 2019-20 IWS results (during Area 2 construction) observed a population increase that was thought to be associated with a mass breeding event in February 2020 that coincided with first significant rainfall after a very dry period. The 2020-21 IWS results observed the continued presence of the cohort from the mass breeding event in February 2020, which had grown large enough to be tagged (>40mm) and therefore resulted in a 5-fold increase in the population numbers that were observed. The UoN results during the current 2021-22 IWS illustrated an overall population decrease following the mass breeding event in February 2020, back to the levels that were observed between 2016-19. The below chart shows the GGBF population 2022-23 has stabilised consistent with prevailing environmental factors. Population model based on annual capture-mark-recapture (CMR) statistics Since 2016 'baseline' pop: **1,000 – 3,500** 2022-23 estimate = **1,000 – 2,500**  **GGBF Population at KIWEF**

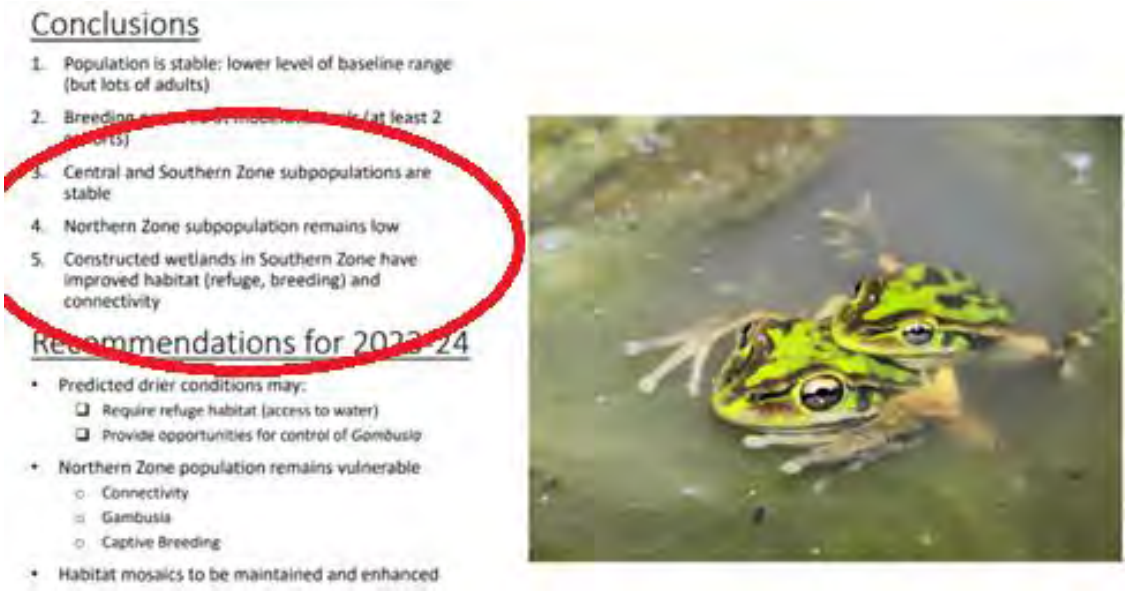
Condition Ref	Condition	Compliance	Evidence/Comments
			The 2022-23 Survey also revealed that GGBF have taken residence in the new Area 2 wetlands. These waterbodies were also observed to be functioning as breeding habitat for the first time since their construction (Source: UoN presentation to stakeholders July 2023

Breeding (2022-23)

- No evidence of successful breeding in Northern Zone
- Widespread **calling** across Central and Southern Zones, including mangroves!

Zone	Calling	Tadpoles	Mets	Xsmall juvs	Small juvs
Northern	2	0	0	0	0
Central	13	0	8	13	13
Southern	16	4	4	6	10

Condition Ref	Condition	Compliance	Evidence/Comments
			 **GGBF Population at Area 2 KIWEF** – constructed wetland in Area 2 (2022-2023 Survey) has the second highest total aggregated detections of any wetland (Source UoN,Island Wide Report, 2023)

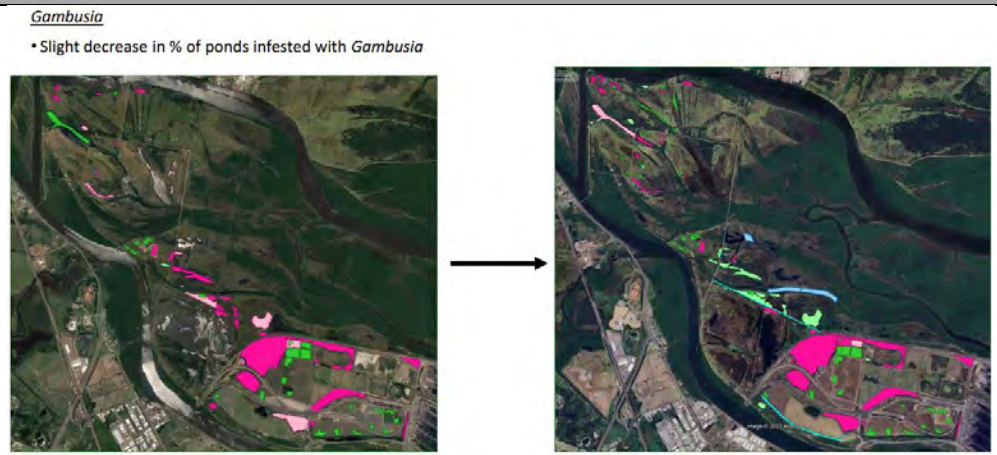
Condition Ref	Condition	Compliance	Evidence/Comments
			The conclusions of the 2022-2023 Island Wide Survey indicate while Northern Zone populations have been "low"" this season (Ash Island, outside the area of influence of the Area 2 project) the Central and Southern Zone populations are "stable" (including the Area 2 and surrounding southern and central wetlands). The results are summarised below (Source: UoN presentation to stakeholders July 2023) 
5.	The person taking the action must revegetate the area marked in yellow and identified as 'Area 2 Closure works' on Map 2 at Attachment A to restore Green and Golden Bell Frog habitat in accordance with the Revegetation Management Plan.	Compliant	At the completion of the Area 2 Closure Works, the site was topsoiled and seeded in accordance with the Revegetation Management Plan. Previous Cap Inspections identified several areas where vegetation growth was low. Rectification works conducted in July/August in 2021 included the placement of additional topsoil and reseeding of the area; consistent with the requirements of the Revegetation Plan. The below aerial images from Nearmap taken in October 2022 and October 2023 shows the continued improvement of vegetation establishment across the capped area, the ongoing cap maintenance program to remove shrubs growing on the cap and the establishment of movement corridors along drainage lines consistent with the GGBF Management Plan (refer to Appendix B).

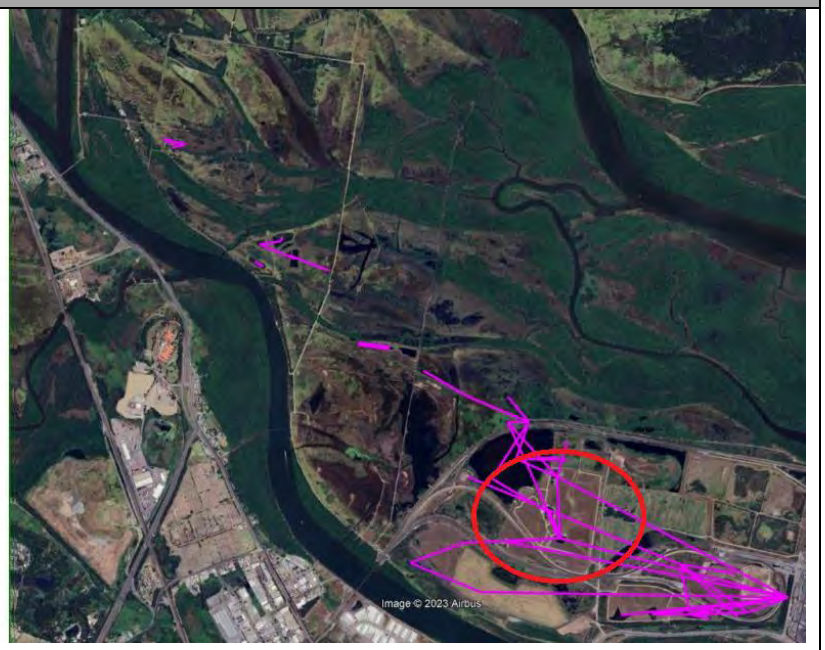
Condition Ref	Condition	Compliance	Evidence/Comments
			Issue Identified: June 2021

Condition Ref	Condition	Compliance	Evidence/Comments
			Restored: October 2022

Condition Ref	Condition	Compliance	Evidence/Comments
			Confirmed Stable: October 2023

Condition Ref	Condition	Compliance	Evidence/Comments
6.	The person taking the action must undertake water quality monitoring for groundwater and surface water at the KIWEF Site in accordance with the Water Quality Management Plan.	Compliant	The continuous datalogging network were downloaded in February/March of 2023. A copy of the March 2023 report and comparison against salinity threshold levels is provided in Appendix D. The continuous datalogger monitoring is required under the Water Quality Management Plan, to continue for 2 years post-construction and was therefore expected to end in July 2022. However, given the prolonged very intense wet weather that was experienced prior to the June 2022 event, several monitoring locations were completely submerged and could not be accessed. An additional download event was completed in early 2023 to remove the dataloggers from the pond environments and complete the final download. No significant changes to the hydro-salinity results have been observed. Changes are consistent with seasonal changes and responses to climatic conditions; also noting that increased rainfall had been experienced during the period as a result of climatic factors (*La Niña*) and several of the loggers were unable to communicate or had lost battery power during the recording period. The Annual Groundwater and Surface Water monitoring program was completed by GHD in November 2023 a copy of the report is provided in Appendix E.
7.	At the completion of the project works, the approval holder must ensure:	-	-
i.	no increased distribution of Gambusia holbrooki due to the project works, within the area identified as 'Potential GGBF foraging or breeding habitat' as identified on Map 2 at Attachment A, and	Compliant	The results reported in the UoN IWS 2022-23 (Appendix C) show the current *Gambusia* distribution across KIWEF. The mapping (below) shows Gambusia distribution across the KI/Ash Island was at relatively high levels in 2021-22 compared to the baseline 2015/16 survey period. The University of Newcastle specialists undertaking monitoring have advised that the driver of increased distribution at that time was a consequence of consecutive years of *La Niña* providing very wet conditions that have increased pond water levels, allowed water to connect between ponds, and therefore providing gambusia with the opportunity to redisperse across the low-lying connected wetlands. The most recent 2022-23 UoN mapping of gambusia distribution (shown below) indicate that: 1. the current gambusia free wetlands are predominantly those constructed by HCCDC as part of the KIWEF capping works, including Area 2. 2. A slight decrease in % ponds with Gambusia, and HCCDC constructed wetlands remaining free of the pest species. UoN have attributed the pest free nature of the HCCDC wetlands as a feature that has supported their function as valuable new breeding habitat.

Condition Ref	Condition	Compliance	Evidence/Comments
			 **Gambusia Distribution 2022/23** (Source UoN Presentation Slides 2023) *Key: Green – Gambusia absent; Light Pink – Gambusia appeared during survey season; Dark Pink – Gambusia present through survey season; Yellow outline – Area 2.*
ii.	no net loss of GGBF foraging or breeding habitat as an impact of the project works.	Compliant	Foraging habitat within the works footprint was temporarily reduced during the construction activities, however the site is being revegetated in accordance with the Revegetation Management Plan following construction completion. The Biannual Inspection identified continued establishment of vegetation across the capped areas in accordance with the Revegetation Management Plan. In addition, movement corridors (through additional aquatic habitat with connecting vegetated drainage lines) have new been well established, consistent with the GGBF Management Plan (refer to Appendix B). During the 2022/23 IWS, UoN ecologists: 1. captured and processed 439 GGBF's from the constructed ponds within Area 2 project (including the Peninsula wetlands), confirming no net loss of GGBF foraging habitat following the project works, and 2. recorded GGBF movement through the now well-established terrestrial habitats in Area 2

Condition Ref	Condition	Compliance	Evidence/Comments
			Movement Huge value in long-term studies for detecting movement Movements detected in 2022-23: • K22-23 • Area 2 • Industrial Zone South • K100A  **Movement Studies 2022/23** (Source UoN Presentation Slides, 2023)

Condition Ref	Condition	Compliance	Evidence/Comments
8.	The approval holder must implement the KIWEF Site EMP.	Compliant	The Post Construction elements of the Construction Environmental Management Framework (CEMF, provided as Appendix A) including the preparation of the Construction Validation Report and Independent Auditors Report of the construction works have been completed and submitted to the NSW EPA in accordance with the requirements of the CEMF and Surrender Notice. The site has continued to implement the requirements of the GGBF Management Plan (Appendix B) throughout the Post-Construction period including the Island Wide Survey monitoring (Appendix C), ecological pre-clearance surveys (Appendix F) prior to any ground disturbing activities (eg cap maintenance works) or works that could potentially harm protected species, and completion of the biannual cap inspections to ensure cap surface remains stable and vegetation is establishing whilst not compromising cap integrity (Appendix G and Appendix H). The Post-Completion Water Monitoring has also been conducted in accordance with the requirements of the CEMF (Appendix D to Appendix E)
PART B – STANDARD ADMINISTRATIVE CONDITIONS			
Notification of date of commencement of the proposed action			
9.	The approval holder must notify the Department in writing of the date of commencement of the action within 10 business days after the date of commencement of the action.	Compliant	HCCDC issued notification to the DCCEEW (previously DAWE) on commencement of works on 4 September 2019. The notification included a confirmation that earthworks had commenced on 21 August 2019
10.	If the commencement of the action does not occur within 5 years from the date of this approval, then the approval holder must not commence the action without the prior written agreement of the Minister.	Not Applicable	HCCDC commenced within one year of the approval being issued.
Compliance records			
11.	The approval holder must maintain accurate and complete compliance records.	Compliant	Reporting and analysis of groundwater, surface water, GGBF monitoring and cap inspection reports are maintained by HCCDC.

Condition Ref	Condition	Compliance	Evidence/Comments
12.	If the Department makes a request in writing, the approval holder must provide electronic copies of compliance records to the Department within the timeframe specified in the request.	Not Applicable	No request has been made by the Department for compliance records to be provided
Note: Compliance records may be subject to audit by the Department or an independent auditor in accordance with section 458 of the EPBC Act, and or used to verify compliance with the conditions. Summaries of the result of an audit may be published on the Department's website or through the general media.			
Preparation and publication of plans			
13.	The approval holder must:	-	-
a.	publish all plans associated with the action on the approval holder's website within 30 business days of the date of approval of the action;	Compliant	Commonwealth and State approval documents/plans were uploaded to the HCCDC website: https://www.hccdc.nsw.gov.au/kooragang-island-waste-emplacement-facility
b.	exclude or redact sensitive ecological data from plans published on the website or provided to a member of the public; and	Not Applicable	No sensitive ecological data was required to be redacted from the documents.
c.	keep plans published on the website until the end date of this approval	Compliant	HCCDC will continue to maintain the project plans on the website until completion of the closure works and the approval is transferred to Port of Newcastle. Port of Newcastle will then be responsible for uploading project plans and relevant documents on their website when approval transfers.
14.	The approval holder must ensure that any monitoring data (including sensitive ecological data), surveys, maps, and other spatial and metadata required under a plan, is prepared in accordance with the Department's Guidelines for biological survey and mapped data (2018) and submitted electronically to the Department in accordance with the requirements of the plan.	Compliant	The data for the current 2022-23 monitoring season compliant with the Department Guidelines is ready to be submitted to the Department once the compliance report has been issued.
Annual compliance reporting			

Condition Ref	Condition	Compliance	Evidence/Comments
15.	The approval holder must prepare a compliance report for each 12 month period following the date of the commencement of the proposed action, or as otherwise agreed to in writing by the Minister. The approval holder must:	Compliant	The Date of Commencement for the Action is 21 August 2019. The Annual Compliance Report for the Construction Period (2019/20) was prepared by an independent firm (Ramboll) who audited HCCDC and its Contractors (Daracon) compliance with the EPBC Approval requirements. The Annual Compliance Reports for the Project Works Period (2 years post-construction, ie 2020/21; 2021/22 and 2022/23 (this submission) were prepared by HCCDC.
a.	publish each compliance report on the website within 60 business days following the relevant 12 month period;	Compliant	The EPBC 2016/7670 Annual Compliance Reports were published on the HCCDC website, on the following dates: • 2019/20 Annual Compliance Report was published on 11 November 2020. • 2020/21 Annual Compliance Report was published on 11 November 2021. • 2021/22 Annual Compliance Report was published on 11 November 2022. The Annual Compliance Report for 2022/23 is to be published prior to 17 November 2023
b.	notify the Department by email that a compliance report has been published on the website within five business days of the date of publication;	Compliant	HCCDC notified DCCEEW (previously DAWE) that the Annual Compliance Reports were published on HCCDC's website, on the following dates: • 2019/20 Annual Compliance Report – DAWE notified 13 November 2020. • 2020/21 Annual Compliance Report – DAWE notified 15 November 2021. • 2021/22 Annual Compliance Report – DAWE notified 14 November 2022. • 2021/22 Annual Compliance Report - DAWE notified 17 November 2023.
c.	keep all compliance reports publicly available on the website until this approval expires;	Compliant	The Annual Compliance Reports for 2019/20, 2020/21, 2021/22 and 2022/23 will remain on the HCCDC website until the KIWEF Area 2 site and Commonwealth Approval are transferred to the Port of Newcastle at completion of the project works. Port of Newcastle will be responsible for uploading project plans on their website when approval transfers.
d.	exclude or redact sensitive ecological data from compliance reports published on the website; and	Not Applicable	No sensitive ecological data was required to be redacted from the documents.

Condition Ref	Condition	Compliance	Evidence/Comments
e.	where any sensitive ecological data has been excluded from the version published, submit the full compliance report to the Department within five business days of publication.	Not Applicable	No sensitive ecological data was required to be redacted from the documents.
Note: The first compliance report may report a period less than 12 months so that it and subsequent compliance reports align with the similar requirement under state approval. Compliance reports may be published on the Department's website.			
Reporting non-compliance			
16.	The approval holder must notify the Department in writing of any: incident; non-compliance with the conditions; or non-compliance with the commitments made in plans. The notification must be given as soon as practicable, and no later than two business days after becoming aware of the incident or non-compliance. The notification must specify:	Not Applicable	There were no non-compliances during the current period; and a notification to the Department was therefore not required.
a.	the condition which is or may be in breach; and	-	-
b.	a short description of the incident and/or non-compliance.	-	-
17.	The approval holder must provide to the Department the details of any incident or non-compliance with the conditions or commitments made in plans as soon as practicable and no later than 10 business days after becoming aware of the incident or non-compliance, specifying:	Not Applicable	There were no incidents or non-compliances during the current period; and a notification to the Department was therefore not required.

Condition Ref	Condition	Compliance	Evidence/Comments
a.	any corrective action or investigation which the approval holder has already taken or intends to take in the immediate future;	-	-
b.	the potential impacts of the incident or non-compliance; and	-	-
c.	the method and timing of any remedial action that will be undertaken by the approval holder.	-	-
Independent audit			
18.	The approval holder must ensure that independent audits of compliance with the conditions are conducted:		
i.	Following the completion of onsite construction works and prior to the completion of the project works period;	Compliant	The Project Works Period is considered to be 2 years post completion of construction. The Area 2 construction works were completed on 10 July 2022 and the Project Works Period therefore completes on 10 July 2023. On 18 May 2022, HCCDC engaged EMM Consulting to act as the Independent Auditor for the Area 2 project works period. EMM's Independent Audit of the Area 2 Closure Works found no non-compliances and three observations. Further details of the Independent Audit provided under Condition 19 and the Audit Report is provided as Appendix I.
ii.	Within a 12month period from the completion of the action;	Not Applicable	Port of Newcastle to undertake Independent Audit at the completion of the project action (post-transfer of the Approval) 31 December 2030.
iii.	or as requested in writing by the Minister.	Not Applicable	No independent audit has been requested by the Minister.
19.	For each independent audit, the approval holder must:		
a.	provide the name and qualifications of the independent auditor and the draft audit criteria to the Department;	Compliant	EMM's nominated Audit team and their qualifications (with David Bone as Lead Auditor) and the draft Audit criteria; were submitted to DCCEEW on 10 June 2022.

Condition Ref	Condition	Compliance	Evidence/Comments
b.	only commence the independent audit once the audit criteria have been approved in writing by the Department; and	Compliant	DCCEEW provided HCCDC with a Letter approving the nominated Auditor, Audit Team and the draft audit criteria on 19 August 2022.
c.	submit an audit report to the Department within the timeframe specified in the approved audit criteria.	Compliant	The DCCEEW Letter Approving the Independent Auditor and Audit Criteria (dated 19 August 2022), confirmed that the Audit Report was to be submitted to DCCEEW by 28 January 2023. On 6 December 2022, HCCDC sought an extension until 28th February 2023 due unforeseen medical issues of a critical staff member. On 9 December 2022, DCCEEW approved the extension of the Area 2 Independent Audit until 28 February 2023. HCCDC submitted the Final Independent Audit Report for the KIWEF Area 2 Closure Works to DCCEEW on 28 February 2023.
20.	The approval holder must publish the audit report on the website within 10 business days of receiving the Department's approval of the audit report and keep the audit report published on the website until the end date of this approval.	Not Applicable	DCCEEW issued an approval of the audit report to HCCDC on 5 April 2023 (including a letter from DCCEEW dated 4 April 2023). The Independent Audit Report was published on the HCCDC website on 6 April 2023.
Completion of the action			
21.	Within 30 days after the completion of the action, the approval holder must notify the Department in writing and provide completion data.	Not Applicable	Port of Newcastle will be taking over the Commonwealth Approval for the Area 2 Closure Works (Post-Construction Phase) and will be responsible for notifying the Department of the completion of the action in 2030, following completion of the necessary monitoring, maintenance and auditing required.

4. Conclusion

This report has been prepared to assess compliance with the conditions of the approval issued under the EPBC Act for the action (EPBC 2016/7670) and to satisfy Condition 15 of that approval. The undertaking of the action during the reporting period has been assessed to be compliant with the conditions of EPBC 2016/7670. No non-compliance issues were identified.

Onsite construction works were completed in July 2020. As such completion of the project works (defined as two years following completion of onsite construction works) will occur in August 2022.

An Independent Audit as required by condition 18 i) for the 'Completion of the Project Works' was commenced in April 2022, with DCCEEW confirming approval of the Audit Team and Audit Criteria on 19 August 2022. The Independent Audit Report found no non-compliances and three observations. The Final Independent Audit Report was submitted to DCCEEW on 28 February 2023 within the agreed timeframe between DCCEEW and HCCDC. DCCEEW reviewed the Independent Audit and issued a letter of Approval of the Area 2 Completion of Project Works Independent Audit on 4 April 2023. HCCDC published the Independent Audit Report on the HCCDC website on 6 April 2023.

Appendix A – Construction Environmental Management Framework (Jacobs, 2019)

Kooragang Island Waste Emplacement Facility Area 2 Closure

Hunter and Central Coast Development Corporation

Construction Environmental Management Framework

IA192100_02 | Final

16 April 2019

HDC369

Kooragang Island Waste Emplacement Facility Area 2 Closure

Project No:	IA192100
Document Title:	Construction Environmental Management Framework
Document No.:	IA192100_02
Revision:	Final
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Author:	Thomas Muddle
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Document history and status

Revision	Date	Description	By	Review	Approved
00	14/09/2018	Draft for Client Comment	T Muddle	A Bowden	T Muddle
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1. Introduction

1.1 Purpose and Scope

This Construction Environmental Management Framework (CEMF) sets out the environmental, stakeholder and community management requirements in relation to the Kooragang Island Waste Emplacement Facility (KIWEF) Area 2 Closure Works. The CEMF provides a link between the environmental and planning regulatory documentation and the construction environmental management documentation to be developed by the Principal Contractors relevant to their scope of works. The Principal Contractors will be required to implement and adhere to the requirements of this CEMF. The requirements of this CEMF will be included as a contract document in all design and construction contracts.

1.2 Project Overview

The endorsed approach to the closure of KIWEF is to implement minimal change in site processes by maintaining similar site hydrology, vegetation and surface soils while further isolating potential contaminants. The isolation of contaminants is to be achieved though the reduction of surface water infiltration resulting from the installation of capping with reduced permeability and a moderation of site surface gradients.

The basic principles of the closure works are to reduce surface water infiltration into the groundwater by the following means:

- Re-grading of the site to a minimum 1% grade to prevent ponding of surface waters;
- Drainage improvements;
- Provision of a 0.5 metre (m) thick, low permeability cap; and
- Rehabilitation using existing topsoil and alternative low nutrient and Chytrid free imported growth medium.

These closure works are to be undertaken within a sensitive and complex environmental context. In particular, the works need to be delivered in a manner which:

- Complies with regulatory requirements;
- Avoids direct impacts to Matters of National Environmental Significance (MNES) in particular Green and Golden Bell Frogs (GGBF) but also migratory wading birds;
- Carefully manages indirect impacts to MNES through avoidance of spread of chytrid fungus and predatory aquatic species and through avoiding impacts to water quality of surrounding waterbodies; and
- Manages fill material such that higher risk materials are appropriately isolated from surface waters.

The closure works area is relatively isolated from sensitive human receptors and standard, reasonable and feasible mitigation measures are also to be deployed to minimise environmental impacts.

1.3 Background

Extensive background information has been prepared in relation to the Project and in the first instance the Contractor should refer to the Tender Specifications. The following background is provided for environmental context only.

KIWEF is a former industrial waste disposal area located off Cormorant Road, Kooragang Island, Newcastle New South Wales (NSW). KIWEF ceased operation in 1999 and until this time was used by Broken Hill Proprietary Company Limited (BHP) as a landfill for disposal of waste from their Mayfield steelworks and associated operations. KIWEF was subject to Environment Protection Licence (EPL) 6437 issued under the

Protection of the Environment Operations Act 1997 (PoEO Act) for the scheduled action of "Waste disposal by application to land" first issued in 1999 to BHP and subsequently transferred to Regional Land Management Corporation Pty Ltd in May 2003 and then Hunter and Central Coast Development Corporation (HCCDC (also referred to as HDC in quoted text and reports commissioned by HCCDC prior to the merger of the Hunter Development Corporation with the Central Coast Development Corporation) in January 2008.

HCCDC surrendered EPL 6437 on 8 December 2010 and the NSW Environment Protection Authority (EPA) issued a conditional Surrender Notice 1111840 with subsequent variation notices being issued on 2 May 2013 (notice number 1510956) and 17 April 2014 (notice number 1520063) collectively referred to as the Surrender Notice for the remainder of this report. The Surrender Notice conditions relate primarily to the closure process, and describe the capping that is required across much of the area, and cross reference the GHD (2009) Revised Final Landform and Capping Strategy (the Capping Strategy).

HCCDC are the NSW Public Authority currently assigned responsibility for the closure of KIWEF on behalf of the NSW Government (the State). The land on which KIWEF is located (the closure works area) is owned by the Port of Newcastle Lessor (a NSW Government entity) who has contracted HCCDC as an agent of the State, to complete the KIWEF remedial works in accordance with a Binding Terms of Agreement.

For the purposes of closure, KIWEF has been divided into three areas with Area 2 being the subject of this CEMF while Areas 1 and 3 closure have been completed. Area 2 is further divided into sub areas K3 to K8 with some sub-areas further divided into specific disposal cells.

1.4 Delivery Mechanism

1.4.1 Closure Works

The closure works are to be delivered as a Construction only contract. As such the Contractor is to refer to the Tender Specifications and Design information provided by HCCDC which incorporates and supersedes any design information provided in this CEMF and supporting environmental assessment and management documentation.

1.4.2 Wedge and Peninsular Access

The access track to the Wedge and Peninsular Borrow Pit will be delivered as a design and construct contract so that the Contractor can design the access to cater to their specific equipment access requirements. In addition to complying with the specific environmental performance expectations and mitigation measures contained in this CEMF, the Wedge and Peninsular access will be required to be designed, constructed and used to the satisfaction of ARTC as the owner of the land accommodating the access track.

2. Regulatory Requirements

The key environmental obligations for the closure works arise under the following legislation:

- *Protection of the Environment Operations Act 1997* (POEO Act);
- *Environmental Planning and Assessment Act 1979* (EP&A Act); and
- *Environmental Protection and Biodiversity Conservation Act 2000* (EPBC Act).

Various environmental assessments and management plans have been prepared under these Acts as follows:

- **POEO Act** - NSW EPA (2010), Approval of the Surrender of a Licence – License 6437, (Ref: 1111840, and as varied by notice number 1510956 and 1520063) and associated documents including:
  - Golders (2011), KIWEF Closure Works, Green and Golden Bell Frog Management Plan;
  - GHD (2009), Report on KIWEF, Revised Final Landform and Capping Strategy; and
  - RCA (2012) Materials Management Plan – Kooragang Island Waste Emplacement Facility.
- **EP&A Act** – Hunter Development Corporation Determination under Division 5.1 of the EP&A Act and associated assessment documentation including:
  - ERM (2016), Review of Environmental Factors, KIWEF Area 2 Closure Works; and
  - Jacobs (2018) Addendum Review of Environmental Factors, KIWEF Areas 2 Closure Works.
- **EPBC Act** – Notice of determination of referral number 2016/7670 dated 22 March 2019 and associated documentation including:
  - ERM (2015), KIWEF Area 2 Closure Works, EPBC Referral;
  - ERM (2016), Response to Request for Information, KIWEF Area 2 Closure Works; and
  - Ramboll (2018), EPBC Referral, Preliminary Documentation Package – KIWEF Area 2 Closure Works.

The conditions and commitments of these documents are consolidated in the attached sub-plans.

The Closure Works design has been prepared to comply with these requirements and the Contractor is responsible for implementing these designs. Where departures are proposed by the Contractor, it is the Contractors obligation to demonstrate how compliance with all applicable environment regulations is achieved.

The Peninsular access track is to be designed and constructed by the Contractor to accommodate safe access for the Contractor's equipment, in a manner that achieves the general environmental performance expectations within this CEMF and to the satisfaction of ARTC.

Various other environmental legislation and requirements apply to the site as documented in Appendix A and their requirements are generally captured in the attached sub-plans.

3. General Environmental Management Requirements

3.1 Environmental and Sustainability Management System

The Contractor is required to have a corporate Environmental Management System certified under AS/NZS ISO 14001:2015.

3.2 Environmental Training

All Contractor personnel and sub-contractors will undergo environmental training before commencing works on site. Training will be undertaken in the following forms:

- Project Induction; and
- Regular (daily) pre-start discussions on environmental topics.

Records of induction and training will be kept on the Contractor's database including the topic of the training carried out, dates, names and trainer details. Inductees will be required to sign-off that they have been informed of the environmental issues and that they understand their responsibilities.

3.2.1 Induction

Prior to working on site, the Contractor will ensure that all staff and sub-contractors working on site are appropriately inducted. The Contractors induction must communicate the environmental performance expectations of this CEMF and the specific mitigation measures to achieve these expectations as documented in the Contractors CEMP. Induction content is expected to include:

- Legal and regulatory requirements including duty of care and potential consequences of infringements;
- Environmental responsibilities with detailed training on the implementation of hygiene protocols and the importance of GGBF;
- Identification of sensitive areas including threatened species habitat, waterways, asbestos impacted waste and other hazardous waste;
- Identification of boundaries for vegetation clearing, washing, refuelling and maintenance areas for vehicles, plant and equipment;
- Environmental management techniques for noise, air, surface and ground water, waste generation, contaminated land etc;
- Emergency plans and incident management including the use of spill kits;
- Reporting processes for environmental harm or environmental incidents;
- Roles and responsibilities in achieving conformance with environmental policies and requirements, including emergency preparedness and response requirements; and
- Identification and management of non-conformances.

3.2.2 Daily pre-start talks

Pre-start talks will help to ensure that timely and relevant information is communicated to the workforce and that feedback can be provided on issues of interest or concern. Pre-start talks should address weather forecasts with implications for daily site environmental management (dust or rainfall response requirements) as a minimum, and where necessary, should be used to provide refresher information on the environmental induction topics and associated environmental procedures.

In the event of environmental near misses or incidents, or changes to procedures that could result in changed levels of environmental risks, pre-start talks may be used to deliver updates.

3.3 Emergency Contacts and Response

An emergency response plan would be prepared and implemented during the Project by the Contractor. The emergency response plan should document the contractor's approach to managing potential hazards and risks, incidents and emergencies. In undertaking planning for emergencies, learning from past incidents, applying risk assessments and training methods should be documented.

3.3.1 Emergency Preparedness

The key to effective prevention of environmental incidents involves selecting the right personnel and subcontractors, promoting a positive attitude to the importance of environmental issues, training, controls, monitoring, and surveillance. During construction activities, inspections and preventative action should include:

- Daily inspections of active work sites;
- Completion of routine environmental checklists;
- Issue and timely and effective close-out of maintenance and non-compliance notices;
- Maintenance of constant supervision on site;
- On-going environmental training; and
- Environmental audits of work sites, subcontractors and compliance issues.

Environmental and safety information on hazardous substances (e.g. safety data sheets) should be made available at the main site office and near to where such substances are stored and used. These locations will be communicated to all personnel.

Testing of and training in environmental response procedures should be conducted in areas where a pollution risk is present, such as on site and near re-fuelling areas for spill awareness, or worksites near environmentally sensitive areas. Personnel involved in emergency response activities should be provided with specific training.

An up-to-date list of emergency response personnel and organisations should be developed and maintained at the Contractor's main project office.

4. Implementation

4.1 Risk Assessment

The consideration of potential environmental risks has been undertaken through the Environmental Impact Assessment Process. This process has drawn on a significant volume of information. As a minimum, the Contractor is required to have read and understood the documents listed in Chapter 2 such that they have an adequate understanding of the environmental context and management expectations for the Closure Works. In preparing the Contractor's Construction Environmental Management Plan, the Contractor is required to undertake any additional risk assessment they deem necessary to manage environmental risks, such that the performance expectations of the CEMF are achieved when implementing their nominated construction methodology.

Based on HCCDC's understanding of the site, the following priority environmental factors and aspects were identified:

- Flora and Fauna Management;
- Erosion and Sediment Control, and Water Management;
- Contaminated Materials Management; and
- Rehabilitation.

In addition to the above priority environmental management requirements, suggested mitigation measures for environmental risks including traffic, air quality, lighting, noise, waste, rehabilitation and heritage are addressed in the attached sub-plans and are to be incorporated into the Contractor's work methods.

4.2 Environmental Management Activities and Controls

The documents listed in Chapter 2 identify environmental management and monitoring measures that apply to the Closure Works. These documents include:

- Hunter Development Corporation - Report on KIWEF - Revised Final Landform and Capping Strategy - August 2009 - Revision 2, prepared by GHD (the Capping Strategy);
- 'Green and Golden Bell Frog Management Plan – Kooragang Island Waste Emplacement Facility Closure Works' dated 19 April 2011 and prepared by Golder Associates;
- 'Materials Management Plan - Kooragang Island Waste Emplacement Facility' dated November 2012 prepared by RCA Australia; and
- 'EPBC Referral Preliminary Documentation Package – KIWEF Area 2 Closure Works' June 2018 prepared by Ramboll (the PDP).

The Surrender Notice also requires that the implementation of these plans and strategies to be validated through a report provided to the NSW EPA to allow the lifting of the Surrender Notice obligations. The summary of the measures required to be implemented and when are presented in Appendix B.

Further detail on the above documents has been incorporated into sub-plans prepared as part of this CEMF. These have been prepared based on requirements of the Surrender Notice, EPBC Act Referral outcome, Review of Environmental Factors, previously completed capping works and current industry practice to provide guidance on how to manage certain aspects of environmental management during construction.

The suite of action plans addressing priority environmental aspects includes the following:

- Appendix C. Materials Management Plan
- Appendix D. Flora and Fauna Management Plan

- Appendix E. Revegetation Management Plan
- Appendix F. Water Quality Management Plan
- Appendix G. Traffic Management
- Appendix H. Air Quality Management
- Appendix I. Noise Management
- Appendix J. Heritage management

The Contractor is expected to be fully aware of the requirements of these sub-plans in preparing their tender and program and to be prepared such that extensive clearing and bulk excavation works on site do not commence prior to all required environment controls being in place for any given works area.

4.3 Environmental Control Plans or Maps

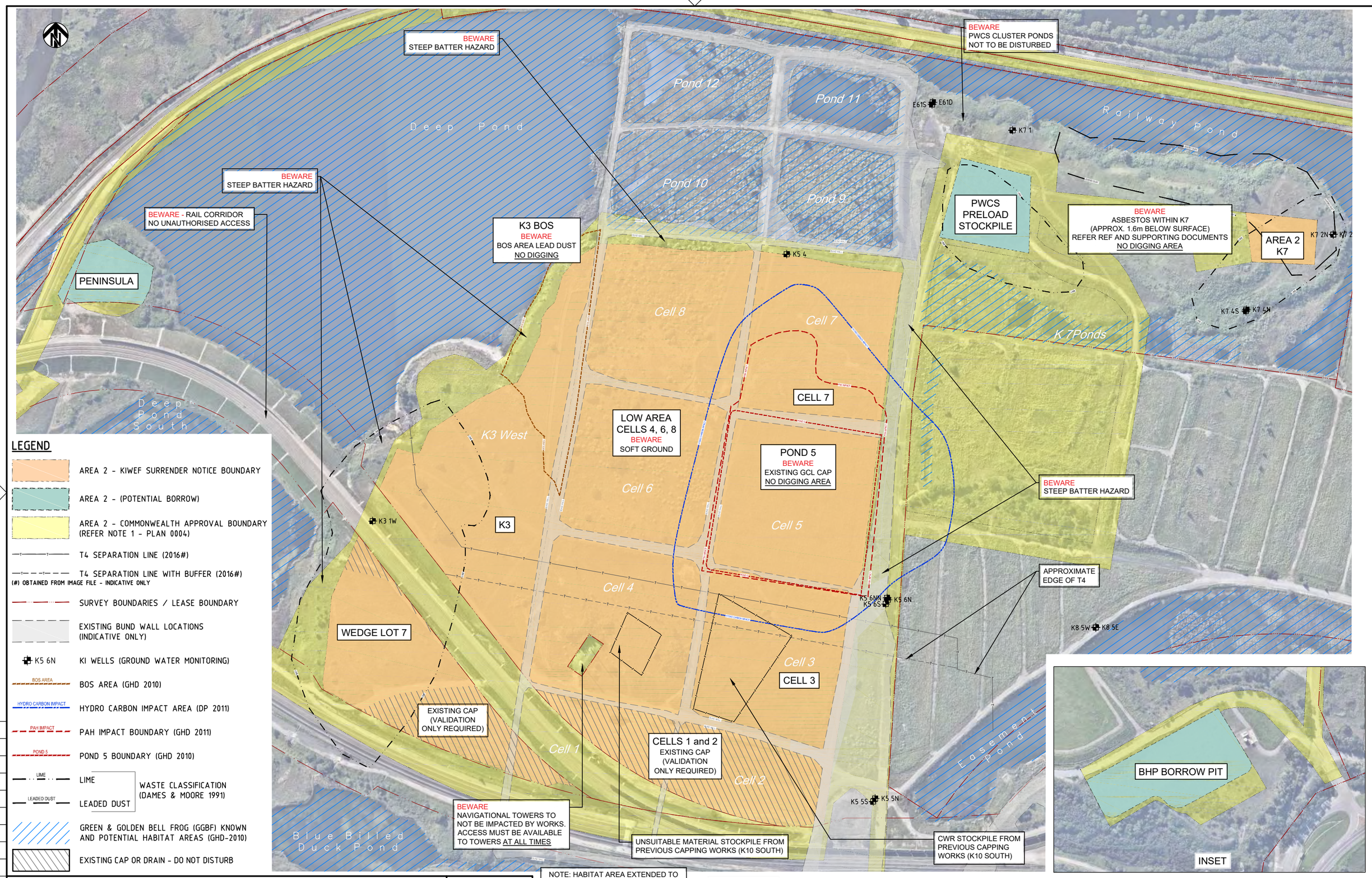
A Preliminary Environmental Control Map, reproduces Constraints Map prepared by SMEC, is provided below. This Preliminary Environmental Control Map is to be updated by the Contractor to address Contractor's specific work methods. The Environmental Control Map is to be specific to the site and outline the location of protection measures, monitoring requirements and environmentally sensitive areas. The Environmental Control Map forms the practical application of the proposed control measures contained within this CEMF.

The Environmental Control Map is to be used in project inductions, work site set-up, reviewing ongoing environmental performance and be included as information in tender documents to subcontractors where applicable.

The project Environmental Control Map is to be updated to include:

- The worksite layout and boundary, including entry/exit points and internal roads and clearing limits;
- Location of adjoining land-use and nearest noise sensitive receivers;
- Location and type of sediment and erosion control measures, including size / capacity of detention basins and wheel wash facilities;
- Location and type of fauna exclusion fences;
- Location of site offices;
- Location of spill containment and clean-up equipment;
- Location of worksite waste management facilities;
- Hours of work applicable to the worksite (including specific time windows for deliveries and any restrictions on high noise generating activities).
- Location of environmentally sensitive areas (e.g. threatened species, critical habitat, known contaminated areas, etc)
- Vegetation and trees to be protected;
- Location of stormwater drainage and watercourses leading to / from the worksite; and
- Summary of specific environmental management requirements from licenses, approvals or permit conditions.

The provisions of this plan apply in addition to any erosion and sediment control plans or other documentation that specify the location of environmental controls on site.



LEGEND

- AREA 2 - KIWEF SURRENDER NOTICE BOUNDARY
- AREA 2 - (POTENTIAL BORROW)
- AREA 2 - COMMONWEALTH APPROVAL BOUNDARY (REFER NOTE 1 - PLAN 0004)
- T4 SEPARATION LINE (2016#)
- T4 SEPARATION LINE WITH BUFFER (2016#)
- (#) OBTAINED FROM IMAGE FILE - INDICATIVE ONLY
- SURVEY BOUNDARIES / LEASE BOUNDARY
- EXISTING BUND WALL LOCATIONS (INDICATIVE ONLY)
- K5 6N — KI WELLS (GROUND WATER MONITORING)
- BOS AREA — BOS AREA (GHD 2010)
- HYDRO CARBON IMPACT — HYDRO CARBON IMPACT AREA (DP 2011)
- PAH IMPACT — PAH IMPACT BOUNDARY (GHD 2011)
- POND 5 — POND 5 BOUNDARY (GHD 2010)
- LIME — LIME
- LEADED DUST — LEADED DUST
- WASTE CLASSIFICATION (DAMES & MOORE 1991)
- GREEN & GOLDEN BELL FROG (GGBF) KNOWN AND POTENTIAL HABITAT AREAS (GHD-2010)
- EXISTING CAP OR DRAIN - DO NOT DISTURB

150 mm ON ORIGINAL

A1

DRAWING FILE LOCATION / NAME: D:\SMEC\30011921_KIWEF\CAD\DWG\0006_D.dwg

PLOT DATE: 16 Dec 2018 TIME: 16:51:10

EXTERNAL REFERENCE FILES: X_AH_Kooragang Image; x_Newc_a1_30011034; x_SMEC MASTER BDY; x_SMEC MASTER HABITAT; x_SMEC MASTER GEO; x_M&P_Survey 160477A_

REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
A1	27.09.18	ISSUED FOR 90% PROGRESS REVIEW	-	-
A2	5.10.18	ISSUED FOR 90% REVIEW	-	-
B	13.11.18	ISSUED FOR 100% REVIEW	-	-
C	28.11.18	ISSUED FOR PRE-TENDER ESTIMATE	-	-
D	17.12.18	ISSUED FOR TENDER	001	EW

TITLE	NAME
DRAFTER	MLC
DRAFTING CHECK	EW
DESIGNER	MLC
DESIGN CHECK	JH
PROJECT MANAGER	EW
PROJECT DIRECTOR	JK

SCALES AT A1 SIZE DRAWING

0 20 40 60 80 100m

SCALE 1:2000 AT ORIGINAL SIZE

DESIGNER

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CLIENT

NSW GOVERNMENT

Hunter & Central Coast Development Corporation

TITLE

KOORAGANG ISLAND WASTE EMPLACEMENT FACILITY
STAGE 5 CLOSURE WORKS AREA 2 (K3/K5/K7) CONTRACT HCCDC 18/04

SEPARABLE PORTIONS 1 and 2 - GENERAL

CONSTRAINTS PLAN

SCALE	PHASE	PROJECT / DRAWING No.	REVISION
1: 2000	TENDER	0006	D

4.4 Environmental Schedules

The Environmental Schedules set out below represent the records likely to be required to be kept during the Project.

- Weekly and post rainfall site inspection checklist;
- Daily materials tracking forms;
- Level 2 and Level 3 notification forms;
- Notified materials tracking register;
- Water quality monitoring results register;
- Dewatering form;
- Waste Register;
- Induction record;
- Internal Audit Register;
- Non-Conformance Register;
- Complaint Form; and
- Complaint Register.

The form and content of the Environmental Schedules is to be provided by the Contractor in accordance with their Environmental Management System.

5. Monitoring, Reporting and Review

5.1 Environmental Monitoring

As part of the overall environmental management of the site, during the landfill closure works, the Contractor is to conduct at least weekly inspections of all mitigation measures. The results of these inspections will be recorded on a weekly environmental inspection record. Should non-conformances be identified, the Contractor is required to undertake corrective action to address the issue.

The following construction monitoring is required:

- Daily prestart checks on amphibian-disease hygiene station functioning and supplies, and weather forecast noting predicted wind and rain;
- Real-time classification of materials to nominated thresholds in accordance with the Materials Management Plan decision matrix;
- Post rainfall checks of sediment dam water level and water quality, and erosion and sediment control functioning;
- Inspection covering sediment dam water levels and water quality, erosion and sediment control structures, frog fences, fuel and chemical storage, stockpile bunding and covers;
- Sediment basin discharge or dewatering water quality sampling and analysis suitable to demonstrate pollution of water has/will not occur;
- noise monitoring of any out of hours construction works in accordance with Interim Construction Noise Guidelines;
- visual observations of visible dust levels to confirm no off site dust impacts; and
- post capping defects and liabilities monitoring including revegetation success monitoring.

Where recommended actions are suggested, priorities should be set against these actions for site implementation. The list of actions should be distributed to the responsible personnel. A close out system must be included.

The defects and liabilities period is linked to a demonstration of performance against parameters to be negotiated with the HCCDC. These are likely to include revegetation success and surface water quality.

In accordance with notice of determination condition 11 and 12, accurate and complete compliance records are required to be maintained and provided to the Department of Environment and Energy on request.

5.1.1 Construction Water Quality Monitoring

The closure works are required to comply with the general duty not to pollute waters under section 120 of the POEO Act. The contractor will be required to take adequate precautions to ensure either that discharge/or dewatering is not required, or otherwise undertake sampling and analysis to demonstrate that pollution of water has or will not occur associated with water releases from sediment basins.

In the absence of an EPL, to avoid causing pollution and breaches of section 120, any water discharged from site must be of the same quality, or better, than the quality of the receiving waters (at the time of discharge) or able to be demonstrated to not have caused water pollution.

It is noted that water pollution or pollution of waters means:

- placing in or on, or otherwise introducing into or onto, waters (whether through an act or omission) any matter, whether solid, liquid or gaseous, so that the physical, chemical or biological condition of the waters is changed, or
- placing in or on, or otherwise introducing into or onto, the waters (whether through an act or omission) any refuse, litter, debris or other matter, whether solid or liquid or gaseous, so that the change in the condition of the waters or the refuse, litter, debris or other matter, either alone or together with any other refuse, litter, debris or matter present in the waters makes, or is likely to make, the waters unclean, noxious, poisonous or impure, detrimental to the health, safety, welfare or property of persons, undrinkable for farm animals, poisonous or harmful to aquatic life, animals, birds or fish in or around the waters or unsuitable for use in irrigation, or obstructs or interferes with, or is likely to obstruct or interfere with persons in the exercise or enjoyment of any right in relation to the waters, or
- placing in or on, or otherwise introducing into or onto, the waters (whether through an act or omission) any matter, whether solid, liquid or gaseous, that is of a prescribed nature, description or class or that does not comply with any standard prescribed in respect of that matter.

A summary of water quality monitoring including sample results is required to be submitted to the HCCDC following any dewatering or discharge event demonstrating that the Contractor has complied with the above obligations.

5.1.2 Environmental Auditing

Internal and external environmental audits should be undertaken throughout the construction process to ensure that the project environmental requirements and Contractors CEMP are implemented appropriately.

The auditing process should be designed to identify any non-conformances, providing an opportunity to apply corrective and / or preventative action where appropriate. The Audit schedule is to include:

- Internal environmental audit by the Contractor's Environmental Manager on a three monthly basis during construction;
- Regular attendance at the site by the KIWEF Area 2 Closure Works Independent Auditor; and
- Independent audit of compliance with the notice of determination conditions following the completion of onsite construction works and prior to completion of the project works period.

5.2 Reporting

The implementation of the Closure Strategy and contract requires the following reporting on environmental performance:

- Daily record of material management including notification of identification of potential Level 2, Level 3 or otherwise hazardous materials;
- Monthly progress reporting;
- Validation reporting following practical completion; and
- Annual compliance reporting against the notice of determination.

Detailed requirements of these reports are included in the Tender Specifications. The following summarises the expected content of each level of reporting.

5.2.1 Daily Record of Material Management

The daily record of material management is required to summarise material interaction for the day and include:

- Description of earthworks activity undertaken;

- Description of cut to fill or cut to stockpile activities including locations;
- Notification of HCCDC of suspected contaminated or otherwise hazardous material encountered and description of handling, current location, further assessment required; and
- Summary of any handling of previously notified material including update on current location.

All notifications are also to be tracked through a notifications register to record final disposal location.

5.2.2 Monthly Progress Reporting

Monthly Progress Reporting is to include details of the implementation environmental management requirements including:

- Update on any environmental risks and opportunities, and significant environmental impacts associated with the work;
- Progress against environmental objectives, targets and measures of performance; and
- Management actions, including environmental controls, training, inspections and testing.

Specifically, the environmental monthly reporting is to include such items as:

- Characterisation, site management and fate of contaminated material, collated materials tracking information;
- Quality assurance on placed material;
- Non-compliances and corrective actions;
- Environmental monitoring requirements; and
- Monthly logs and photographs and other records of the progressive compilation of information that will be integrated into the Validation Report on completion.

5.2.3 Validation Report

The Validation Report is required to satisfy Condition 4h of the Surrender Notice which requires that there is written confirmation that the cap was established in accordance with relevant specifications as follows:

"Within three months of completion of the installation of the final cap, the licensee must provide the EPA with a written Validation Report that includes:

i) Advice that the final cap has been installed;

ii) Advice from a suitably qualified and experienced person as to whether or not the cap was installed in accordance with Chapter 7 of the Landform and Capping Strategy and relevant conditions of this Notice, or future variations to this Notice;

iii) Provision of the results of all relevant test results to validate that the permeability of the final capping layer is less than or equal to K = 1 x 10^{-7}m/s. Permeability testing must be taken of the sealing layer material at a rate of not less than 1 per 2000T (or 1250m^3);

iv) Provision of information that establishes the thickness of the installed sealing and revegetation layers in the format of either:

(i) As constructed drawings, including cross sections, of the surfaces of the coal washery reject layer; and

(ii) The results of surveys undertaken for each capping layer by a registered surveyor".

The Contractor is to allow for all effort necessary to assemble adequate validation evidence throughout the implementation of the Closure Works and for the preparation of the validation report. For the avoidance of doubt, the Contractor is required to validate that the Closure works have been delivered in accordance with the design and Tender Specification in relation to capping parameters and the Materials Management Plan in relation to materials handling and tracking. The environmental performance expectations within this CEMF must be achieved as part of the Contract but are not required to be incorporated into the Validation Report. Evidence of compliance is to be available on request by HCCDC.

5.2.4 Annual compliance reporting

During the performance of the contract, and as a condition of satisfaction of the care and maintenance obligations, the Contractor will be responsible for the preparation of an annual compliance report against the conditions of the notice of determination.

5.3 Corrective Action

Non-compliance may be identified through routine weekly site inspections, impromptu site inspections, via the CEMF or CEMP review or audit process or be incident based.

Environmental non-conformance include:

- non-compliance with environmental management controls or mitigation measures specified within the CEMP;
- environmental incidents not threatening material harm to the environment; and
- environmental emergencies threatening material harm to the environment.

Corrective actions may be triggered by any of the above and will include immediate steps taken to control event, investigation and development additional controls to prevent recurrence. Corrective actions will be developed in consultation with the HCCDC and will be assigned to the appropriate staff for close out. All corrective actions will be tracked through to completion through the non-conformance tracking register.

All environmental non-conformances with project approvals, this EMP or Contractor procedures is to be recorded as an incident, investigated and closed out by the Contractor. Close-out is required to include Construction supervisor sign-off that corrective actions have been implemented or alternative solutions substituted. A summary of all non-conformances and associated corrective actions is to be provided to the HCCDC.

In addition to the above, incidents causing or threatening material harm to the environment are regulated under the POEO Act, which defines material harm under section 147, as follows:

(1a) harm to the environment is material if

(i) it involves actual or potential harm to the health or safety of human beings or to ecosystems that is not trivial, or

(ii) it results in actual or potential loss or property damage of an amount, or amounts in aggregate, exceeding $10,000 (or such other amount as is prescribed by the regulations), and

(1b) loss includes the reasonable costs and expenses that would be incurred in taking all reasonable and practicable measures to prevent, mitigate or make good harm to the environment;

(2a) it does not matter that harm to the environment is caused only in the premises where the pollution incident occurs.

The POEO Act requires incidents causing or threatening material harm to the environment to immediately notify the relevant authorities, which include:

- the EPA;
- Newcastle Council;
- the Ministry of Health;
- the WorkCover Authority; and
- Fire and Rescue NSW.

The POEO Act outlines responsibilities down to an individual level to notify incidents threatening material harm to the environment immediately. In general terms all individuals are responsible for reporting such incidents to the Construction Project Manager who in turn will inform HCCDC. HCCDC would then notify relevant authorities. It also requires that an individual notify the incident where they cannot make contact with their employer. Relevant authority contact details are included in the table below and should be displayed where all site workers can access them easily in the event of a notifiable incident occurring.

Table 1 Relevant Authority Contact Details

Contact	Phone Number
The EPA Environment Line	131 555
The Ministry of Health via the Public Health Unit	1300 066 055
SafeWork NSW	13 10 50
Newcastle City Council	02 4974 2000
Fire and Rescue NSW	000

Environmental incidents relating to the *Environmental Protection and Biodiversity Conservation Act 1999* must be notified to the Secretary of the Department of the Environment and Energy. Specifically, conditions 16 and 17 of the Notice of determination require the following:

16. The approval holder must notify the Department in writing of any: incident; non-compliance with the conditions; or non-compliance with the commitments made in plans. The notification must be given as soon as practicable, and no later than two business days after becoming aware of the incident or non-compliance. The notification must specify:

a. the condition which is or may be in breach; and

b. a short description of the incident and/or non-compliance.

17. The approval holder must provide to the Department the details of any incident or non-compliance with the conditions or commitments made in plans as soon as practicable and no later than 10 business days after becoming aware of the incident or non-compliance, specifying:

a. any corrective action or investigation which the approval holder has already taken or intends to take in the immediate future;

b. the potential impacts of the incident or non-compliance; and

c. the method and timing of any remedial action that will be undertaken by the approval holder.

5.4 CEMF Review

This CEMF forms the basis on which the contractor's CEMP should be prepared and as such is to be reviewed/adapted or superseded based on the contractor's specific work methods and approach to environmental management. The Contractor's CEMP should be reviewed in accordance with the requirements of their environmental management system but should also be reviewed during implementation as and when required, including when the following situations arise:

- Client recommendations for changes (particularly following initial review);
- Opportunities for improvement or deficiencies in the project system are identified; or
- Following an audit of the system or the occurrence of significant incidents and non-conformances.

Appendix A. Legislative requirements

Legislation and administering authority	Requirement	Application to Closure Works
Environment Protection and Biodiversity Conservation Act 1999 Commonwealth Department of the Environment and Energy	The relevant objective of the Act is to provide for the protection of the environment, especially those aspects of the environment that are matters of national environmental significance. A project may be defined as a controlled action under the Act due to impacts on matters of national environmental significance.	The Project was determined to be a Controlled Action due to potential impacts to the identified key population of Green and Golden Bell Frogs and associated impacts to the ecology of the Hunter Estuary Ramsar wetland should this population be threatened. The project was approved by the Commonwealth on 22 March 2019 on the basis of the preliminary documentation provided by HCCDC. Conditions of determination have been issued and are incorporated into this CEMF. Notwithstanding anything else within this CEMF and the contract documents, the Contractor is responsible for understanding and complying with the Conditions of determination.
Environmental Planning and Assessment Act 1979 Department of Planning and Environment	Encourages proper environmental impact assessment and management of development areas for the purpose of promoting the social and economic welfare of the community and a better environment.	The Project was assessed and determined under the former Part 5 (now referred to as Division 5.1) of the EP&A Act and found unlikely to significantly impact the environment subject to the implementation of a range of mitigation measures contained within the assessment documentation. These mitigation measures have been incorporated into this CEMF.
Protection of the Environment Operations Act 1997 Environment Protection Authority (EPA)	The relevant objective of the Act is to prevent environmental pollution.	The Project is regulated under the POEO Act through the Surrender Notice but does hold a current Environment Protection Licence (for activities listed under Schedule 1). In addition to complying with the conditions of the surrender notice the general duties to prevent air/ noise/ water pollution and manage waste correctly do apply. It is the contractor's obligation to undertake works in accordance with the surrender notice and in a manner that prevents pollution. Further, the Contractor is the occupant of the site under the POEO Act (as per HCCDC18/04 contract).
Contaminated Land Management Act 1997 NSW EPA	The Act provides a process for the investigation and remediation of land where contamination presents a significant risk of harm to human health or some other aspect of the environment.	While the site is known to contain contamination it is not currently regulated under this Act as it is regulated by the EPA through the POEO Act and it is not the intention of the EPA to regulate the same site under both Acts concurrently. It is the contractor's obligation to manage contaminated materials in accordance with the

Legislation and administering authority	Requirement	Application to Closure Works
		Materials Management Plan such that contaminated materials encountered is appropriately managed to avoid exacerbation and such that the fate of such material is documented.
Dangerous Goods (Road and Rail Transport) Act 2008 EPA / SafeWork NSW	A licence is required for the storage (SafeWork NSW) and /or transport (EPA) of prescribed quantities of dangerous goods.	The Contractor is required to ensure that the transport and storage of dangerous goods exceeding licensable quantities is lawfully undertaken.
Environmentally Hazardous Chemicals Act 1985 EPA	Management of Environmentally Hazardous Chemicals.	Should any material generated or encountered at the site contain chemicals that are the subject of NSW's five (5) current Chemical Control Orders (CCO), then the material will need to be managed in accordance with that CCO. Current CCO include: · Chemical control order in relation to aluminium smelter wastes containing fluoride and/or cyanide (1986) · Chemical control order in relation to dioxin-contaminated waste materials (1986) · Organotin waste materials chemical control order 1989 · Polychlorinated biphenyl (PCB) chemical control order 1997 · Scheduled chemical wastes chemical control order 2004.
Heritage Act 1977 NSW Office of Environment and Heritage (OEH)	The Act aims to encourage the conservation of the State's heritage and provides for the identification and registration of items of State heritage significance.	Not expected to impact any items on the State Heritage Register (SHR). Should the project unexpectedly find any heritage artefacts, the relevant notifications and management actions may need to be taken.
National Parks and Wildlife Act 1974 OEH	The objectives of the Act are for the conservation of nature and the conservation of objects, places or features (including biological diversity) of cultural value within the landscape.	The proposal would not affect any area declared as a National Park, historic site, nature reserve or Aboriginal area nor would it impact any historic Aboriginal object or place, threatened species, population or endangered ecological community. The potential exists for unexpected objects to be found of significance to Aboriginal people. The Chief Executive of the OEH is the authority responsible for the protection of all Aboriginal objects and places in NSW, whether they are on national park estate or not.

Legislation and administering authority	Requirement	Application to Closure Works
Threatened Species Conservation Act 1995 OEH	Provides for the protection of any threatened species on-site.	Impacts to Threatened Species are assessed through the REF and mitigation measures to prevent significant impacts are incorporated into this EMP. Any unexpected species encountered during construction may require further assessment.
Biodiversity Conservation Act 2016 OEH	The purpose of this Act is to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development. The BC Act commenced on 25 August 2017 repealing the *Threatened Species Conservation Act 1995* (TSC Act).	The proposal would be considered a pending Part 5 assessment if it commences within 18 months of August 2017. Under Clause 29 of the BC (ST) Regulations, the former planning provisions continue to apply (and Part 7 of the new Act does not apply) to a pending Part 5 assessment, with the former planning provisions defined as the provisions of the EP&A Act that would be in force if that Act had not been amended by the BC Act and which call-up guidelines established under the TSC Act.
Biosecurity Act 2015 OEH	The primary object of this Act is to provide a framework for the prevention, elimination and minimisation of biosecurity risks which includes the management of plant and animal pests.	The following pests are known to be present on site and will require appropriate management · Bitou Bush (Chrysanthemoides monilifera subsp rotundata), · Crofton Weed (Ageratina adenophora); · Pampas Grass (Cortaderia selloana). · African Olive (Olea europaea), · Lantana (Lantana camara); and · Groundsel Bush (Baccharis halimifolia). In accordance with the Act all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable. Surrounding ponds are also populated by Mosquito Fish (*Gambusia Holbrooki*) and the works are required to avoid any transfer or connection of water bodies that could lead to their spread.
Water Management Act 2000 Department of Lands - Water	The relevant objective of the Act is to protect, enhance and restore water sources, their associated ecosystems, ecological processes and biological diversity and their water quality.	Clause 38 or the Water Management (General) Regulation 2011 provides that a public authority is exempt from section 91E (1) of the WM Act in relation to all controlled activities that it carries out in, on or under waterfront land. As such a

Legislation and administering authority	Requirement	Application to Closure Works
		controlled activity approval is not required for the proposed activity. The water within the fill aquifer is not considered to occur naturally, no use of water in surface water bodies is proposed and no use of other naturally occurring water sources is proposed and as such a water use approval is not deemed necessary. The proposed works do not include aquifer interference and it is understood that the Aquifer interference requirements of the Act are yet to commence and as such aquifer interference approval is not deemed necessary.
State Environmental Planning Policy (Three Ports) 2013 Department of Planning and Environment	The aim of this Policy is to provide a consistent planning regime for the development and delivery of infrastructure on land in Port Botany, Port Kembla and the Port of Newcastle.	The closure works are within the land application area and Lease Area and Environmental Management Works / Environmental Protection works are permissible without consent in the Three Ports Lease Area. The Project has been assessed under the former Part 5 (Division 5.1) of the EP&A Act (refer above).
State Environmental Planning Policy 55 Department of Planning and Environment / Council	The object of this Policy is to provide for a Statewide planning approach to the remediation of contaminated land.	While the closure works also meet the definition of remediation works under this policy, the Three Ports SEPP prevails to the extent of any inconsistency. Clause 8 (4) requires that a person who carries out a remediation work must ensure that the Council notification requirements of clause 16, 17 and 18 are complied with in relation to the work. Notification of Council required 30 days in advance of commencement of Category 2 remediation. Notification of Council following completion.
State Environmental Planning Policy (Coastal Management) 2018	The aim of this Policy is to promote an integrated and co-ordinated approach to land use planning in the coastal zone in a manner consistent with the objects of the Coastal Management Act 2016, including the management objectives for each coastal management area, by: · managing development in the coastal zone and protecting the environmental assets of the coast, and	The closure works area is surrounded by, but does not include, land mapped as coastal wetlands. Parts of the closure works area are mapped as proximity area for Coastal Wetlands, Coastal Environment Area and Coastal Use Area. Importantly, the closure works area is within the Lease Area under the Three Ports SEPP and the Coastal Management SEPP does not apply through the workings of Clause 7 of the Coastal Management SEPP.

Legislation and administering authority	Requirement	Application to Closure Works
	· establishing a framework for land use planning to guide decision-making in the coastal zone, and · mapping the 4 coastal management areas that comprise the NSW coastal zone for the purpose of the definitions in the Coastal Management Act 2016.	
Newcastle Local Environment Plan Newcastle Council	This Plan aims to make local environmental planning provisions for land in the City of Newcastle in accordance with the relevant standard environmental planning instrument under the EP&A Act.	While located within the Newcastle Local Government Area the site is not located on land to which the *Newcastle Local Environmental Plan 2012* (NLEP) applies.

Appendix B. Environmental Obligation Interface

Sequence of Work Activities	Controls/Mitigation Measures	Primary Responsible
Tender and award	· Establish all required approvals under EPBC Act and EPA Act. · Finalise Closure Works design to comply with approvals. · Integrate above requirements into CEMF and Tender Specifications. · Scheduling works to the extent possible to occur outside of the core GGBF breeding period (that is, September to March), especially in areas adjacent to known and potential breeding habitat.	State. Contractor responsible for review of approvals in place and obtaining any additional necessary approvals.
Peninsular / Wedge Access	· Complete access upgrade design to accommodate Contractor equipment in agreement with ARTC.	Contractor in consultation with ARTC
Pre-earthworks monitoring and ongoing EPL Surrender Notice monitoring.	· Update relevant GGBF abundance survey data and water level and salinity logger data. · Undertake annual surface and groundwater monitoring as per EPL Surrender notice.	State Contractor to facilitate access through Closure Works Area as required.
Auditor oversight	· Undertake all necessary site inspections, provide input into materials management decision making to allow auditor sign-off of Closure Works completion.	State to appoint auditor. Contractor to facilitate access and provide validation information as requested by Auditor.
Site Establishment	· Implement hygiene protocol as required for the closure works area (NSW Threatened Species Management Information Circular No.6 (April 2008)). · Establish any controls necessary to prevent works from occurring outside the referral boundary. · Temporary frog exclusion fencing to surround the Closure Works site and ensure GGBF habitat protected from unauthorised access prior to works commencing in those works areas or their parts. · Conduct pre-clearance surveys by a qualified ecologist in week prior to works commencing in works areas or their parts. · Apply erosion and sediment controls as per sensitive environments (Managing Urban Stormwater – Soils and Construction (Landcom 2004)) and complete and line permanent basins as per designs provided by the State.	Contractor

Sequence of Work Activities	Controls/Mitigation Measures	Primary Responsible
	· Prepare stockpile area with adequate space for 'topsoil' level 1, 2 and 3 material and erosion and sediment controls as per ESCP and Materials Management Plan (RCA Australia 2012). · Level 2 and level 3 stockpile areas are to be lined in accordance with materials management plan (RCA Australia 2012) as necessary. · Store all hazardous liquids and chemicals in covered, bunded areas with capacity to retain 110% of largest container in the event of a spill. Proprietary available spill mats, drip trays and pallets can be used as appropriate. · Provide fully stocked spill kit/s and ensure that operators are aware of the location of these kits and are trained in their use.	
Bulk earthworks	· Undertake weed management in advance of broad scale clearing and bulk earthworks. · Win and transport site derived capping and land forming materials. · Use of imported capping material assessed as having a low risk of containing Chytrid Fungus. · Use of revegetation medium materials demonstrated to be low in nutrients and assessed as having a low risk of containing Chytrid Fungus. · Works are to be staged to reduce area of exposure and minimise dust, infiltration and sediment laden run-off. · Qualified ecologist to be available on call during earthworks in the event that any GGBF individuals are encountered during works, the ecologist must be called in to capture and relocate the individuals. · Materials will be managed in accordance with the approved Materials Management Plan and GGBF management plan within each area and no transport of fill, capping or topsoil between areas is to occur. · Strip topsoil to a minimum of 100mm following material management plan decision matrix for suitability for re-use. · Topsoil to be stored separately in prepared stockpile areas as per detailed design documentation. · Stockpiles to be stored for long periods are to be wrapped, covered, re-seeded or wet to minimise dust generation. · Cut to base of excavations as per detailed design documentation insuring minimum 1% grade. Cut material to be used as fill and capping in accordance with materials management plan decision matrix. · The final surface of both capped and uncapped areas will be protected by a vegetative layer. The extent of the revegetation will depend on the proposed site use (i.e. undeveloped, commercial development or habitat areas).	Contractor

Sequence of Work Activities	Controls/Mitigation Measures	Primary Responsible
	· The use of imported topsoil is to be avoided where possible. · Upon completion of the works, the works areas must be rehabilitated in accordance with Rehabilitation Management Plan. · Dispose of materials unsuitable for reuse in accordance with materials management plan. · All waste to be removed upon completion. · Upon completion, site facilities, frog exclusion fencing and security fencing shall be removed as necessary. · Non-permanent erosion and sediment controls are to remain in place until they are no-longer required. · Sediment basins and drains will remain in place as landscape features until they are no longer required. · Refuelling is not to occur in the vicinity of sediment dams, drainage lines or water bodies. · Refuel plant using drip trays/spill mats and other spill containment devices. · Store all hazardous liquids and chemicals in covered, bunded areas with capacity to retain 110% of largest container in the event of a spill. Proprietary available spill mats, drip trays and pallets can be used as appropriate. · Do not leave chemical containers open outside or inside of the bunded areas. · Provide fully stocked spill kit/s and ensure that operators are aware of the location of these kits and are trained in their use. · Spills are to be immediately contained and absorbed using materials provided in the spill kit. · All personnel are to be trained in the appropriate use and disposal of spill kit materials.	
Construction Monitoring	· Daily prestart checks on amphibian disease hygiene station functioning and supplies and weather forecast noting predicted wind and rain. · Real-time classification of soils to nominated thresholds in accordance with the Materials Management Plan decision matrix. · Post rainfall checks of sediment dam water level and water quality and erosion and sediment control functioning.	Contractor

Sequence of Work Activities	Controls/Mitigation Measures	Primary Responsible
	· Weekly site inspection checklist covering sediment dam water levels and water quality, erosion and sediment control structures, frog fences, fuel and chemical storage, stockpile bunding and covers. · Pre-discharge physical water quality condition (temperature; dissolved oxygen; pH; electrical conductivity (EC)) and chemical water quality condition in sediment dams. · Noise monitoring of any out of hours construction works in accordance with interim construction noise guidelines. · Reference to available PWCS/NCIG dust monitoring results to determine off site dust levels.	
Defect Liability period	· Check and maintain the erosion and sediment controls regularly, especially after rainfall, to ensure that they remain effective including: o Collected sediment is to be removed from the controls as necessary to ensure they remain effective. o Collected sediment is to be combined with planting medium for reuse on the site – if appropriate. o All vehicle wheels, tracks and undercarriages must be cleaned prior to exiting the site and travelling on public roads. · Three month vegetation maintenance program to include, watering, weeding as appropriate but excluding the use of fertilisers and pesticides and herbicides. · Pre and post discharge surface water monitoring in sediment dams and receiving waters. · Revegetation monitoring and maintenance to ensure adequate cover. · Preparation of an annual compliance report against the conditions of the notice of determination.	Contractor

Appendix C. Materials Management Plan

Hazardous / Contaminated Material	
Objective	To comply with legislative requirements and ensure that hazardous / contaminated material from construction activities does not cause an environmental nuisance / harm and is handled, categorised, tracked and placed in accordance with the RCA (2012) Materials Management Plan.
Targets	No exacerbation of contamination during construction No environmental incidences involving contaminated/ hazardous materials No pollution events of the surrounding environmental and water ways by contaminated material The movement and ultimate fate of materials is fully tracked
Key Documents	**State Documents** NSW EPA (2010), Approval of the Surrender of a Licence – License 6437, (Ref: 1111840, and as varied by notice number 1510956 and 1520063) GHD (2009), Report on KIWEF, Revised Final Landform and Capping Strategy (Ref: 22/14371/85882 R4) RCA (2012) 'Materials Management Plan - Kooragang Island Waste Emplacement Facility' dated November 2012.
Material Classification	**Level 1** material is any material not exhibiting characteristics indicative of other categories. **Level 2** material is identified as material with any of the following characteristics: strong hydrocarbon odour, ammonia odour, asbestos containing material, evidence of PCB impact (dark staining and phenolic odour), materials with an average concentration of >2,000 mg/kg PAH or material represented by individual PAH concentration >2,500 mg/kg. **Level 3** material is material containing Separate Phase Hydrocarbons.
Mitigation Measures and Controls	The following is generally reproduced from RCA (2012).
Contaminated material identification and management	The Contractors Materials Management Plan is to be adequate to ensure that material management is undertaken in accordance with RCA (2012) in addition to meeting the performance expectations of the Contract Specifications and this CEMF. The Contractors Materials Management Plan is to incorporate a protocol for identification and management of Contaminated Materials that is to include the following: · Appropriate resourcing for real-time supervision of all ground disturbance activities by a suitably qualified and environmental practitioner;

Hazardous / Contaminated Material	
	· Stop work requirements (localised) if any soils are encountered which have distinguishing Level 2 or Level 3 characteristics. · Characterising and delineated Level 2 and Level 3 materials in-situ or at the place of storage following excavation including input from occupational hygienist or other appropriately qualified specialist (Contractor's Specialist) to identify the substance. · Consultation with third party advisors, the State and the auditor to confirm management expectations. All contaminated material encountered during the landfill closure works will be assessed and categorised in accordance with RCA (2012). All material is to be adequately tracked such the that the composition and location of all Level 2, Level 3 and asbestos waste fate is documented and able to be validated. Uncovering of suspected level 2, level 3 or otherwise hazardous material requires the following steps to be undertaken: · Immediately cease work and contact the Site Supervisor · Demarcate the 'unexpected find' to prevent access and install appropriate environmental and safety controls. · Follow the management steps specified below in relation to each material classification; and · If substance is assessed as level 1 material not presenting an unacceptable risk to human health the Site Supervisor to remove controls and continue work.
Level 1 Material management	There is no specific management required for Level 1 material on the site and Level 1 material has unrestricted onsite re-use classification (Section 5.6.1 of RCA 2012). Level 1 material may be used for: · Topsoil where sourced from top 100mm of existing landform; · General land forming; · Buffer material to be placed above Level 2 and Level 3 Material; · Interim bunding for stockpiled material; and · Site capping material. Level 1 material properties are to be validated in accordance with the Tender Specifications for testing and analysis.
Level 2 Material management	Level 2 material is designated as having restricted site use and where encountered is to be managed as follows: · Where suspected Level 2 soils are encountered then the nature and extent of the materials should be validated by laboratory testing to assess whether the materials are still to be classified as Level 2 or Level 3 materials. · If Level 2 material is encountered but is to remain in place and will have sufficient cap (ie >500mm), the vertical extent does not need to be validated.

Hazardous / Contaminated Material	
	· The Contractor is to develop a notification detailing material type, location, estimated quantity and potential contaminants. · The Contractor is to notify the State or its representative within 24 hours of encountering Level 2 material. · Level 2 material may be relocated to a lined and covered short-term stockpiling or skip-bin for further quantification, characterisation and categorisation. · Confirmed Level 2 contaminated material is to be isolated by covering with at least 500mm of Level 1 material, plus 500 mm of cap with preference for material to be left in situ provided there is no immediate risk to the environment or community or otherwise be relocated to an on-site location.
Level 3 Material Management	Level 3 material is designated as having restricted site use and must managed as follows: · The Contractor is to develop a notification detailing material type, location, quantity and potential contaminants. · The contractor is to notify the HCCDC as soon as possible and on the day the material is encountered. · HCCDC will then notify the EPA; · Level 3 material may be relocated to a lined and covered stockpile or skip bin for further characterisation and categorisation and while a decision is made by HCCDC on the preferred manner of ultimate disposal. The HCCDC will provide direction as to the required treatment of Confirmed Level 3 contaminated material which may include: · Isolated by covering with at least 1000mm of Level 1 material, plus 500mm of cap with preference for material to be left in situ provided there is no immediate danger to the environment or community or otherwise be relocated to an on-site location with the area having appropriate controls in place; or · Transported off-site for disposed in a legal manner.
Asbestos Management	Asbestos materials (and ACM) should be managed generally as follows as specified in RCA MMP (2012): · Where at all possible, materials containing bonded asbestos wastes would be fully delineated, be assessed to be at least 1m below final capping, and remain as undisturbed materials managed by in-situ containment; · Should any fill materials containing bonded asbestos wastes require excavation as they are not in-situ more than 1m from the final cap in the earthworks, then consideration would be given to removing the materials and emplaced at a depth of 1m; · Friable asbestos would be assessed and considered for emplacement at a depth of 2.5m below the underside of the capping layer within a purpose built excavation at a location to be agreed with HCCDC; · Final location of any asbestos discovered shall be thoroughly documented including accurate survey of the emplacement area;

Hazardous / Contaminated Material	
	· Where asbestos waste is found in fill that also contains volatile organic compounds or separate phase hydrocarbons, appropriate treatment for recorded contaminants will be required; and · All asbestos is to be managed and handled in accordance with the recommendations of an appropriately licensed Asbestos Assessor/handler. The use of in-situ or ex-situ treatment approach for any materials containing bonded and friable asbestos wastes will be assessed on a case by case basis in relation to volume and risk to human health.
Other waste management	Minimal volumes of material requiring off-site disposal have been encountered in previous stages of KIWEF closure works. In the event that such material is encountered it will be classified in accordance with the Waste Classification Guidelines (2015) and disposed of to a landfill legally able to accept the waste. Wastes generated in completing the capping works are also required to disposed of off-site. All other contaminated materials will be managed on site in accordance with the Materials Management Plan. Waste management measures to be implemented include: · Licensed waste contractors will be utilised to remove waste. · All waste is to be disposed of at a lawful facility (Note: A lawful facility includes one that has the appropriate Development Consent, Environment Protection Licence or is complying with EPA approved conditions and requirements). · Waste must be classified prior to disposal – refer to NSW EPA Waste Classification Guidelines (2015). · Records of the quantity and final locations of all on and offsite waste will be maintained · Provision of skip bins (or equivalent) to be used to collect all general wastes generated during the works. · Provide an adequate number of skip bins on site to contain all general waste generated throughout the works. · Provide bins to enable waste segregation · Provide recycling services (e.g. Paper, Concrete, Steel, Cardboard, Timber). · Ensure housekeeping is maintained and waste is disposed of to the appropriate bin. · Retain waste disposal permits and figures on the amount of waste that has been removed from site.
Monitoring & Reporting	**Real-time Supervision -** Real-time observation of all ground disturbances by a suitably qualified environmental practitioner to identify and manage suspected contaminated material. **Sampling and analysis** of material properties for categorisation and validation purposes in accordance with the tender specifications. The **daily record of material management** is required to summarise material interaction for the day and include: · Description of earthworks activity undertaken;

Hazardous / Contaminated Material	
	· Description of cut to fill or cut to stockpile activities including locations; · Notification to HCCDC of suspected contaminated or otherwise hazardous material encountered and description of handling, current location, further assessment required; and · Summary of any handling of previously notified material including update on current location. All notifications are also to be tracked through a notifications register to record final disposal location. **Monthly Progress Reporting** is to include details of the implementation environmental management requirements including: · Update on any environmental risks and opportunities, and significant environmental impacts associated with the work; · Progress against environmental objectives, targets and measures of performance; and · Management actions, including environmental controls, training, inspections and testing. Specifically, the environmental monthly reporting is to include such items as: · Characterisation, site management and fate of contaminated material, collated materials tracking information; · Quality assurance on placed material; · non-compliances and corrective actions; · environmental monitoring requirements; and · monthly logs and photographs and other records of the progressive compilation of information that will be integrated into the Validation Report on completion. A **Validation Report** is required to satisfy Condition 4h of the Surrender Notice which requires that there is written confirmation the cap was established in accordance with relevant specifications.
Actions	The Contractor's CEMP is to include specific procedure for monitoring, management and documentation of materials management suitable for implementation to achieve the intent of the Materials Management Plan and Surrender Notice under the Contractors specific construction methodology.
Responsibilities	The Contractor is to ensure that appropriate resources and processes are in place and that appropriate records are kept to allow validation that materials have been managed in accordance with the Surrender Notice.
Timeframe	Duration of site activities where works may encounter potentially contaminated fill materials.

Appendix D. Flora and Fauna Management Plan

Flora and Fauna	
Objective	To comply with contractual and legislative requirements and ensure that native fauna and flora are protected from construction activities.
Targets	No death or injury to fauna including the Green and Golden Bell Frog No unapproved destruction of flora
Legal, Contractual & Other Requirements	*Environmental Protection and Biodiversity Conservation Act 1999* *Threatened Species Conservation Act 1995 (repealed)* *Biodiversity Conservation Act 2016 (Transitional Arrangements).*
Site specific planning / approval conditions / licence conditions	**State Documents** NSW EPA (2010), Approval of the Surrender of a Licence – License 6437, (Ref: 1111840, and as varied by notice number 1510956 and 1520063) Golders (2011), KIWEF Closure Works, Green and Golden Bell Frog Management Plan (Ref: 117623029-001-R-Rev0) Jacobs (2018) Addendum Review of Environmental Factors, KIWEF Area 2 Closure Works **Commonwealth Documents** Ramboll (2018), EPBC Referral, Preliminary Documentation Package – KIWEF Area 2 Closure Works (Ref: 318000395)
General Flora and Fauna Mitigation Measures and Controls	General mitigation measures to be considered include: · Adequate run-off, erosion and sedimentation controls should be in place during construction, particularly in areas where run-off has the potential to impact on nearby waterways, surrounding native vegetation, EEC regrowth, and existing drainage line and dam areas. · Care should be taken that any noxious weeds occurring on the site are not further dispersed as a result of the Proposal. A follow up Weed Control Program may be necessary to control the encroachment of these species into surrounding areas. The landowner has a legal responsibility to control and suppress these species on their property under the *Noxious Weeds Act 1995*. The Weed Control Program should be remove weeds by physical means and avoid the use of herbicides. · Stockpiling of soil that may contain seeds of exotic species shall be stockpiled away from adjacent vegetation or drainage lines where they could be spread during rainfall events. · Placement of soil stockpiles away from vegetated areas. · Utilising existing disturbed corridors such as cleared areas, roads, tracks and existing easements, where possible for set up of equipment, stockpile areas and site facilities.

Flora and Fauna	
	· Noxious weeds to be managed in accordance with the expectations under the *Biosecurity Act 2018*. It is recommended that the plants be removed by physical removal, as herbicides may impact GGBFs and their habitat. · Open excavations and storage areas to be inspected regularly for the presence of fauna species. · Plant and equipment brought on to site must be cleaned and free of deleterious material, mud and other material that may harbour weed seeds · Proposed hours of construction are to be maintained to restrict noise and light impacts on nocturnal fauna. · Utilise an onsite ecologist during construction to re-locate any native fauna which may be displaced. · Avoid rubbish and other waste build up to deter feral animals. · Habitat features such as woody debris that may be utilised by fauna within the construction area would be retained and set-aside during the construction period for reinstatement at completion of works. · Any water required for dust suppression will be drawn from ponds established for the purpose. No water for dust suppression will be drawn from existing ponds on the site. The establishment of dedicated dust suppression ponds will be undertaken to prevent the potential spread of Plague Minnow into ponds currently free of this species. The location and procedure for those dedicated dust suppression ponds will be communicated during the site induction and training. · No night works are permitted without additional assessment of potential noise and light impacts. · Lighting of site compounds, if required for safety and security, will avoid light spill outside of the construction works footprint and will be undertaken in accordance with *Australian Standard 4282—1997 Control of the obtrusive effects of outdoor lighting.*
GGBF Management	GGBF impact avoidance is to be based on the following: · Establishment and use of Chytrid Hygiene procedures such that the Chytrid fungus is not brought to site or transferred between areas of the site; · Appropriate levels of GGBF pre-clearance/disturbance surveys and relocation to ensure to the extent possible that direct disturbance areas are free of GGBF on commencement of works in each area; · Establishment of GGBF exclusion fencing such that the risk of GGBF re-entering surveyed areas is prevented; · Establishment of clear boundaries of works areas such that unnecessary disturbance is avoided, particularly adjacent to existing ponds; · Establishment of appropriate erosions and sediment controls to prevent sedimentation and pollution of waters; · Implementation of GGBF risk consideration to all decision making such that unintended consequences to GGBF can be avoided. This includes in considering suitability of imported materials from a Chytrid risk and nutrient perspective and use of chemicals including flocculants, herbicides and pesticides; and · Rehabilitation using species preferred by GGBF (refer to rehabilitation management plan).

Flora and Fauna	
Chytrid Fungus hygiene protocol	A Chytrid Hygiene procedure in accordance with the NSW Threatened Species Management Information Circular No.6 – Service Hygiene Protocol for the Control of Disease in Frogs (April (2008) or most recent revision of that document, must be implemented on the Closure Works site during all works and any other activities undertaken as part of the action. This procedure is to include: · Dedicated disinfection bays established at site entry and all vehicles required to enter via this bay; · All disinfection processes will be monitored and controlled at the Closure Works entry point; · The location of these disinfection bays, and the obligations of disinfection, will be communicated during the site induction and training; · Cleaning and disinfection of workers boots upon entry and exit from the site; · Procedures will be implemented to inspect mobile plant entering the Project site during construction activities to control soil and/or organic matter and to disinfect tyres and wheels of vehicles entering the Project site; and · Vehicles arriving at site muddy will be sent away for more intensive cleaning prior to disinfection.
Chytrid Fungus Risk Assessment Process	The contractor is to demonstrate that suitable risk assessment has been undertaken by an appropriately qualified and experienced ecologist on all imported capping and revegetation materials to demonstrate that it contains a low risk of containing Chytrid. Risk assessment should consider as a minimum: · Material not sourced from known, suspected or likely amphibian habitat areas; · Material unlikely to have had contact with amphibians and no amphibians present in material; and · Material are not to be stored in, or come in contact with material sourced from, areas of known, suspected or likely amphibian habitat prior to transport.
Pre-clearance survey design and clearance methodology.	The Contractor will be responsible for developing a pre-clearance survey and clearing methodology suitable for implementation with the contractors specific construction methods that minimises potential harm to GGBF species. The survey methodology should give consideration to the following factors: · Level of effort warranted in different areas and habitats; · Seasonal factors on GGBF use of habitat; and · Need for night time surveys. · Survey effort required is likely to include: o Targeted active searches of potential GGBF habitat located within the disturbance footprint; o Conducted to minimise disruption of breeding activities: relocated tadpoles or metamorphs; · Be conducted in accordance with hygiene protocol;

Flora and Fauna	
	· Habitat resources including all wet areas as well as rocks, logs, tussock forming vegetation, and other cover will be searched during diurnal visual inspections. · A nocturnal habitat search including visual search, spotlighting and call playback may be conducted to assess nocturnal use (breeding/calling) in the habitat supported in disturbance area, if the surveys are conducted during core breeding season (spring/summer); · Any GGBF observed within the disturbance footprint will be relocated in accordance with relocation procedure provided in the GGBF Management Plan prior to commencement of disturbance; and · The survey methodology implemented should allow the qualified and experienced ecologist to confirm that the risk of GGBF mortality has been reduced to the extent reasonable and feasible for the applicable habitat type/area. The clearing methodology should include the following: · Consideration of most appropriate time to install frog exclusion fences; · Presence of an appropriately qualified and experienced ecologists during clearing; · Gradual degradation of higher risk habitat areas progressing from areas furthest away from pond towards areas of refuge; · Relocation of cleared vegetation to areas away from immediate works that allow remaining amphibians to escape; and · Ability to open amphibian fences during clearing at key times to allow fauna to escape.
Amphibian Relocation	If any frog specimens thought to be a GGBF are observed and are within project disturbance area the following relocation procedure will be implemented: · Observer to notify Site supervisor who in turn is to notify the HCCDC, a suitably qualified ecologist, and the Contractor's supervisor of the frog's location immediately; · Contractor supervisor to halt work in the immediate vicinity to prevent accidental interaction with the frog; · The ecologist or HCCDC's environmental representative will determine whether the frog is likely to be harmed by works or is likely to migrate to an area that it could be harmed; · If likely to be harmed by works the GGBF will be captured by the ecologist or suitably trained frog handler following GGBF handling and Hygiene procedures; · A one frog per bag policy will be observed with disinfection of all equipment undertaken immediately following any contact with frogs of any description; · If healthy the frog will be held in a cool, dark, moist place until nightfall before being released to a suitable location in the immediate vicinity of capture but outside the disturbance footprint;

Flora and Fauna	
	· GGBF showing Chytrid symptoms and deemed unlikely to survive transportation will be euthanized and preserved prior to dispatch to a designated sick or dead frog recipient in accordance with Appendix 2 of the National Parks and Wildlife Service's Hygiene protocol for the control of disease in frogs (NPWS, 2008); · If deemed likely to survive transportation GGBF will be placed in a damp cloth bag or partially inflated plastic bag with leaf litter; · Dead frogs will be preserved in accordance with the approved GGBF management plan including cutting open stomach and preserving in 10 times the volume of the specimen of 65% ethonol or 10% buffered formalin · The designated sick or dead frog recipient will be contacted prior to transport to confirm appropriate procedures; · Containers used for storing frogs will be labelled with date, location and species if known; and · A standardised collection form must be completed and a copy sent with the specimen.
Actions	The contractors CEMP is required to establish the actual pre-clearance and clearance methodology, exclusion fence designs and Chytrid Risk assessment and documentation proposed.
Responsibilities	Contractor's Ecologist is responsible for ensuring risks to Fauna is minimised to the extent reasonable and feasible. Contractor's Project Manager is responsible for allowing sufficient time within program to conduct pre-clearance and clearance in a manner that maximises survival of GGBF and other fauna following the advice of the Ecologist. Contractor is responsible for notifying the Principal of any sick or dead GGBF. All personnel are responsible for ensuring that the clearing limits are addressed and native flora and fauna species are protected. All site personnel to undertake toolbox talks in relation to the reporting process for injury/ death to fauna or clearing of flora occurring beyond the required limits for construction.
Timeframe	Duration of the works.
Monitoring & Reporting	Daily visually monitoring by site supervisors for obvious signs of fauna and the functioning of controls including fences and Chytrid hygiene stations. Weekly inspections to be documented on a Weekly Environmental Inspection Checklist. Outcomes of pre-clearance surveys are to be documented and provided to the HCCDC. Observed sick or dead GGBF are to be notified to the Principal immediately.

Appendix E. Revegetation Management Plan

Revegetation Management Plan	
Objective	To comply with State and Commonwealth approvals requirements and related conditions. To provide a post construction environment that is revegetated to stabilise the capping surface; and planted with species known to be favoured by GGBF.
Targets	The capped surface is stabilised and vegetated within 12 months of construction completion. Provide a revegetated capped surface that includes species of flora known to be favoured by GGBF.
Key Documents	**State Documents** NSW EPA (2010), Approval of the Surrender of a Licence – License 6437, (Ref: 1111840, and as varied by notice number 1510956 and 1520063) Golders (2011), KIWEF Closure Works, Green and Golden Bell Frog Management Plan (Ref: 117623029-001-R-Rev0) GHD (2009), Report on KIWEF, Revised Final Landform and Capping Strategy (Ref: 22/14371/85882 R4) Jacobs (2018) Addendum Review of Environmental Factors, KIWEF Area 2 Closure Works **Commonwealth Documents** Ramboll (2018), EPBC Referral, Preliminary Documentation Package – KIWEF Area 2 Closure Works (Ref: 318000395)
Mitigation Measures and Controls	General mitigation measures to be considered include: · Care should be taken that any noxious weeds occurring on the site are not further dispersed as a result of the Proposal. A follow up Weed Control Program may be necessary to control the encroachment of these species into surrounding areas. The landowner has a legal responsibility to control and suppress these species on their property under the *Noxious Weeds Act 1995*. The Weed Control Program should be remove weeds by physical means and avoid the use of herbicides · Stockpiling of soil that may contain seeds of exotic species shall be stockpiled away from adjacent vegetation or drainage lines where they could be spread during rainfall events. · Placement of soil stockpiles away from vegetated areas. · Utilising existing disturbed corridors such as cleared areas, roads, tracks and existing easements, where possible for set up of equipment, stockpile areas and site facilities · Bitou Bush and Crofton Weed would be managed by following the Local Noxious Weed Control Plans (NCC 2006). It is recommended that the plants be removed by physical removal, as herbicides may impact GGBFs and their habitat.

Revegetation Management Plan	
	· Plant and equipment brought on to site must be cleaned and free of deleterious material, mud and other material that may harbour weed seeds · Works associated with the closure of the KIWEF must only occur within the closure works area (project footprint); and must be restricted to the extent required to satisfy the Surrender Notice requirements. · All disturbed surfaces will be revegetated within 1 month of final land forming and in compliance with the landscaping plans. · Any capping materials that are imported from outside the KIWEF facility must be sourced from an area that is assessed as having a low risk of containing Chytrid Fungus. The Chytrid Assessment Process will follow the below procedure: · The contractor is to demonstrate that suitable risk assessment has been undertaken by an appropriately qualified and experienced ecologist on all imported capping and revegetation materials to demonstrate that it contains a low risk of containing chytrid. Risk assessment should consider as a minimum: o Material not sourced from known, suspected or likely amphibian habitat areas; o Material unlikely to have had contact with amphibians and no amphibians present in material; and o Material stored in a dry location prior to transport. · Topsoil to be used for surface layers must be sourced from within KIWEF to the extent possible and will otherwise be assessed as low in nutrients and having a low risk of containing Chytrid Fungus to be protective of adjacent MNES habitat. · Upon completion of works, the works area will be rehabilitated with vegetation species known to be favoured by GGBF. · Open stormwater infrastructure across the KWIEF site will be planted with species known to be favoured by GGBF. This revegetation and rehabilitation strategy will include a 2m wide buffer on either side of the stormwater drains. The intention is to provide movement corridors for GGBF across the site. · Drainage culverts will, where practicable, be vegetated and lined with rocks and objects that may provide temporary frog refuge, in the event that a frog seeks to traverse the future capped area of KIWEF. · Habitat features such as woody debris that may be utilised by fauna within the construction area would be retained and set-aside during the construction period for reinstatement at completion of works. · Prior to the Construction Completion dates the Contractor is required to seed the vegetation layer above the capping layer and reseed areas where sparse vegetation coverage is achieved by the end of the care and maintenance period.
Species Mix	<u>Aquatic vegetation:</u> · Selection of reeds that provide good habitat cover such as Typha, Bolboshoenus, Phragmites, and Juncus; · A mixed community is preferable to single species stands;

Revegetation Management Plan	
	· GGBF prefer wetlands with sections of open water. Water depth should be deep enough to prevent Typha spreading across the entire pond area; the reeds should be mainly at the edge of ponds; Substrate at edges should be suitable for reed growth (i.e. not too many pebbles, sandbags, etc.); · Areas of low blanketing vegetation are also desirable for GGBF breeding, for example, Paspalum grass and Shoenoplectus rush; · Establishing aquatic plants with planting after Closure Works: will maximise structural suitability of wetland to immigrating GGBF as soon as construction is completed. <u>Terrestrial vegetation:</u> · Stabilise new works with sterile millet (or other suitable cover crop); · Retain seed bank in fill taken from site (to be reused); · Avoid large tree species (as roots may potentially compromise the cap); Allow terrestrial species to re-colonise Drainage culverts will, where practicable, be vegetated and lined with rocks and objects that may provide temporary frog refuge, in the event that a frog seeks to traverse the future capped area of KIWEF.
Performance Criteria	Establish adequate vegetation coverage across the closure area. Where vegetation regrowth is sparse (ie less than 50% growth) in areas of greater than $10m^2$, the performance criteria will be considered to have failed and contingency measures are required. No deep-rooted vegetation (ie large shrubs or trees) on top of capped surface
Contingency Measures	Where Vegetation Coverage has been identified to be insufficient, the area will be reseeded. Where deep-rooted vegetation is identified on top of capped surface. The vegetation will be removed (mechanically where possible).
Responsibilities	The Contractor is responsible for undertaking the work, monitoring and maintenance of all elements of the revegetation management plan, until the completion of the construction maintenance period (indicatively 3 months post construction completion). The State (or its agent) is responsible for the monitoring and maintenance of all elements of the revegetation management plan and any rectification works, following the completion of the construction maintenance period.
Timeframe	For the duration of the construction works; and the construction maintenance period.
Monitoring & Reporting	Vegetation establishment will be visually monitored monthly during the construction works and construction maintenance period to identify any areas where vegetation is failing to establish. Should vegetation not establish within the construction maintenance period then targeted seeding and/or planting would be undertaken.

Appendix F. Water Quality Management Plan

Water Quality Management Plan	
Objective	To comply with State and Federal approval requirements. To prevent water discharges from construction works area to the extent possible. To manage water discharged to avoid impact to receiving waters.
Targets	No sediment or water quality impacts to the surrounding environment and waterways from the construction works.
Key Documents	**State Documents** NSW EPA (2010), Approval of the Surrender of a Licence – Licence 6437, (Ref: 1111840, and as varied by notice number 1510956 and 1520063). GHD (2009), Report on KIWEF, Revised Final Landform and Capping Strategy (Ref: 22/14371/85882 R4) **Commonwealth Documents** Ramboll (2018), EPBC Referral, Preliminary Documentation Package – KIWEF Area 2 Closure Works (Ref: 318000395)
Controls	Erosion and sediment control will be designed, installed and managed as follows: · Progressive erosion and sediment control plans (ESCPs) will be developed by the Contractor and implemented prior to the commencement of topsoil stripping and earthworks. · The for construction design for permanent sediment basins is to be in accordance with the environmental protection standards for sensitive environments based on Managing Urban Stormwater - Soils and Construction, (Landcom, 2004), as well as documents from other States and internationally (such as “International Erosion Control Association – Australasia”). · The Contractor is required to install the permanent sediment basins as per the for construction design and any necessary temporary erosion and sediment control measures in advance of bulk-earthworks reporting to each basin. · Alternative arrangements proposed by the Contractor are also required to be in accordance with these standards. · Erosion and sediment control structures are to be regularly inspected and maintained, particularly in advance of and following significant rainfall events. · Any water discharges are required to be managed to avoid pollution of waters having regard to the sensitivity of the receiving environment. In particular, any flocculants are to be demonstrated as being both effective and safe for amphibians prior to use. · Top soil/mulch stockpiles to be not greater than 2.0m in height. All stockpiles will be located clear of watercourses and drainage works. · Wastewater management facilities shall only be provided through proprietary storage and pump out systems. · All disturbed surfaces will be revegetated as soon as possible.

Water Quality Management Plan	
	· All temporary ESC works will be removed immediately prior to final completion and all surfaces will be returned to pre-existing condition. · Provision of shaker grids or rumble strip at site egress points. · if contaminated materials are encountered, they are to be managed in accordance with Materials Management Plan, and as a minimum isolated and covered to avoid runoff.
Performance Criteria	Discharge quality must comply with Performance Criteria: · TSS: < 50mg/Lt (~Turbidity 30NTU). · pH: Between 6.5 and 8.5. · Otherwise able to be demonstrated not to have caused pollution of waters.
Contingency Measures	If Water Quality performance criteria is not suitable for discharge, other management measures must be implemented prior to discharge. These may include such things as: · the trapped sediment laden water may be treated with flocculants at a rate demonstrated in advance to be effective on the local material properties and using substances safe for amphibians; · Dosing with appropriate buffers to neutralise water; · Other mitigation measures deemed appropriate which may include a purpose constructed soak-away where HCCDC advices a suitable location such that contamination in fill is not likely to be mobilised.
Responsibilities	The Contractor is responsible for undertaking the work, monitoring and maintenance of all elements of the water quality management plan until the completion of the construction maintenance period (indicatively 3 months post construction completion). The State (or its agent) is responsible for the monitoring described under the KIWEF Annual Water Monitoring and the KIWEF Continuous Data Logging.
Timeframe	Construction Water Quality and Erosion Sediment Controls will be maintained and monitored throughout the duration of site works.
Monitoring and Reporting	Daily visual monitoring by site supervisors. Documented post rainfall checks of sediment basin water level and water quality and erosion and sediment control functioning. Weekly documented inspections. Maintenance activities for ESCPs shall be documented. Sediment basin discharge or dewatering water quality sampling and analysis suitable to demonstrate pollution of water has/will not occur. All water quality data including quantity, quality and dates of water release will be maintained within the project records.

Appendix G. Traffic Management

Traffic Management	
Objective	To ensure that additional traffic from construction activities does not cause an environmental nuisance.
Targets	No valid complaints resulting from congestion from construction traffic Comply with traffic management standards
Legal, Contractual and Other Requirements	*Protection of the Environment Operations Act 1997* *Roads Act 1993* RTA Traffic Control at Worksites Roads (General) Regulation 2000 *Local Government Act 1993*
Site specific planning / approval conditions / licence conditions	Not applicable.
Controls (means and resources)	The Contractor is required to develop a Traffic Management Plan detailing the route to the site, times of activity, types of machinery, signage, traffic control measures, once the source of any imported materials has been identified. The following traffic management control measures to be implemented are to be detailed in Construction Traffic Management Procedures (CTMP): · Traffic will be required to adhere to routes and speed limits designated by the Contractor, in consultation with the HCCDC, ARTC, NCIG and RMS and the RMS Contractor for the Tourle Street / Cormorant Road upgrade works (if ongoing); · Worksite speed limits will be determined for areas of the site based on road type, road condition and adjacent work activity; · Normal road rules apply unless specifically stated otherwise; · Barrier systems may be used at the discretion of the Contractor to define the designated routes; · All project personnel will be required to undertake the site induction that will specify appropriate traffic practices on site; · Site staff with responsibilities for control of construction activities will perform site inspections aimed at maintaining traffic at determined worksite speed limits; · Following site surface stabilisation/ rehabilitation works to control erosion, foot and vehicular traffic will be avoided on recently stabilised areas wherever practical; · Water spraying (where appropriate) will be used to minimise the generation of dust from roadway surfaces; · An inspection system will be established by the Contractor to assess effectiveness of traffic control measures. The assessments will determine if any modification is required to practices on site or the CTMP; and · An incident management procedure for emergencies relating to traffic management for the project works.

Traffic Management	
Actions	Contractor to incorporate the above traffic management measures into Contractor's Traffic Management Plans.
Responsibilities	The Contractor is responsible for ensuring traffic management plans are developed, approved and implemented.
Timeframe	Duration of site works.
Monitoring and Reporting	Daily inspection, checks and regular maintenance to be completed for traffic control measures.

Appendix H. Air Quality Management

Dust and Air Quality	
Objective	To ensure that dust and other air emissions from construction activities do not cause impacts on sensitive receivers and equipment.
Targets	No visible dust (or offensive odours) leaving site and reaching: · Identified or potential GGBF habitat, particularly water bodies and fringing vegetation; and · Cormorant Road or neighbouring coal loader operations.
Legal, Contractual and Other Requirements	Contract specification Review of Environmental Factors Kooragang Island Waste Emplacement Facility Area 2 Closure Works (ERM 2016) *Protection of the Environment Operations Act 1997* *Protection of the Environment Operations (Clean Air) Regulation 2002*
Site specific planning / approval conditions / licence conditions	All activities associated with the closure, capping, rehabilitation and post-closure maintenance and monitoring at the premises must be carried out in a manner that will minimise the emission of dust from the premises.
Controls (means and resources)	Mitigation measures include amending the nature of work in the event that construction works do not meet the above Objective. Operation of all facilities and equipment on the site will be performed so as to minimise reduce the emission of dust, odour and other air impurities including: · Use of water sprays to reduce dust emission from trafficable areas, work areas, stockpiles and other exposed areas but not to draw water from existing ponds as per the flora and fauna management plan; · Where necessary, stabilisation of long term stockpiles; · Reduce the number and extent of disturbed areas at a given time during the remediation activity on site; · Control of haul loading vehicles, whereby the load will not exceed the height of the haul boards and tailboards on the vehicles; · The vehicle speed shall be restricted along the haul roads on site to minimise dust generation and potential spilling of hauled material; · Cleaning/maintenance of the access and haul roads where they interface with public roads to prevent sediment tracking; · Loads of soil or contaminated material entering and leaving site will be covered. Internal material transport will also require a cover if material is likely to or observed to be generating dust; · Any excavated material likely to generate odours will be covered; · Maintenance and servicing of plant and vehicles to minimise reduce emission of air pollutants; · Observations of prevailing (and forecast) weather conditions, to program site activities in order to minimise air quality issues;

Dust and Air Quality	
	· Modify work practices during dry and windy conditions; · Progressively stabilise and/or revegetate as areas of works as completed; · Provide shaker grids or rumble strip at site egress points and where aggregate is used, minimum size is 150mm; · Remove mud from haul vehicles prior to entering public roads; · Remove spilt mud by construction equipment or vehicles on public roads; and · Provide awareness training in the need to minimise dust during site inductions and toolbox talks.
Actions	Contractor to implement reasonable and feasible measures from the above to achieve air quality goal.
Responsibilities	Contractor
Timeframe	Duration of site works. Water tankers and other measures available at the commencement of earthworks. Spilt mud and sediment to be removed from public roads as soon as practicable, and at least prior to the end of each shift.
Monitoring and Reporting	Daily observations of dust generation, mud tracking, vehicle emissions, site generated odours and weather conditions (wind direction and strength). Weekly inspect to record functioning of air quality controls.

Appendix I. Noise Management

Noise and Vibration	
Objective	To ensure that noise and vibration from construction activities does not cause environmental nuisance or unnecessarily disturb fauna.
Targets	No valid noise / vibration complaints resulting from construction works. No unreasonable noise or vibration. No noise and vibration impacts on external receptors.
Legal, Contractual and Other Requirements	Works are to be undertaken in accordance with the Interim Construction Noise Guidelines with works to be restricted to: · 7 am to 6 pm Monday – Friday · 8 am to 1 pm Saturdays No work outside of these hours without HCCDC's approval (except for emergency situations). *Protection of the Environment Operations Act 1997* *Protection of the Environment Operations (Noise Control) Regulation 2000*
Site specific planning / approval conditions / licence conditions	All activities associated with the closure, capping, rehabilitation and post-closure maintenance and monitoring at the premises must be carried out in a competent manner. This includes: · The processing, handling, movement and storage of materials and substances used at the premises; and · The treatment, storage, processing, reprocessing, transport and disposal of any waste generated by the activity. All plant and equipment installed at the premises or used in connection with the closure, capping, rehabilitation and post-closure maintenance and monitoring activities at the premises must be: · Maintained in a proper and efficient condition; and · Operated in a proper and efficient manner.

Noise and Vibration	
Controls (means and resources)	No work will be undertaken outside of the agreed hours without prior approval (except in an emergency situation). Delivery operations or other noise generating activities at compound and storage areas will take place during the designated construction hours nominated above, unless specifically required by Police or RTA requirements. Reasonable and feasible mitigation measures to be considered as required include: · Avoiding where practical the use of noisy plant simultaneously close together or adjacent to sensitive receptors; · All plant will be maintained in accordance with the manufacturer's requirements; · Stationary noise generating equipment to be orientated away from sensitive areas; · Undertaking loading and unloading activities away from sensitive areas and during designated construction hours; · Selection of the most appropriate plant and equipment to minimise noise generation and include where necessary screening and enclosures; · Regular checks are to be undertaken to ensure all equipment and vehicles are in good working order and are operated correctly; and · Awareness training and information will be provided to project personnel in relation to the vibration requirements on the project and the need to minimise vibration when in close proximity to operational areas (rail corridor).
Responsibilities	Contractor
Timeframe	Duration of site works.
Monitoring and Reporting	Vehicle inspections to be recorded on daily vehicle pre-start checks.

Appendix J. Heritage management

Heritage Management Archaeology and Heritage	
Objective	To ensure that undiscovered heritage and archaeological items are protected from construction activities.
Targets	Unknown or undocumented heritage sites are not knowingly destroyed, defaced or damaged. Identify and protect any new artefacts or heritage sites before any harm can take place.
Legal, Contractual & Other Requirements	*Heritage Act 1977* *National Parks and Wildlife Act 1974*
Controls (means & resources)	No known heritage items or areas have been identified within the project site or surrounds. As such, heritage mitigation measures are limited to restricting access beyond the project boundary and the implementation of the following 'chance find' protocol: · In the event that potential Aboriginal and Historic heritage items are discovered, STOP ALL WORK in the vicinity of the find and immediately notify the relevant Construction Supervisor and Environmental Manager; · Contact HCCDC to notify of the find as soon as they receive notification; · In the event of uncovering remains that are potentially human, the NSW Police are also to be contacted immediately; · Record the details and take non-intrusive photos of the find and relay information to HCCDC; · HCCDC will contact a qualified archaeologist to get advice regarding the nature and potential significance of the find; · If the qualified archaeologist advises that the find is not a potential heritage item, work will recommence in consultation with HCCDC; · If the qualified archaeologist advises that the find is a potential heritage item HCCDC will contact and notify the relevant authority; and · Work is not to recommence in the area of the identified find until clearance is received from HCCDC.
Responsibilities	All persons are responsible for reporting items of potential cultural or heritage value. Contractor's representative will ensure the implementation of the above chance finds protocol in the event that items of potential cultural or heritage value are uncovered.
Timeframe	Duration of site works
Monitoring & Reporting	Ongoing visual observations for previously unidentified items. Reporting of any chance finds in accordance with the above protocol.

Appendix B – Green and Golden Bell Frog Management Plan (Golder Associates, 2011)

19 April 2011

GREEN AND GOLDEN BELL FROG MANAGEMENT PLAN

Kooragang Island Waste Emplacement Facility Closure Works

Submitted to:
Hunter Development Corporation
Suite B, Level 5
PricewaterhouseCoopers Centre
26 Honeysuckle Drive
Newcastle, New South Wales 2300

REPORT

Report Number. 117623029-001-R-Rev0

Golder Associates

Executive Summary

The Kooragang Island Waste Emplacement Facility (KIWEF) is located on land owned by the New South Wales (NSW) State Property Authority, which is managed under delegated-authority by the Newcastle Port Corporation (NPC).

The KIWEF contains various wastes from the former BHP steelworks at Mayfield. Hunter Development Corporation (HDC) is in the process of closing the KIWEF via implementing certain landfill closure works, which include land-forming of waste emplacement cells and construction of a capping layer over much of the KIWEF site.

Historically, HDC was the holder of an Environment Protection Licence (EPL) over the site for the former BHP Solid Waste facility (refer to Figure 1). That EPL has now been surrendered, subject to the implementation of landfill closure works required by the NSW Office of Environment and Heritage (OEH) (formerly the NSW Department of Environment, Climate Change and Water (DECCW)). HDC, as the Agents for the Crown, are undertaking those necessary landfill closure works, on lands administered by NPC, which encompass the KIWEF (Figure 1).

The KIWEF site supports known populations and habitat of the Green and Golden Bell Frog (*Litoria aurea*). A flora and fauna impact assessment (GHD, 2010a) of the proposed landfill closure works concluded that the works are "*designed to minimise the direct and indirect impacts on biodiversity of the locality, especially in relation to the Green and Gold Bell Frog... The Proposal also addresses the risks posed from the prior disposal of BHP waste on the site*" and is unlikely to result in "*long-term decrease in the size of a population, reduce the area of occupancy of species, fragment an existing population, adversely affect habitat critical to the survival of a species, disrupt the breeding cycle of a population, modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that a species is likely to decline, result in invasive species that are harmful to an endangered species becoming established in the endangered habitat, or interfere with the recovery of any threatened species*".

Overall, the flora and fauna impact assessment (GHD, 2010a) reported that the proposed capping strategy is unlikely to impact significantly on Green and Golden Bell Frogs, provided the works are managed through an appropriate environmental management plan.

In order to assist in minimising impacts of the landfill closure works, HDC engaged Golder Associates Pty Ltd (Golder) to develop this Green and Golden Bell Frog Management Plan (the GGBF Management Plan). HDC intend to incorporate this GGBF Management Plan into the detailed design documentation currently being developed for the landfill closure works. An Action Plan has been developed by Golder in conjunction with this GBBF Management Plan and is reported to HDC separately (Golder, 2011).

The Green and Golden Bell Frog is listed as 'endangered' under the NSW *Threatened Species Conservation Act 1995*, and 'vulnerable' under the federal *Environmental Protection and Biodiversity Conservation Act 1999*. Historically, this species was widespread across much of the Hunter Valley; however, it is now believed to be restricted to four key populations, including a large population on Kooragang Island (including the KIWEF site).

The Green and Golden Bell Frog is a relatively large species and is usually green, most often with irregular large gold spots and/or stripes. The Green and Golden Bell Frog can be regarded as somewhat of a habitat generalist, dispersing widely and maturing early. It is known to inhabit marshes, dams and stream sides and appears to prefer those water bodies where Bulrushes (*Typha* spp.) or Spikerushes (*Eleocharis* spp.) grow (NPWS, 1999). Green and Golden Bell Frogs are also known to inhabit highly disturbed sites (NPWS, 1999), such as the KIWEF site. The Green and Golden Bell Frog is known to travel significant distances across often seemingly inhospitable habitat. Distances of up to 1.5 km day/night are not unknown, particularly associated with significant rain events.

Frog Chytrid Fungus (FCF) has been identified as a key threatening process, at both the state and national level, for the Green and Golden Bell Frog (DSEWPC, 2009). FCF is widespread on Kooragang Island and Hexham Swamp, the other key Green and Golden Bell Frog population in the Newcastle area (DECC, 2007).

Section 3 of this document details the management procedures to be implemented, including identification and delineation of disturbance areas, pre-work surveys, identification of relocation areas, relocation procedures and rehabilitation of disturbed habitat, environmental induction training and site hygiene management for Chytrid fungus.

Section 4 of this document outlines the proposed monitoring programme for Green and Golden Bell Frogs at the KIWEF site. The monitoring programme includes annual review of publicly available baseline and ongoing data from other surveys including frog populations (such as that being undertaken by NCIG across the KIWEF site). An Annual Environmental Monitoring Report (AEMR) discussing the results of analysis of monitoring data will be presented to OEH.

Section 5 of this document identifies specific management and mitigation measures for disturbed areas and triggers for the development of response criteria in the unlikely event that the landfill closure works have an impact on the Green and Golden Bell Frogs. If the results of the monitoring programme indicate a decline in Green and Golden Bell Frog numbers across the site, which cannot be attributed to natural population fluctuations and variability, and is potentially a direct result of the landfill closure works, specific response criteria will be developed by HDC in consultation with the OEH.

Section 6 of this document outlines proposed review and reporting actions. HDC will report to OEH annually for 5 years following completion of the landfill closure works, unless analysis shows that Green and Golden Bell Frog populations are being impacted, then further reporting will be undertaken until a time agreed with OEH.

In accordance with the *Approval of Surrender of Licence Number 6437*, the Director-General will be notified of any incident with actual or potential significant off-site impacts on people or the biophysical environment, as soon as practicable after the occurrence of the incident. The Director-General will be provided with written details of the incident within seven days of the date on which the incident occurred.

The AEMR will be distributed to relevant government agencies and stakeholders, and copies provided to other interested parties, if requested.

In accordance with the *Approval of Surrender of Licence Number 6437*, this Management Plan will be made available on the HDC website.

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APPENDICES

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1.0 INTRODUCTION

1.1 BACKGROUND

The Kooragang Island Waste Emplacement Facility (KIWEF) is located on land owned by the New South Wales (NSW) State Property Authority, which is managed under delegated-authority by the Newcastle Port Corporation (NPC).

The KIWEF contains various wastes from the former BHP steelworks at Mayfield. Hunter Development Corporation (HDC) is in the process of closing the KIWEF via implementing certain landfill closure works, which include land-forming of waste emplacement cells and construction of a capping layer over much of the KIWEF site.

Historically, HDC was the holder of an Environment Protection Licence (EPL) over the site for the former BHP Solid Waste facility (refer to Figure 1). That EPL has now been surrendered, subject to the implementation of landfill closure works required by the NSW Office of Environment and Heritage (OEH) (formerly the NSW Department of Environment, Climate Change and Water (DECCW)). HDC, as the Agents for the Crown, are undertaking those necessary landfill closure works, on lands administered by NPC, which encompass the KIWEF (Figure 1).

The KIWEF site supports known populations and habitat of the Green and Golden Bell Frog (*Litoria aurea*). A flora and fauna impact assessment (GHD, 2010a) of the proposed landfill closure works concluded that the works are "*designed to minimise the direct and indirect impacts on biodiversity of the locality, especially in relation to the Green and Gold Bell Frog... The Proposal also addresses the risks posed from the prior disposal of BHP waste on the site*" and is unlikely to result in "*long-term decrease in the size of a population, reduce the area of occupancy of species, fragment an existing population, adversely affect habitat critical to the survival of a species, disrupt the breeding cycle of a population, modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that a species is likely to decline, result in invasive species that are harmful to an endangered species becoming established in the endangered habitat, or interfere with the recovery of any threatened species*".

Overall, the flora and fauna impact assessment (GHD, 2010a) reported that the proposed capping strategy is unlikely to impact significantly on Green and Golden Bell Frogs, provided the works are managed through an appropriate environmental management plan.

In order to assist in minimising impacts of the landfill closure works, HDC engaged Golder Associates Pty Ltd (Golder) to develop this Green and Golden Bell Frog management plan (the GGBF Management Plan) to support the landfill closure works. HDC intend to incorporate this GGBF Management Plan into the detailed design documentation currently being developed by HDC for the landfill closure works.

This GGBF Management Plan has been prepared in accordance with HDC's Request for Tender No. 141 ("Green & Golden Bell Frog Management Plan and Action Plan for K26/32 Ponds: KIWEF"), dated February 2011, and Golder's responding proposal, dated 28 February 2011 as accepted via a letter from HDC emailed to Golder on 16 March 2011. This Management Plan has been prepared via review of documentation provided by HDC to Golder on 22 March 2011, a visual site visit by Golder personnel and written commentary from HDC.

An Action Plan for the K26/K32 Ponds has been developed by Golder in conjunction with this GBBF Management Plan and is reported to HDC in a separate document (Golder, 2011).

1.2 A SUMMARY OF WORKS COMPLETED TO DATE

A range of studies have been completed by others in relation to the Green and Golden Bell Frogs on the KIWEF site since its hand over to the Crown in 2002. The most recent relevant studies are listed in the following. It is noted that other previous studies are summarised in these works, and, therefore, are not identified here.

- Revised Capping Strategy, Flora and Fauna Impact Assessment, Rev 3 (GHD, 2010a).
- March 2011 Green and Golden Bell Frog (Litoria aurea) Survey at the Kooragang Island Waste Emplacement Facility (Umwelt, 2011).
- Revised Final Landform and Capping Strategy, Rev 4, (GHD, 2010b).

The key findings of those reports, as relevant to the ongoing management of Green and Golden Bell Frogs on the KIWEF site, are presented below.

1.2.1 Flora and Fauna Impact Assessment

The flora and fauna impact assessment of the revised capping strategy was undertaken as part of the EPL surrender, which the then DECCW required to identify any impacts resulting from the implementation of the final capping strategy on Green and Golden Bell Frogs (and other threatened species). The assessment was also required to identify associated mitigation measures for those species and their habitats.

Key Findings

The key findings of the flora and fauna impact assessment (GHD, 2010a) comprised the following:

- The assessment identified areas of known and potential Green and Golden Bell Frog Habitat (as indicated on Figure 1), and determined the presence, relative abundance and distribution of Green and Golden Bell Frogs on the KIWEF site, and the adjacent Ash Island. A summary of the locations and numbers of Green and Golden Bell Frogs recorded on the KIWEF site is presented in Figure 1. During the assessment (that is February and March 2009), 59 Green and Golden Bell Frogs were recorded from the KIWEF and surrounding area; 38 individuals were recorded on the KIWEF site.
- Two important factors to note, as identified in the report, are:
  - The Green and Golden Bell Frog's ongoing survival on Kooragang Island, and the KIWEF site, may be related to the protection that the brackish wetland habitat provides from the Chytrid fungus (Stockwell, pers. comm., in GHD, 2010a).
  - The terrestrial habitats and ephemeral water bodies supported on the KIWEF site and the larger Kooragang Island may provide important movement corridor refuges for Green and Golden Bell Frogs (Hamer *et al.*, 2008, in GHD, 2010a).
- Potential changes to water quality, especially salinity, may adversely affect the Green and Golden Bell Frogs on the KIWEF site.
- The *in situ* contaminated materials present across the KIWEF site will be addressed by the capping strategy. There is, therefore, the potential for water quality in, and adjacent to, the capped location to remain similar or improve.
- The capping strategy was designed to minimise changes to hydrology. As noted, however, the construction of the NCIG rail loop has impacted on the known Green and Golden Bell Frog habitat supported in the K26 and K32 cells, and potentially already altered the hydrology of these ponds.
- Where the proposed capping strategy would impact on streamside vegetation and banks, and, hence, potential Green and Golden Bell Frog habitat, that vegetation would be reinstated immediately following capping works to a state as close as possible to the original.
- Plague Minnow (*Gambusia holbrooki*), a known predator of Green and Golden Bell Frog tadpoles, was recorded in ponds across the KIWEF site.
- The assessment considered that the capping strategy would result in minimal fragmentation or isolation of currently interconnecting areas of Green and Golden Bell Frog habitat. The capping strategy would

leave areas of appropriate habitat in areas within the KIWEF site and the adjacent Hunter Estuary National Park.

- That vegetation that may be cleared or capped is considered unlikely to constitute key foraging habitat for Green and Golden Bell Frogs.
- The potential cumulative impacts on Green and Golden Bell frogs and their habitat across the local area from other proposals, is unknown; particularly impacts on potential movement between populations north and south. Furthermore, inference is made that competition for resources, required by the species, may have potentially increased because of the translocation of individuals into suitable areas on the KIWEF site from areas impacted by other proposals. However, the proposed "*capping strategy aims to avoid increasing these pressures while dealing with the potentially harmful pollutants on site*" and "*is unlikely to add to these previous impacts or add to cumulative adverse impacts on threatened species at the KIWEF site*".
- Overall, the assessment reports that the proposed capping strategy is unlikely to impact significantly on Green and Golden Bell Frogs, provided the works are managed through an appropriate environmental management plan. Those assessments of significance were undertaken in accordance with the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the NSW *Environmental Planning and Assessment Act 1979* (EPA Act).

Mitigation Measures

The following mitigation measures were recommended in the flora and fauna impact assessment:

- A 30 m buffer zone is proposed around fresh and brackish water wetlands, ponds, and identified areas of Green and Golden Bell Frog habitat.
- If it is identified that works will occur in Green and Golden Bell Frog habitat (such as the fringing habitat near Deep Pond), one week prior to those works commencing, a pre-clearance survey is required to be conducted by a qualified ecologist. In the event that any Green and Golden Bell Frogs are identified, they will be relocated (using appropriate amphibian hygiene protocols).
- Once works are complete, the restoration and rehabilitation of that habitat should be undertaken.
- Control of noxious weeds on the site should be undertaken limiting the use of herbicides, which may be detrimental to Green and Golden Bell Frogs.
- Maintenance of the current hydrological and water chemistry regimes; in particular, low levels of salinity in the brackish wetlands, which may protect amphibian species from the Chytrid fungus. The maintenance of runoff volumes into these areas may help conserve appropriate salinity levels.
- Similarly, general erosion and sediment control should be implemented to limit the transport of other contaminants across the KIWEF site.
- Capping and grading activities should be conducted outside of the Green and Golden Bell Frog's core breeding period (that is, September to March). If works need to be undertaken during this time, they should be limited to areas outside of recognised breeding habitat. For the purposes of this GGBF Management Plan, breeding habitat is defined as areas within or immediately adjacent to emergent, aquatic macrophytes.
- Standing water should not be transferred between waterbodies, to prevent the spread and establishment of the Plague Minnow.
- Suitable hygiene protocols must be developed and adhered to for all plant and personnel entering the KIWEF site to avoid the spread of Chytrid fungus.

- Compensatory habitat for the Green and Golden Bell Frog may be considered as part of the capping strategy. For example, the capping works may facilitate rehabilitation of suitable Green and Golden Bell Frog habitat. However, HDC has indicated that it is not intending to create artificial habitat, interfere with existing habitat, nor are seeking to modify frog population numbers or habitat.

- Ongoing, long-term monitoring of the Green and Golden Bell Frog population across the entire KIWEF site, and adjacent areas, such as the NCIG facility, should be undertaken seasonally. This data will help identify if any adverse impacts have affected the Green and Golden Bell Frog population and habitat across Kooragang Island.

1.2.2 March 2011 Survey

The March 2011 survey of GGBF (Umwelt, 2011) targeted the rail loop area, including K26 and K32 Ponds (as well as K24 and K31 Ponds). Overall, this survey was suitable for its purpose. However, the following comments are made in relation to the survey scope and its findings. Those comments were used to assist in the development of the Action Plan for the K26/K32 Ponds (Golder, 2011).

- No detailed surface water quality data have been collected and analysed for the standing water in the Ponds.

- It is known that some contaminants are detrimental to frog embryos and development, as well as known to lead to malformations in frogs for example, Abbasi and Soni, 1984; Anon., 1999, Arrieta *et al.*, 2004, Guillermo *et al.*, 2000; Marquis *et al.*, 2006; Rice *et al.*, 2002; Stabenau *et al.*, 2006; Wang and Jia, 2008). Some surface water chemistry data are available (see NCIG, 2008, in GHD, 2010b) that indicate values exceeding ANZECC trigger values for aquatic ecosystems; however, these are limited. In the absence of detailed water chemistry data, there is no baseline to compare for the long-term monitoring of the water quality, correlated with the frog populations. This represents a significant data gap.

- Data on the periodicity of the standing water in the cells has not been collected. Such data would assist in the understanding of the impacts of changes in local hydrology, such as may have occurred during construction of the NCIG rail loop.

- The mere presence of calling males may not be a useful indicator of successful breeding in the ponds. This, to some extent, has been alluded to in both the GHD (2010) and the Umwelt (2011) studies in that no tadpoles were recorded in the cells during either of those studies.

- The presence of juveniles may be a valid indicator of a sustainable population as this species is known to emigrate over large distances. Therefore, it would be useful to confirm that there has been effective breeding over one or more seasons, with tadpoles that survive to adulthood.

- The baseline comparison that the Umwelt (2011) report makes with the GHD (2010) results, in particular, that “There is no substantial change in the numbers recorded from 2009 to 2011.” (page 8) needs to be further qualified. A stable number of frogs each year over a relatively short time frame could result from a variety of factors (such as low mortality or in-migration) and is not necessarily confirmation of sustainable breeding.

To meet HDC’s requirements regarding management of contamination and frog habitat at the Ponds it is recommended that these data gaps are addressed by HDC.

1.2.3 Capping Strategy

The objectives of the capping strategy were to “*reduce risks to the environment associated with migration of contaminated groundwater and to prevent the risk of biological harm associated with contaminated soil and groundwater*” (GHD, 2010b). This objective had the associated objectives of preserving and maintaining habitat for shorebirds and other threatened species, and endangered ecological communities.

The strategy assessed the KIWEF based on sub-areas, with each sub-area assessed for the requirement for capping, and the effects that capping may have on the ecology. The locations of those sub-areas are presented on Figure 1. In terms of impacts to ecology, in particular the ecology of the Green and Golden Bell Frog, the following sub-areas were important:

- K1 – This sub-area presents a low risk to the surrounding environment from contamination. Capping of this area would have a significant impact on the ecology of the area.
- K2 – This sub-area presents a low to moderate risk to the surrounding environment from contamination. Capping of this area could impact on Green and Golden Bell Frog habitat.
- K3 – This sub-area presents a low to moderate risk to the surrounding environment from contamination. Capping of the fringing areas of this sub-area may have an impact on Green and Golden Bell Frog habitat. Therefore, capping is suggested only up to within 30 m of that habitat, with the exception of the area located near K3/1W.
- K4 (deep pond) – Contamination in this sub-area presents a low risk to the environment. However, filling and capping of this sub-area will have a significant impact on Green and Golden Bell Frog habitat, and the overall ecology of the area.
- K6 – This sub-area presents a low risk from contamination. However, capping of this sub-area will have a significant impact on the ecology of the area.
- K7 – The sub-area presents a low to moderate risk to the environment from contamination. Capping of the edges of the site will significantly impact on Green and Golden Bell Frog habitat.
- K26/K32 cells – These cells present a high risk to the environment. However, they also support Green and Golden Bell Frog habitat. Capping is not recommended, but rather a monitoring and risk assessment be completed. Details of recommended actions for the K26/K32 Ponds are presented in an Action Plan (Golder, 2011).

Based on the above assessment, a capping strategy was developed that minimised the impacts to Green and Golden Bell Frog habitat. A brief summary of the other sub-areas, suggested for capping, is provided below.

- K5 (excluding pond 5) – This sub-area presents a low to moderate risk to the environment from contamination. There is no significant Green and Golden Bell Frog habitat in this area; therefore, capping is an option.
- Pond 5 – Migration of contaminants from this sub-area may impact the estuarine aquifer. This sub-area does not support significant Green and Golden Bell Frog habitat. Therefore, capping is an option.
- K10 (excluding K26/K32) – The sub-area presents a low to moderate risk to the environment from contamination. The BOS area presents a moderate risk to the environment. Capping is suggested for this area.

1.3 Other Relevant Management Plans and Guidelines

This GGBF Management Plan should be read and in conjunction with the following management plans and guidelines, which are relevant to the Green and Golden Bell Frog population on Kooragang Island and the KIWEF:

- *Coal Export Terminal Green and Golden Bell Frog Management Plan* (Newcastle Coal Infrastructure Group (NCIG) (Document No. GGBFMP-R01-E.DOC, 2007)) (the NCIG management plan)
- *Draft Management Plan for the Green and Golden Bell Frog Key Population in the Lower Hunter* (Department of Environment and Climate Change (DECC) (NSW) 2007) (the Lower Hunter management plan)
- *Significant impact guidelines for the vulnerable Green and Golden Bell Frog (*Litoria aurea*)* (Department of Sustainability, Environment, Water, Populations and Communities (DSEWPC), Nationally threatened species and ecological communities; Background paper to the EPBC Act policy statement 3.19, 2009)
- *Best practice guidelines: Green and Golden Bell Frog habitat* (DECC, 2008)
- *Protecting and restoring Green and Golden Bell Frog habitat* (DECC, 2008)
- *Draft Recovery Plan for the Green and Golden Bell Frog (*Litoria aurea*)*. (DECC, 2005)
- *Threatened Species Management Information Circular No.6, Hygiene Protocol for the Control of Disease in Frogs* (NPWS, 2001) (the hygiene protocol) (Appendix A).

1.4 Project Approval

This GGBF Management Plan has been developed in order to partly address the KIWEF site's *Approval of Surrender of Licence Number 6437*, dated 8 December 2010, Condition 5.b), which requires the following:

b) The licensee shall prepare and submit a Green and Golden Bell Frog Management Plan to the EPA for approval by 13 April 2011. The Plan shall encompass the entire premises occupied by the licensee and include, but not be limited to:

i) Management measures to be undertaken to minimise the spread of the amphibian Chytrid fungus including:

> *(i) the training of project personnel in site hygiene management; and*
>
> *(ii) site hygiene procedures for project personal, mobile plant and equipment, in accordance with the NPWS Hygiene Protocol for the Control of Disease in Frogs 2001; and*

ii) Measures to maintain, restore and enhance Green and Golden Bell Frog habitat, including movement corridors across the site.

Additionally, obligations exist under the DSEWPC's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as to the protection of this nationally threatened species. These obligations are detailed in the EPBC Act policy statement 3.19 (see above for reference), as well as the significant impact criteria set out in the NSW *Threatened Species Conservation Act 1995* (TSC Act).

1.5 Objectives of this Plan

In relation to Green and Golden Bell Frogs on the KIWEF site, one of the overall aims of the KIWEF landfill closure works is to manage those works in a manner that does not impact threatened species and their habitat, and to restore small areas of temporary disturbance to their original (or better) condition. To that end, the objectives of this GGBF Management Plan are:

1) To maintain the existing Green and Golden Bell Frog populations supported on the KIWEF site.

2) To reduce the spread of the amphibian Chytrid fungus (*Batrachochytrium dendrobatidis*).

3) To protect the existing Green and Golden Bell Frog habitat on the KIWEF site.

4) To increase connectivity between the existing areas of Green and Golden Bell Frog habitat on the KIWEF site.

5) To restore Green and Golden Bell Frog habitat that may be disturbed during the landfill closure works to a condition as-good or better than prior to the works.

Hence, this GGBF Management Plan aims to assist HDC in the implementation of appropriate environmental management measures during the KIWEF closure works.

1.6 Scope and Use of this Plan

The scope of this GGBF Management Plan covers that area known as the KIWEF (Figure 1), before, during and after landfill closure works.

This GGBF Management Plan has been prepared in accordance with the relevant state guidelines as identified in Section 1.3.

This GGBF Management Plan will be reviewed and updated by those responsible for undertaking the detailed design and associated documentation to ensure that it is current at the time that the landfill closure works are tendered. Once tendered, the Contractor will incorporate the revised GGBF Management Plan into their Environmental Management Plans (EMP). Where there is any conflict between the provisions of this GGBF Management Plan and Contractors' obligations under their respective contracts, including the various statutory requirements (that is, licences, permits, project approval conditions and relevant laws), the contract and statutory requirements are to take precedence. In the case of any real or perceived ambiguity between elements of this GGBF Management Plan and the above statutory requirements, the Contractor shall first gain clarification from HDC, prior to implementing that element of this GGBF Management Plan over which the ambiguity is identified.

It is intended that this GGBF Management Plan should complement those studies identified in Section 1.2. To that end, this management plan should be supplemented by publicly available monitoring results collected by others for projects on Kooragang Island. For example, it is understood that the NCIG plan requires monitoring to occur on an annual basis until 2020, as outlined in the EPBC Act Particular Matter conditions for that project. The NCIG monitoring data will be useful input into management of Green and Golden Bell Frogs on the KIWEF site.

1.7 Structure of this Plan

The structure of this GGBF Management Plan is provided below. This structure has been adopted to address the requirements as specified in the HDC brief (document number HDC141), and be in accordance with required guidelines.

- Section 2: Provides a profile of the Green and Golden Bell Frog, including its key identifying features in the field, similar species on the KIWEF site, general ecology relevant to the KIWEF site, its conservation status and distribution on the KIWEF site.
- Section 3: Details the management procedures to be implemented, including identification and delineation of disturbance areas, pre-work surveys, identification of relocation areas, relocation procedures and rehabilitation of disturbed habitat, environmental induction training and site hygiene management for Chytrid fungus.
- Section 4: Outlines the monitoring programme for the KIWEF site.
- Section 5: Response criteria and mitigation measures, including comparison with previous data collected at the site, and procedures to be followed if a decline in the Green and Golden Bell Frog population is detected.

- Section 6: Lists the reporting and review requirements of this management plan.
- Section 7: Lists references cited in this Green and Golden Bell Frog Management Plan and other supporting information.

GREEN AND GOLDEN BELL FROG MANAGEMENT PLAN

HUNTER DEVELOPMENT CORPORATION

SITE LOCATION

381,000 382,000 383,000

6,363,000 6,362,000 6,361,000

N

Deep Pond North
Deep Pond East
Deep Pond West
Deep Pond Rail
Deep Pond SE
Deep Pond SW
Delta Channel
Pond 5
K2 NORTH
K2
K3
K5
K7
K10
K26
K32
ACCESS OFF PACIFIC NATIONAL DR
CORMORANT RD TO NEWCASTLE
HUNTER RIVER SOUTH ARM

LEGEND

- Kooragang Island Waste Emplacement Facility License Area
- Known and Potential Habitat Areas (GHD, 2010)
- Capping Extent Landfill Closure Works
- HDC Closure Area 2010

NOTES

Imagery provided by The Hunter Development Corporation 16/03/2011
Data digitised from Land & Property Management Authority
Request for Tender - RFT No. HDC141, February 2011
Appendix A - Site and Access Map

0 40 80 160 240 320 400 metres

SCALE (at A3) 1:10,000

Coordinate System: GDA 1994 MGA Zone 56

PROJECT: 117623029
DATE: 18/04/2011
DRAWN: AJW
CHECKED: TC

FIGURE 1

Golder Associates

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File Location: J:\GIS\Jobs\117623029_HDC_Frog Management Plan\Workspaces\117623029_F004.mxd

2.0 SPECIES PROFILE – GREEN AND GOLDEN BELL FROG (*LITORIA AUREA*)

2.1 Conservation Status

2.1.1 Listing

The Green and Golden Bell Frog's conservation status is listed as follows:

- **Endangered** under the NSW *Threatened Species Conservation Act 1995*
- **Vulnerable** under the federal *Environmental Protection and Biodiversity Conservation Act 1999*.

2.1.2 Known Populations

The Green and Golden Bell Frog is estimated to have disappeared from 90% of its former range within NSW over the last 30 years (Pyke and White, 1996; DECC, 2007), although populations in Victoria are believed to be secure (Gillespie, 1996).

There are about 45 known populations of Green and Golden Bell Frog within NSW (DECC, 2007). Of these, only a few occur in conservation reserves; Kooragang Island Nature Reserve supports the closest protected population to the KIWEF site (DECC, 2007). Historically, this species was widespread across much of the Hunter Valley; however, it is now believed to be restricted to four key populations:

- a large population on Kooragang Island (including the KIWEF site)
- small, isolated populations at Sandgate on the margins of Hexham Swamp
- a meta-population in the Gillieston Heights/East Maitland, Ravensdale areas (also including Wentworth Swamp)
- a meta-population in the Ravensworth/Liddell/Bayswater area.

2.1.3 Management and Recovery Plans

To "ensure that the Lower Hunter population is successfully managed and monitored such that the species continues to persist in the Lower Hunter and that 'measures' of the two populations' viability are maintained or improved over time", the following key documents are important:

- *Draft Management Plan for the Green and Golden Bell Frog Key Population in the Lower Hunter* (Department of Environment and Climate Change (DECC) (NSW) 2007) (the Lower Hunter management plan)
- *Draft Recovery Plan for the Green and Golden Bell Frog (*Litoria aurea*)*(DECC, 2005).

2.2 Key Distinguishing Features

The following provides some key diagnostic features that are important for quick and easy field-identification of this species.

2.2.1 Adult Frogs

- Relatively large, muscular species with robust body form and smooth skin compared to other species known to inhabit the KIWEF site (Barker *et al.*, 1995).
- The background colouration is usually green, most often with irregular large spots and/or stripes of gold (Barker *et al.*, 1995), refer to Figure 2. It should be noted that adults can vary considerably in pattern; however, the background colouration will always be green.

- Males vary in size from 60 to 70 mm (snout to vent length (SVL)); females vary from 65 to 110 m SVL (Tyler and Knight, 2009). Typically, most individuals being in the range of 60 to 80 mm SVL (DEC, 2005).
- A white or cream stripe extends from above the nostril, over the eye and ear (tympanum) and continues as a fold down the side (Robinson, 1998). There is usually a darker stripe below the white stripe, and another pale stripe from below the eye, extending to the base of the forearm (Robinson, 1998).
- The groin area, and behind the thighs, is usually pale blue or bluish-green, particularly in breeding males (Tyler and Knight, 2009). Mature males may also have a yellowish darkening of the throat area (DEC, 2005).
- The tympanum is usually brown (Tyler and Knight, 2009).
- The belly is usually creamish-white (DEC, 2005); the lower sides of the body are adorned with raised glandular, creamish-coloured spots of irregular size.
- The eye has a horizontally elliptical pupil and a golden yellow iris. The toes are three-quarters to nearly fully webbed (Robinson, 1998).

Figure 2: Adult Green and Golden Bell Frog (Litoria aurea)
(Source: A. White (2007), as in the NCIG plan)

2.2.2 Tadpoles

- Relatively large, reaching 65 to 100 mm at limb bud development stage (DEC, 2005). May be confused with other large-bodied tadpoles of species in the KIWEF site; for example, Peron's Tree Frog (*Litoria peronii*).
- Deep bodied and possess long tails with a high fin that extends almost half way along the body (refer to Figure 3).
- Although not typically used in field identification given the need for a microscope, the mouthparts consist of two upper and three lower labial rows (Anstis, 2002).

Figure 3: Tadpole Green and Golden Bell Frog (Litoria aurea)
(Source: A. White (2007), as in the NCIG plan)

2.2.3 Similar Species within the KIWEF Area

The Green and Golden Bell Frog should not be confused with any other species in the KIWEF area, given its very distinctive features and large size, wart-free skin, expanded finger and toe pads, and lack of spotting or marbling on the hind side of the thigh (Robinson, 1998).

Nevertheless, to the untrained eye, metamorphosing individuals may be confused with the adults and metamorphs of the following species that are known to occur on the KIWEF site:

- Eastern Dwarf Tree Frog (*Litoria fallax*)

  This species is also green, but lacks any of the golden markings on the back and presents with a plain, single colour.

- Peron's Tree Frog (*Litoria peronii*)

  Adults have bright yellow with black mottling on armpits, groin, and backs of thighs. The back texture is rough, and often is covered with faint, emerald spots, giving its other common name, the Emerald-spotted Treefrog.

- Broad-palmed Rocket Frog (*Litoria latopalmata*)

This species ranges from light to dark brown on its back, sometimes with darker blotches. The backs of the thighs are yellow and dark brown.

- Spotted Marsh Frog (*Limnodynastes tasmaniensis*)

  Adults usually have large regularly-shaped olive green blotches on the back and sometimes have a yellow, red, or orange mid-dorsal stripe. The background colouration is not green.

2.3 Aspects of Ecology Important for Management

2.3.1 Preferred Habitat

The Green and Golden Bell Frog can be regarded as somewhat of a habitat generalist, dispersing widely and maturing early. It is known to inhabit marshes, dams and stream sides and appears to prefer those water bodies where Bulrushes (*Typha* spp.) or Spikerushes (*Eleocharis* spp.) grow (NPWS, 1999). In the Lower Hunter region, such plant species as Salt Marsh Rush (*Juncus kraussi*), Coast Club Rush (*Schoenoplectus subulatus*), and Salt Couch (*Sporobolus virginicus*) are indicators of habitat suitability for Green and Golden Bell Frogs (DECC, 2007). Such habitat is typically unshaded, free of Plague Minnow (*Gambusia holbrooki*), have a grassy area nearby and diurnal sheltering sites (NPWS, 1999).

Green and Golden Bell Frogs are also known to inhabit highly disturbed sites (NPWS, 1999), such as the KIWEF site.

Typically, Green and Golden Bell Frogs will require habitat for breeding, foraging, shelter, movement and over wintering. All such habitat types occur across the KIWEF site, and have been incorporated under the banner of known and potential Green and Golden Bell Frog habitat by GHD (2010a). These habitat areas are indicated on Figure 1.

2.3.2 Habits

The Green and Golden Bell Frog is frequently active during the day, although it is known to forage at night on insects, as well as other frogs (Cogger, 2000; Barker *et al*., 1995; NPWS, 1999). Tadpoles are known to feed on algae and other vegetative matter (NPWS, 1999; Anstis, 2002).

The Green and Golden Bell Frog exhibits strong migration tendencies, and is known to travel significant distances across often seemingly inhospitable habitat (DECC, 2007). Distances of up to 1.5 km in a single day/night are not unknown (Wellington, 1998; Pyke and White, 2001; DECC, 2007). It should be noted that such movements most often occurred during or immediately after significant rain events.

2.3.3 Breeding

The Green and Golden Bell Frog usually breeds in summer when conditions are warm and wet, typically after rain (Cogger, 2000; Barker, *et al*., 1995). The core breeding period for this species is generally accepted to be between September and February (DECC, 2007), provided sufficient rainfall occurs during this time.

Males call while floating in water and females produce a floating raft of eggs, which gradually settle to the bottom (NPWS, 1999).

Tadpoles take around six weeks to develop depending on environmental conditions (for example, temperature) (Pyke and White, 1996; NPWS, 1999).

Adult male Green and Golden Bell Frogs may only live for around two years in a hostile environment but, typically, life expectancy is likely to vary markedly according to the quality of the habitat (Goldingay and Newell, 2005).

2.3.4 Threats

Frog Chytrid Fungus (FCF) has been identified as a key threatening process, at both the state and national level, for the Green and Golden Bell Frog (DSEWPC, 2009). FCF is widespread on Kooragang Island and Hexham Swamp, the other key Green and Golden Bell Frog population in the Newcastle area (DECC, 2007).

Recent evidence suggests that occasional exposure to saline influences and/or certain contaminants may be attenuating the effects of the FCF (DECC, 2007). Such saline and polluted conditions occur on the KIWEF site. Hypotheses supporting this scenario are presently being tested by M. Stockwell and M. Mahoney from the University of Newcastle (NCIG, 2007).

3.0 MANAGEMENT PROCEDURES

3.1 Identification and Delineation of Disturbance Areas

Known and potential Green and Golden Bell Frog habitat is located across the KIWEF site and surrounds. GHD (2010a) identified and mapped that habitat (as identified in Figure 5.5 of their report), which is presented in Figure 1 of this GGBF Management Plan. Prior to capping works commencing, this habitat will be clearly identified on the ground (with appropriate signage), and the locations of it communicated to personnel undertaking works on the site. This communication will be undertaken as part of the site induction (refer to section 3.3), and will include obligations of personnel to maintain and protect that habitat.

Ponds P and Q (that is, cells K26 and K32) will be subject to a separate Action Plan (Golder, 2011) due to their significance as habitat and the presence of contaminated soil and groundwater.

3.2 Identification of Areas of Disturbance to Habitat

As part of the capping strategy, a small proportion of the known and potential Green and Golden Bell Frog habitat may be disturbed. This habitat area comprises the fringing habitat adjacent to Deep Pond, that is the area located near K3/1W and the BOS area (Figure 1).

The frogs will be relocated within the KIWEF during the capping works.

3.3 Environment Induction and Training

All HDC personnel, contractors and sub-contractors will undergo environmental induction and training before commencing work on-site. As it pertains to the Green and Golden Bell Frog, information addressed during this training will include (NCIG, 2007):

- Green and Golden Bell Frog profile and identification (Section 2).
- Identification of Green and Golden Bell Frog habitat areas. Project personnel will be prohibited from entering Green and Golden Bell Frog habitat areas located outside defined works areas.
- Site hygiene management in accordance with the Hygiene Protocol (Section 3.4).
- Procedures to be followed in the event Green and Golden Bell Frogs are found (Section 3.6).

3.4 Site Hygiene Management

The proposed hygiene management protocol described below largely follows that prepared by NCIG (2007), which has been accepted by OEH.

FCF (refer to section 2.3.4) has the potential to adversely affect Green and Golden Bell Frogs. It is known to occur on Kooragang Island, and potentially on the KIWEF site. Infection occurs through waterborne zoospores released from an infected amphibian in water (NPWS, 2001) and the fungus infects both frogs and tadpoles (Berger *et al.*, 1999). Therefore, the spread of FCF can occur via the movement of water around the site and/or soil attached to equipment (both plant and personal protective equipment).

Typical clinical signs of frogs infected with FCF (after Berger *et al.*, 1999) include:

- lethargy
- loss of appetite
- skin discoloration
- presence of excessive sloughed skin
- sitting unprotected during the day with hind legs held loosely to the body.

3.4.1 Hygiene Training

To reduce the likelihood of spreading FCF, all HDC employees and contractors involved in activities in areas of known habitat for the Green and Golden Bell Frog (and other amphibian species) will be trained in site hygiene management in accordance with the hygiene protocol (Appendix A). This will be part of the environmental induction and training (Section 3.3).

3.4.2 Inspection and Disinfection of Mobile Plant

Any mobile plant entering and leaving the KIWEF site during the closure and capping activities will be routinely disinfected at a designated wash bay.

Similarly, personal protective equipment (PPE) of HDC employees and contractors entering and leaving the site will be disinfected as a matter of routine, following the methods outlined in the Hygiene Protocol (Appendix A).

Inspection and disinfection of mobile plant, and affected PPE, will be undertaken at a designated, concrete-bunded disinfection area at the entrance of the KIWEF site. The location of this area, and the disinfection procedure, will be incorporated into the site induction and training programme (refer to Section 3.3).

3.5 Pre-works Surveys for Disturbance Areas

Pre-works surveys will include targeted active searches of potential Green and Golden Bell Frog habitat located within proposed disturbance areas. These surveys will be undertaken by a suitably qualified and licensed ecologist.

The pre-works surveys (and, if applicable, relocation activities) will be conducted to minimise disruption to breeding activities and the need to relocate tadpoles or metamorphs, where practicable. All these activities will be conducted in accordance with the relevant measures outlined in the hygiene protocol (Section 3.4).

Habitat resources typically associated with the lifecycle components of the Green and Golden Bell Frog (for example, ponded areas, rocks, logs, tussock forming vegetation and other cover) will be searched during a diurnal visual inspection.

Following the diurnal habitat searches, a nocturnal habitat search may be conducted to assess nocturnal usage (that is, breeding/calling) in the habitat supported in the disturbance area, if the surveys are conducted during the core breeding season. The nocturnal habitat searches may include:

- searching of habitat features, which were searched during the day
- spotlighting
- call play-back.

In the event that any Green and Golden Bell Frogs are observed during the diurnal or nocturnal searches, the relocation procedures outlined in Section 3.6 will be initiated prior to the commencement of disturbance works. In some cases a frog-proof fence may be used to protect the frogs in-situ or to exclude frogs from the surveyed area.

The results of the pre-works surveys will be recorded and reported in the Annual Environmental Management Report (AEMR) (Section 6).

3.6 Green and Golden Bell Frog Relocation Procedures

The proposed relocation procedure described below largely follows that proposed by NCIG (2007), which has been accepted by OEH.

3.6.1 Relocation Procedure during Pre-works Surveys

In the event a Green and Golden Bell Frog is identified within the disturbance areas during pre-works surveys, the following relocation procedure will be initiated:

a) The ecologist undertaking the pre-clearance survey will capture the frog.

b) If the frog appears to be healthy:

    a. A suitable release location in the immediate vicinity of the disturbance area, yet outside of potential areas of disturbance, will be identified by the ecologist.

    b. The frog will be released into the relocation area. Any frog to be relocated will be held in a cool, dark, moist place until nightfall. Where practicable, relocation will be timed to coincide with periods of recent rainfall to optimise chances of survival of the frog.

c) If the frog appears to be sick, or is dead:

    a. the procedures outlined in Section 3.6.3 will be followed.

Relocation of Green and Golden Bell Frogs during pre-works surveys will be conducted in accordance with the relevant measures outlined in the hygiene protocol (Section 3.4).

Details of Green and Golden Bell Frogs that are relocated (that is, lifecycle stage and sex of individual [if possible], location where found and location of release) conducted during pre-works surveys will be recorded and reported in the AEMR (Section 6).

3.6.2 Relocation Procedure Outside of Pre-works Surveys

In the event a frog is observed within the KIWEF site outside of the designated pre-works surveys (for example, within an area already disturbed), and is thought to be a Green and Golden Bell Frog, the following relocation procedure will be initiated if the frog is likely to be harmed by the capping works:

a) The observer will notify the HDC's Environmental Representative, or suitably-qualified ecologist, of the frog's location.

b) The Environmental Representative, or suitably-qualified ecologist, will determine whether the frog is likely to be harmed by works.

c) If the frog is likely to be harmed by works, a suitably-qualified ecologist, will capture the frog.

d) If the frog appears to be healthy:

    a. A suitable release location (that is, one of the potential relocation areas identified on Figure 1) will be identified by the ecologist.

    b. The frog will be released into the relocation area. Any frog to be relocated will be held in a cool, dark, moist place until nightfall. Where practicable, relocation will be timed to coincide with periods of recent rainfall to optimise chances of survival of the frog.

e) If the frog appears to be sick, or is dead:

    a. the procedures outlined in Section 3.6.3 will be followed.

Relocation of Green and Golden Bell Frogs outside pre-works surveys will be conducted in accordance with the relevant measures outlined in the hygiene protocol (Section 3.4).

Details of Green and Golden Bell Frogs that are relocated (that is, lifecycle stage and sex of individual [if possible], location where found and location of release) during pre-work surveys will be recorded and reported in the AEMR (Section 6).

3.6.3 Procedures for Handling Sick or Dead Green and Golden Bell Frogs

Table 1 presents the range of symptoms that may be exhibited by sick or dying frogs, while Table 2 provides diagnostic behaviour tests, which can be used to determine if a frog is sick (for example, infected with FCF) (after NCIG, 2007).

Table 1: Symptoms of sick and dying frogs

Appearance	Behaviour
■ Darker or blotchy upper (dorsal) surface ■ Swollen hind limbs ■ Very thin or emaciated ■ Reddish/pink-tinged lower (ventral) surface and/or legs and/or webbing or toes ■ Skin lesions (sores, lumps) ■ Infected eyes ■ Obvious asymmetric appearance	■ Lethargic limb movements, especially hind limbs ■ Abnormal behaviour (e.g. a nocturnal burrowing frog sitting in the open during the day and making no vigorous attempt to escape when approached) ■ Little or no movement when touched

Source: after NPWS (2001)

Table 2: Diagnostic behaviour tests – sick frogs will fail one or more of the following tests

Test	Healthy	Sick
■ Gently touch with finger	■ Frog will blink.	■ Frog will not blink.
■ Turn frog on its back	■ Frog will flip back over.	■ Frog will remain on its back.
■ Hold frog gently by its mouth	■ Frog will use its forelimbs to try to remove grip	■ No response from frog

Source: after NPWS (2001)

In the event that a Green and Golden Bell Frog appears to be sick, or is dead, the following procedures will be followed (after NPWS, 2001):

- Disposable gloves will be worn when handling all frogs, as well as sick or dead frogs.
- To prevent cross-contamination, new gloves and a clean plastic bag will be used for each frog specimen.
- Frogs exhibiting one or more of the symptoms for sick frogs listed in Table 1 or 2, and considered unlikely to survive transportation will be euthanised[1].
- Sick frogs likely to survive transportation will be placed into either a moistened cloth bag with some damp leaf litter, or into a partially-inflated, clean plastic bag with damp leaf litter. All frogs will be kept separate during transportation.
- Dead frogs will be kept cool and preserved as soon as possible. The belly of the frog will be cut open and the specimen placed in preservative (approximately 10 times the volume of the specimen). Specimens will be preserved in either 65% ethanol or 10% buffered formalin.
- The recipient of the sick or dead frog will be contacted to confirm the appropriate procedure prior to transport[2].

[1] Terminally ill frogs will be placed into a container with the bottom covered with 3% chloral hydrate (NPWS, 2001).

- Containers will be labelled with the following details: date, location and species (if known).
- Standardised collection form will be filled out and a copy sent with the specimen (in Appendix A).
- Individual containers will be used for each specimen.

Details of sick or dead Green and Golden Bell Frogs found at the KIWEF site will be recorded and reported in the AEMR (Section 6).

[2] A list of potential sick and dead frog recipients is provided in Attachment 4 (NPWS, 2001), including Associate Professor Michael Mahony of the School of Biological Sciences, University of Newcastle.

4.0 GREEN AND GOLDEN BELL FROG MONITORING PROGRAMME

Baseline monitoring of the Green and Golden Bell Frog has been undertaken by GHD (2010 and Umwelt (2011).

NCIG has also implemented a monitoring programme that collects data that includes the Green and Golden Bell Frog populations on the KIWEF site.

The NCIG monitoring will be conducted annually until 2020 and then three-yearly till 2030. On the basis that the NCIG monitoring programme continues to be implemented, HDC do not propose to undertake any further monitoring, other than that specified in the Action Plan for the K26/K32 Ponds (Golder, 2011).

HDC propose to annually review the NCIG data to ensure that it meets HDC's requirements. The overall objective of HDC's review of the Green and Golden Bell Frog monitoring programme is to monitor the dynamics of the Green and Golden Bell Frog populations supported within known and potential habitat areas within the KIWEF site. The intention of the review programme will be to ascertain if the landfill closure works have an effect on the population.

Monitoring parameters that will be used for comparison will include, yet not be limited to:

a) Green and Golden Bell Frog presence/absence, distribution, habitat utilisation, behaviour and abnormalities.

b) observations of other frog species distribution, relative abundance and abnormalities.

c) habitat condition.

d) date

e) time of day

f) rainfall (mm)

g) site location (GPS co-ordinates and map location)

h) survey method utilised

i) sampling effort

j) habitats surveyed

k) weather conditions (including temperature)

l) number of observers

m) photographs taken

HDC will report to OEH annually for 5 years following the completion of the landfill closure works, unless analysis shows that Green and Golden Bell Frog populations are being impacted, then further reporting will be undertaken until a date agreed with OEH.

Monitoring and research to understand better the extent and dynamics of Green and Golden Bell Frog populations is a proposed action of the Draft Recovery Plan (DECC, 2005). This action has been adopted as a strategy to achieve the objectives of the Lower Hunter Management Plan. The results of this monitoring programme would contribute to this action/strategy.

The results of the monitoring programme will be recorded and reported in the AEMR (Section 6).

5.0 RESPONSE CRITERIA AND SPECIFIC MITIGATION AND MANAGEMENT MEASURES

The following proposed mitigation measures have been developed based on a review of information provided by GHD (2010a) and a review of site conditions.

5.1 Management of All Disturbance Areas

The following mitigation measures will be implemented to manage areas proposed for disturbance.

- The boundaries of all Green and Golden Bell Frog habitat will be clearly identified on the ground.
- Appropriate erosion and sediment control structures will be installed at least 30 metres upslope of all such habitat areas. These erosion and sediment control structures will be regularly inspected and maintained, particularly after significant rainfall events.
- All plant entering and leaving the KIWEF site will be, as a matter of routine, disinfected via a wash bay. The location and procedures involved at this wash bay will form part of the site induction and training (see Section 3.3). Records will be kept.
- Similarly, all HDC employees and contractors involved in activities in areas of known habitat for the Green and Golden Bell Frog (and other amphibian species) will be trained in site hygiene management in accordance with the hygiene protocol (Appendix A). This will be part of the environmental induction and training (Section 3.3). Records will be kept.
- All PPE in contact with soil, particularly boots, of HDC employees and contractors entering and leaving the site will be disinfected as a matter of routine, following the methods outlined in the Hygiene Protocol (Appendix A).
- All disinfection processes will be monitored and controlled at the KIWEF site's entry and exit point. The location of these disinfection bays, and the obligations of disinfection, will be communicated during the site induction and training (Section 3.3).
- All water required for dust suppression will be drawn from ponds established for the purpose. No water for dust suppression will be drawn from current ponds on the site. The establishment of dedicated dust suppression ponds will be undertaken to prevent the potential spread of Plague Minnow into ponds currently free of this species. The location and procedure for those dedicated dust suppression ponds will be communicated during the site induction and training (Section 3.3).
- Stormwater diversion measures, if required, will be put in place to maintain the current hydrological regime for the site.
- If practicable, the capping and grading activities will be scheduled to occur outside of the core Green and Golden Bell Frog breeding period (that is, September to March), especially in areas adjacent to known and potential breeding habitat.

5.2 Specific Management Measures for Disturbed Areas

The following mitigation measures will be implemented to manage areas proposed for disturbance. It should be noted that these measures do not negate the need for the measures outlined in Section 5.1.

- The disturbance area will be clearly delineated on the site plan and on the ground. The boundaries of the area and its location will be made known to all personnel involved during the site induction (refer to Section 3.3).
- One week prior to works commencing in the disturbance area, a pre-works survey will be conducted by a qualified ecologist (refer to Section 3.5 for a suggested survey protocol).

- In the event that any Green and Golden Bell Frogs are identified in the area, they will be relocated (using appropriate amphibian hygiene protocols) to known and suitable Green and Golden Bell Frog habitat areas immediately adjacent to the disturbance footprint (refer to Section 3.6 for appropriate relocation procedures).
- The works will be scheduled to occur outside of the core breeding period for Green and Golden Bell Frogs, that is, September to March.
- An on-site, suitably-qualified ecologist will be available during all clearing and capping works undertaken in the habitat areas to be disturbed. This person will be available to relocate Green and Golden Bell Frogs that may be found in the disturbance footprint during capping activities.
- In an attempt to limit the potential for Green and Golden Bell Frogs to enter the disturbance footprint, and if practicable, a frog-proof barrier will be erected around the disturbance footprint.
- Appropriate erosion and sediment control measures will be put in place around the disturbance area, prior to any works commencing, to prevent sediment from moving into adjacent habitat.
- Once works are complete, the restoration and rehabilitation of that habitat will be undertaken in accordance with a rehabilitation and revegetation plan.

5.3 Measures to Enhance Restore and Maintain Habitat

It is noted that the proposed capping works have been designed to minimise impacts on Green and Golden Bell Frog Habitat and will impact upon only two small areas.

It is anticipated that the mitigation measures presented in Sections 5.1 and 5.2 will assist in the management of the Green and Golden Bell Frogs, and their habitat on the KIWEF site, during and immediately following the landfill closure work, and the associated activities. In addition to those, the following mitigation measures have been developed to assist, where practicable, in the enhancement, restoration and maintenance of Green and Golden Bell Frog habitat following the completion of the landfill closure works.

- The capping strategy has been designed to limit and ultimately reduce the exposure of potential Green and Golden Bell Frog habitat, and the wider ecosystems of Kooragang Island, to soil and groundwater contaminants.
- As part of the rehabilitation and revegetation plan for the KIWEF site, open stormwater infrastructure across the KIWEF site may be planted with species known to be favoured by Green and Golden Bell Frogs. This revegetation and rehabilitation strategy will include a 2 metre wide buffer on either side of the stormwater drains. The intention of these areas is to provide movement corridors for Green and Golden Bell Frogs across the site.
- The capped areas will ideally be designed to shed water to table drains, which, in a similar manner to other stormwater infrastructure, will be vegetated with species known to be favourable to Green and Golden Bell Frogs.
- Drainage culverts will, where practicable, be vegetated and lined with rocks and objects that may provide temporary frog refuge, in the event that a frog seeks to traverse the future capped area of KIWEF.
- The drainage culverts in the NCIG rail loop may provide additional areas that can be rehabilitated to facilitate the migration and dispersal of the Green and Golden Bell Frog (Connell Hatch, 2008, in GHD, 2010b).

5.4 Response Criteria

5.4.1 General Site Environmental Management

As part of the overall environmental management plan for the site, during the landfill closure works, the HDC's environmental representative will conduct weekly inspections of all the management measures identified in Sections 5.1, 5.2 and 5.3. The results of these inspections will be recorded and a summary provided in the AEMR.

Should non-conformances be identified, HDC's environmental representative will contact the Site Foreman within 24 hours and request a remediation action. The Site Foreman will have 48 hours to correct the non-conformance.

5.4.2 Population Monitoring

If the results of the monitoring programme indicate a decline in Green and Golden Bell Frog numbers across the site, which cannot be attributed to natural population fluctuations and variability, and is potentially a direct result of the landfill closure works, specific response criteria will be developed by HDC, in consultation with the OEH. The aim of these response criteria will be to determine whether declining populations (if evident from the monitoring programme [Section 4]) are directly attributable to the capping project.

6.0 REPORTING AND REVIEW

In accordance with the *Approval of Surrender of Licence Number 6437*, the Director-General will be notified of any incident with actual or potential significant off-site impacts on people or the biophysical environment, as soon as practicable after the occurrence of the incident. The Director-General will be provided with written details of the incident within seven days of the date on which the incident occurred.

HDC will prepare an Annual Environmental Management Report (AEMR) that:

a) Reviews the performance of the capping project against this management plan.

b) Provides an overview of environmental management actions and summarises monitoring results over the 12 month reporting period.

c) Continues on an annual basis for a minimum of five years following completion of the Landfill Closure Works.

d) Will be phased out on presentation of adequate information to establish that the Landfill Closure Works have had no measurable impacts to Green and Golden Bell Frog populations on the KIWEF site. In the unlikely event that changes in the Green and Golden Bell Frog population are observed, which appear to be attributable to the Landfill Closure Works, extended review will be undertaken. This may involve a more detailed monitoring and investigation programme to address the potential cause of the decline in those areas. The programme will aim to identify direct evidence indicating that the Landfill Closure Works contributed to the decline. The details of that programme will be developed through discussion with OEH.

The AEMR will be distributed to relevant government agencies and stakeholders, and copies provided to other interested parties, if requested.

In accordance with the *Approval of Surrender of Licence Number 6437*, this management plan will be made available on the HDC website.

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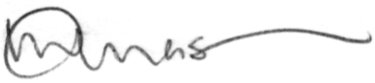

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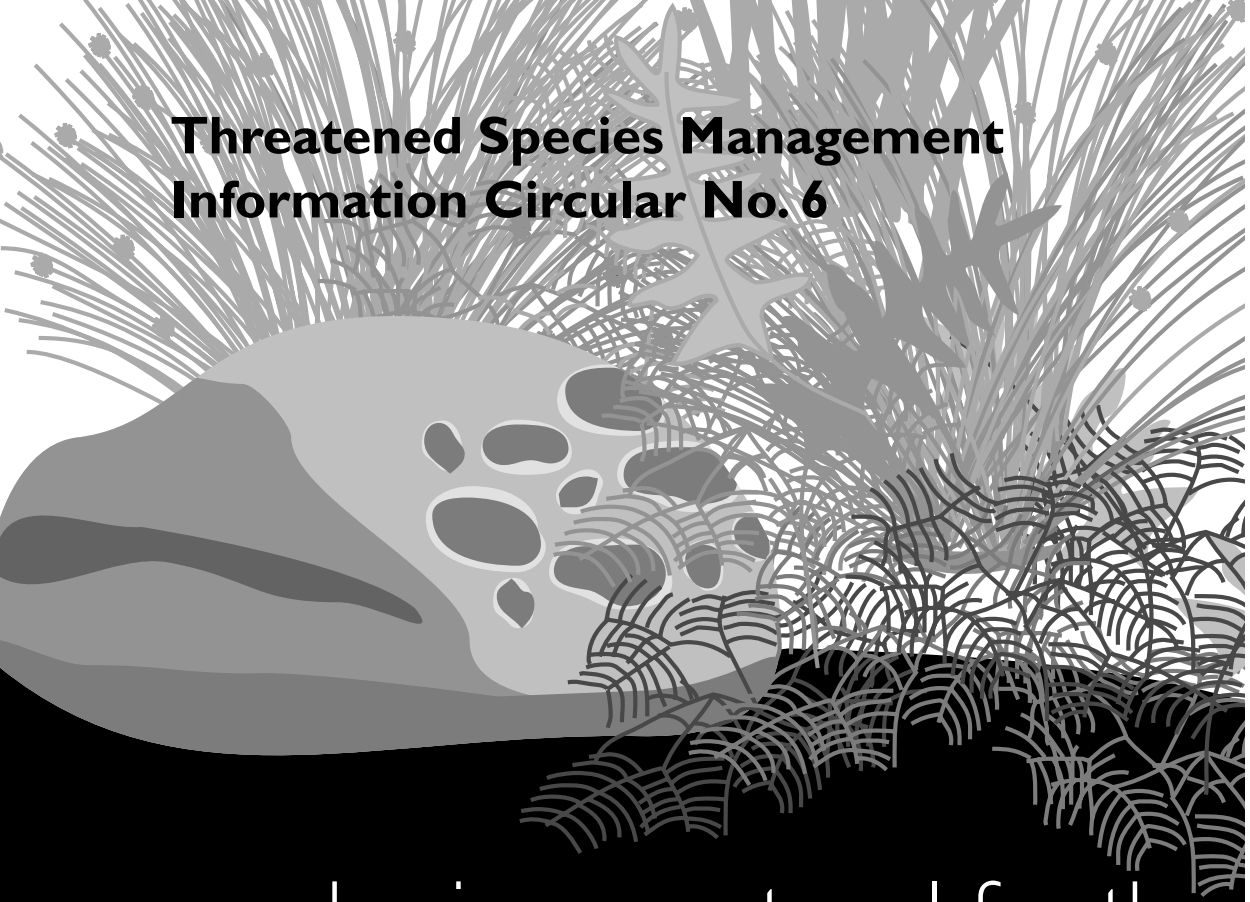
APPENDIX A

Hygiene Protocol for the Control of Disease in Frogs

Threatened Species Management Information Circular No. 6



hygiene protocol for the control of disease in frogs

April 2008

Department of **Environment & Climate Change** NSW

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hygiene protocol for the control of disease in frogs

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1 introduction

This information circular outlines measures to:

- Prevent or reduce disease causing pathogens being transferred within and between wild populations of frogs.
- Ensure captive frogs are not infected prior to release.
- Deal safely with unintentionally transported frogs.
- Assist with the proper identification and management of sick and dead frogs in the wild.

1.1 Who should read this document?

This protocol is intended for use by all researchers, wildlife consultants, fauna surveyors and students undertaking frog field-work. In addition, the protocol should be read by Department of Environment and Climate Change (DECC) personnel, frog keepers, wildlife rescue and carer organisations, herpetological/frog interest groups/ societies, fauna park/zoo operators/workers and other individuals who regularly deal with or are likely to encounter frogs.

This protocol outlines the expectations of the DECC regarding precautionary procedures to be employed when working with frog populations. The intention is to promote implementation of hygiene procedures by all individuals working with frogs. New licences and licence renewals will be conditional upon incorporation of the protocol. The DECC recognises that some variation from the protocol may be appropriate for particular research and frog handling activities. Such variation proposals should accompany any licence application or renewal to the DECC.

1.2 Background

1.2.1 Amphibian Chytrid Fungus

The apparent decline of frogs, including extinctions of species and local populations, has attracted increased international and national concern. Many potential causes for frog declines have been proposed (eg see Pechmann et al., 1991; Ferrero and Bergin, 1993; Pechmann and Wilbur, 1994; Pounds and Crump, 1994; Pounds et al., 1997). However, the patterns of decline at many locations suggest that epidemic disease maybe the cause (Richards et al., 1993; Laurance et al., 1996; Alford and Richards, 1997). Recent research has implicated a water-borne fungal pathogen *Batrachochytrium dendrobatidis* as the likely specific causative agent in many of these declines both in Australia and elsewhere (Berger et al., 1998; 1999). This agent is commonly known as the amphibian or frog chytrid fungus and is responsible for the disease Chytridiomycosis (Berger et al., 1999).

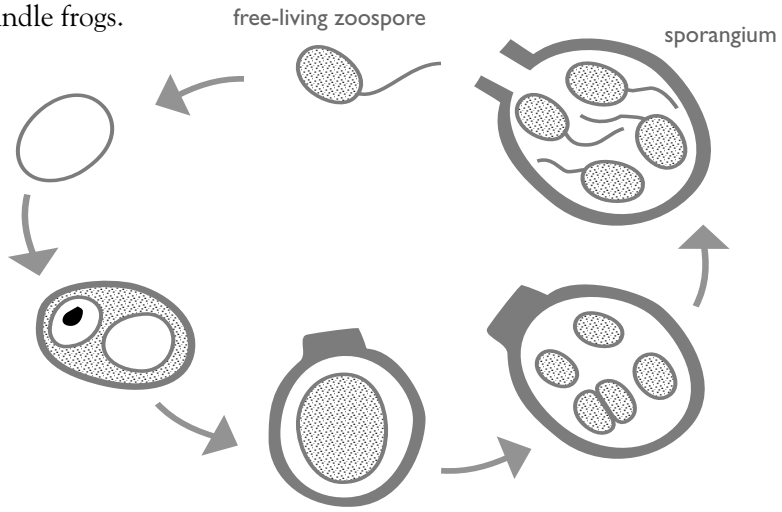
B. dendrobatidis is a form of fungus belonging to the phylum Chytridiomycota. Most species within this phylum occur as free-living saprophytic fungi in water and soil and have been found in almost every type of environment including deserts, artic tundra and rainforest and are considered important primary biodegraders (Powell 1993). *B. dendrobatidis* is a unique parasitic form of Chytridiomycete fungi, in that it invades the skin of amphibians, including tadpoles, often causing sporadic deaths with up to 100% mortality in some populations. Chytridiomycosis has been detected in over 40 species of native amphibian in Australia (Mahony and Workman 2000). However, it is not currently known whether the fungus is endemic or exotic to Australia.

The infective stage of *B. dendrobatidis* is the zoospore and transmission requires water (Berger et al.,1999). Zoospores released from an infected amphibian can potentially infect other amphibians in the same water. More research is needed on the dynamics of infection in the wild. *B. dendrobatidis* is known to be susceptible to seasonal temperature changes, dehydration, salinity, water pH, light, nutrition and dissolved oxygen (Berger et al., 1999).

1.3 Objectives

The objectives of the hygiene protocol are to:

- Recommend best-practice procedures for DECC personnel, researchers, consultants and other frog enthusiasts or individuals who handle frogs.
- Suggest workable strategies for those regularly working in the field with frogs or conducting fieldwork activities in wetlands and other aquatic environments where there is the potential for spreading pathogens such as the frog chytrid fungus.
- Provide background information and guidance to people who provide advice or supervise frog related activities.
- Provide standard licence conditions for workers engaged in frog related activities.
- Inform Animal Care and Ethics Committees (ACEC) for their consideration when granting research approvals.



Life cycle of frog chytrid fungus from infective free-living zoospore stage to sporangium (adapted from L. Berger).

2 site hygiene management

A checklist of risk management procedures and recommended standard hygiene kit is provided in Appendix 1. Please note Footnote 1 on page 4.

Individuals studying frogs often travel and collect samples of frogs from multiple sites. Some frog populations can be particularly sensitive to the introduction of infectious pathogens such as the frog chytrid fungus. Also, the arrangement of populations in the landscape may make frogs particularly vulnerable to transmission of infectious pathogens. Therefore, it is important that frog workers recognise the boundaries between sites and undertake measures which reduce the likelihood of spreading infection.

Where critically endangered species or populations of particular risk are known to occur, this protocol should be applied over very short distances ie a single site may need to be subdivided and treated as separate sites.

When planning to survey multiple sites, always start at a site where frog chytrid fungus is not known to be present before entering other infected areas.

2.1 Defining a site

Defining the boundary of a site maybe problematic. In some places, the boundary between sites will be obvious but in others, less so. Undertaking work at a number of sites or conducting routine monitoring at a series of sites within walking distance creates obvious difficulties with boundary definitions. It is likely that defining the boundary between sites will differ among localities. It may be that a natural or constructed feature forms a logical indicator of a site boundary eg a road/track, a large body of water such as a river or the sea, a marked habitat change or a catchment boundary.

As a guiding principle, each individual waterbody should be considered a separate site.

When working along a river or stream or around a wetland or a series of interconnecting ponds it is reasonable, in most instances, to treat such examples as a single site for the purposes of this protocol. Such a case would occur in areas where frogs are known to have free interchange between ponds.

Where a stream consists of a series of distinctive tributaries or sub-catchments or where there is an obvious break or division then they should be treated as separate sites, particularly if there is no known interchange of frogs between sites.

2.2 On-site hygiene

When travelling from site to site it is recommended that the following hygiene precautions be undertaken to minimise the transfer of disease from footwear, equipment and/or vehicles.

Footwear

Footwear must be thoroughly cleaned and disinfected at the commencement of fieldwork and between each sampling site.

This can be achieved by initially scraping boots clear of mud and standing the soles in a disinfecting solution. The remainder of the boot should be rinsed or sprayed with a disinfecting solution that contains *benzalkonium chloride* as the active ingredient. Disinfecting solutions should be prevented from entering any water bodies.

Rubber boots such as 'gum boots' or 'Wellingtons' are recommended because of the ease with which they can be cleaned and disinfected.

Several changes of footwear bagged between sites might be a practical alternative to cleaning.

Equipment

Equipment such as nets, balances, callipers, bags, scalpels, headlamps, torches, wetsuits and waders etc that are used at one site must be cleaned and disinfected before re-use at another site.

Disposable items should be used where possible. Non-disposable equipment should be used only once during a particular field exercise and disinfected later or disinfected at the site between uses using procedures outlined in 2.4 below.

Vehicles

Where necessary, vehicle tyres should be sprayed/flushed with a disinfecting solution in high-risk areas.

Transmission of disease from vehicles is unlikely to be a problem. However, if a vehicle is used to traverse a known frog site, which could result in mud and water being transferred to other bodies of water or frog sites, then wheels and tyres should undergo cleaning and disinfection. This should be carried out at a safe distance from water bodies, so that the disinfecting solution can infiltrate soil rather than run-off into a nearby water body.

Spraying with 'toilet duck' (active ingredient *benzalkonium chloride*) is recommended to disinfect car wheels and tyres.

Cleaning of footwear before getting back into the car will prevent the transfer of pathogens from/to vehicle floor and control pedals.

2.3 Handling of frogs in the field

The spread of pathogenic organisms, such as the frog chytrid fungus, may occur as a result of handling frogs.

Frogs should only be handled when necessary.

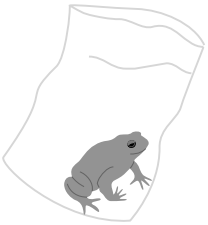
Where handling of frogs is necessary the risk of pathogen transfer should be minimised as follows:

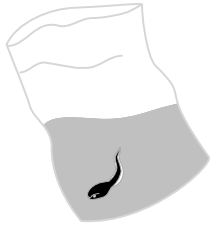
- Hands should be either cleaned and disinfected between samples or a new pair of disposable gloves used for each sample[1]. This may be achieved by commencing with a work area that has a dish containing a disinfecting solution and paper towels.
- A 'one bag – one frog' approach to frog handling should be used especially where several people are working together with one person processing frogs and others doing the collecting. Bags should not be reused.
- A 'one bag – one sample' approach to tadpole sampling should be used. Bags should not be reused.

Researchers who use toe clipping or Passive Integrated Transponder (PIT) tagging are likely to increase the risk of transmitting disease between frogs due to the possibility of directly introducing pathogens into the frogs' system. This can be minimised by using:

- Disposable sterile instruments
- Instruments disinfected previously and used once
- Instruments disinfected in between each frog

Disinfecting solutions containing *benzalkonium chloride* are readily available from local supermarkets. Some brands include Toilet Duck, Sanpic, New Clenz and Pine Clean.





[1] As a principle, this protocol assumes that not all frogs in an infected pond will be contaminated by the frog chytrid fungus. The infective load of a body of water may not be high enough to cause cross contamination of individual frogs in the same pond. Therefore care should be taken to use separate gloves and bags and clean hands for each sample, to avoid transmission of high infective loads between individuals.

Open wounds from toe clipping and PIT tagging should be sealed with a cyanoacrylate compound such as *Vetbond*© to reduce the likelihood of entry of pathogens. The DECC ACEC further recommends the application of topical anaesthetic *Xylocaine*© cream and *Betadine*© disinfectant (1% solution) before and after any surgical procedure. This should then be followed by the wound sealant.

All used disinfecting solutions, gloves and other disposable items should be stored in a sharps or other waste container and disposed or sterilised appropriately at the completion of fieldwork. Disinfecting solutions must not come into contact with frogs or be permitted to contaminate any water bodies

2.4 Disinfection Methods

Disinfecting agents for hands and equipment must be effective against bacteria and both the vegetative and spore stages of fungi. The following agents are recommended:

- Chloramine and Chlorhexidine based products such as *Halamid*©, *Halasept*© or *Hexifoam*© are effective against both bacteria and fungi. These products are suitable for use on hands, footwear, instruments and other equipment. The manufacturers instructions should be followed when preparing these solutions.
- Bleach and alcohol (ethanol or methanol), diluted to appropriate concentrations can be effective against bacteria and fungi. However, these substances may be less practical because of their corrosive and hazardous nature.

  When using methanol either:

  - immerse in 70% methanol for 30 minutes or
  - dip in 100% methanol then flame for 10 seconds or boil in water for 10 minutes

Fresh bleach (5% concentration) may be also effective against other frog pathogens such as Rana Virus.

Some equipment not easily disinfected in these ways can be effectively cleaned using medical standard 70% isopropyl alcohol wipes – *Isowipes*©.

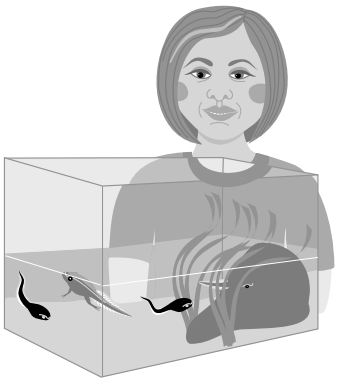
3 captive frog hygiene management

3.1 Housing frogs and tadpoles

Frogs and tadpoles should only be removed from a site when absolutely necessary.

When it is necessary for frogs or tadpoles to be collected and held for a period of time, the following measures should be undertaken:

- Animals obtained at different sites should be kept isolated from each other and from other captive animals.
- Aquaria set up to hold frogs should not share water, equipment or any filtration system. Splashes of water from adjacent enclosures or drops of water on nets may transfer pathogens between enclosures.
- Prior to housing frogs or tadpoles, ensure that tanks, aquaria and any associated equipment are disinfected.
- Tanks and equipment should be cleaned, disinfected and dried immediately after frogs/tadpoles are removed.



Careful maintenance of your enclosures will ensure a safe and hygienic environment for captive frogs and tadpoles.

When contemplating a release of captive bred tadpoles for conservation purposes a Translocation Proposal should be submitted to the DECC and pathological screening for disease should be undertaken (see also DECC Translocation Policy). Tadpoles can be tested by randomly removing 10 individuals at 6 weeks and again at 2 weeks before anticipated release. Testing could be undertaken by the pathology section at Taronga Zoo, Newcastle University, CSIRO Australian Animal Health Laboratories at Geelong and James Cook University at Townsville. Such an arrangement would need to be negotiated by contacting one of these institutions well before the anticipated release date. (see Appendix 2 for contact details)

DECC have licenced NSW Schools to allow students and/or teachers to remove tadpoles for classroom life cycle studies. They are authorised to remove individuals from only one location, each school also requires endorsement from Department of Education and Training Animal Care and Ethics Committee and comply with this protocol.

Tadpoles collected for these purposes are to be obtained from the local area of the school and are not to be obtained from DECC Reserves. As soon as tadpoles have transformed, froglets must be returned to the exact point of capture. Tadpoles from different locations are not to be mixed.

Antifungal cleansing treatments to clear tadpoles of the frog chytrid fungus are currently being trialed. In the future, such a treatment may be an added procedure required prior to froglet releases.

Detailed information on safely maintaining frogs in captivity is provided in Voigt (2001).

3.2 Tadpole treatment

In most instances:

Release to the wild of tadpoles held or bred in captivity should be avoided.

3.3 Frog treatment

The rigour with which frogs must be treated to ensure pathogens are not introduced to native populations means that any proposal for the removal of adult frogs (particularly threatened species) from wild populations should be given careful consideration.

When it is essential for frogs to be removed from the wild, the following should apply.

Individuals to be released should be quarantined for a period of 2 months and monitored for any signs of illness or disease.

Frogs must not be released if any evidence of illness or infection is detected. If illness is suspected, further advice must be sought from a designated frog recipient (Appendix 2) as soon as possible to determine the nature of the problem. Chytridiomycosis can be diagnosed in live frogs by microscopical examination of preserved toe clips or from shedding skin samples. Research is still in progress on the development of a simple technique for the detection of Chytridiomycosis and a treatment for infected frogs.

Current methods which may be used include:

- A technique for the treatment of potentially infected frogs is to place the frogs individually in a 1mg/L benzalkonium chloride solution for 1 hour on days 1, 3, 5, 9, 11 and 13 of the treatment period. Frogs are then isolated/quarantined for two months. This and other possible treatments are documented in Berger and Speare (1998)
- *Betadine*© and *Bactone*© treatments have also been used on adult frogs with some success (M. Mahony, Newcastle University pers. comm.)
- *Itraconazole*© is an expensive drug which has been used successfully (Lee Berger CSIRO Australian Animal Health Laboratory pers. comm.). Information on this method is available on the Website http://www.jcu.edu.au/school/PHTM/frogs/adms/attach6.pdf.

Frogs undergoing treatment should be housed individually and kept separate from non-infected individuals.

3.4 Displaced frogs

Displaced frogs are those native frog species and introduced Cane Toads (Bufo marinus) which have been unintentionally transported around the country with fresh produce, transported produce and landscaping supplies. Procedures to be undertaken when encountering introduced/displaced native frog species (as well as Cane Toads) are as follows.

3.4.1 Banana box frogs

'Banana Box' frog is the term used to describe several native frog species (usually Litoria gracilenta, L. infrafrenata, L. bicolor and L. caerulea) commonly transported in fruit and vegetable shipments and landscaping supplies. In the past, well meaning individuals have attempted to return these frogs to their place of origin but this is usually impossible to do accurately. There is risk of spread of disease if these frogs are transferred from place to place.

It is strongly recommended that:

Displaced Banana Box frogs should be treated as if they are infected and should not to be freighted anywhere for release to the wild unless specifically approved by DECC.

When encountering a displaced frog:

- Contact a licensed wildlife carer organisation to collect the animal. The frog should then undergo a quarantine period of 2 months along with an approved disinfection treatment.
- Post-quarantine, the frog (if one of the species identified above) may be transferred to a licensed frog keeper. All other species require the permission from DECC Wildlife Licensing and Management Unit (WLMU) prior to transfer. Licensed carer groups are to record and receipt frogs obtained and disposed of in this way.
- Licensed Frog Keepers are to list these frogs in their annual licence returns to DECC.

Frogs held by licensed frog keepers are not to be released to the wild except with specific DECC approval.

Displaced frogs may be made available to recognised institutions for research projects, display purposes or perhaps offered to the Australian Museum as scientific specimens once approval has been provided by the DECC WLMU.

Frogs are often unintentionally transported with fresh produce and landscaping supplies. They are collectively known as 'banana box' or displaced frogs.

3.4.2 Cane toads

Cane toads are known carriers of the Frog chytrid fungus and should not be knowingly transported or released to the wild.

If a cane toad is discovered outside of its normal range, it should be humanely euthanased in accordance with the recommended NSW Animal Welfare Advisory Council procedure (see Appendix 3). Care should be taken to avoid euthanasia of native species due to mistaken identity.

3.4.3 Local frog species

Frogs encountered on roads, around dwellings and gardens or in swimming pools should not be considered as displaced frogs.

Frogs encountered in these situations should be assisted off roads, away from dwellings, or out of swimming pools preferably to the nearest area of vegetation or suitable habitat.

Incidences of frogs spawning or tadpoles appearing in swimming pools should be referred to a wildlife carer/rescue organisation for assistance (see Appendix 4).

Contact the Frogwatch Helpline if you are unsure whether a frog is a local species or displaced.

An NPWS information brochure titled 'Cane Toads in NSW' provides further information on cane toads and assistance with identification of some of the commonly misidentified native species. This information is also available on the DECC website.

4 sick or dead frogs

Unless an obvious cause of illness or death is evident (eg predation or road mortality): Sick or dead frogs encountered in the wild should be collected and disposed of in accordance with the procedures described in section 4.2 below.

4.1 Symptoms of sick and dying frogs

Sick and dying frogs exhibit a range of symptoms characteristic of chytrid infection. Symptoms may be expressed in the external appearance or behaviour of the animal. A summary of these symptoms are described below. More detailed information can be found in Berger et al., (1999) or at the James Cook University Amphibian Disease website at: http://www/jcu.edu.au/school/phtm/PHTM/frogs/ampdis.htm.

Appearance (one or more symptoms)

- darker or blotchy upper (dorsal) surface
- reddish/pink-tinged lower (ventral) surface and/or legs and/or webbing or toes
- swollen hind limbs
- very thin or emaciated
- skin lesions (sores, lumps)
- infected eyes
- obvious asymmetric appearance

Behaviour (one or more symptoms)

- lethargic limb movements, especially hind limbs
- abnormal behaviour (eg a nocturnal, burrowing or arboreal frog sitting in the open during the day and making no vigorous attempt to escape when approached)
- little or no movement when touched

Great barred frog (*Mixophyes fasciolatus*) with severe Chytrid infection — note lethargic attitude and sloughing skin. Photo: L. Berger

Diagnostic behaviour tests

Sick frogs will fail one or more of the following tests:

test	healthy	sick
Gently touch with finger	Frog will blink	Frog will not blink above the eye
Turn frog on its back	Frog will flip back over	Frog will remain on its back
Hold frog gently by its mouth	Frog will use its forelimbs to try to remove grip	No response from frog

4.2 What to do with sick or dead frogs

A procedure for the preparation and transport of a sick or dead frog is given below[2]. Adherence to this procedure will ensure the animal is maintained in a suitable condition for pathological examination and assist the DECC and researchers to determine the extent of the disease and the number of species affected.

- Disposable gloves should be worn when handling sick or dead frogs. Avoid handling food and touching your mouth or eyes as this could transfer pathogens and toxic skin secretions from some frog species.
- New gloves and a clean plastic bag should be used for each frog specimen to prevent cross-contamination. When gloves are unavailable, use an implement to transfer the frog to a container rather than using bare hands.
- If the frog is dead, keep the specimen cool and preserve as soon as possible (as frogs decompose quickly after death making examination difficult). Specimens can be fixed/preserved in 70% ethanol or 10% buffered formalin.

Cut open the belly and place the frog in about 10 times its own volume of preservative. Alternatively, specimens can be frozen (although this makes tissues unsuitable for some tests). If numerous frogs are collected, some should be preserved and some should be frozen. Portions of a dead frog can be sent for analysis eg a preserved foot, leg or a portion of abdominal skin.

- The container should be labelled showing at least the species, date and location. A standardised collection form is provided in Appendix 5.
- If the frog is alive but unlikely to survive transportation (death appears imminent), euthanase the frog (see Appendix 3) and place the specimen in a freezer. Once frozen, the specimen is ready for shipment to the address provided below.
- If the frog is alive and likely to survive transportation, place the frog into either a moistened cloth bag with some damp leaf litter or into a plastic bag with damp leaf litter and partially inflated before sealing. Remember to keep all frogs separated during transportation.
- Preserved samples can be sent in jars or wrapped in wet cloth, sealed in bags and placed inside a padded box.
- Send frozen samples in an esky with dry ice (available from BOC/CIG Gas outlets).
- Place live or frozen specimens into a small styrafoam esky (available from K-Mart/Big W for approximately $2.50).
- Seal esky with packaging tape and address to one of the laboratories listed in Appendix 4.
- Send the package by courier.

Further information on sick and dying frogs is available on the Amphibian Disease Home Page at http://www.jcu.edu.au/dept/PHTM/frogs/ampidis.htm — in particular refer to *'What to do with dead or ill frogs'*.

[2] The measures described below are standard procedures and may vary slightly depending on the distance and time required to reach the intended recipient. Contact the intended recipient of the sick or dead frog prior to sending to confirm the appropriate procedure.

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appendix 1

hygiene protocol checklist and field kit

The following checklist and field kit are designed to assist with minimising the risk of transferring pathogens between frogs.

Have you considered the following questions before handling frogs in the field:

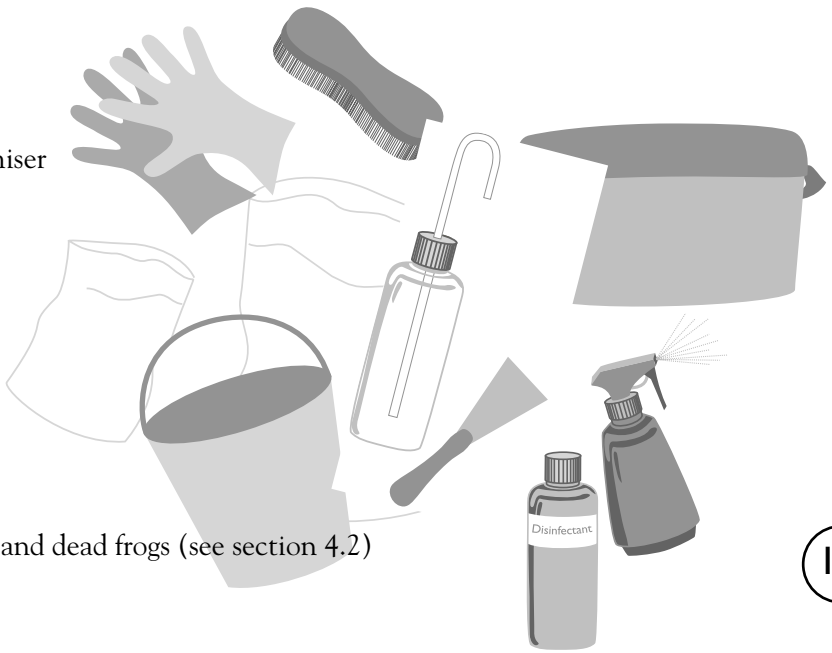
- Has your proposed field trip been sufficiently well planned to consider hygiene issues?
- Have you taken into account boundaries between sites (particularly where endangered species or populations at risk are known to occur)?
- Have footwear disinfection procedures been considered and a strategy adopted?
- Have you planned the equipment you will be using and developed a disinfection strategy?
- Are you are planning to visit sites where vehicle disinfection will be needed (consider both vehicle wheels/tyres and control pedals) and if so, do you have a plan to deal with vehicle disinfection?
- Have handling procedures been planned to minimise the risk of frog to frog pathogen transmission?
- Do you have a planned disinfection procedure to deal with equipment, apparel and direct contact with frogs?

If you answered NO to any of these questions please re-read the relevant section of the DECC Hygiene Protocol for the Control of Disease in Frogs and apply a suitable strategy.

Field hygiene kit

When planning to survey frogs in the field a portable field hygiene kit should be assembled to assist with implementing this protocol. Recommended contents of a field hygiene kit would include:

- Small styrofoam eski
- Disposable gloves
- Disinfectant spray bottle (atomiser spray) and/or wash bottle
- Disinfecting solutions
- Wash bottle
- Scraper or scrubbing brush
- Small bucket
- Plastic bags large and small
- Container for waste disposal
- Materials for dealing with sick and dead frogs (see section 4.2)



appendix 2

designated sick and dead frog recipients

Always contact the relevant specialist prior to sending a sick or dead frog. In some cases, only wild frogs will be assessed for disease. Analysis may also attract a small fee per sample.

Contact one of the following specialists to arrange receipt and analyse sick and dead frogs. Make contact prior to dispatching package:

Karrie Rose
Australian Registry if Wildlife Health
Taronga Conservation Society, Australia
PO Box 20
MOSMAN NSW 2088

Phone: 02 9978 4749
Fax: 02 9978 4516
Krose@zoo.nsw.gov.au

Diana Mendez or
Rick Speare
School of Public Health,
Tropical Medicine and
Rehabilitation Sciences
James Cook University
Douglas Campus
TOWNSVILLE QLD 4811

Phone: 07 4796 1735
Fax: 07 4796 1767
Diana.Mendez@jcu.edu.au
Richard.Speare@jcu.edu.au

Michael Mahony
School of Biological Sciences
University of Newcastle
CALLAGHAN NSW 2308

Phone: 02 4921 6014
Fax: 02 4921 6923
bimjm@cc.newcastle.edu.au

For information on frog keeping licences and approvals to move some species of displaced frog contact:

Co-ordinator, Wildlife Licensing
Wildlife Licensing and Management Unit
DECC
PO Box 1967
Hurstville NSW 1481
Ph 02 9585 6481
Fax 02 9585 6401
wildlife.licensing@environment.nsw.gov.au

For information on the possible identity of displaced frogs contact:

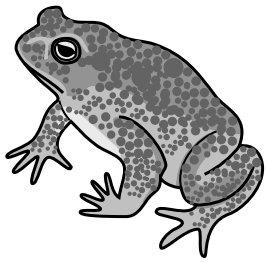
Frog and Tadpole Society (FATS)
Frogwatch Helpline

Ph: 0419 249 728

appendix 3

NSW Animal Welfare Advisory Council methodology

The NSW Animal Welfare Advisory Council procedure for humanely euthanasing cane toads or terminally ill frogs is stated as follows:



- Using gloves, or some other implement, place cane toad or terminally ill frog into a plastic bag.
- Cool in the refrigerator to 4°C.
- Crush cranium with a swift blow using a blunt instrument.

Note: Before killing any frog presumed to be a cane toad, ensure that it has been correctly identified and if outside the normal range for cane toads in NSW (north coast) that local DECC regional office is informed.

appendix 4

licensed wildlife carer and rescue organisations

Following is a list of wildlife rehabilitation groups licensed by Department of Environment and Climate Change (NSW):

Northern NSW

Australian Seabird Rescue
For Australian Wildlife Needing Aid (FAWNA)
Friends of the Koala
Friends of Waterways (Gunnedah)
Great Lakes Wildlife Rescue
Koala Preservation Society of NSW
Northern Rivers Wildlife Carers
Northern Tablelands Wildlife Carers
Tweed Valley Wildlife Carers
Seaworld Australia
WIRES branches in Northern NSW

Southern NSW

Looking After Our Kosciuszko Orphans (LAOKO)
Native Animal Network Association
Native Animal Rescue Group
Wildcare Queanbeyan
WIRES branches in Southern NSW

Sydney, Hunter and Illawarra

Hunter Koala Preservation Society
Ku-ring-gai Bat Colony Committee
Kangaroo Protection Co-operative
Native Animal Trust Fund
Organisation for the Rescue and Research of Cetaceans (ORRCA)
Sydney Metropolitan Wildlife Services
Wildlife Aid
Wildlife Animal Rescue and Care (Wildlife ARC)
Waterfall Springs Wildlife Park
Oceanworld
Wildlife Care Centre, John Moroney Correctional Centre
Koalas in Care
WIRES branches around Sydney, Hunter and Illawarra

Western NSW

Rescue and Rehabilitation of Australian Native Animals (RRANA)
RSPCA Australian Capital Territory Inc.
Wildlife Carers Network (Central West)
WIRES branches in Western NSW
Cudgegong Wildlife Carers

[4] Note: some of these organisations may not care for frogs.

appendix 5 — sick or dead frog collection form

Sender details:

name: address: postcode:

phone: (w) (h) fax: email:

Collector details: (where different to sender)

name: address: postcode:

phone: (w) (h) fax: email:

Specimen details:

record no: no. of specimens: species name: date collected:
day/month/year

time collected: sex: status at time of collection: date sent:
male/female healthy(H)/ sick(S)/ dead(D) day/month/year

location: map grid reference:
(easting) (northing)

reason for collection:

Batch details for multiple species collection:

species	no.	locality	(AMG)	date	sex	status (H/S/D)

habitat type: vegetation type: micro habitat:
eg creek, swamp, forest eg rainforest, sedgeland eg creek bank, under log, amongst emergent vegetation, on ground in the open

unusual behaviour of sick frogs:
eg lethargic, convulsions, sitting in the open during the day, showing little or no movement when touched.

dead frogs appearance:
eg thin, reddening of skin on belly and/or toes, red spots, sore, lumps or discolouration on skin

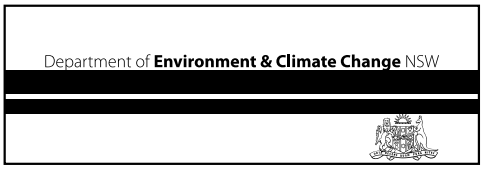
deformed frogs: dead/sick tadpoles:
eg limb(s) missing, abnormal shape or length eg numbers/behaviour

unusual appearance of egg masses: recent use of agricultural chemicals in area:
eg grey or white eggs eg pesticides, herbicides, fertilisers

other potential causes of sickness/mortality/comments/additional information:

NSW
NATIONAL
PARKS AND
WILDLIFE
SERVICE

General inquiries: PO Box A290 South Sydney 1232
Phone: 9995 5000 or 1300 361967
Fax: 02 9995 5999 **Web site:** www.environment.nsw.gov.au



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APPENDIX B

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Appendix C – Kooragang Island Wide GGBF Survey Program, 2022/23 Report (University of Newcastle, 2023)

Green and Golden Bell Frog (*Litoria aurea*) Research Program on Kooragang Island: Annual Report (2022-23)

Conducted by the Amphibian Research Group, University of Newcastle

Report prepared by Colin McHenry & John Gould

Finalised November 2023

Executive Summary

This section highlights the key findings of the *Litoria aurea* population on Kooragang Island from the 2022-23 data:

1. Population estimates
2. Summary of detections
3. Environmental factors:
    a. Rainfall and hydrology
    b. *Gambusia*
4. Spatial patterns
5. Demographic composition of population
6. Persistence and movement
7. Breeding records
8. Habitat use
9. Multi-year pattern of abundance and occupancy
10. Constructed wetlands
11. Conclusions

1. **Population estimates**

An updated model of the population dynamics since 2014 indicates:

i. Population growth from 2014 to 2016. Note that this is in part likely to be an artefact of increased sampling intensity in that period.

ii. Baseline population levels of approximately 2,000 individuals (>40 mm SVL) from 2016-19.

iii. A large boom in the population in 2020-21 following a massive breeding event in February-March 2020. Demographic analysis (see Section 4 below) shows that juvenile frogs formed a large part of the population at this time.

iv. A decline in the population size from 2020 to 2021-23, with levels at approximately 1,000 – 2,500. Note that these are consistent with the baseline population size before the 2020-21 'boom'.

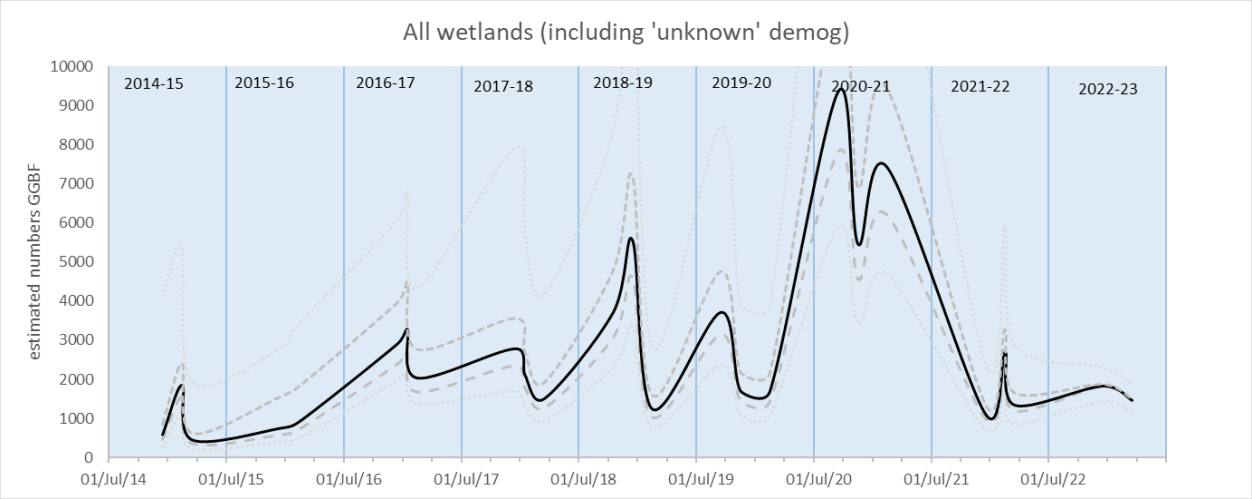


Figure A1.1: Population estimates for *L. aurea* on Kooragang Island for the 9 seasons up until 2022-23. Dashed lines indicate conservative and extreme uncertainty estimates; 'including unknown' refers to the model used (see Section 8 of the main report for discussion).

Assessment of the Kooragang *L. aurea* population dynamics should take note that:

- Many species of amphibian display 'boom and bust' population dynamics, and *L. aurea* can be characterised as one of these. A short-term decline in population size following a clear boom period is not in itself an indication of long-term population decline. Demographic analysis indicates that the adult population is at levels consistent with the population size prior to the 2019-20 drought and has remained relatively stable for the past two seasons.

- Previous 'booms' in the Kooragang *L. aurea* population have been preceded by a dry summer followed by significant rainfall. With an expected drying of the Australian East coast in the coming summer, this scenario may potentially arise in the 2023-24 breeding season. Given the relatively high proportion of adult females in the population (see point 5 below), the current population level might thus be described as a 'lull' between 'booms'.

- Note than dry spells can reduce chytrid levels and *Gambusia* infestation across *L. aurea* habitat mosaics, which can benefit the *L. aurea* population. However, prolonged dry spells can lead to higher adult mortality and reduced breeding. Management strategies to mitigate those effects should be prepared in advance.

2. Summary of detections

Detections and captures were similar in both main rounds, but slightly less in the second round (February-March), correlating with drier conditions in the summer. Additional survey rounds in between the main survey rounds detected bell frogs consistently, sometimes in high numbers.

Table A2.1: Summary data from all surveys in the 2022-23 season. 'Detections' refers to total encounters (i.e., captures and non-capture observations). Because some individuals are encountered and captured multiple times, 'Detections', and 'Captures' provide overestimates of the number of unique individual frogs actually encountered ('Unique').

	Round 1	Round 2	Additional surveys	Total
Search effort (VES)	**3,651**	**3,194**	7,138	**13,983**
VES Detections	**360**	**284**	495	**1,139**
All Detections	**577**	**415**	1,688	**2,680**
Captures	**387**	**330**	1,270	**1,987**
Unique	**359**	**274**	867	**1,274**

More detections were made in the Central Zone compared to all other zones. However, when accounting for Search Effort, a higher number of detections were made in the Southern Zone, with Search Sensitivity (i.e., the number of detections per unit search effort) being the highest for this zone compared to all others. The lowest number of detections occurred in the Northern Zone, which also had the lowest Search Sensitivity. There was a slight increase in numbers in the North from the previous season, which was the lowest recorded over the past five years, indicating a persisting but small population in this part of the Island.

Table A2.2: Location (summarised by Zone) of *L. aurea* detected.

Region (detections)	Search effort (VES)	VES	Total	Search Sensitivity
Northern	1,726	41	46	0.02
Central	8,498	544	1,509	0.06
Southern	3,759	554	1,125	0.15

3. Environmental factors

a. Rainfall & Hydrology

The 2022-23 season was drier than the recent (very wet) seasons. Since 2020, rainfall totals have been high (> 1200 mm per year), and although the annual total for 2022-23 exceeded 1000 mm, rainfall in the *L. aurea* breeding season (September-March) was similar to the levels seen in the 'dry years' from 2017 until 2020. In particular, the middle part of the breeding season (December and January) had few rainfall events.

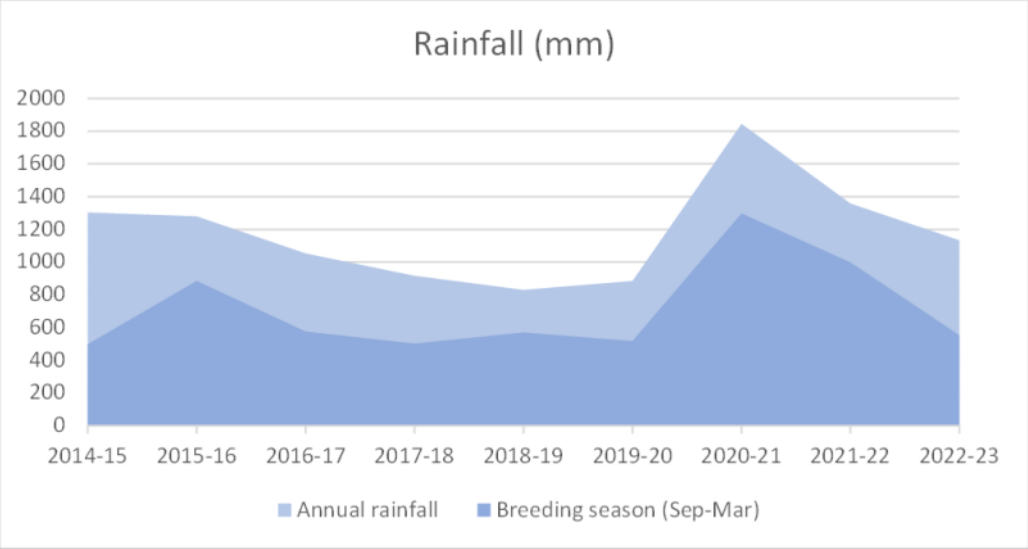


Figure A3.1: Rainfall during the breeding season and across the entire season cycle for each year from 2014-15 to 2022-23 on Kooragang Island. Measurements obtained from BoM records for Williamtown airport.

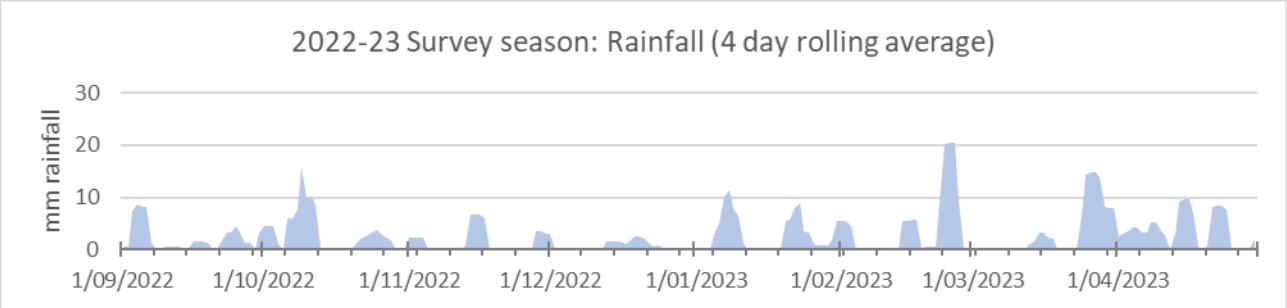


Figure A3.2: Weekly rainfall during the 2022-23 survey season (October to April) on Kooragang Island. Measurements obtained from BoM records for Williamtown airport.

Lower than average rainfall in the middle of season resulted in several ephemeral and semi-permanent ponds drying across the island. This included pools that often dry each year (e.g., K112, 113, K106A, K106B, and K9) but also other seasonal/semi-permanent wetlands that have not dried for several seasons (e.g., K114). Several of these dried ponds were recharged by the end of the season, which may have positive implications for *L. aurea* during the overwintering period by providing additional moisture refuges in the environment.

Table A3.1: Summary of water presence at each wetland during the 2022-23 survey season. Depths are indicated on a scale of 0-9; 'w' indicates that water was present but depth not recorded, and 'nd' indicates that data was not recorded.

	Water presence & depth			
Wetland	Spring	Summer	Autumn	Pond dried during season?
NCIG-1.1	7	7	7	
NCIG-1.3	5	3	5	
K3	4	5	5	
K4	5	4	4	
NCIG-3.1	3	5	3	
K5	nd	3	4	
K7	nd	7	4	
K2	4	4	4	
NCIG-T13	4	5	nd	
NCIG-T14	nd	5	nd	
NCIG-T15	nd	4	nd	
K58B	3	2	3	dried
NCIG-4.7	nd	4	4	
NCIG-4.9	8	4	7	
NCIG-5.1	7	4	2	
NCIG-7.1	nd	4	5	
NCIG-7.2	4	5	4	
NCIG-7.3	nd	3	3	
K9	3	1	1	dried
K9A/B	nd	2	3	
BHP-1A	6	4	3	
BHP-1B	9	7	6	
BHP-2A	7	5	4	
BHP-2B	5	3	2	
BHP-2C	8	6	4	
BHP-3A	7	5	4	
BHP-4A	6	3	5	
BHP-4B	5	3	3	
BHP-4C	3	1	1	dried
K10	nd	3	3	
K25	nd	nd	4	
K26	3	3	4	
K48	3	3	3	
K9C	3	2	3	
K11	1	0	w	dried
K13	w	1	1	dried
BHP-14B	5	2	2	
BHP-14A	8	8	8	
K20A	3	1	3	dried
K20B	nd	1	4	dried
K21	4	0	5	dried
K22	4	3	3	
K23	5	5	5	

	Water presence & depth			
Wetland	Spring	Summer	Autumn	Pond dried during season?
K105A	6	5	4	
K105AS	4	4	3	
K105B	4	4	nd	
K128	2	4	3	
K127	3	2	nd	
K124	3	3	4	
K125	3	2	4	
K126	4	4	4	
C1	8	6	5	
K106A	3	0	0	dried
K106B	1	0	1	dried
NP-W4	3	2	0	dried
NP-W5	5	8	4	
NP-E4	4	3	3	
K29	7	7	4	
K103	5	7	5	
K31	nd	5	3	
K33	nd	3	nd	
K34	7	5	0	
K42	5	4	4	
K104	4	4	4	
K100A	5	5	5	
K102	4	4	3	
K111	4	2	3	
K112	3	1	2	dried
K113	3	0	2	dried
K114	5	2	4	dried
C4	7	5	1	dried
C5	7	7	5	
K108	nd	w	7	
K108B	nd	nd	3	
C2	8	8	6	
K121	3	2	4	
K122	nd	3	5	
K123	nd	3	4	
C3	nd	7	1	
K36	3	5	5	
K49B	nd	4	3	
K129	nd	nd	3	
K117	nd	2	8	
K118	2	4	3	
K46	3	4	5	

b. Gambusia

Gambusia is present across all zones on Kooragang Island, with lower rates of infestation in the Central and Industrial Zones, partly the result of the presence of constructed ponds that have remained *Gambusia* free. There are currently 44 ponds with *Gambusia* present, compared to 43 sites in 2021, 7 sites in 2020, 13 sites in 2019, 16 sites in 2018 and 24 in 2017. This reverse in trend since 2020 is likely due to the limited amount of pond drying that occurred during the winter period and throughout the breeding season, given high amounts of rainfall. Since last year, the fish has disappeared from 15 ponds, likely the result of drying during periods of low rainfall. Areas with low pond infestation include constructed ponds in Area two (K124-126), K10S (K121-123), and K10N (K111-114), which have all seen consistent indications of successful breeding over the past 2-3 seasons.

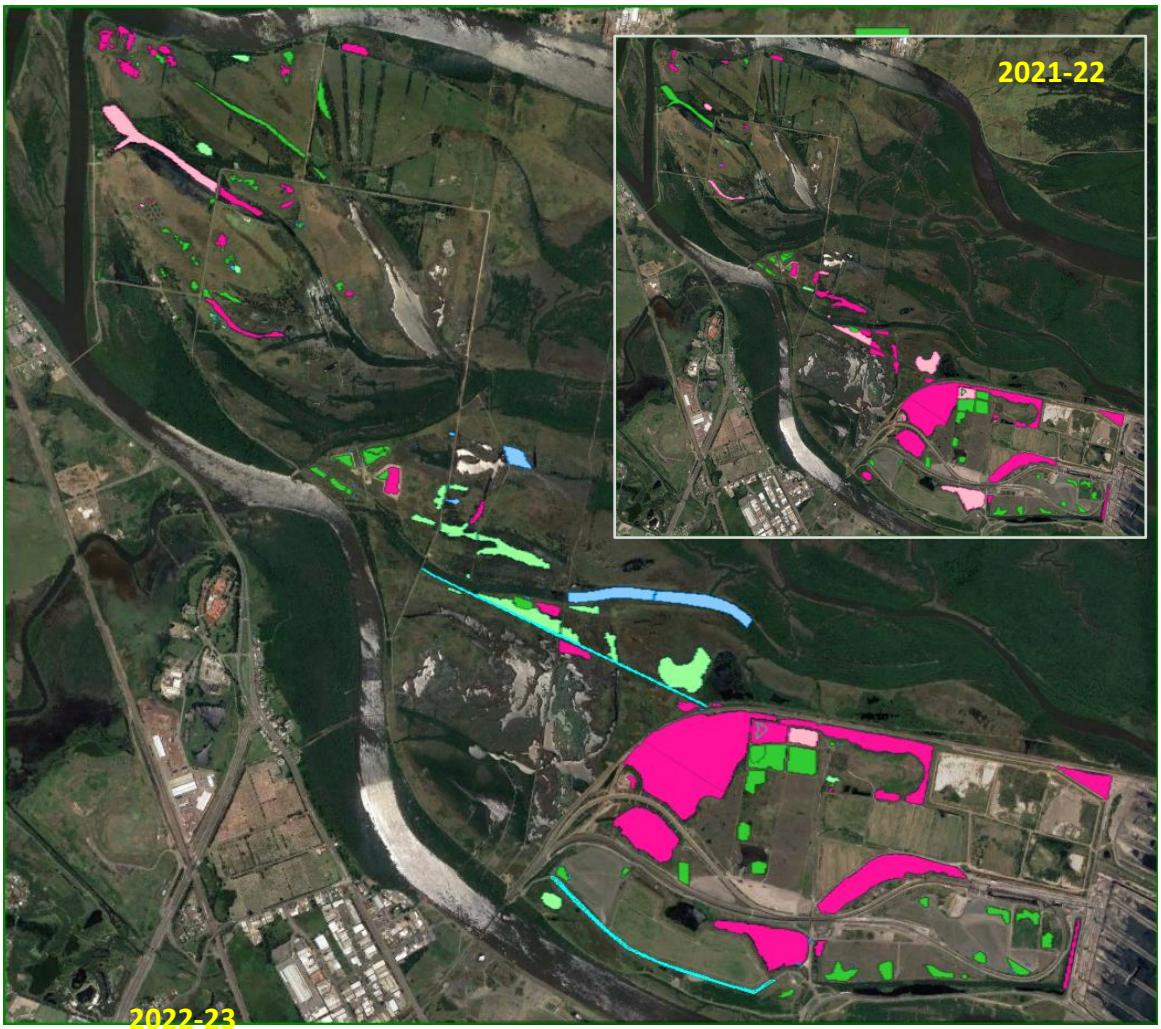


Figure A3.3: Distribution of *Gambusia* in wetlands across Kooragang Island for the 2022-23 season and the preceding 2021-22 season (inset). Dark pink = *Gambusia* present through the season; Light pink = *Gambusia* appeared during the season; Green = *Gambusia* absent.

4. Spatial patterns

High search sensitivity values were obtained across the Southern Zone, especially the Deep Pond, KIWEF *K5* (Area 2), KIWEF *K2*, Delta Ponds, and Rail Loop *K10S* subregions (Table A4.1). Individual wetlands with the highest Search Sensitivity were K127, K128, and K118. (Figure A4.1). There were strong breeding indicators in the constructed wetlands of K10N and Area 2 (Table A4.2). Note that all of the constructed wetlands in these areas are free of *Gambusia*. In the Central Zone, the BHP-CHEMP wetlands (Ramsar Way West and Bellfrog Way West) generally have good *L. aurea* abundance and breeding indicators, and *Gambusia* is mainly absent. Abundance was high along Bellfrog Way overall, especially K23 and BHP-14B (Figure A4.1)

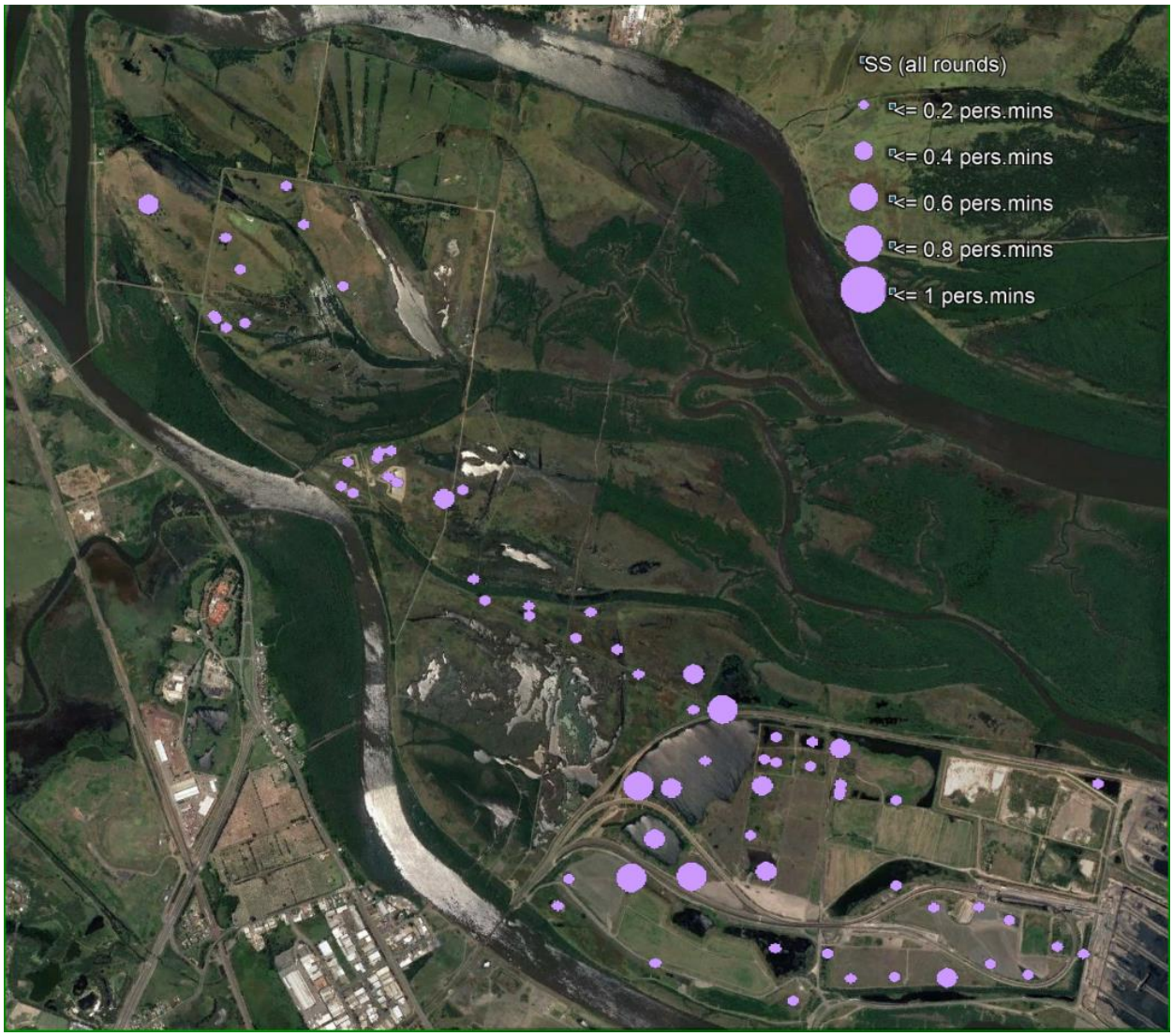


Figure A4.1: Search sensitivity (frogs detected per person.minute) across all wetlands surveyed in 2022-23.

Table A4.1: Search effort, detections, and Search Sensitivity summed by Zone and Subregion.

Zone	search effort	VES detected	Total detected	Search Sensitivity
Northern	1,726	41	46	0.02
Central	8,498	520	1,445	0.06
Southern	3,759	539	1,104	0.14
Subregion				
Scott's Point	411	0	0	0.00
Riverside park	345	0	0	0.00
Wet meadow	273	2	2	0.01
Millam's Pond	697	39	44	0.06
Ramsar Road West	5511	213	534	0.04
Ramsar Road East	255	8	31	0.03
Bellfrog Way West	1621	147	285	0.09
Bellfrog Way NE	736	50	162	0.07
Bellfrog Way SE	375	102	433	0.27
Deep pond	460	107	188	0.23
KIWEF K5 (Area 2)	590	125	433	0.21
Northern Ponds	514	47	66	0.09
KIWEF K7	222	6	7	0.03
Delta Ponds	159	31	61	0.19
NCIG rail central & east	235	14	25	0.06
Rail loop (K10N)	654	67	112	0.10
Rail loop SW (K10S)	474	77	120	0.16
NCIG rail south	173	5	7	0.03
KIWEF K2	278	60	85	0.22
Cormorant Road	0	0	0	-

Much lower densities were obtained for the Northern Zone, which are findings similar to previous seasons. Ponds with the highest search sensitivity values in the North included NCIG-7.2 and NCIG-4.9. However, the largest adult females across all Zones on Kooragang Island were found in the School House region of the Northern Zone, specifically in the wetlands NCIG-T14, NCIG-7.3, K58B, NCIG-5.8; these females are likely > 3 yrs in age and are important and noteworthy demographic.

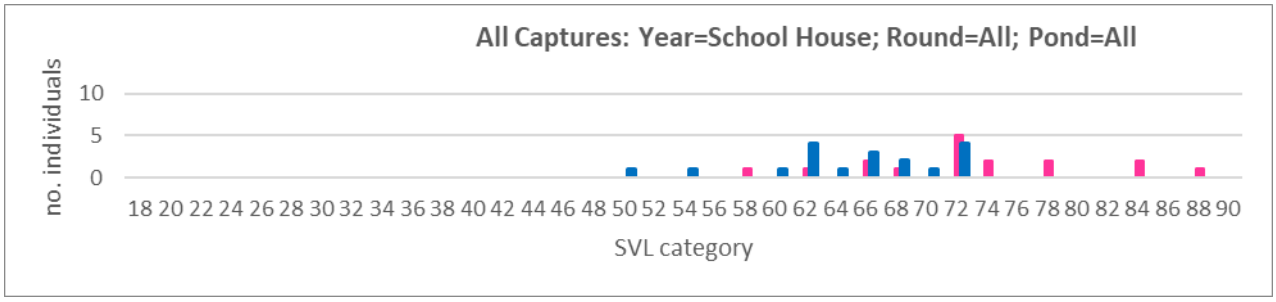


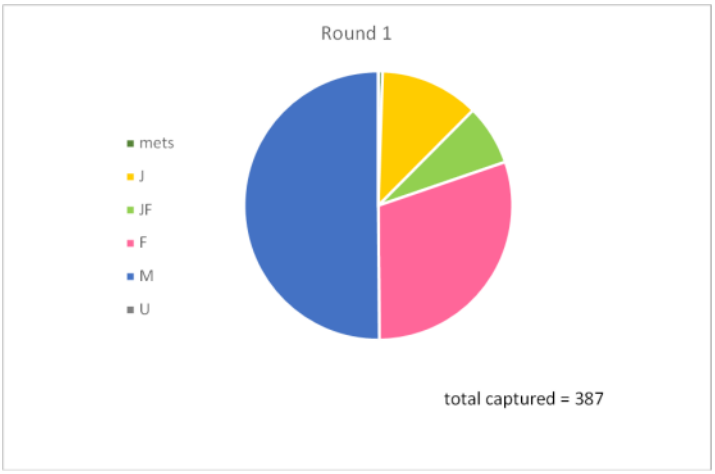
Figure A.4.2: Combined frequency distribution of size classes for sites in the School House region (Northern Zone)

Table A4.2: Breeding indicators summed by Zone and Subregion. See Section 3.6 for explanation of each breeding indicator.

Zone	Calling	Tadpoles	Mets	Xsmall juvs	Small juvs
Northern	2	0	0	0	0
Central	13	0	6	13	13
Southern	16	4	4	6	10
Subregion					
Scott's Point	0	0	0	0	0
Riverside Park	0	0	0	0	0
Wet meadow	0	0	0	0	0
Millam's Pond	2	0	0	0	0
Ramsar Road West	6	3	5	8	8
Ramsar Road East	1	0	0	0	0
Bellfrog Way West	2	1	1	2	2
Bellfrog Way NE	4	0	0	1	1
Bellfrog Way SE	0	0	0	2	2
Deep Pond	4	0	0	1	2
KIWEF K5 (Area 2)	4	1	2	2	2
Northern Ponds	2	1	1	0	2
KIWEF K7	0	0	0	0	0
Delta Ponds	1	0	0	0	0
NCIG rail central & east	0	0	0	0	0
Rail loop (K10N)	2	1	0	2	2
Rail loop SW (K10S)	2	1	1	1	1
NCIG rail south	1	0	0	0	0
KIWEF K2	0	0	0	0	1
Cormorant Road	0	0	0	0	0

5. Demographic composition of population

The number of *L. aurea* captured in Round 1 and 2 was roughly equivalent. In both rounds, the majority of captures were adult males, making up a half of captures in Round 1 and more than a third in Round 2. In both rounds, adult females made up a quarter of all captures. The number of metamorph and juvenile captures were smaller in Round 1 compared to Round 2, but small in general for both rounds, suggesting that there wasn't a large breeding event this season. This is in contrast to previous seasons where juveniles made up more than half of all captures in some rounds.



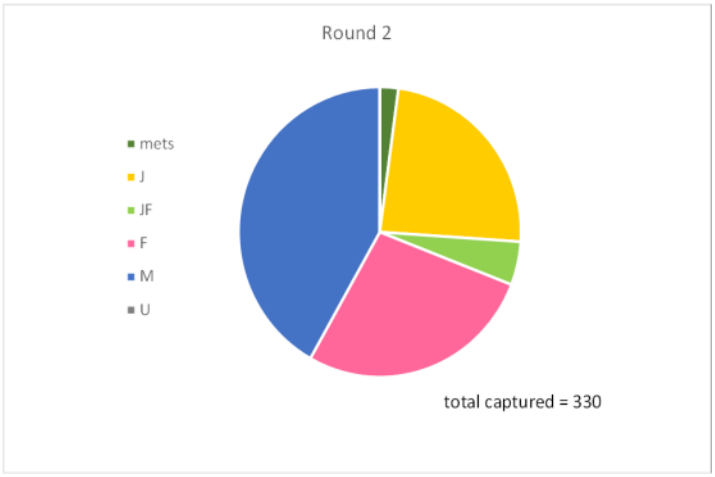
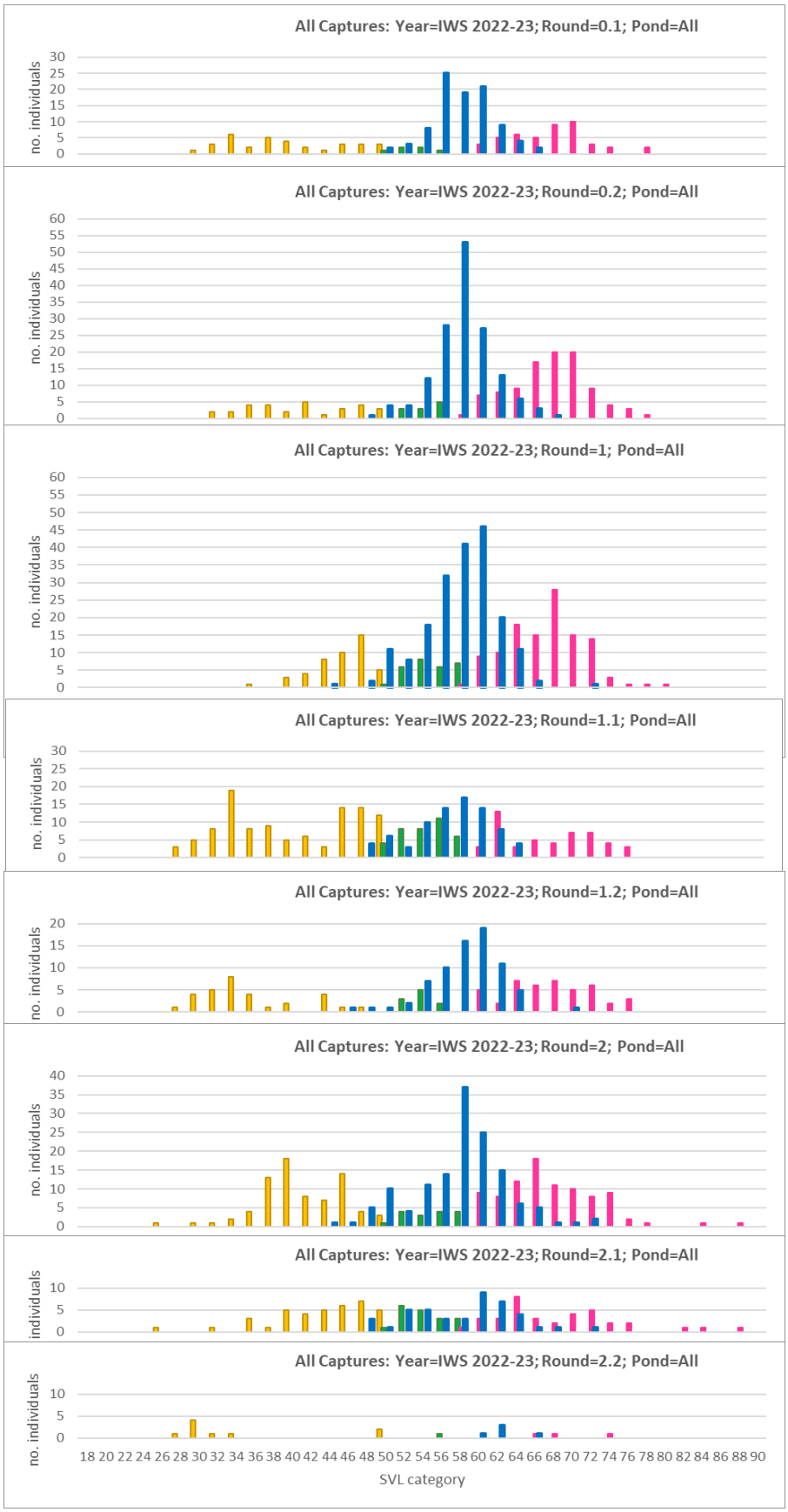


Figure A5.1: Summary demographics of all captured *L. aurea* (i.e. VES surveys, including recaptures and non-tagged individuals) for primary rounds. Mets, metamorphs; M, adult males; J, juveniles; JF, subadult females; F, adult females; U, animals of unknown demography.



Two clearly distinct juvenile cohorts were apparent this season. One cohort was detected early in the season (Round 0.1), likely reflecting offspring that spawned in the previous season. The second cohort was initially detected in Round 1.1, likely spawned at the start of this current season. The increasing size of juvenile frogs from both cohorts can be seen in subsequent rounds, indicating their maturation over time and subsequent recruitment into the adult population. A third potential cohort of juveniles is visible in Round 2.2 at the end of the season.

The size distribution of adult males, females, and sub-adult females were similar between all rounds. As expected, there were increases in adult numbers during the main rounds 1 and 2, likely due to the larger number of ponds surveyed. Fewer individuals were captured after the second main round, particularly in Round 2.2, which would suggest an expected decline in overall activity at ponds during the later months of the season.

Figure A5.2: Frequency distribution of size classes, showing all captures for each survey round (VES). See Fig 3.4.4.

Multi-year demographic analysis of the Kooragang *L. aurea* population supports the interpretation that (i) recruitment was low in the 2022-23 season following the boom of juveniles in 2019-20, and whilst overall population numbers are lower **in 2022-23, the numbers of adult females was as high or higher than previous seasons**. Note that adult females are an important component of the demographic make-up of the population and largely control effective population size. Juveniles have been detected in all survey years, indicating breeding has been successful in all years of the program to date; this is critical given the reduction in adult lifespan caused by chytrid infection, with yearly breeding allowing for continual recruitment into the adult population to replenish individuals lost to the pathogen.

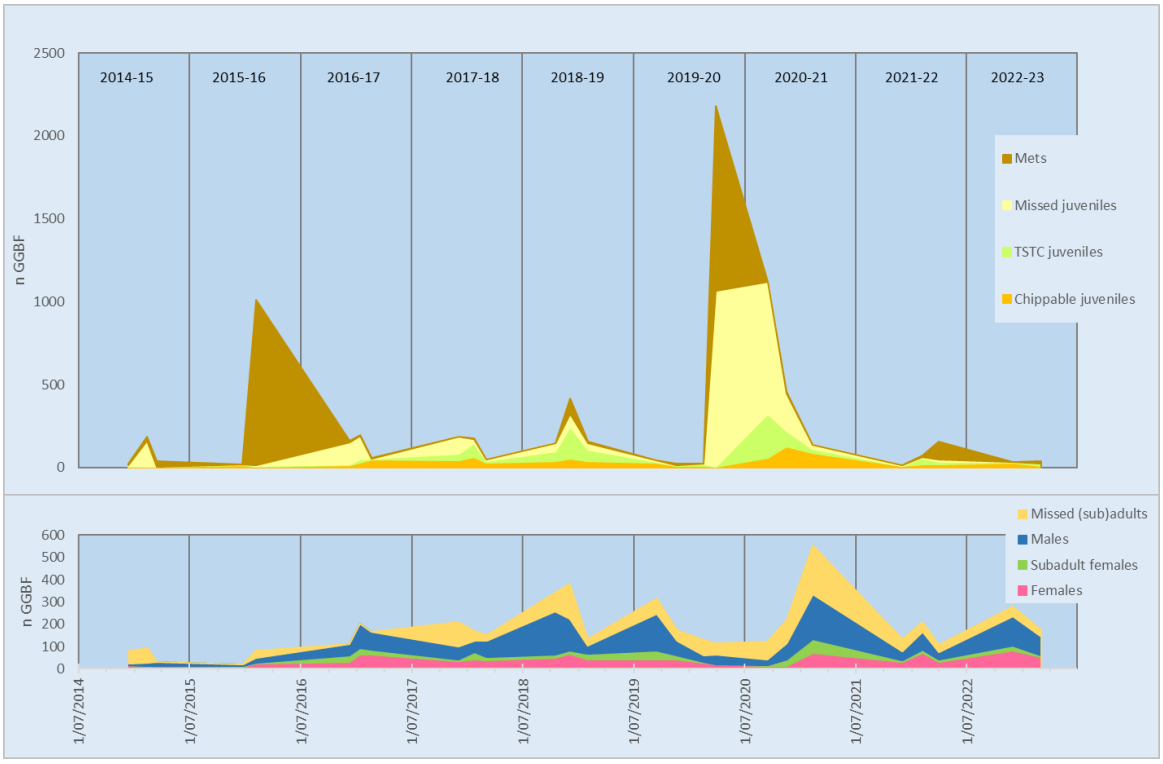


Figure A5.3: Demographic composition of *L. aurea* detected as part of the IWS program, from the 2014-15 season. Numbers are for animals detected during VES in each main survey round. Top figure highlights juvenile (green) and subadult/adult (brown) classes, with animals of unknown demography (because they were seen but not captured) in grey. Middle figure highlights the different juvenile classes, and lower figure highlights the subadult/adult classes.

6. Persistence and movement

Persistence (time between first and last captures) is generally low for *L. aurea* on Kooragang, with less than 8% being recaptured more than 12 months after their initial capture. This pattern is understood to be linked to mortality rates, particularly with respect to chytrid infection. The data in 2022-23 is consistent with that from previous seasons.

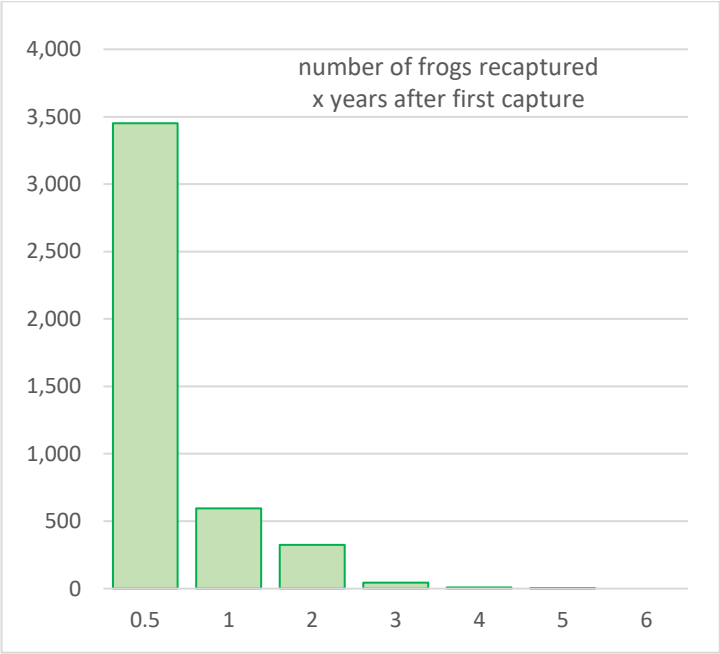


Figure A6.1: Persistence of *L. aurea* individuals.

The pattern of movements detected in 2022-23 was different from other seasons, showing high levels of movement along Bellfrog Way and across the southern part of the Industrial Zone. Connectivity between the Central and Southern Zones was centred though K22-23. Recently constructed wetlands in Area 2 were also involved in detected movements, indicating that these have improved connectivity across the central part of the Southern Zone. Large numbers of detected movements also involved *K10 North* and *K10 South* (around the NCIG rail-loop); these detections followed intensive tagging of individuals around the Eastern Ponds in the previous two seasons. Curiously, although the number of individuals detected at K100A were unusually low this season, many movements away from K100A were detected.

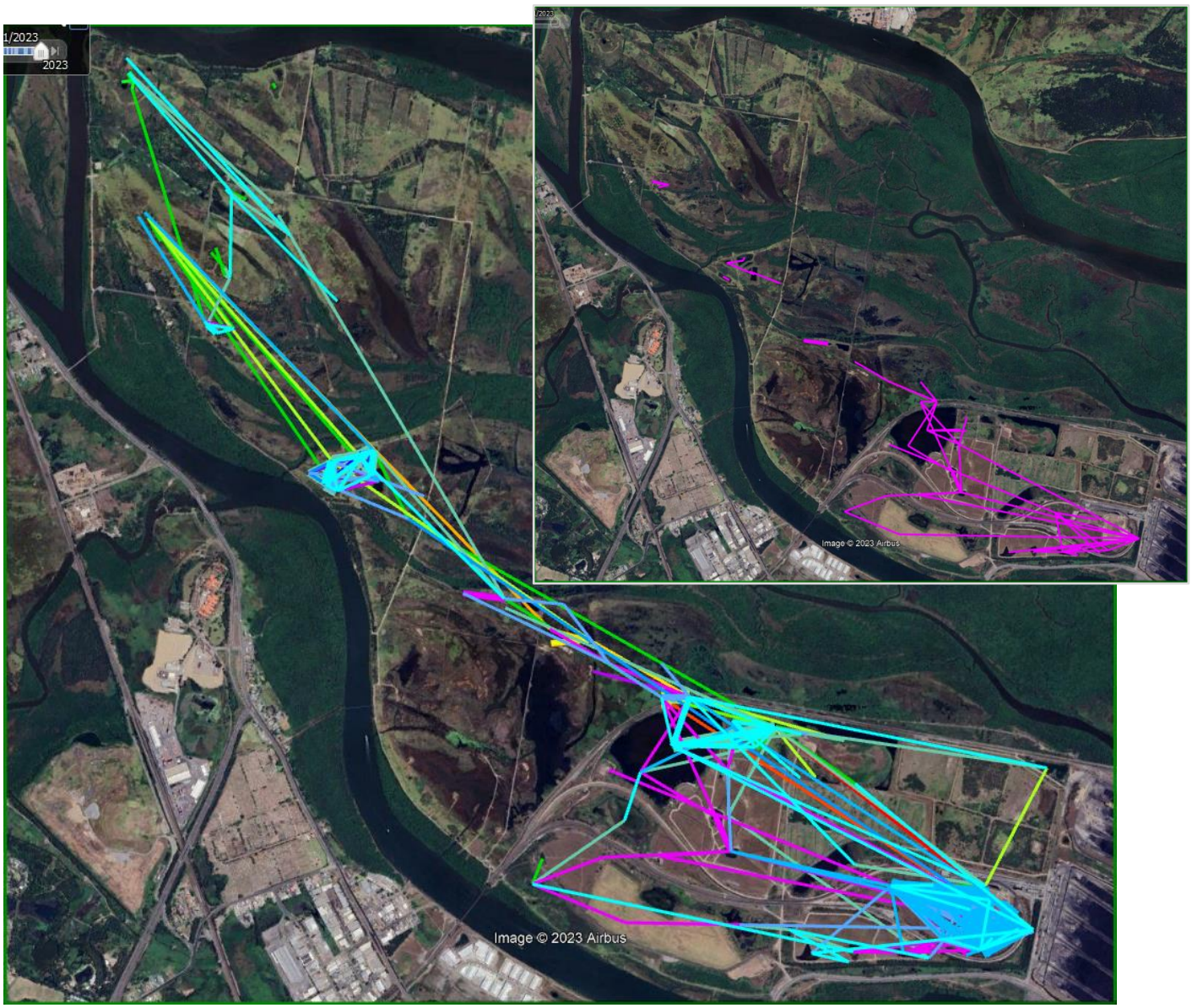


Figure A6.2: Detected movements of *L. aurea* in Kooragang Island, 2011-23. Each colour indicates movements detected in different years. **Inset**: movements detected in the 2022-23 season.

7. Breeding

Indicators of breeding include behaviours (mainly calling), the presence of tadpoles and metamorphs, and the presence of small and extra-small juveniles. Breeding behaviour in *L. aurea* is strongly associated with rainfall during the warmer months. Calling was primarily concentrated during rainfall within the first half of the breeding season, with less activity in the second half of the season. Tadpoles and metamorphs were detected in the second half of the season, following Spring rains; metamorphs were detected primarily at permanent wetlands free of *Gambusia* within the Central Zone (6 ponds all of which were BHP ponds) and the Industrial Zone (4 ponds within the Rail loop and Area 2 subregions). The presence of small juveniles detected across the breeding season suggests that some tadpoles overwintered and metamorphosed at the start of the season, in addition to those that were spawned during the 2022-23 breeding season.

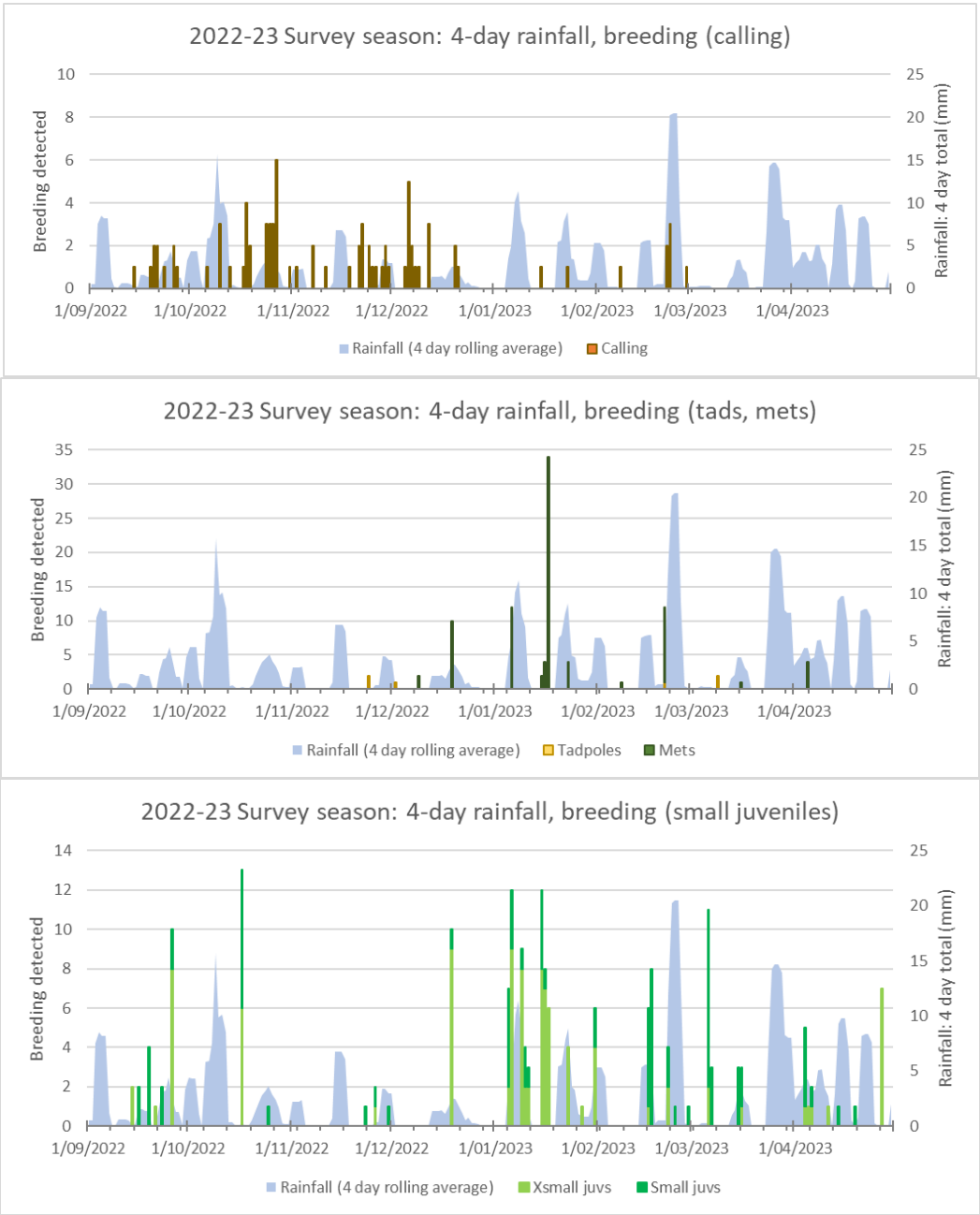


Figure A7.1: Survey nights (top), nights where calling was heard (middle top), detections of tadpoles and metamorphs (middle bottom), and detections of small juveniles (bottom), correlated with rainfall.

8. Habitat use

The use of microhabitat types by *L. aurea* in the 2022-23 season was consistent with data from previous seasons; they are often detected on emergent vegetation within wetlands, at the surface of the water, on the ground, and in trees.

Table A8.1: Broad microhabitat categories of *L. aurea* captures, pooled across the 2022-23 season.

Structures groups	n
tree	69
emergent	1,106
water	324
ground	263
man-made	3
ground vegetation	134
shrub	73

9. Multi-year pattern of *Litoria aurea* abundance and occupancy

Detection data for adult *L. aurea* show that abundance is lower than some recent years, but not by a large degree. This is consistent with the observation (Section 1) that the marked fluctuations in population size are driven by juvenile size classes (Sections 1, 5). Numbers in the Northern Zone are low but have increased from a low in 2018-19, mostly in the Milam's Pond subregion (NCIG Stage 4, 5 and 7). The more northern sections of the island continue to show low animal numbers.

The number of animals detected in the Central Zone remains high but search sensitivity appears to have declined compared to the previous two seasons, showing a negative trend. There has been a decline in detections in Bellfrog Way West from a high in 2021-22, however detections are still high compared to all other years. The Bellfrog Way NE subregion has seen a doubling in detections since the previous season and is the highest since the program began. Similarly, detections in the Bellfrog Way SE subregion have shown a positive trend since a low in 2019-20, and are the highest they've been since 2016-17.

As in previous years, the Industrial Zone remains an important area of *L. aurea* occupancy and breeding. Similar to previous years, the Southern Zone had the highest search sensitivity values, more than double that of the Central Zone and nearly four times that of the Northern Zone. The Area 2 subregion has seen an increase in detections since a low in 2020-21. This is likely the result of constructed ponds in the region that have become key breeding sites for the species in the Northern Industrial Zone. Similarly, both Rail loop subregions had relatively high numbers of total detections and remain key breeding and refuge sites for the species in the South-east of the Southern Zone

Table A9.1: Total numbers of *L. aurea* detected summed for the various subregions of each Zone (see Table 3.9.2), for **all survey rounds** of the IWS dataset.

Subregion	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Scott's Point	0	0	0	3	3	3	6	0	0
Riverside park	0	0	0	0	0	1	3	0	0
Wet meadow	5	3	0	1	8	7	6	0	2
Millam's Pond	0	1	0	7	91	77	20	25	44
Ramsar Road West	1	28	3	405	322	556	593	635	597
Ramsar Road East	12	6	2	0	0	13	25	28	31
Bellfrog Way West	4	2	7	2	5	14	97	521	286
Bellfrog Way NE	12	5	8	0	5	12	1	55	162
Bellfrog Way SE	433	223	463	330	100	76	289	189	433
Deep pond	2	5	99	308	748	808	823	139	188
KIWEF K5 (Area 2)	-	-	-	-	91	3116	20	69	439
Northern Ponds	246	1047	1513	967	464	157	233	76	77
KIWEF K7	76	10	94	26	15	46	100	8	7
Delta Ponds	209	860	725	566	728	135	79	65	61
NCIG rail central & east	0	13	103	99	167	535	363	137	25
Rail loop (K10N)	66	36	387	108	121	888	959	1417	112
Rail loop SW (K10S)	0	0	16	89	326	1117	345	86	124
NCIG rail south	11	2	58	45	81	91	90	24	7
KIWEF K2	2	0	17	91	38	38	128	82	85
Cormorant Road	0	2	6	-	-	-	-	-	-

10. Constructed wetlands

Since 2015, the most important environmental management strategy for the Kooragang *Litoria aurea* population has been the construction of wetlands across the island; these now number more than half of the regularly surveyed wetlands under the IWS program. There are 6 types of constructed wetlands:

1. NCIG Trial Ponds
2. NCIG CHEMP wetlands
3. BHP CHEMP wetlands
4. Cluster Ponds
5. HCCDC sedimentation ponds
6. Fire-pit/construction ponds

Each of these have different construction techniques, size, hydrology, and microhabitat characteristics. Since 2016, the proportion of the estimated *L. aurea* population occupying these wetlands has increased and they now house a significant portion of the population. The constructed wetlands are of particular importance because a large proportion of breeding indicators are detected in these; in particular, the BHP-CHEMP and the HCCDC ponds. Note that these are largely free of *Gambusia*.

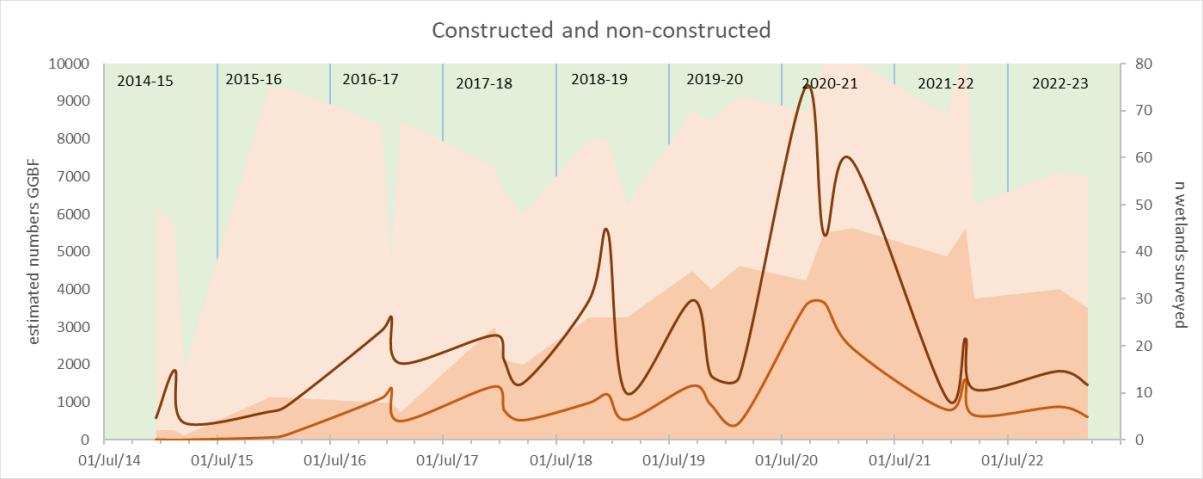


Figure A10.1: Estimates of the Kooragang *L. aurea* population located at 'constructed' and 'non-constructed' wetlands (orange and brown lines respectively). The number of wetlands in each category is shown by the shaded areas; darker pink for constructed wetlands and lighter pink for non-constructed.

11. Conclusions

- Following a large boom in 2020-21, the population has returned to levels consistent with the baseline from 2016-2019.
- The numbers of adults present in 2022-23 is similar to the previous season.
- Adult females, which are important indicator of effective population size, are present in good numbers.
- There was evidence of moderate breeding in the 2022-23 season across both the Central and Southern Zones of the island.
- The population in the Northern Zone of the island continues to remain at very low levels but has shown a local increase in the Millam's subregion. The largest adult females are present in the Northern Zone.
- The populations of the Central and Southern Zone remain relatively stable but with fluctuations in numbers between subregions.
- Survivorship (measured by persistence) is low overall, with less than 8% of recaptured frogs being detected more than 1 year after their initial capture. However, this figure has been more or less stable over the last few seasons.
- Environmental management of the Kooragang population through the construction of artificial wetlands is proving effective at providing i) habitat for *L. aurea* occupancy and breeding, ii) resistance against infestation by *Gambusia*, and iii) connectivity within and between habitat mosaics.
- With the ending of La Nina and the anticipated onset of drier conditions across Eastern Australia in 2023-24, managers should consider appropriate 'defensive' (e.g. ensuring availability of permanent aquatic refuge habitats) and 'offensive' (e.g. opportunities to remove *Gambusia* from nearly-dry wetlands) strategies.

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1. Introduction

1.1 Background to the study: Historical context and research objectives.

The Conservation Biology Research Group (formerly the Amphibian Research Group) at the University of Newcastle (UoN) has been conducting annual surveys of the green and golden bell frog (*Litoria aurea*) on Kooragang Island since 2010. The research aims to provide insight into the biology and ecology of this endangered species, in order to inform effective habitat management and creation by the partner organisations. Those partner organisations – Port Waratah Coal Services (PWCS), Newcastle Coal Infrastructure Group (NCIG), the Hunter and Central Coast Development Corporation (HCCDC; formally HDC), and more recently Port of Newcastle (PoN)– are involved with 'on ground' management and landscape works across Kooragang Island. By providing high quality data from population monitoring, this project aims to inform those activities to ensure long-term persistence of *L. aurea* on the island.

Over the course of these surveys more than ten thousand *L. aurea* have been captured, with this extensive data set representing one of the most comprehensive investigations of this threatened species to date. Continuous monitoring of this scale, especially of amphibian species, remains rare in an Australian context, and yet is essential given that amphibian populations exhibit classic boom and bust population growth linked closely to climate and weather patterns. Only long-term datasets such as these allow scientists to determine whether changes to the conservation status of threatened species is associated with weather fluctuations or is influenced by acute human actions (e.g. habitat clearing and fragmentation). This is critically important for *L. aurea* as it is now found in less than 10% of its former range, confined largely to coastal environments that are also in high demand for human land use.

The original wetlands surveyed over the past decade have remained consistent, however, some additional wetlands have been constructed and others have been altered. The absolute number of wetlands surveyed has thus increased, and the focus of each seasons' survey has shifted when necessary to track significant changes in population demographics. Nevertheless, the primary aims and methodology of consecutive surveys has remained consistent between years, and the original project aims continue to be prioritized. With respect to population monitoring, these are:

1. Gaining general insights into the biology and ecology of *L. aurea*.
2. Meeting population monitoring requirements for operation on Kooragang Island by:
    a. Providing a population size estimate for *L. aurea* on the island;
    b. Describing the demographic composition of the island population of *L. aurea*; specifically, the ratio of adults to juveniles and the ratio of males to females.
    c. Defining the spatial distribution of *L. aurea* across the island, considering movement patterns and aggregations.
3. Informing 'on the ground' management plans of partner organisations to balance business with the protection of the existing population of *L. aurea* on Kooragang Island.

1.2 Context of the green and golden bell frog decline; bell frogs in SE Australia

The general background to the decline of *Litoria aurea* – a once common and widespread species along Australia's East Coast and inland tablelands from northern New South Wales to southern Victoria – has been described in detail in our previous annual reports (see, for example, McHenry et al. 2019) and various published papers (Mahony et al., 2013, Pyke and White, 1996, Pyke et al., 2002). The current population is understood to be much smaller than it was 50 years ago and persists in less than 10% of its historical range, occupying fewer than forty sites in a highly fragmented set of small refuge habitats (White and Pyke, 1996, Mahony et al., 2013). While there has been some argument about the causes of decline in this species, attention has focused upon three primary threats; (i) habitat loss/degradation, (ii) the invasive fish species *Gambusia holbrooki*, and (iii) the fungal disease known as 'chytrid'.

Habitat changes: The former range of *L. aurea* largely encompasses regions that have been highly modified for agriculture, urban development, and industry since European occupation. In NSW, the frog was distributed across the Eastern coastal plains and slopes, the coastal hinterland highlands on the east side of the Great Dividing Range, the tablelands that make up the upper parts of the Murray-Darling catchment on the west side of the Great Dividing Range, and the slopes and plains of the Murray River catchment. Most of these areas have been profoundly altered in the last 200 years, and hence the loss and degradation of habitat is a clear potential factor in the decline of this species in the last 50 years (Mahony 1999, Clemann & Gillespie 2012, Mahony et al. 2013). In particular, removal of riparian vegetation and river access by sheep and cattle has caused severe bank erosion and sedimentary infill of deeper holes in riverbeds, resulting in the loss of basking, foraging, and refuge microhabitats for frogs such as *L. aurea* that require access to standing water all year around (David Hunter, pers. comm.). Regulation of rivers by large dams has also altered the timing and extent of flooding events, which has likely had negative consequences for *L. aurea* breeding habitat.

The eastern plague minnow, *Gambusia holbrooki*: This invasive species was introduced to many countries including Australia through the 20th Century as a putative control measure against mosquitos. It has been described as a voracious predator and possesses a combination of life-history traits that make it a highly successful invader of aquatic ecosystems. It has been demonstrated to significantly reduce survivorship of *L. aurea* tadpoles in laboratory experiments (Morgan & Buttemer 1996, Pyke and White 2000). *Litoria aurea* tadpoles also do not show any avoidance or refuge seeking behaviours when introduced to *Gambusia*, further increasing their susceptibility (Hamer et al., 2002b). Its current range in NSW and Victoria has strong overlap with the locations from which bell frogs have declined; as a result, ecologists seeking to understand the decline of bell frogs in the 1990s drew attention to the potential impact of *Gambusia* (Gillespie 1996, Mahony 1999).

Chytrid: Over the course of the 1990s, ecologists suspected that the pattern of amphibian declines and extinctions closely fitted that of a disease epidemic, rather than the effects of habitat degradation or predation by an invasive species. Support for this was found in 1996 with the description of chytrid; more correctly known as chytridiomycosis, this is a disease caused by the pathogenic fungus *Batrachochytrium dendrobatidis* which can be fatal to a range of amphibian species (see summaries in Berger et al. 2007, Skerratt et al. 2018, Scheele et al. 2019).

Some aspects of the decline of *L. aurea* match the general pattern of chytrid-mediated decline of frog species. *Batrachochytrium dendrobatidis* is more active in cooler temperatures, and its greatest impacts have been upon frogs living at higher altitudes (Puschendorf et al. 2009, Puschendorf et al. 2013, Geoff Heard pers. comm.). This species has largely disappeared from the high-altitude parts of its former range, and persists mainly in warmer coastal zones. More recently, *B. dendrobatidis* has been shown to have a

low tolerance to saline environments, again consistent with the coastal distribution of surviving populations of *L. aurea*.

Combined effects: As much as chytrid appears to be the smoking gun behind *L. aurea* declines, there are some aspects that suggest that chytrid on its own may not be the whole story and that it is the interaction between these potential threatening processes that have contributed to declines. For example, at higher altitudes (coastal highlands of NSW and inland tablelands), *L. aurea* has experienced severe declines even with moderate or low habitat degradation and despite the absence of *Gambusia*. However, at lower altitudes and in more coastal areas, the situation becomes more complex. When *Gambusia* is present in high densities, the species persists only in saline environments, irrespective of the level of habitat degradation (coastal plains of NSW). When *Gambusia* is present at lower densities and habitat modification is not extreme, it may also persist (Mahony 1999, Gillespie & Clemann 2012). Similarly, where coastal plains have lower levels of both degradation and *Gambusia*, it persists (Heard et al. 2013, Gillespie and Clemann 2012), and where habitat modification is minimal and *Gambusia* is completely absent, the frog shows little evidence of decline (e.g., East Gippsland region of Victoria; Graeme Gillespie, pers. comm.). This pattern suggests that, whilst chytrid alone has likely extirpated *L. aurea* from the higher parts of its former range, the disease alone does not account for the pattern of decline in the lower-lying coastal and inland regions. The complexities of habitat degradation can be difficult to understand, but there appears to be a very clear signal with respect to the interaction between chytrid and *Gambusia.*

1.3 Threats interacting at a small scale: *Litoria aurea* on Kooragang Island

In laboratory challenge experiments, *L. aurea* is particularly susceptible to the chytrid fungus, (Stockwell et al., 2010), and whilst it is unlikely the disease kills all infected wild individuals, the fungus clearly poses substantial threat to the persistence of wild populations. Survival estimates of the Kooragang Island population demonstrate significantly lower over-winter survival rates in infected individuals when compared with non-infected individuals (Stockwell et al, 2011). The population level effects of this mortality are significant: infected populations are predicted to decline at twice the rate of healthy ones (Stockwell et al, 2011).

The majority of extant *L. aurea* populations are found in coastal environments, consistent with the suggestion that the sensitivity of the chytrid fungus to salt may explain the persistence of *L. aurea* in weakly saline environments (White, 2006; Stockwell et al., 2012). Significant negative correlations have been experimentally confirmed between infection load in captive *L. aurea* and the salinity of the water bodies they are kept in (Stockwell, 2011). Wild populations of *L. aurea* inhabiting water bodies with up to 3.5 ppt salt were also found to have lower infection loads than those frogs not exposed to saline conditions (Stockwell et al. 2012, Clulow et al. 2018). Indeed, salt concentrations above 2 ppt but not exceeding 5 ppt were found to be beneficial (Stockwell et al., 2015b, Stockwell et al., 2015a). The potential for using salt as part of a management tool for *L. aurea* on Kooragang was investigated by Callen (2018), who found that an array of wetland habitats which provided wild *L. aurea* with access to at least some saline wetlands did result in improved survivorship.

Callen (2018) also found that variation in hydroperiod was also important for the persistence of the subpopulation that was the focus of the study. This variation in wetland characteristics between neighbouring wetlands has been dubbed the 'habitat mosaic' and is emerging as an important concept in the conservation management of *L. aurea*. Connectivity (i.e. proximity of an array of wetlands to each other, with suitable interconnecting habitat) is a key attribute of an effective mosaic (Hamer et al. 2008, Wassens et al. 2008, Heard et al. 2015), but variation in hydroperiod among wetlands is just as important

(Klop-Toker 2016, Callen 2018). In the context of *L. aurea* on Kooragang Island, an effective habitat mosaic should have variation in microhabitat sufficient to provide environmental protection against chytrid via access to increased salinity and temperatures (Heard et al. 2014, Heard et al. 2018). Variation in hydroperiod can also provide protection against *Gambusia*, which have a significant impact on *L. aurea* recruitment on the island (Klop-Toker 2016).

Whilst the relationship between *L. aurea* declines and the expansion of *Gambusia* into NSW has been debated, numerous sites exist where *L. aurea* declined despite local water bodies being free of the predatory fish (Mahony et al. 2013). While several studies have noted the co-occurrence of *L. aurea* tadpoles and *Gambusia* in the same water body (Sanders et al., 2015, Hamer et al., 2002a), the pattern seen from field studies on Kooragang leaves little doubt that *L. aurea* recruitment is heavily affected by the presence of *Gambusia* (Klop-Toker 2016, McHenry et al. 2017, 2019, this annual report). *Gambusia* do not affect adult *L. aurea* (Klop-Toker 2016), but their impact on tadpoles means that *L. aurea* populations subject to chytrid and coexisting with *Gambusia* will be subject to both increased adult mortality and reduced recruitment. Bell frogs appear to have bred in permanent water bodies more frequently in the past than they do now and this may be because ephemeral water bodies that dry frequently do not sustain populations of the fish (Pyke and White 1996; Hamer et al. 2002; Pyke, White et al. 2002), highlighting the importance of designing wetland infrastructure to control for *Gambusia* infestation.

1.4 Research Objectives

Research objectives for the 2022-23 season are largely consistent with previous years, and target areas of *L. aurea* biology and ecology that are relevant for management of this species and its habitat on Kooragang Island:

1. What is the estimated population size on the island?
2. What is the demographic composition on the island?
    - What are the proportions of juveniles, adult males, and adult females?
    - How much recruitment is known, and where is it occurring on the island?
3. How do *L. aurea* utilise the island landscape?
    - What is the distribution?
    - What factors affect distribution, abundance, and recruitment?
4. What information can be gained from longitudinal data?
    - What are the growth patterns of *L. aurea* on the island?
    - How long do individual *L. aurea* persist?
    - What are the movements of *L. aurea* across the island?

In addition, there were several objectives that relate to specific management issues faced by partner organisations:

5. **Habitat corridor mitigation strategy (PWCS)**: A long-term aim is to decrease the proportion of *L. aurea* occupancy of wetlands in the north of the precinct (previously earmarked for development - see Section 2.1: Site Context), and to increase occupancy of wetlands in the southern part of that site. This requires detailed understanding of population numbers, distribution and movement in the northern and the southern parts of the Industrial Zone.

6. **Rail infrastructure mitigation strategy (NCIG)**: The construction of the NCIG 'rail loop' enclosed several wetlands that were important habitat for *L. aurea* with a high traffic rail line. It is important for NCIG to understand if the rail loop has effectively isolated the populations in those wetlands from the Kooragang Island metapopulation. This requires detailed understanding of population numbers, distribution, and movement within the rail loop and adjacent wetlands.

7. **Constructed wetlands strategy (HCCDC)**: As part of capping within the rail loop in 2015, HCCDC constructed sedimentation ponds that were designed to provide suitable habitat for *L. aurea*. The efficacy of that design, and the location of these artificial wetlands within the landscape, is an important question for HCCDC as further capping works are implemented. This requires detailed understanding of population numbers, distribution, and movement at the HCCDC constructed and adjacent wetlands.

Of these, objectives #5 and #6 have largely been addressed: *L. aurea* now occupy the Southern part of the Industrial Zone in strong numbers, and there is no evidence that rail infrastructure negatively affects the population. With the recent completion of Area 2 and Eastern Ponds, some residual questions about optimal design and spatial contexts of constructed wetlands remain.

2. Methods

2.1 Site context

Kooragang Island lies at the northern boundary of the Newcastle Local Government Area, on the NSW Central Coast (Figure 2.1.1). The island itself is estuarine in nature, and is bounded to the north and south by channels of the Hunter River. Soils are composed of deposited sand, silt and clay sediments. Several tidal channels extend onto the island, which historically once separated the current landmass into smaller islands prior to human development. The natural hydrology of the island has been considerably altered, with agricultural development (e.g., draining of land for pastures) and industrial activity (e.g., road construction and land reclamation). Its deltaic nature, which includes low elevation, supports a diversity of wetlands ranging from saltmarsh and tidal flats to freshwater swales and large permanent freshwater wetlands.

Sixty wetlands have been the focus of the island-wide surveys, and these were all surveyed again in the 2022-23 breeding season. Additional surveys of other wetlands were added to the dataset. This approach gives a largely consistent list of wetlands surveyed each year, with some variation between each season (see Table 2.2.1). Figures 2.1.3 and 2.1.4 show the nomenclature used by UoN to identify specific wetlands.

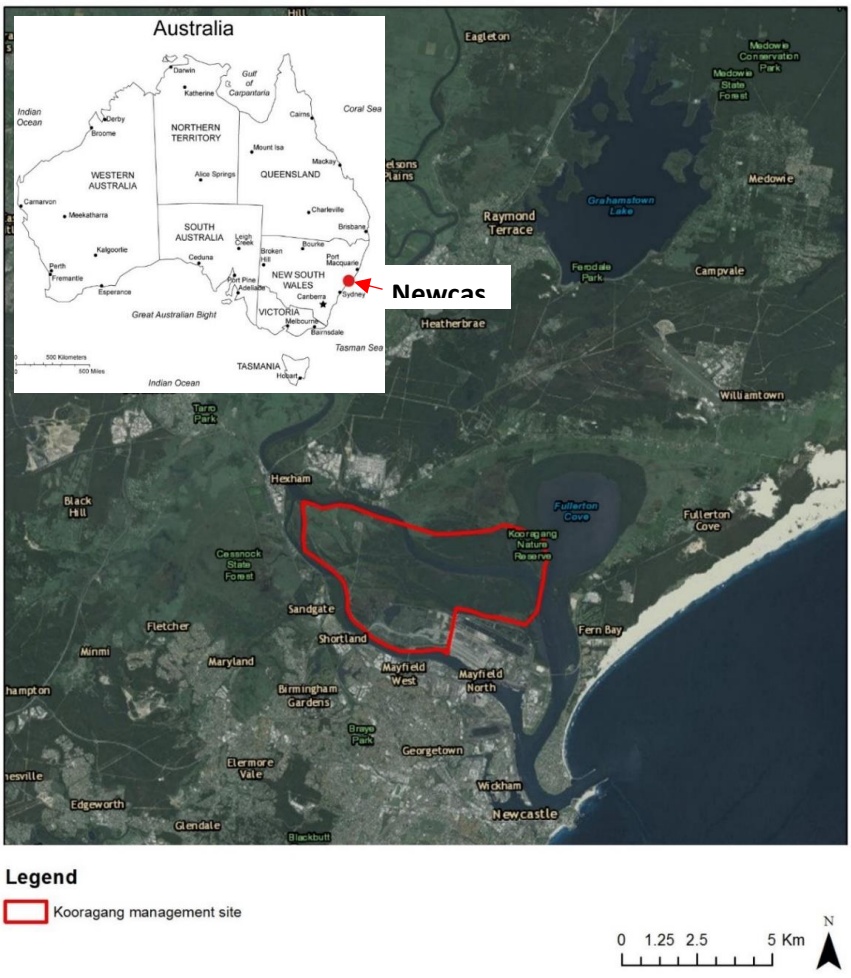

Figure 2.1.1: Contextual map depicting the location of Kooragang Island, near Newcastle, NSW.

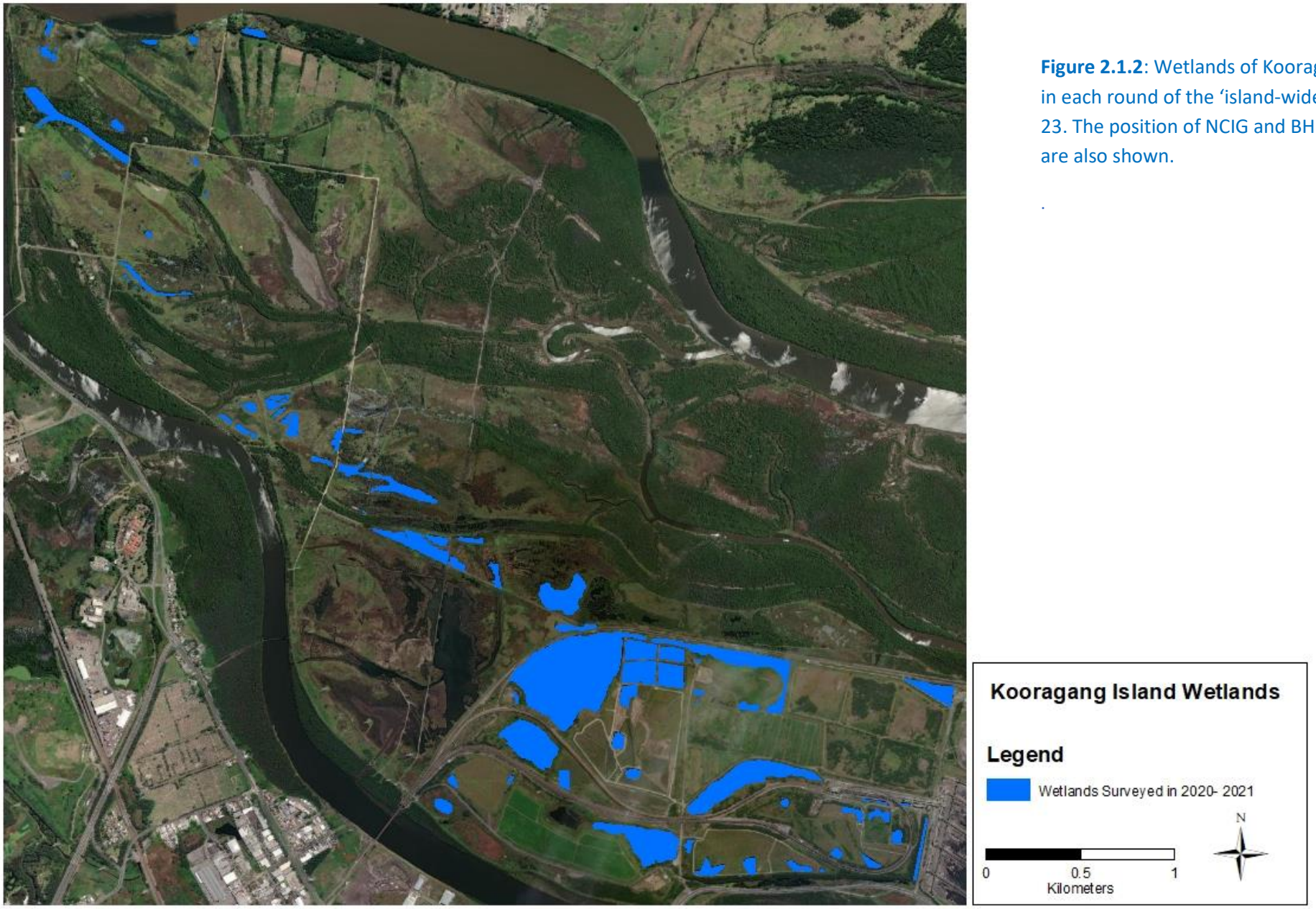

Figure 2.1.2: Wetlands of Kooragang Island surveyed in each round of the 'island-wide' surveys of 2022-23. The position of NCIG and BHP CHEMP wetlands are also shown.

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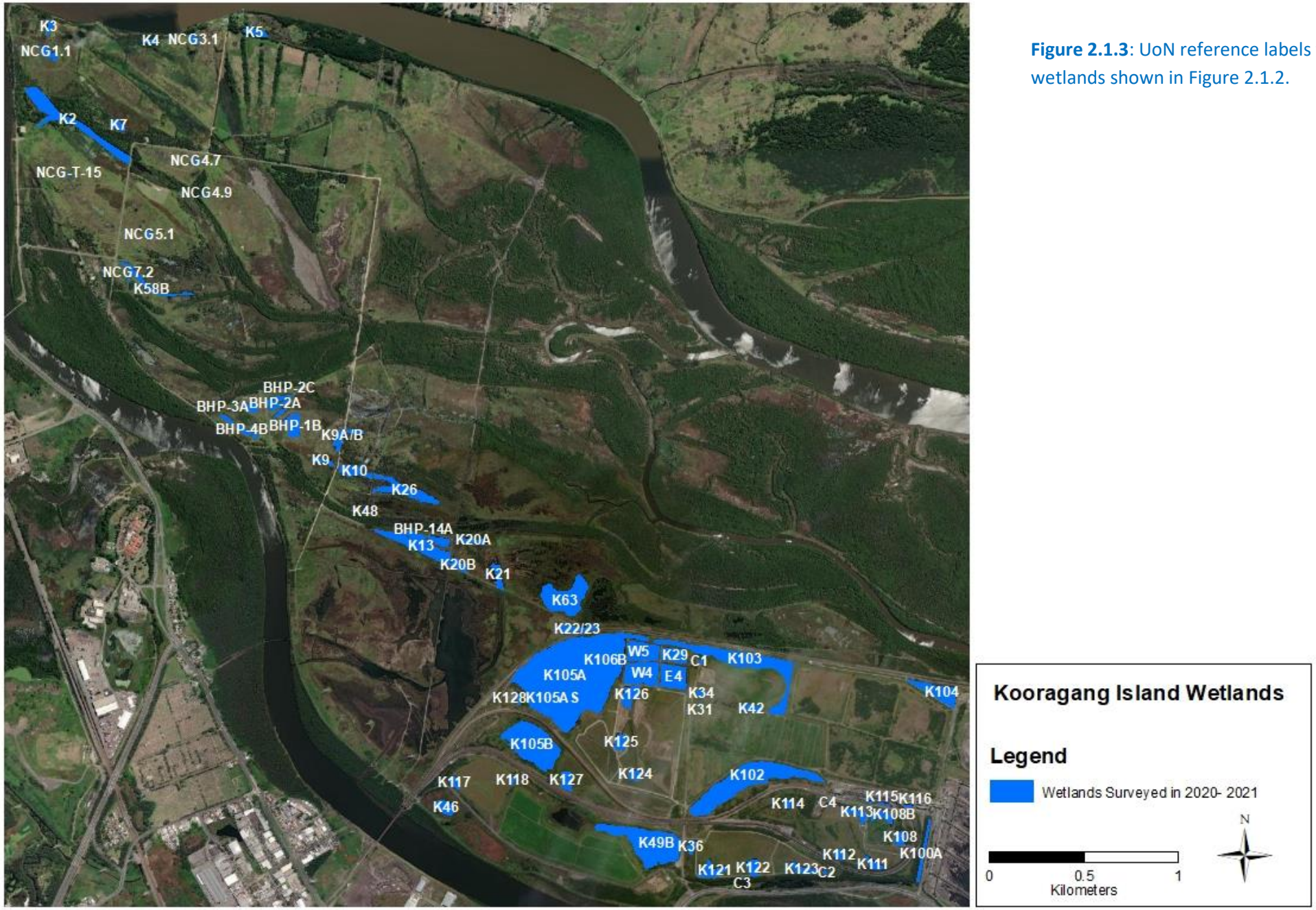


Figure 2.1.3: UoN reference labels for the wetlands shown in Figure 2.1.2.

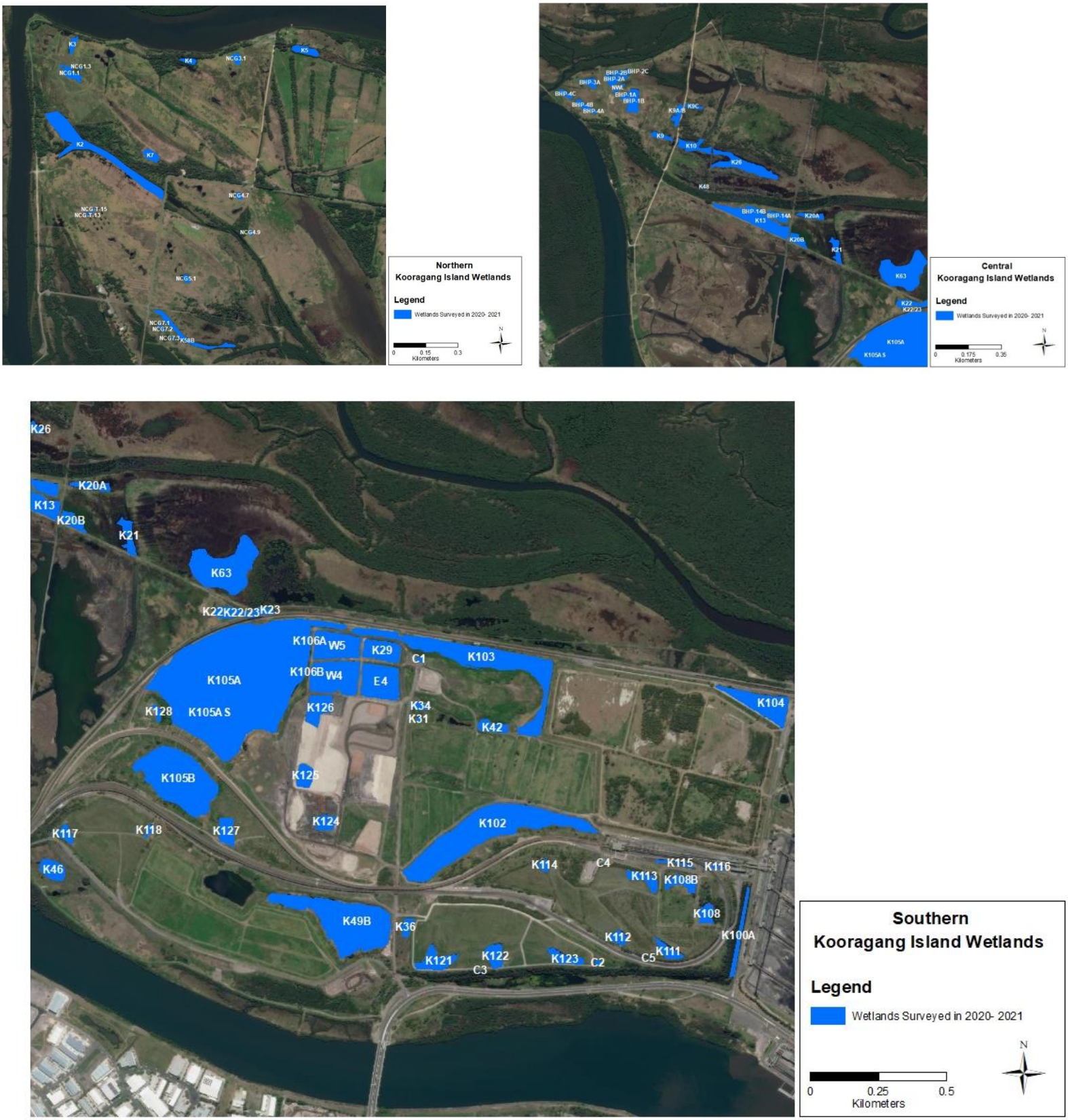


Figure 2.1.4: Close-up of wetlands (with UoN labels) in each of the three zones: Northern Zone (top-left), Central Zone, (top right), and Southern 'Industrial' Zone (bottom) – see Section 2.2. Note that the Industrial Zone lies in the southern portion of Kooragang Island.

2.2 Groupings of wetlands: Zones, Regions, Subregions, and Jurisdictions

To assist survey logistics and analysis of spatial patterns of *L. aurea* distribution, the surveyed wetlands on Kooragang Island are organised into areas as follows:

Zones: wetlands are grouped into three geographical zones - the Northern, Central and Southern zones.

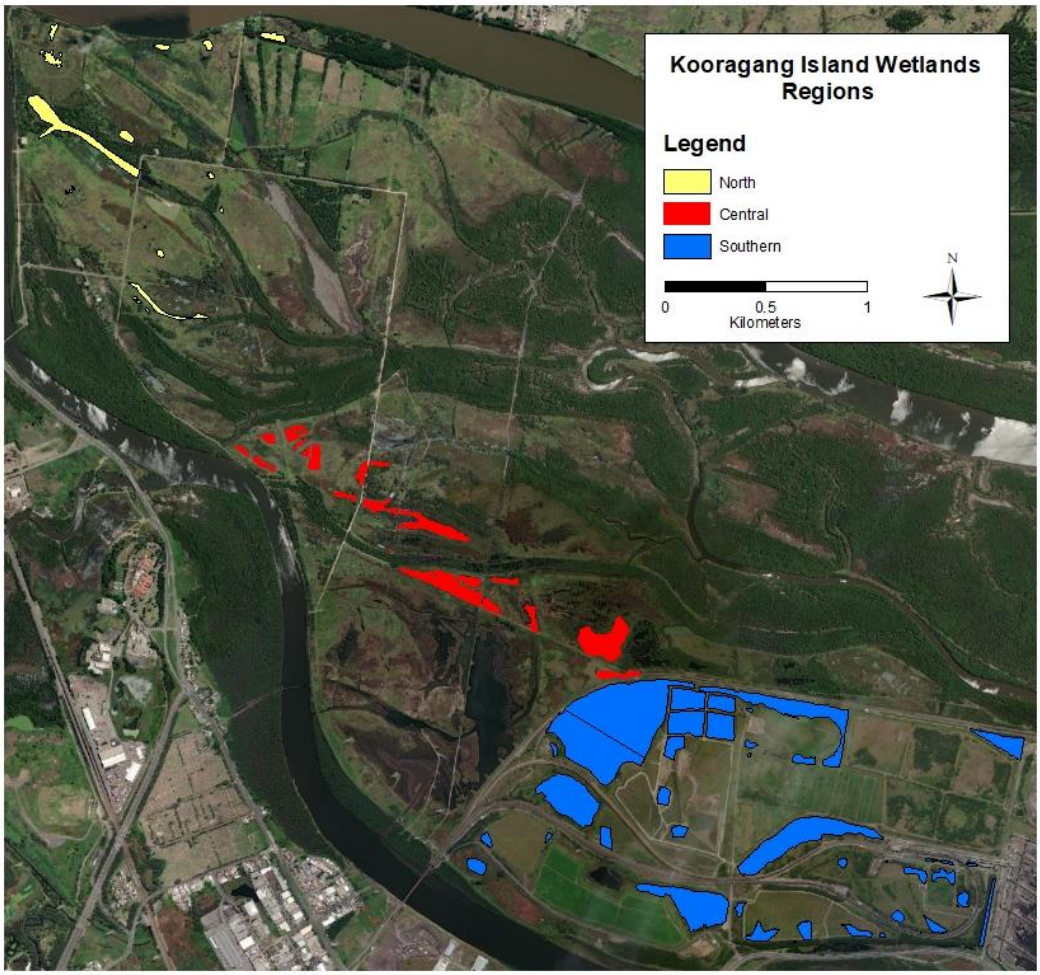


Figure 2.2.1: Location of surveyed wetlands on Kooragang Island within Zones; see text and Table 2.2.1 for explanation.

Northern Zone: this zone includes the Hunter Wetlands National Park from the Sandgate bridge in the south to Scott's Point in the north, and has an area of 377 ha. Within this zone there are 58 wetlands sampled as part of the program this year. Overall, the zone has experienced a range of disturbance histories, including, grazing, clearing, draining, impounding, flood-gating and other types of human development.

Central Zone: this zone also includes part of the National Park Estate. It ranges from the south from the PWCS rail line, where wetland sample sites are found adjacent to Bell Frog Track, to north at Milam Rd and terminating at the north arm of the Hunter River. Overall, this zone has an area of 293 ha, of which 90% is mangrove forest community. Within this zone there are 29 wetlands sampled as part of this program this year. Compared to the Northern Zone, this area has been less impacted by human activity. Nonetheless, there is evidence of historic disturbance, including clearing, draining, impounding, road construction, utility easements, and flood-gating.

Southern Zone (= 'Industrial Zone or 'KIWEF'): Wetlands in this zone are located in the south-eastern part of the island, on industrial and commercial lands leased or owned by organisations undertaking a range of business activities on the site. Industry dominates this zone and it has been both historically modified and continues to be a modified and disturbed part of the site. Nonetheless, the wetlands within this zone are easily delineated and in numerous cases protected from the chronic impacts of industrial activities. The Southern Zone is dominated by the Kooragang Island Waste Emplacement Facility (KIWEF), a series of constructed 'cells' on top of the estuarine wetland floor that were filled with industrial waste from the Newcastle steelworks and other heavy industry through the 20th Century. Some of the unfilled cells now provide wetland habitat, whilst closure works on filled cells have required the construction of sediment control ponds that have now also provided suitable habitat for *L. aurea*. Within this zone there are 43 wetlands sampled as part of this program this year, with a wide variety of types and sizes represented in the overall area of 346 ha. The northern part of the zone was the approved site for the development of a fourth coal terminal ('T4'), but progress on that development was halted in 2019 and is not expected to proceed. Compared to the rest of Kooragang Island, this area has undergone the greatest level of historical disturbance and continues to be impacted by human activity, yet supports the largest numbers of *L. aurea* on the Island.

Regions: each zone is subdivided into two regions. This grouping of wetlands into regions allows (1) the habitat corridor mitigation strategy to be assessed (as this involves comparison of the northern vs southern parts of the Industrial Zone), and (2) equivalent subdivisions of the other two zones for the purposes of multi-year occupancy analysis (**Section 3.9**).

Northern Zone:

- Hunter River North
- School House

Central Zone

- Cobban's Creek
- Bellfrog Way

Southern Zone

- Industrial Zone North
- Industrial Zone South

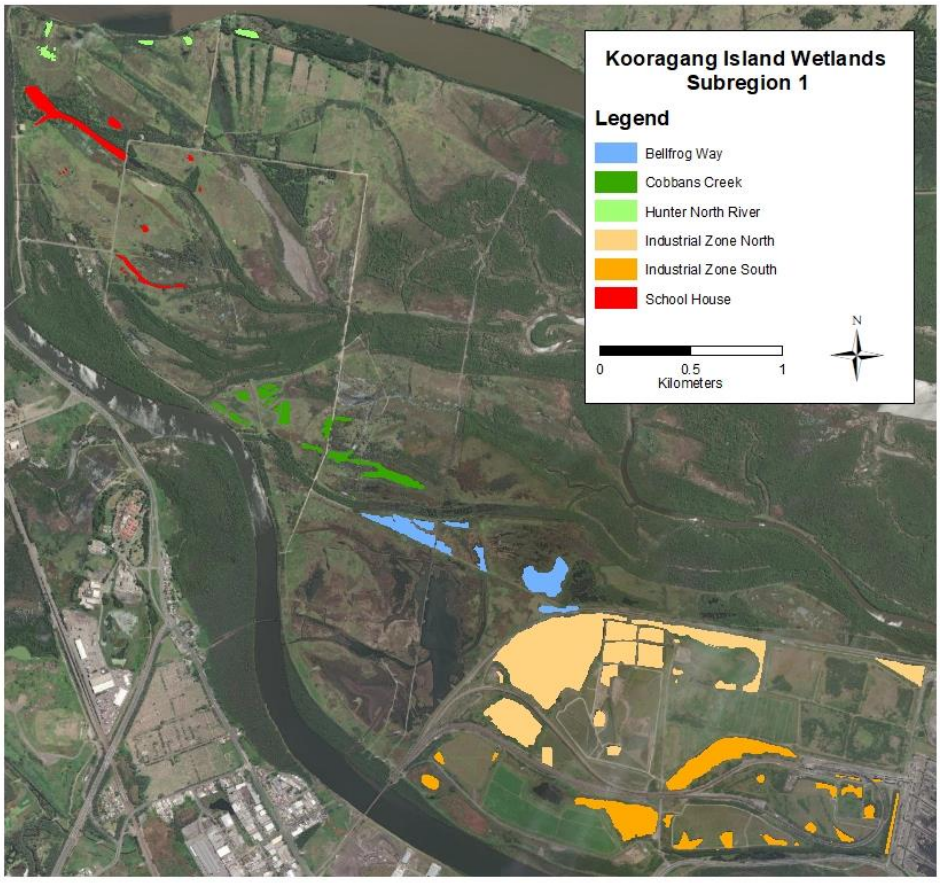


Figure 2.2.2: Allocation of surveyed wetlands to Regions. See text and **Table 2.2.1** for explanation.

Subregions: the regions are subdivided into a number of subregions (Figure 2.3.3), each at a consistent spatial scale (<1 km across) and determined by natural and artificial boundaries such as creeks, roads, and rail-lines. Grouping of wetlands at this scale is required for assessment of the rail infrastructure mitigation strategy and the constructed wetlands strategy:

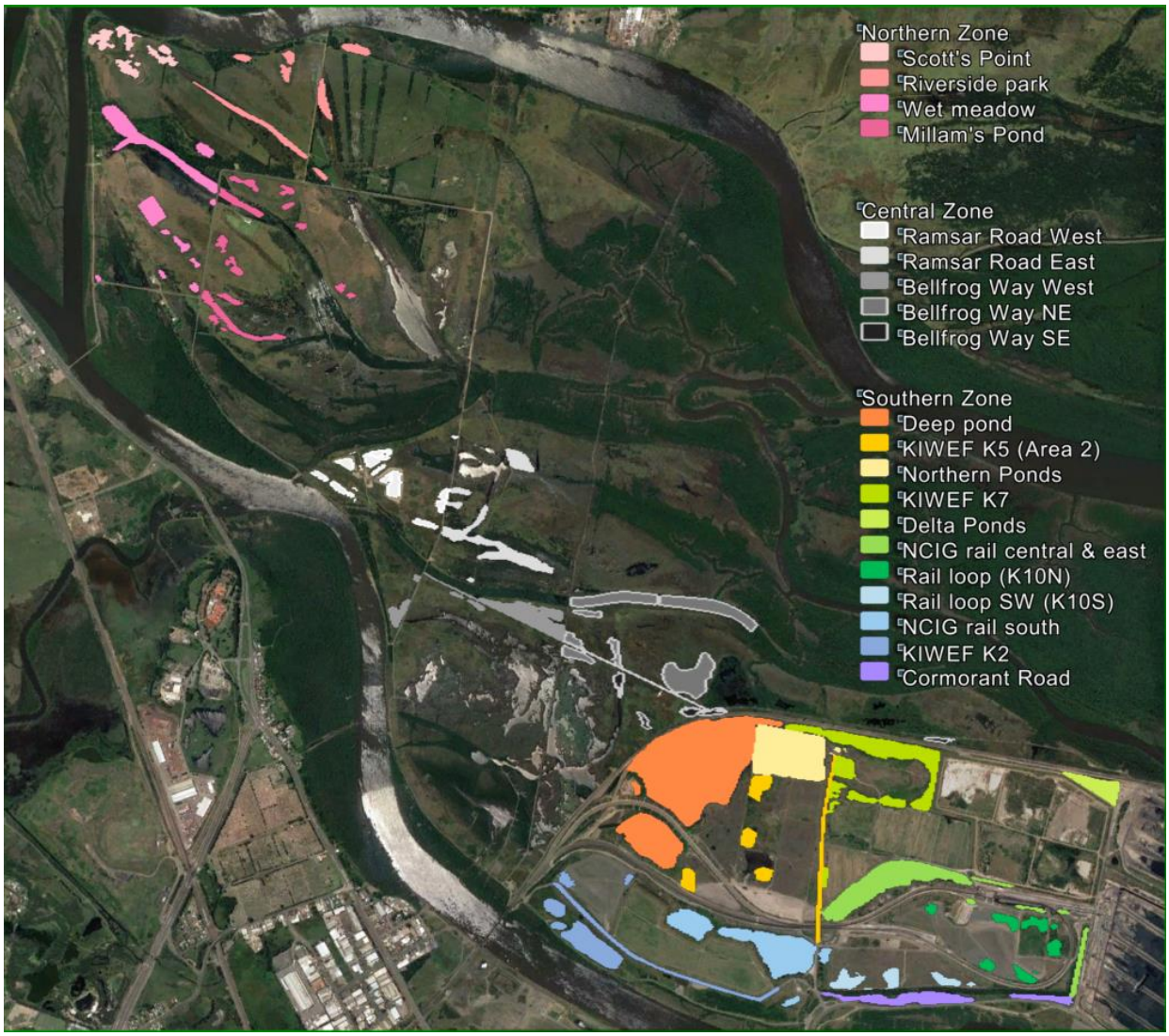


Figure 2.2.3: Allocation of surveyed wetlands to Subregions. See text and Table 2.2.1 for explanation.

Note that the Northen Ponds (Industrial Zone North) is a new subregion formally grouped within the KIWEF *K7* subregion. A total of 75 focus wetlands were surveyed in the 2022-23 in each of the two main survey rounds. A further 55 wetlands were surveyed at least once this season. A full list of the wetlands included in each zone, region, and subregion is included in Table 2.2.1.

Table 2.2.1: Categorisation of surveyed wetlands into Zones and Regions. Wetlands shown in bold *italics* are those that are also surveyed as part of the Saving Our Species (SoS) program.

Zone	Region	Wetland	no. of VES
Northern	Scott's Point	***NCIG-1.1***	3
		NCIG-1.2	1
		NCIG-1.3	3
		NCIG-1.4	1
		NCIG-2.1	1
		NCIG-2.2	1
		NCIG-2.3	1
		NCIG-2.4	1
		NCIG-8.19a	1
		NCIG-8.19b	1
		NCIG-8.19c	1
		NCIG-8.19d	1
		NCIG-8.20	1
		K3	3
	Riverside Park	***K4***	3
		NCIG-3.1	2
		NCIG-3.3	1
		NCIG-3.4	1
		NCIG-3.5	1
		NCIG-3.1-2	1
		K5	3
		K15	1
		K18	1
		K16	1
		K6	1
	Wet meadow	***K7***	3
		K2	3
		K17	1
		K19	1
		K8	1
		K1	1
		NCIG-T13	1
		NCIG-T14	1
		NCIG-T15	1
		NCIG-6.1	1
		NCIG-6.2	1
		NCIG-6.6	1
		NCIG-6.3-5	1
	Millam's Pond	K7A	1
		K27	1
		K58A	1
		K58B	3
		NCIG-4.6	1
		NCIG-4.7	3
		NCIG-4.8	1

Zone	Region	Wetland	no. of VES
		NCIG-4.9	3
		NCIG-4.10	1
		NCIG-4.11	1
		NCIG-4.1-4	1
		NCIG-5.1	3
		NCIG-5.2	1
		NCIG-5.5	1
		NCIG-5.8	1
		NCIG-5.3-4	1
		NCIG-5.6-7	1
		NCIG-7.1	3
		NCIG-7.2	3
		NCIG-7.3	3
Central	Ramsar Road West	***K9***	2
		K9A/B	2
		BHP-1A	7
		BHP-1B	7
		BHP-2A	7
		BHP-2B	7
		BHP-2C	7
		BHP-3A	7
		BHP-4A	6
		BHP-4B	6
		BHP-4C	6
	Ramsar Road East	K10	2
		K25	1
		K26	2
		K48	2
		K9C	2
	Bellfrog Way West	K11	1
		K13	2
		BHP-14B	7
		BHP-14A	7
		BFW Trnsct W	3
	Bellfrog Way NE	K20A	2
		K20B	2
		K20C	1
		K21	1
		K63	1
		BFW Trnsct E	3
	Bellfrog Way SE	***K22***	6
		K23	6

Zone	Region	Wetland	no. of VES
Southern	Deep Pond	K105A	6
		K105AS	2
		K105B	2
		K128	2
	KIWEF K5 (Area 2)	K127	2
		K124	6
		K125	5
		K126	6
	Northern Ponds	***C1***	2
		K106A	2
		K106B	2
		NP-W4	2
		NP-W5	2
		NP-E4	2
		K29	2
	KIWEF K7	***K103***	2
		K31	2
		K33	1
		K34	2
		K42	2
	Delta Ponds	***K104***	5
	NCIG rail central & east	***K100A***	6
		K102	2
	Rail loop (K10N)	***K111***	7
		K112	2
		K113	2
		K114	6
		C4	3
		C5	2
		K108	3
		K108B	1
	Rail loop SW (K10S)	C2	2
		K121	6
		K122	4
		K123	4
		C3	2
	NCIG rail south	***K36***	2
		K49B	2
		K129	1
	KIWEF K2	***K117***	2
		K118	2
		K46	2
		Minyan Rd	2

Jurisdiction

Core wetlands surveyed for the Whole Island Monitoring Program fall under the following seven jurisdictional categories (see Figure 2.2.4).

- National Parks and Wildlife (NPWS): 14 wetlands (North and Central Zones)
- CHEMP (NCIG and BHP): 13 wetlands in the North and Central Zones of the National Park.
- Port of Newcastle (PoN): 2 wetlands (Central Zone)
- Port Waratah Coal Services (PWCS): 1 wetland (Industrial Zone)
- Newcastle Coal Infrastructure Group (NCIG): 2 wetlands (Industrial Zone).
- Hunter Development Corporation (HDC): 33 wetlands (Industrial Zone)

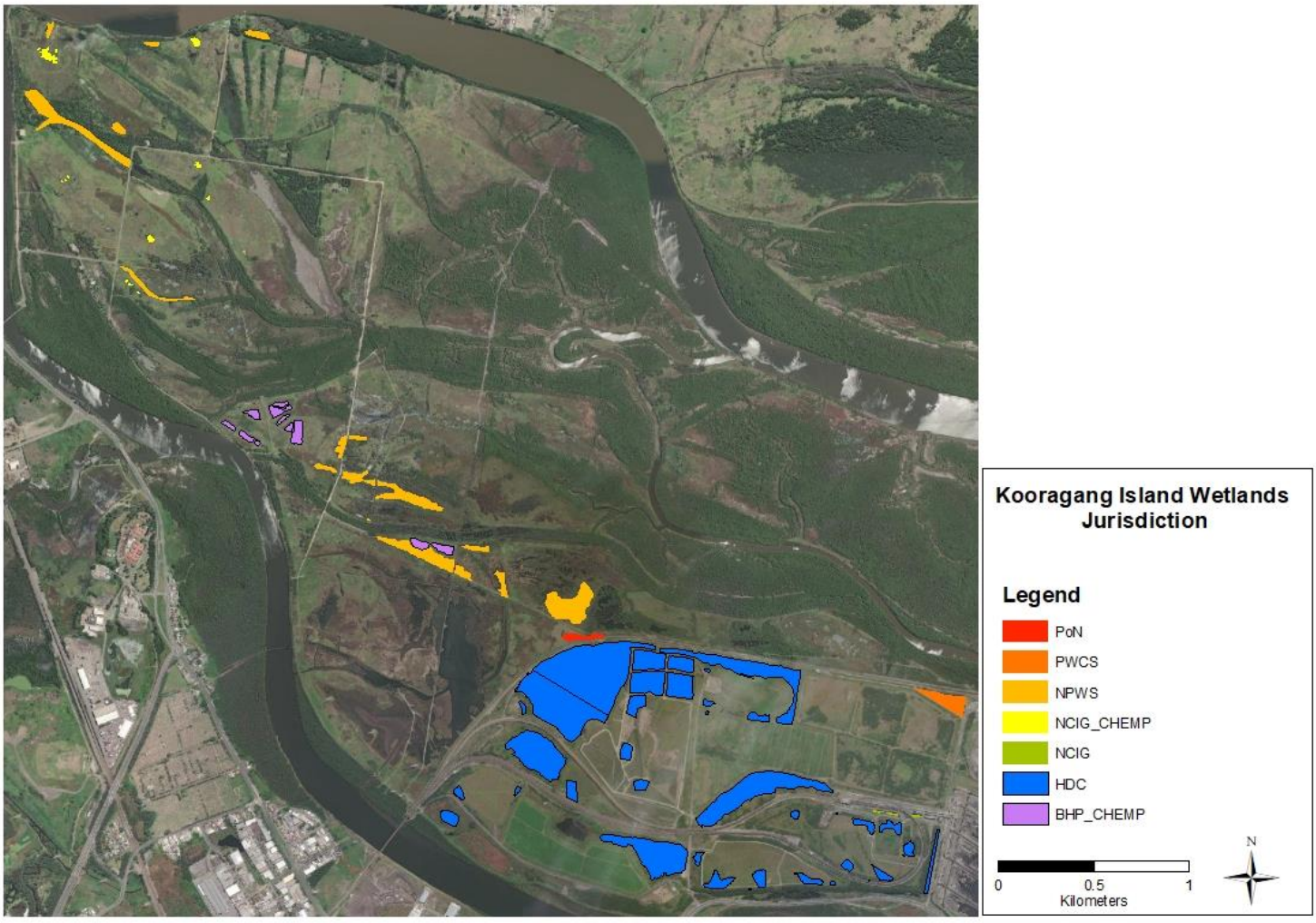


Figure 2.2.4: Named wetlands on Kooragang Island, summarized by jurisdiction. Note that not all of these were surveyed in the 2022-23 season.

2.3 Long-term monitoring approach

The whole island monitoring program has followed a standard method for ten years and was established to enable tracking of *L. aurea* distribution and abundance against time. In the past five years, significant habitat creation projects and other landscape works have occurred on the site that materially should affect the distribution and abundance of the *L. aurea* population. These new wetlands must be included to enable assessment of the effectiveness of mitigation strategies in increasing distribution and abundance of the *L. aurea* population. Therefore, whilst consistency is important and we aim to monitor within a predefined set of wetlands, we must also be responsive to landscape changes. Finally, several newly constructed wetlands created by HDC following capping works across the southern part of the Industrial Zone were included in surveys.

2.4 Survey techniques

Visual Encounter Survey (VES) of wetlands involved systematic night-time surveying by between 2-4 people, using >150 lumen LED head torches. Surveys began by listening for calling activity. The surveys involved walking slowly through the wetland habitats, paying careful attention to vegetation that *L. aurea* tend to associate with (mainly emergent reeds).

Recording of Climatic conditions

Climatic variables were recorded at each wetland site during each night of surveying. We recorded: temperature, dew point, wet bulb temperature, barometric pressure, wind speed (average and maximum), and relative humidity, using a multi-probe instrument (Kestrel).

Methodology - Adult Frogs

For each survey, each surveyor recorded

i. Start and end times of survey,
ii. Any frogs (*L. aurea* or other species) heard calling
iii. Water depth (qualitative)
iv. Presence/absence of *Gambusia*
v. Other non-target species of frog seen
vi. For each *L. aurea* encountered:
    - Time of capture
    - Habitat structure (tree, reed, grass, rock, ground, aquatic)
    - Height from ground/water surface
    - Distance from water's edge
    - Size class (adult/juvenile)
    - Calling occurrence
    - Other relevant observations

In general, we attempted to capture all *L. aurea* observed. This was done using a thin plastic bag (sandwich bags). Captured frogs were labelled with a capture code, and tied in the bag with sufficient air. If the frog was touched during capture, we washed hands with disinfectant gel (NSW NPWS Hygiene Protocol).

Captured frogs were processed as follows:

i. Scanned using a Passive Induction Transponder reader to see if the frog had been previously captured and tagged.
ii. If the frog had a passive induction transponder (PIT) tag, the number was recorded.
iii. Visual inspection of frog for injuries, as well as nuptial pads (to identify males from females) and candle lit (to identify gravid females).
iv. Snout-vent-length (SVL) and tibia length (TL) were measured using callipers.
v. Body weight was measured using a 10 g, 60 g or 100 g spring balance (Pesola).
vi. The frog was swabbed for chytrid fungus by the standard protocol used by the UoN Amphibian Research Lab (flank, inguinal region, posterior thigh, palms of hands, soles of feet).
vii. If the animal had not been previously tagged:
    - A small tissue sample (piece of webbing from a foot) was taken using a biopsy punch and stored in 70% ethanol.
    - A PIT tag was injected subcutaneously into the lower back and manipulated into the inguinal region.

Tadpoles and metamorphs

Where possible, tadpoles were identified in the field, using the key in Anstis (2002). Metamorph*s* were identified and classified on the basis of the presence of a tail stub combined with adult colouration.

Data collection

Processing took approximately 10 person-minutes per frog. Swabs for chytrid are not collected in the summer, while tissue samples for genetic analysis are collected from a subsample of captured frogs only. Frogs were returned to their point of capture after completion of the survey.

A single **primary** VES was performed at each wetland during each survey round; two survey rounds were performed between September 2022 and March 2023. In Visual Encounter Surveys, the entirety of each wetland was surveyed for a maximum of 30 minutes. Care was taken not to overlap surveys by each person, or to search the same area more than once. We attempted to keep a uniform survey speed at each wetland, although that did vary between and within wetlands depending on vegetation density. Any frogs captured were processed at the end of the survey, and frogs were then released at their point of capture.

2.5 Search effort

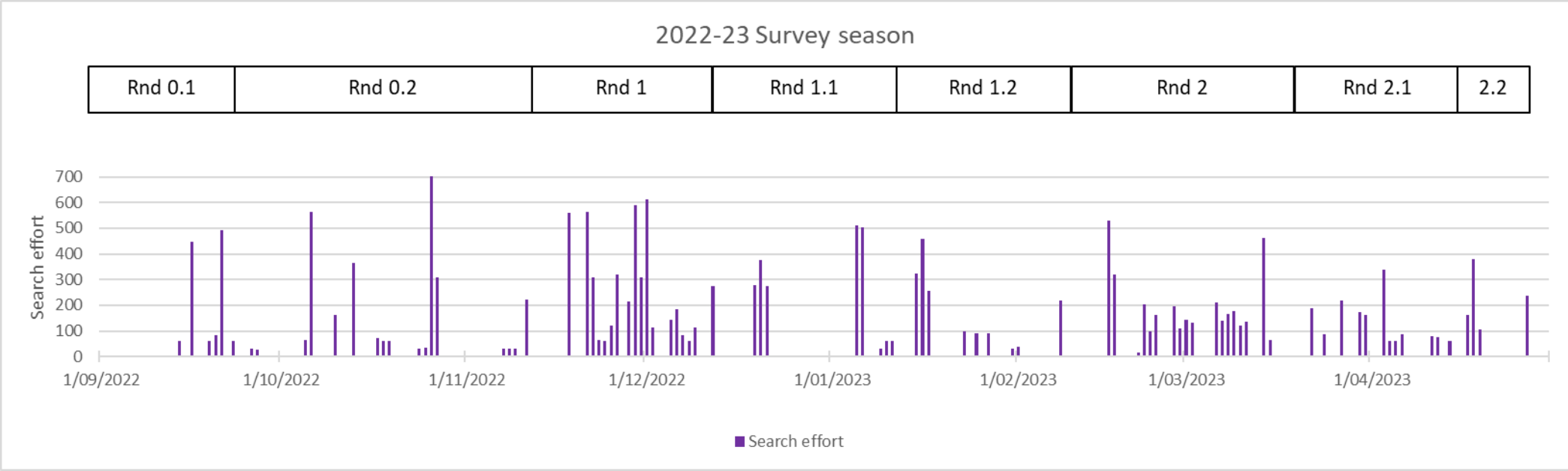


Figure 2.5.1: Search effort across the 2022-2023 survey period, separated into discrete rounds.

Table 2.5.1: Number of wetlands surveyed

VES surveys	
Wetlands surveyed	130
Total wetland surveys	326
Day/Nights of field surveys	66
Total search effort (person.mins)	13,983

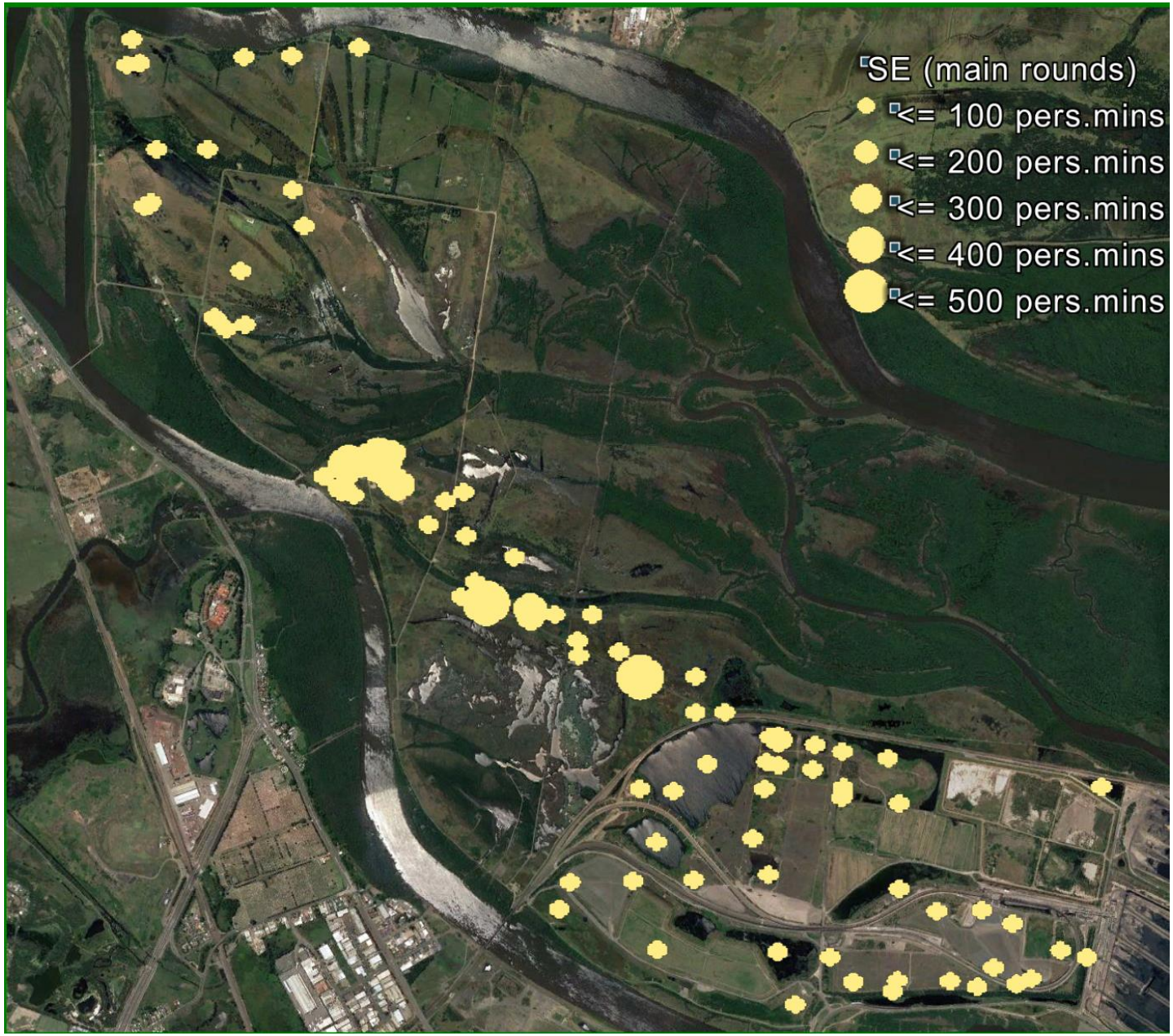


Figure 2.5.2: Search effort (person.minutes) across main round surveys of wetlands surveyed as part of Island-wide monitoring in 2022-23.

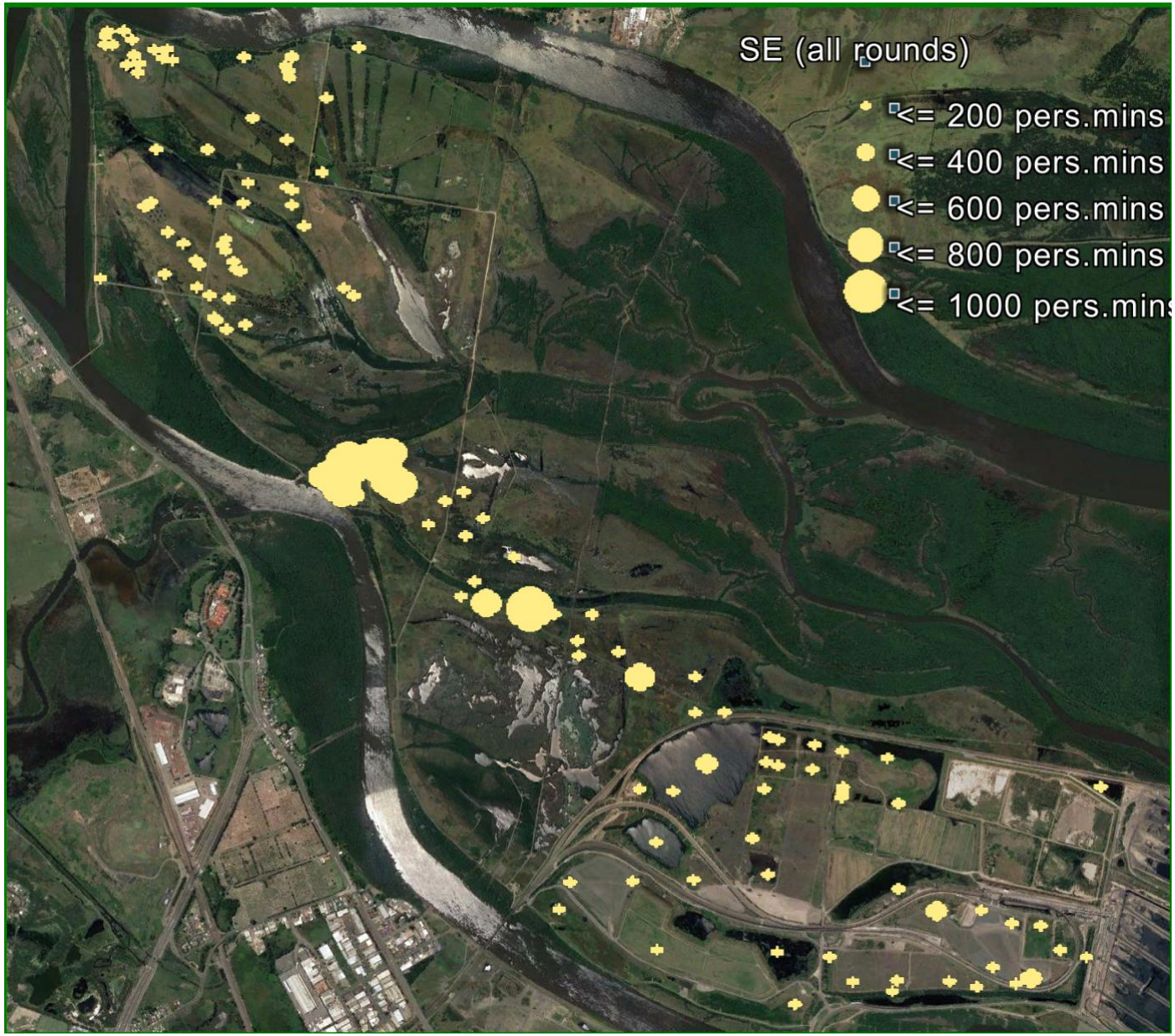


Figure 2.5.3: Search effort (person.minutes) across all surveys at wetlands surveyed as part of Island-wide monitoring in 2022-23.

2.6 Methodological approaches used to address objectives

Estimating population size

Over past breeding seasons, population estimates have been obtained for three specific wetlands (K22-23, K29 'the cell' and K104) based on data from Capture-Mark-Recapture (CMR) surveys. Repeated CMR surveys at a wetland provide data on the ratio of captured to uncaptured animals in a population, allowing an estimate of total population size (Figure 2.6.1). This CMR survey data can be used to extrapolate island-wide population estimates using VES survey data obtained from each wetland.

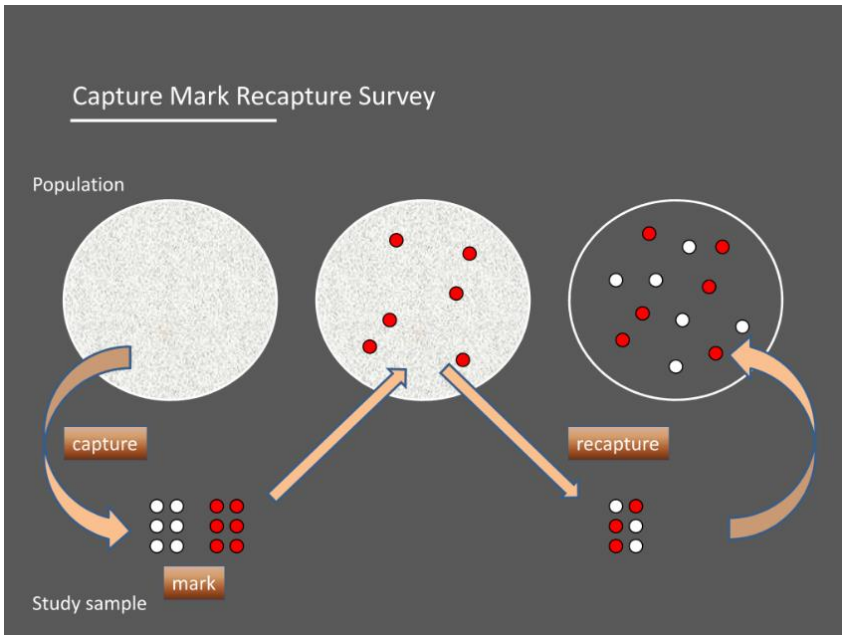


Figure 2.6.1. A simple illustration of capture-mark-recapture survey (based on two capture events only). Left circle: nothing is known about the population size, during the first capture event animals are caught, marked and released. Middle circle: the number of marked animals within the population is known. During the second capture event marked and unmarked individuals are caught. Right circle: the population size can be estimated based on the proportion of marked individuals caught during the second capture event.

Assumptions applied to survey effort and population modelling

For analytical purposes, we assume that survey efforts were consistent across the entire monitoring season. In reality, there are several important sources of variation:

Within and between individual observers: survey effectiveness can vary among observers, particularly given that *L. aurea* are generally cryptic and difficult to see. To overcome detection bias we used a core of experienced observers within the survey teams but this remains an important methodological limitation.

Within and between sites: Along with being cryptic and difficult to see, *L. aurea* are well camouflaged in a variety of vegetation types. They are particularly difficult to spot in dense vegetation, and so wetlands with dense reeds (many of the wetlands on the northwest part of Kooragang, such as K7, K5, K4; also K13, K21) are expected to have low detection rates for a given abundance of frogs. The highest probability of detection seems to be in wetlands that have a narrow band of *Juncus acutus* surrounding open water that is > 3 metres across and > 1 metre deep (e.g., K23; southern side of K104); during summer, the frogs sit on the edge of the vegetation. Parts of a wetland with dense *Typha* and especially *Phragmites* may hold large numbers of *L. aurea*, but have low detection rates. Weather conditions also influence detection probability; warmer nights with low wind speeds seem to be better for detecting *L. aurea* (although this is difficult to demonstrate quantitatively). Temporal variation in frog detectability can occur across one evening (frogs seem to be more detectable past 1 hour after sunset), across consecutive nights (with weather), and across the season; the evidence is that some wetlands (e.g. K23, K29, K108) are over-wintering sites, from which frogs disperse to ephemeral wetlands during the mid-summer and then return to towards autumn.

So that we could account for the inherent bias produced by habitat complexity, all surveys were timed, with survey effort calculated as part of the detection probability. We also calculated wetland size and perimeter length so that we could assess frog density. Limiting bias created by different weather patterns and seasonal conditions is more difficult to account for in analysis. To limit the effect of different weather patterns we aimed to accomplish a complete survey of all wetlands in a two to three-week period, thus limiting the impact of short-term climate variations. To overcome seasonal effects, the surveys were replicated twice, one in November-December, and one in February-March. Despite this design, the *L. aurea* breeding season is often punctuated with discrete rainfall events that occur in the middle of and before surveys. Such events do effect frog detection and occupancy at wetlands. Detection of bell frogs is increased when males are actively calling, and during these times they are more active around the edge of wetlands and on the water surface, making visual encounter easier. Associated with large rain events, bell frogs disperse from permanent wetlands and move to ephemeral wetlands. In some situations, this may only be a matter of metres and in others it may involve distances of tens of metres.

Demographic composition and effective population size

To construct the age-class structure of the *L. aurea* population, we determined the age of individual frogs collected based upon a growth curve developed for this species on Kooragang Island (see Hamer et. al., 2008 for a description of the method used to construct and verify the growth curve). This approach relies on knowing the relationship between body length, measured as snout to vent length (SVL), and the age of the frog. Since bell frogs have seasonal reproduction (the summer season when reproduction occurs and tadpoles usually metamorphose) most individuals can be placed in a yearly cohort, although tadpoles may overwinter and metamorphose early in a subsequent breeding year, adding a level of complexity to identifying cohorts. Thus, it is possible to assign all individuals to size-classes and express the population demography in age cohorts.

Designation of adult males, adult females, and sub-adult females.

In previous years, we categorised animals into age classes by using SVL data, based on the analysis of Hamer et al. (2008). Adulthood is defined as the capacity to reproduce. In 2015-16, this was designated as SVL >49 mm for males, and SVL > 68 mm for females. This difference between the sexes is due to the fact that *L. aurea* adults are sexually dimorphic; females reach a large body size and mass than the equivalent aged males. Based on these criteria, the categories used in earlier (prior to 2015) years of the project were:

Age-class determination:

- Nuptial pads apparent adult male (typically > 44 mm SVL)
- Body length < 44 mm and nuptial pads not apparent Juvenile (sex unknown)
- Body length > 44 mm, nuptial pads not apparent juvenile females
- Body length > 68 mm, nuptial pads not apparent adult female.

The very large number of captures in the 2016-17 provided the opportunity to test these categories quantitatively. Males were determined on the basis of nuptial pads. Since females are identified on the basis of the absence of these pads, there is some uncertainty as to what point a small individual can be considered a juvenile female as opposed to a juvenile.

Plotting the percentage of males captured against SVL (Figure 2.6.3) indicates that, between 50 mm and 60 mm SVL, adult males are consistently 60% of the population. At 48 mm, about 35% of captured animals display nuptial pads, but above 49 mm 60% do. An animal above 49 mm without nuptial pads is therefore a sub-adult female (until large enough to be considered an adult female).

Gravid females can be detected by 'candle-lighting' (= 'candling'), i.e., placing a bright light such as a head-torch against their back, and looking at the silhouetted visceral organs from the ventral surface for the presence of eggs (Figure 2.6.2). Large females were checked for gravidity *ad hoc*. The smallest females to be found gravid were 58 mm SVL, and by 68 mm 100% of inspected females were gravid. The onset of adulthood for females is therefore less than 68 mm (used in 2015-16); we used a length of 58 mm in this analysis. Note that this is similar to the analysis conducted in the previous two years, but quite different to the categories used to analyse demography in previous years.

Figure 2.6.2: Illustration of the 'candle-light' method of checking for gravidity in females. A large, bilateral mass in the mid to upper trunk region indicates enlarged ovaries and thus gravidity.

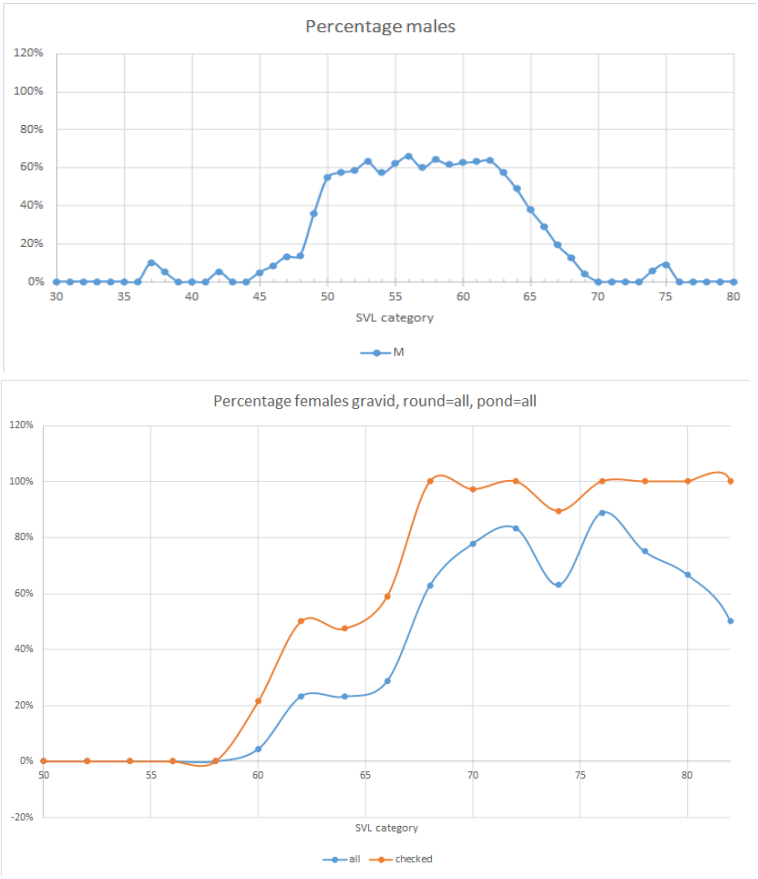


Figure 2.6.3: Proportion of animals that can be confirmed as reproductively mature (i.e., adult), plotted against SVL. Top, males; Bottom, females captured in 2016-17 surveys. In the lower chart, the red line represents the number of females found to be gravid, as a proportion of the animals inspected for gravidity, whilst the blue line shows that number as a proportion of all animals captured.

The categories used this year are thus:

- Nuptial pads apparent = adult male (typically > 44-58 mm SVL)
- Body length < 49 mm and nuptial pads not apparent = Juvenile (sex unknown)
- Body length > 49 mm, nuptial pads not apparent = juvenile female
- Body length > 58 mm, nuptial pads not apparent = adult female

3. Results

3.1 Summary of survey counts

Detections and captures were similar in both main rounds (Table 3.1.1), indicating a slight decrease in frog numbers / activity at wetland sites across the season after the summer. There was little difference in search effort applied in both main rounds. A majority of captures in round 1 (93%) and round 2 (83%) were unique individuals, which is expected as ponds were only surveyed once per round (only ponds that were surveyed multiple times per round as part of capture-mark-recapture studies are likely to result in recaptures). Additional surveys in between the main survey rounds consistently detected bell frogs, sometimes in high numbers.

Table 3.1.1: Summary data from all surveys in the 2022-23 season. 'Detections' refers to total encounters (i.e., captures and non-capture observations). Because some individuals are encountered and captured multiple times, 'Detections', and 'Captures' provide overestimates of the number of unique individual frogs actually encountered ('Unique').

	Round 1	Round 2	Additional surveys	Total
Search effort (VES)	**3,651**	**3,194**	7,138	**13,983**
VES Detections	**360**	**284**	495	**1,139**
All Detections	**577**	**415**	1,688	**2,680**
Captures	**387**	**330**	1,270	**1,987**
Unique	**359**	**274**	867	**1,274**

It must be noted that Search Effort was not evenly distributed between zones, with higher search effort in the Central Zone, closely followed by the Southern Zone, and much lower for the Northern Zone (Table 3.1.2). This disparity is related to differences in the total number of ponds present within each zone. The high levels of Search Effort in the Central Zone are linked to the ongoing PhD studies by Lynne Matthews at wetlands present within the BHP-CHEMP jurisdiction.

Table 3.1.2: Location (summarised by Zone and Jurisdiction) of *L. aurea* detected.

Zone	Search effort VES)	VES	Total	Search Sensitivity	n Wetlands
Northern	1,726	41	46	0.02	58
Central	8,498	544	1,509	0.06	29
Southern	3,759	554	1,125	0.15	43
Jurisdiction					
NPWS	2,358	153	307	0.06	32
NCIG_CHEMP	1,178	31	34	0.03	42
BHP_CHEMP	6,313	299	781	0.05	11
PoN	375	102	433	0.27	2
PWCS	159	31	61	0.19	1
NCIG	0	0	0	0	0
HDC	3,600	523	1,064	0.15	42
RMS	0	0	0	0	0

More detections were made in the Central Zone compared to all other zones. However, when accounting for Search Effort, a higher number of detections were made in the Southern Zone, with Search Sensitivity (i.e., the number of detections per unit search effort) being the highest for this zone compared to all others. The lowest number of detections occurred in the Northern Zone, which also had the lowest Search Sensitivity. There was a slight increase in numbers in the North from the previous season, which was the lowest recorded over the past five years, indicating a persisting but small population in this part of the Island.

When focusing on particular jurisdictions, the highest search sensitivity occurred at the PoN wetlands within the Central Zone, followed by the PWCS and HDC wetlands in the Industrial Zone. Interestingly, Search Sensitivity at the BHP-CHEMP wetlands was much lower this year when compared to the previous year, accounting for the lower search sensitivity for the Central Zone in general.

Table 3.1.3: Summary of demographic data. Recapture index shows the ratio of captures per unique individuals (i.e., higher values indicate a higher probability of recapture).

	Primary VES	Total
Detections	1, 139	2,680
Captures	760	1,987
	Captures	**Unique**
PIT tagged frogs	1,732	1,274

Demographic summary	Captured		PIT Taggable		Unique		Recapture index
	number	%	number	%	number	%	
juveniles (SVL < 49.5 mm)	388	20%	209	12%	168	13%	1.23
subadult females (49.5mm<SVL<58mm, no nups)	135	7%	135	8%	86	8%	1.41
adult males (>49.5, nups)	880	46%	880	50%	615	48%	1.43
adult females (>58mm SVL, no nups)	523	27%	523	30%	392	31%	1.33
Metamorphs	56		-		-		
unknown animals (not tagged)	0		0		0		
	1,982		**1,747**		**1,271**		

Total detections and captures are similar to the previous season and indicate that the population has remained stable after an increase over the past few years post-fires. The demographics of animals captured in this season are also similar to the previous season, with nearly half of all captures being adult male (46%), and nearly a third being adult females (27%) (Table 3.1.3). The high proportion of female captures indicates that the potential effective population size is high. The proportion of juveniles captured is comparable to the previous season, and much lower than a high recorded in 2020 (46%) that occurred as a result of a mass breeding event. This suggests that there hasn't been a large breeding event on the island for several years, which is not surprising as this species follows cycles stereotypical of boom-and-bust populations.

The proportion of unique animals to total captures was low, indicating a large number of recaptures within season. The recapture index was higher for adult males (1.43) and sub-adult females (1.41) compared to adult females (1.33); this means that the probability of recapturing females is low compared to other demographics. These results may not be surprising as females may spend comparatively less time at aquatic sites to breed than adult males, while sub-adult females may be utilising the ponds for other tasks such as acquiring food. Only frogs above 40 mm SVL are tagged, and smaller individuals are counted but not tagged. As such, the large percentage of PIT taggable animals that were juvenile reflects that a large proportion of juveniles were captured at a chippable size.

Survey Rounds: general observations

Round 0.1 (13th to 30th September). This was a smaller, targeted survey of 22 ponds within the Central and Industrial Zones to compare chytrid rates between natural versus constructed ponds, as well as to survey the BHP ponds for Lynne Matthew's PhD project. In this round, large numbers of adults (>20) were detected at K23, K126, and K104. Few adults were detected at the BHP ponds, although calling was detected at BHP-3A. Calling was also detected along Bellfrog Way at K63, K20A, and BHP-14B, as well as in the Industrial Zone at Area 2, the Rail-loop, and K104. A small number of juveniles (<5) were recorded across 7 ponds, while a large number (>10) was detected at K23. Presumably, these individuals were spawned during rain in autumn and overwintered as tadpoles, given that no tadpoles or metamorphs were detected in this round. Only a small amount of rainfall was recorded during this period (37 mm), occurring over three rainfall events.

Round 0.2 (1st October to 20th November). This was another smaller, targeted survey of 23 ponds within the Central and Industrial Zones. Large numbers of adults (>20) were detected at K23 in the Central Zone, as well as K121, K124 and K126, constructed ponds in the Industrial Zone. Few adults were detected at the BHP ponds, although calling was detected at three ponds. Calling was detected at six sites along Bellfrog Way in the Central Zone, as well as in Area 2, the Rail-loop, K29, and Bigpond in the Industrial Zone. A small number of juveniles (<5) were recorded across 4 ponds, while a large number (>10) was detected at K23 and K126. Presumably, these individuals were spawned during rain in autumn and overwintered as tadpoles, given that no tadpoles or metamorphs were detected in this round. There were three discrete periods of high rainfall of more than 20 mm during this round (total 127 mm).

Round 1 (21st November to 12th December). This was the first main round this season, with surveys conducted across all three island zones (78 wetland sites). Large numbers of adults (>20) were detected in Area 2 (K127), the Rail-loop (K123), and at the BHP ponds (BHP-3A). Calling was detected at four BHP ponds, 3 ponds along Bellfrog Way, and 11 ponds across the Industrial Zone. Juveniles were detected in low numbers (<10) at 14 ponds. Metamorphs were detected in Area 2 at K126 and tadpoles at K111 in the Rail-loop and K127 near Big-Pond, suggesting breeding had occurred in the Industrial Zone earlier in the season. This round occurred during a period of little rainfall (total 14 mm), primarily over one rainfall event at the end of November.

Table 3.1.4: Summary of detections and captions for each survey round in 2022-23.

	0.1	0.2	1	1.1	1.2	2	2.1	2.2
VES Search effort	1,203	1,405	3,651	1,053	1,280	3,194	1,960	237
VES Detections	82	108	360	60	133	284	96	16
All Detections	216	563	577	447	271	415	173	18
Captures	183	401	387	345	181	330	142	18
Unique	155	277	359	166	135	274	123	11

Round 1.1 (13th December to 15th January). This was a small round that targeted 12 wetland sites within the Central Zone, primarily the BHP ponds, as well as K22-23 and BHP-14B along Bellfrog Way. A large number of adults (>20) were detected at K23, K22, and BHP-14B. Few adults were detected at the BHP ponds, although calling was detected at 3 sites here. Further calling was only detected at BHP-14B. Juveniles were detected at 11 of the 12 sites, including in large numbers (>10) along Bellfrog Way at K23, and at two BHP ponds (BHP-4A and BHP-4B). Metamorphs were only detected at BHP-4B, indicating breeding occurred earlier in the season. This round occurred during a period of moderate rainfall (total 64 mm), primarily confined to one rain rainfall event in early January.

Round 1.2 (16 January to 14 February). This was a small, targeted round where 19 wetlands were surveyed in the Central and Industrial Zones. Large numbers of adults (>20) were detected at two sites (BHP-14B and K123). Juveniles were detected in small numbers (<5) at 9 ponds, primarily within the BHP site, while a large number (>10) was detected at BHP-1A. Calling was only detected at two sites (BHP-14B and K124). Metamorphs were detected at 6 sites, including at the BHP ponds in the Central Zone and in the Industrial Zone at K124 in Area 2, suggesting breeding activity in the middle of the season. This round occurred during a period of relatively high rainfall (total 83 mm), including three main rainfall events over 20 mm.

Round 2 (15th February to 26th March). This was the second and final main round this season, with surveys conducted across all three island zones (77 wetland sites). Large numbers of adults (>20) were only detected at K9A/B within the Central Zone. The most northern that calling was detected was at K58B. Calling was also detected at the K9 ponds in the Central Zone, and in Area 2 of the Industrial Zone. Juveniles were detected at 25 sites, with a large number (>10) detected at BHP-1B. Tadpoles were detected at C1 and K121, while metamorphs were detected at C1 and BHP-2A, suggesting breeding took place in the middle of the season in the Central and Industrial Zones. This round occurred during a period of relatively high rainfall (total 160 mm), although rainfall was primarily focused over a single rain event at the end of February and again at the end of the survey round.

Round 2.1 (27th March to 26th April). This was a large round with 78 wetland sites surveyed across all three island zones. However, this was not considered a main round, as many of the ponds surveyed where non-target, such as NCIG ponds in the Northern Zone. Only small numbers of adults were detected in this round, with the only large population (>20) detected at K23. No calling was detected this round, suggesting breeding activity had concluded for the season. Juveniles were detected in low numbers at 12 sites, including within the BHP site and along Bellfrog Way in the Central Zone, as well as Big Pond and Area 2 in the Industrial Zone. Juveniles were detected in the recently constructed K108 site, which suggests the site has already started to be colonised after being excluded for several years by fencing. Metamorphs were only detected in the Industrial Zone at K121, which likely spawned earlier in the year (Jauary-Febuary). This round occurred over a period of high rainfall (total 142 mm) distributed over five rainfall events.

Round 2.2 (27th April to 31st May). This was a small round that targeted ponds within the Rail-loop of the Industrial Zone. Only small numbers of adults and juveniles were detected (<6), and no calling or metamorphs were detected. Juveniles were detected in the recently constructed K108 site. This round occurred over a period of moderate rainfall (total 95 mm,) restricted primarily over two rainfall events in April.

3.2 Seasonal context: environmental factors

Overview

The 2022-23 season was comparatively drier than recent previous seasons (Figure 3.2.1). Since 2020, rainfall totals have been high (> 1200 mm per year), and although the annual total for 2022-23 exceeded 1000 mm, rainfall in the *L. aurea* breeding season (September-March) was similar to the levels seen in the 'dry years' from 2017 until 2020 (Figure 3.2.3). In particular, the middle part of the breeding season (December and January) had few rainfall events (Figure 3.2.2), resulting in several of the ephemeral and semi-permanent wetlands drying completely. Most wetlands were recharged by heavier rainfall at the end of the season.

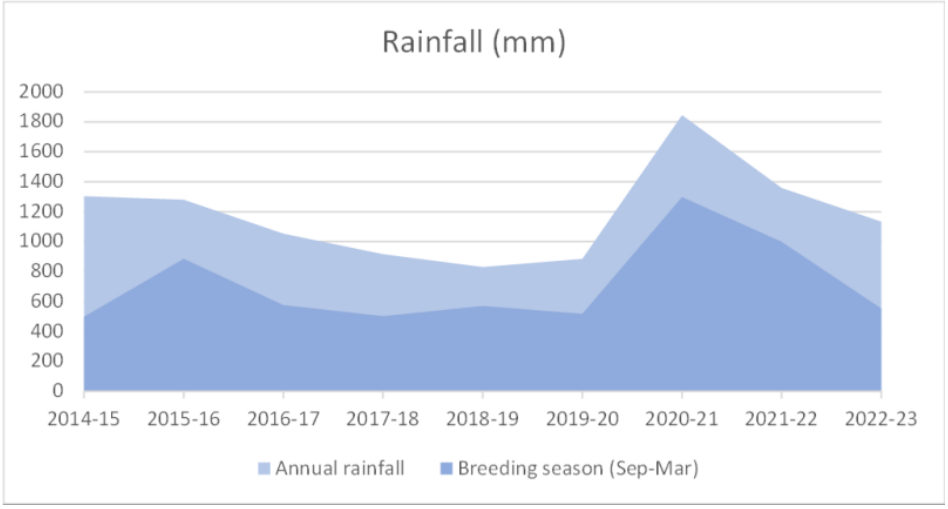


Figure 3.2.1: Rainfall during the breeding season and across the entire season cycle for each year from 2014-15 to 2022-23 on Kooragang Island. Measurements obtained from BoM records for Williamtown airport.

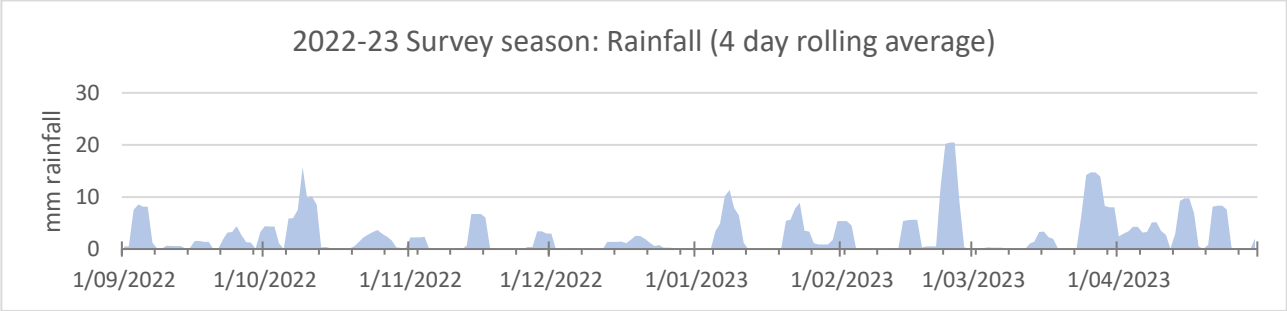


Figure 3.2.2: Weekly rainfall during the 2022-23 survey season (October to April) on Kooragang Island. Measurements obtained from BoM records for Williamtown airport.

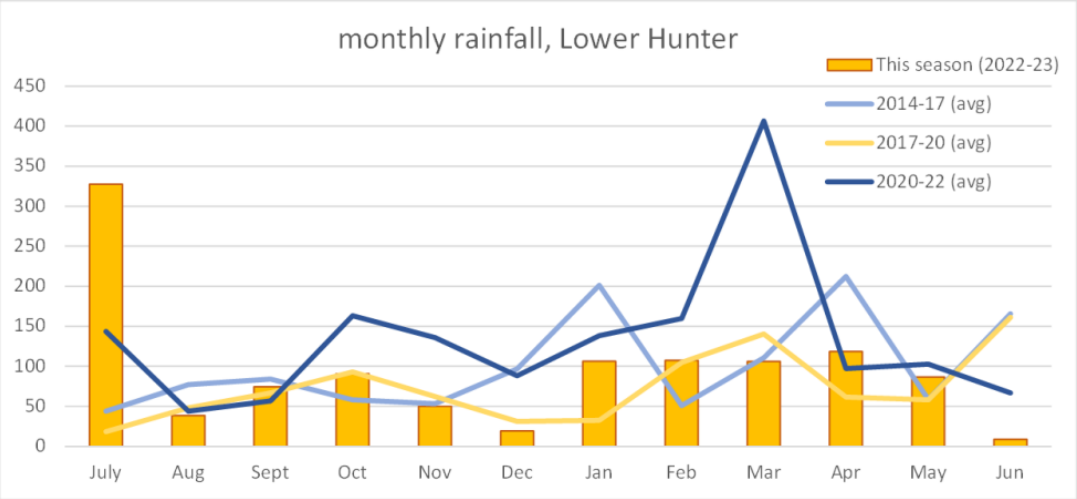


Figure 3.2.3 Monthly rainfall data for Williamtown, showing totals for the 2022-23 season (columns) and the average monthly values for 2014-2017 ('typical' years), 2017-20 ('dry' years), and 2020-22 ('wet' years). The 2022-23 season had high winter rainfall, but low rainfall in summer, especially December. Autumn rainfall totals were much lower than in the recent 'wet' years but were sufficient to recharge most wetlands on Kooragang.

Hydrology

Lower than average rainfall in the middle of season resulted in several ephemeral and semi-permanent ponds drying across the island (Table 3.2.1). This included pools that often dry each year (e.g., K112, K113, K106A, K106B, and K9) but also other ephemeral sites that have not dried for several seasons (e.g., K114). One of the cluster ponds also dried (C4), which is uncommon and could be the result of a leak. After several wet years, the complete desiccation of ponds is likely to have prevented the continued spread of *Gambusia* and/or caused it to disappear, thereby increasing the capacity of these sites to be used for breeding once they are recharged by rainfall. Several of these dried ponds were recharged by the end of the season, which may have positive implications for *L. aurea* during the overwintering period by providing additional moisture refuges in the environment.

Table 3.2.1 (next page): Summary of water presence at each wetland along with presence of *Gambusia* during the 2022-23 survey season. Depths are indicated on a scale of 0-9; 'w' indicates that water was present but depth not recorded, and 'nd' indicates that data was not recorded.

Zone	Subregion	Wetland	pH (avg)	Salinity (avg)	Water presence & depth				*Gambusia*
					Spring	Summer	Autumn	Pond dried during season?	
Northern	Scott's Point	NCIG-1.1	6.6	0.2	7	7	7		Present
		NCIG-1.3	6.2	0.1	5	3	5		Absent
		K3	6.4	0.1	4	5	5		Present
	Riverside Park	K4	6.5	0.5	5	4	4		Disappeared
		NCIG-3.1	6.8	0.2	3	5	3		Absent
		K5	6.4	4.2	nd	3	4		Present
	Wet meadow	K7	5.5	3.1	nd	7	4		Disappeared
		K2	6.4	0.3	4	4	4		Present
		NCIG-T13	7.0	2.2	4	5	nd		Present
		NCIG-T14	7.1	0.1	nd	5	nd		Absent
		NCIG-T15	6.9	0.2	nd	4	nd		Present
	Millam's Pond	K58B	6.3	8.5	3	2	3	dried	Present
		NCIG-4.7	6.1	0.1	nd	4	4		Present
		NCIG-4.9	6.5	0.2	8	4	7		Absent
		NCIG-5.1	6.4	0.1	7	4	2		Disappeared
		NCIG-7.1	6.7	0.2	nd	4	5		Disappeared
		NCIG-7.2	6.5	0.1	4	5	4		Absent
		NCIG-7.3	6.2	0.8	nd	3	3		Disappeared
Central	Ramsar Road West	K9	5.6	2.0	3	1	1	dried	Disappeared
		K9A/B	6.5	4.9	nd	2	3		Disappeared
		BHP-1A	7.3	0.2	6	4	3		Absent
		BHP-1B	8.9	4.1	9	7	6		Present
		BHP-2A	7.0	0.1	7	5	4		Absent
		BHP-2B	6.9	0.1	5	3	2		Absent
		BHP-2C	6.8	0.1	8	6	4		Absent
		BHP-3A	7.6	0.3	7	5	4		Absent
		BHP-4A	7.3	0.1	6	3	5		Absent
		BHP-4B	7.2	0.1	5	3	3		Absent
		BHP-4C	6.5	0.1	3	1	1	dried	Absent
	Ramsar Road East	K10	6.0	14.1	nd	3	3		Disappeared
		K25	6.6	0.3	nd	nd	4		Present
		K26	5.4	10.0	3	3	4		Disappeared
		K48	5.6	13.8	3	3	3		Disappeared
		K9C	4.5	6.5	3	2	3		Disappeared
	Bellfrog Way West	K11	6.8	6.4	1	0	w	dried	Absent
		K13	6.2	8.7	w	1	1	dried	Disappeared
		BHP-14B	8.1	1.1	5	2	2		Absent
		BHP-14A	8.7	9.7	8	8	8		Present
	Bellfrog Way NE	K20A	6.9	8.0	3	1	3	dried	Disappeared
		K20B	7.0	7.9	nd	1	4	dried	Disappeared
		K21	5.4	7.2	4	0	5	dried	Absent
	Bellfrog Way SE	K22	7.8	1.5	4	3	3		Present
		K23	7.6	0.8	5	5	5		Present

Zone	Subregion	Wetland	pH (avg)	Salinity (avg)	Water presence & depth				*Gambusia*
					Spring	Summer	Autumn	Pond dried during season?	
Southern	Deep Pond	K105A	7.9	0.9	6	5	4		Present
		K105AS	8.5	0.8	4	4	3		Present
		K105B	7.7	0.5	4	4	nd		Present
		K128	7.4	0.4	2	4	3		Present
	KIWEF K5 (Area 2)	K127	9.5	0.2	3	2	nd		Absent
		K124	8.2	0.1	3	3	4		Absent
		K125	8.5	0.2	3	2	4		Absent
		K126	8.1	0.2	4	4	4		Absent
	Northern Ponds	C1	7.3	0.4	8	6	5		Absent
		K106A	8.1	1.4	3	0	0	dried	Absent
		K106B	6.8	0.2	1	0	1	dried	Absent
		NP-W4	8.1	0.5	3	2	0	dried	Absent
		NP-W5	7.6	0.7	5	8	4		Present
		NP-E4	7.9	0.4	4	3	3		Absent
		K29	8.2	0.5	7	7	4		Appeared
	KIWEF K7	K103	7.5	2.0	5	7	5		Present
		K31	7.2	0.6	nd	5	3		Present
		K33	7.6	0.4	nd	3	nd		Absent
		K34	7.0	0.4	7	5	0		Absent
		K42	7.3	1.9	5	4	4		Present
	Delta Ponds	K104	7.4	2.2	4	4	4		Present
	NCIG rail central & east	K100A	7.3	0.8	5	5	5		Present
		K102	7.2	0.9	4	4	3		Present
	Rail loop (K10N)	K111	7.8	0.3	4	2	3		Absent
		K112	8.6	0.1	3	1	2	dried	Absent
		K113	8.8	0.1	3	0	2	dried	Absent
		K114	7.4	0.1	5	2	4	dried	Absent
		C4	7.0	0.4	7	5	1	dried	Absent
		C5	7.5	0.2	7	7	5		Absent
		K108	7.3	0.4	nd	w	7		Absent
		K108B	7.2	0.3	nd	nd	3		Absent
	Rail loop SW (K10S)	C2	6.9	0.4	8	8	6		Absent
		K121	8.4	0.2	3	2	4		Absent
		K122	6.7	0.1	nd	3	5		Absent
		K123	7.6	0.1	nd	3	4		Absent
		C3	7.6	0.2	nd	7	1		Absent
	NCIG rail south	K36	7.0	0.2	3	5	5		Present
		K49B	7.5	0.5	nd	4	3		Present
		K129	6.9	0.1	nd	nd	3		Absent
	KIWEF K2	K117	6.8	0.4	nd	2	8		Absent
		K118	7.0	0.1	2	4	3		Absent
		K46	6.8	1.0	3	4	5		Disappeared

Salinity

Average salinity levels recorded at wetland sites across the island are shown in Figure 3.2.4. A majority of surveyed wetlands (78%) had salinity values less than 2 ppt, well below the known tolerance levels observed for successful development in *L. aurea* tadpoles (up to 5 ppt in the field). A further 9% of wetlands had salinity values ranging between 2 and 5 ppt, with the remaining wetlands having salinity values between 5 and 14.1 ppt. As with previous seasons, the highest salinity levels were seen in subregions within the Central Zone (averaging 5.3 ppt). The highest values were recorded at wetlands K10 (14.1 ppt) and K48 (13.8 ppt), indicating connectivity with estuarine water, especially during drier periods when they can be inundated by estuarine water during king tides. Salinity was low in subregions across the Northern and Industrial Zones, averaging 0.7 ppt. Generally, salinity was lower in constructed wetlands in the Industrial Zone compared to natural wetlands across the island, in part as they are protected from inundation by estuarine water.

Ponds with evidence of breeding in the current season (i.e. tadpoles and/or metamorphs) all had low salinity values below 1.1 ppt. However, it must be stated that salinity levels were not necessarily recorded at the same time that breeding was observed, which may change depending on rainfall, tides, and drying.

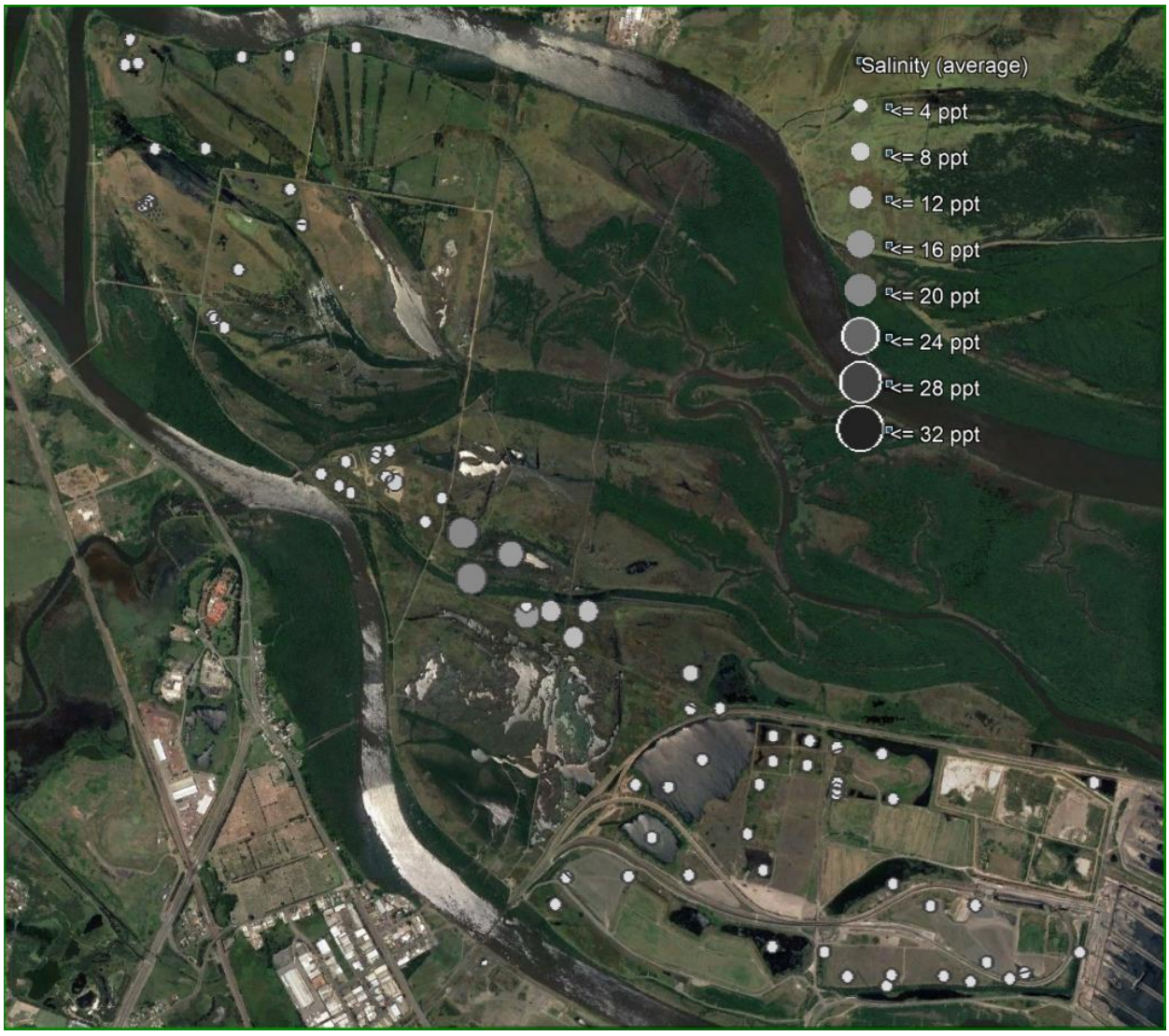


Figure 3.2.4: Average salinity levels (ppt) of wetland sites recorded across the 2022-23 survey season.

pH

The average pH across all measured wetlands was neutral (6.9). However, some wetlands were moderately acidic, the lowest being 3.3 at K15, or moderately alkaline, with the maximum recorded pH being 9.5 at K127. There were regional variations in pH readings (Figure 3.2.5), with the lowest average readings in the Riverside Park subregion (5.6 pH) and the highest in the Area 2 subregion (8.6 pH). It is possible that constructed ponds in Area 2 are alkaline as they are relatively new, with water exposed to recently laid material such as rock and associated dust causing higher readings.

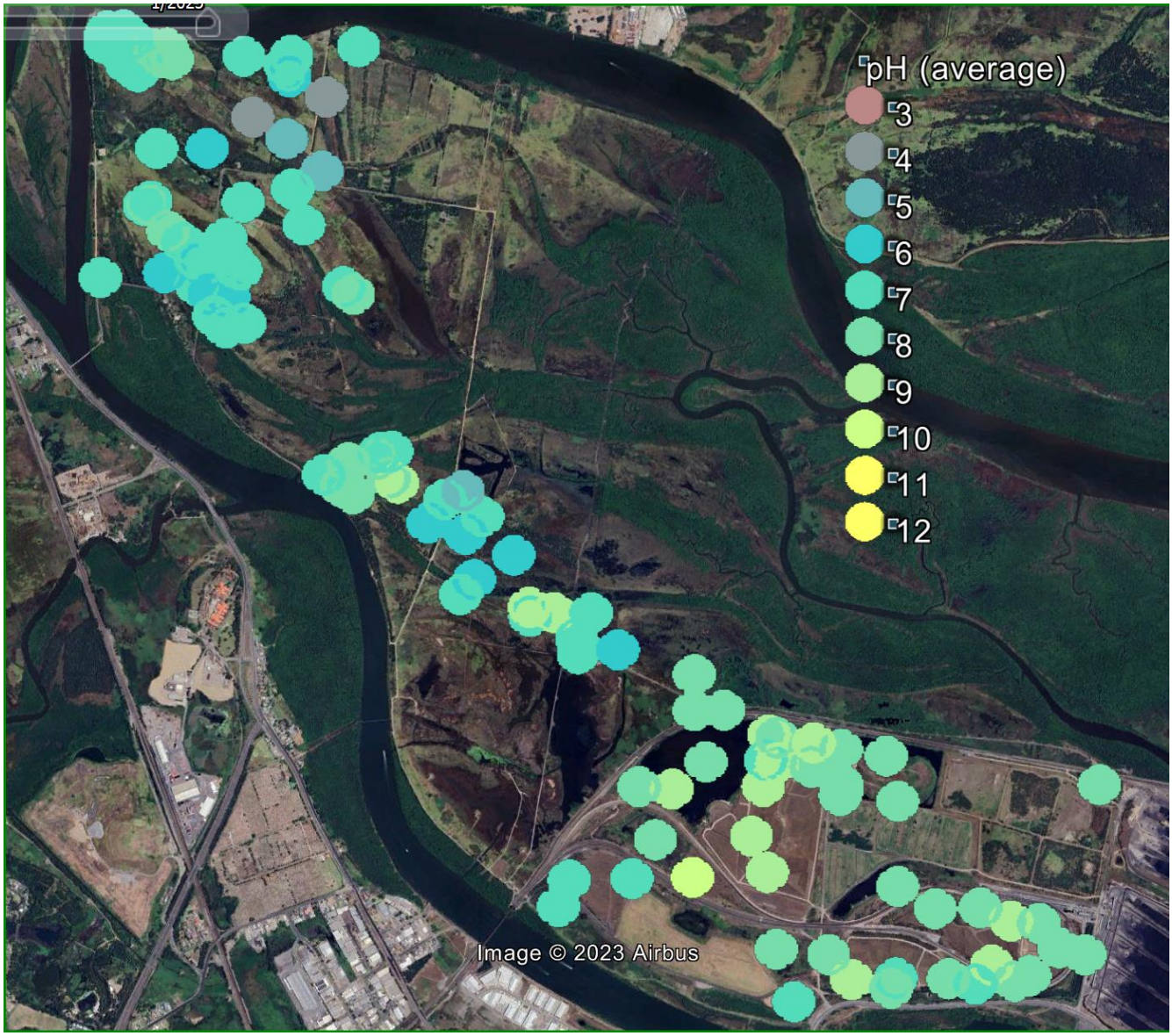


Figure 3.2.5 Average pH of wetland sites recorded across the 2022-23 survey season.

	Temp				pH				Salinity			
	Spring	Summer	Autumn		Spring	Summer	Autumn		Spring	Summer	Autumn	
Subregion	**19.4**	**22.0**	**22.7**	**average**	**7.5**	**7.2**	**6.6**	**average**	**1.1**	**2.4**	**2.3**	**average**
Scott's Point	21.2	23.3	21.3	**21.9**	6.3	6.3	6.8	**6.5**	0.1	0.1	0.4	**0.2**
Riverside Park	18.0	21.5	20.1	**19.9**	6.5	6.8	5.5	**6.3**	0.2	0.8	1.5	**0.9**
Wet meadow	15.0	21.7	19.6	**18.8**	6.4	6.8	6.3	**6.5**	0.6	0.7	1.3	**0.9**
Millam's Pond	19.1	21.2	18.8	**19.7**	6.9	6.4	6.4	**6.6**	0.1	0.2	2.2	**0.8**
Ramsar Road West	17.7	22.1	20.7	**20.2**	6.9	7.2	7.2	**7.1**	0.5	1.0	1.5	**1.0**
Ramsar Road East	20.4	22.7	24.9	**22.7**	6.6	6.3	3.9	**5.6**	5.5	16.7	9.2	**10.5**
Bellfrog Way West	20.7	22.6	22.5	**21.9**	7.8	8.1	6.8	**7.5**	3.7	7.9	8.2	**6.6**
Bellfrog Way NE	20.5	23.0	26.6	**23.4**	7.4	7.9	5.8	**7.0**	3.8	8.7	9.0	**7.2**
Bellfrog Way SE	18.9	22.6	25.1	**22.2**	7.8	7.6	7.7	**7.7**	0.6	1.2	1.8	**1.2**
Deep Pond	20.3	21.7	25.3	**22.4**	8.4	7.7	7.4	**7.8**	0.4	0.7	1.0	**0.7**
KIWEF K5 (Area 2)	20.1	22.8	22.6	**21.8**	9.3	8.4	7.5	**8.4**	0.1	0.3	0.1	**0.2**
Northern Ponds	21.8	21.7	23.3	**22.3**	7.9	8.0	7.3	**7.7**	0.5	0.4	0.5	**0.5**
KIWEF K7	19.2	21.0	21.8	**20.7**	7.3	7.1	7.5	**7.3**	1.3	1.0	1.4	**1.2**
Delta Ponds	19.3	22.7	23.2	**21.7**	7.6	7.0	7.7	**7.4**	0.8	2.8	3.1	**2.2**
NCIG rail central & east	19.1	23.3	21.8	**21.4**	7.2	7.3	7.2	**7.3**	0.6	1.0	0.8	**0.8**
Rail loop (K10N)	19.7	21.4	23.3	**21.5**	8.1	7.1	7.8	**7.7**	0.2	0.3	0.2	**0.2**
Rail loop SW (K10S)	19.5	23.9	23.3	**22.2**	8.3	7.1	7.4	**7.6**	0.2	0.3	0.2	**0.2**
NCIG rail south	17.7	19.0	23.6	**20.1**	7.1	7.1	7.2	**7.1**	0.3	0.2	0.3	**0.3**
KIWEF K2	19.9	20.2	23.7	**21.3**	7.2	7.2	6.3	**6.9**	0.4	0.6	0.5	**0.5**
Cormorant Road	-	-	-	**-**	-	-	-	**-**	-	-	-	**-**

Table 3.2.2: Water quaility for subregions on Kooragang Island measured during the 2022-23 season. Temperature, pH and salinity values for each season except winter, along with averages, have been presented.

Hydroperiod

It has become increasingly apparent that a mosaic of interconnected wetland habitats is required to maintain a healthy *L. aurea* population on Kooragang Island. Wetland hydroperiod is a key attribute of such mosaics, with clear evidence to suggest that frogs transition between sites due to spatio-temporal differences in resource availability. In particular, ephemeral sites are often used for breeding when they are recharged by rainfall, while more permanent sites are used as refuge when conditions become dry.

In recent reports, wetland hydroperiod has been categorised at a 'fine-grain' to capture the complexities of habitat that we perceive in the course of fieldwork and to ensure that it is relevant to understanding *L. aurea* ecology (Table 3.2.2). The 'finer-grained' categorisation used here has several advantages:

- It helps explain current *Gambusia* distribution; i.e., by distinguishing between wetlands that did not dry out in a drought year (deep permanent), and those that did dry out, the categorisation system accounts for the distribution and density of *Gambusia* immediately following a drought.
- It better shows the range of wetland hydroperiods in locations with good *L. aurea* numbers. This subtle variation in wetland hydroperiod within a relatively small area may be an important factor in determining habitat mosaics that support *L. aurea*.

In 2019 we allocated wetlands to one of these categories, based upon hydrology data from 2015-16 (a wet year) and 2016-17 (a dry year), as well as 2017-18 and 2018-19 (drought years) (Table 3.2.3, Figure 3.2.6 and 3.2.7).

Table 3.2.2: Categories of wetland hydroperiod used in the present analysis of *L. aurea* habitat on Kooragang Island

Category	Notes	Score
Managed (effectively permanent)	Artificial/operational ponds whose water levels can be regulated by deliberate removal or addition of water. (e.g., cluster ponds, NCIG conveyor ponds)	9
Saline (irregular)	Wetlands that can be influenced by large tides when their own levels of fresh water are low (i.e., a king tide during a drought). Lack of tidal flushing can produce hypersaline conditions (e.g., K26)	8
Saline (regular)	Wetlands that are close to estuarine waters and which are influenced by regular tidal cycles (e.g., K5)	7
Deep Permanent	Deep wetlands that always hold water	5
Nearly permanent	Hold water year around, except in drought (e.g., 2017-18)	4
Semi-permanent	Hold water year around in normal years but not in dry years (e.g., 2016-17)	3
Seasonal (long-term ephemeral)	Hold water for long periods after rain	2
Temporary (short-term ephemeral)	Hold water for short periods after rain (e.g., K106A, K106B), sufficient to allow breeding by *L. aurea*	1
Non-breeding ephemeral	Wetlands that even after significant rainfall only hold water for a period too short for successful breeding by *L. aurea* (e.g., K7)	0

The categorisation of wetlands is currently under review and will be updated for the 2023-24 season, incorporating data from the 2020-2023 seasons.

Wetland	Score	Description
K2	2	Seasonal
K3	3	Semi-permanent
K4	2	Seasonal
K5	7	Saline (regular tidal)
K7	1	Temporary
K58B	8	Saline (irregular)
NCIG_1.1	5	Deep permanent
NCIG_3.1	2	Seasonal
NCIG_4.7	5	Deep permanent
NCIG_5.1	3	Semi-permanent
NCIG_7.1	5	Deep permanent
NCIG_T13	5	Deep permanent
NCIG_T14	2	Seasonal
NCIG_T15	5	Deep permanent
BHP-1A	5	Deep permanent
BHP-2C	5	Deep permanent
BHP-3A	5	Deep permanent
BHP-4B	3	Semi-permanent
BHP-14A	8	Saline (irregular)
K9A/B	8	Saline (irregular)
K9C	8	Saline (irregular)
K9	3	Semi-permanent
K26	8	Saline (irregular)
K48	8	Saline (irregular)
K13	2	Seasonal
K21	8	Saline (irregular)
K63	8	Saline (irregular)
K22	2	Seasonal
K23	4	Nearly permanent
K104	5	Deep permanent
K103	5	Deep permanent
K105A	5	Deep permanent
K105AS	5	Deep permanent
K105B	3	Semi-permanent
K106A	1	Temporary
K106B	1	Temporary
K106C	4	Nearly permanent
K29	4	Nearly permanent
C1	9	Managed
K31	3	Semi-permanent
K34	3	Semi-permanent
K42	4	Nearly permanent
K102	5	Deep permanent
K36	5	Deep permanent
C2	9	Managed
K115	9	Managed
K116	9	Managed
K100A	5	Deep permanent
K108	1	Temporary
K111	3	Semi-permanent
K112	2	Seasonal
K113	2	Seasonal
K114	3	Semi-permanent
K121	3	Semi-permanent
K122	3	Semi-permanent
K123	3	Semi-permanent
K46	3	Semi-permanent
K49B	4	Nearly permanent
K117	5	Deep permanent
K118	4	Nearly permanent
K124	4	Nearly permanent
K125	4	Nearly permanent
K126	4	Nearly permanent
K127	4	Nearly permanent
K128	4	Nearly permanent

Table 3.2.3: Categorisation of hydroperiod for selected wetlands, based on data from 2015-2021 (to be updated).

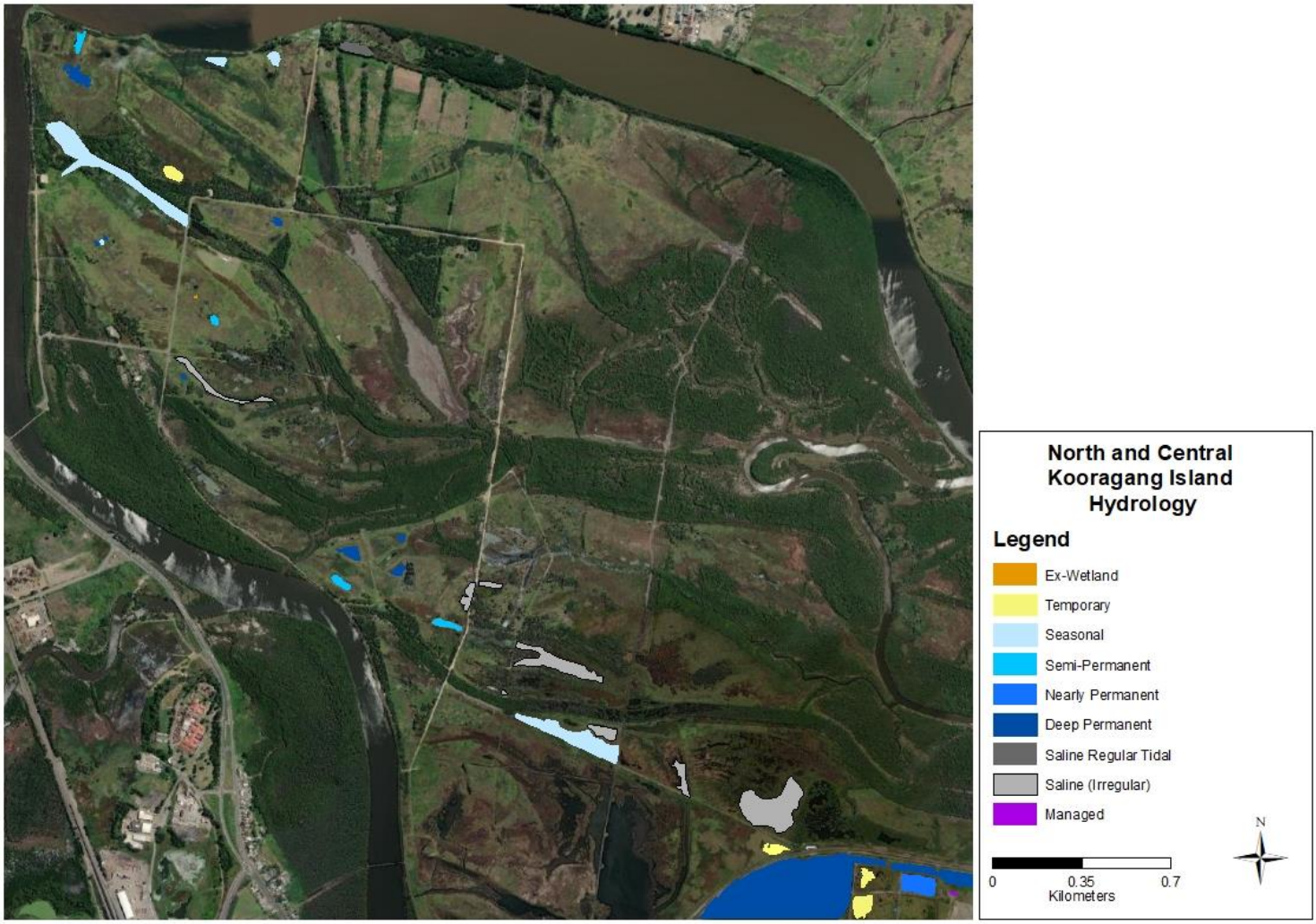


Figure 3.2.6: Hydroperiod scores for wetlands across the Northern and Central Zones of Kooragang Island (2015-19).

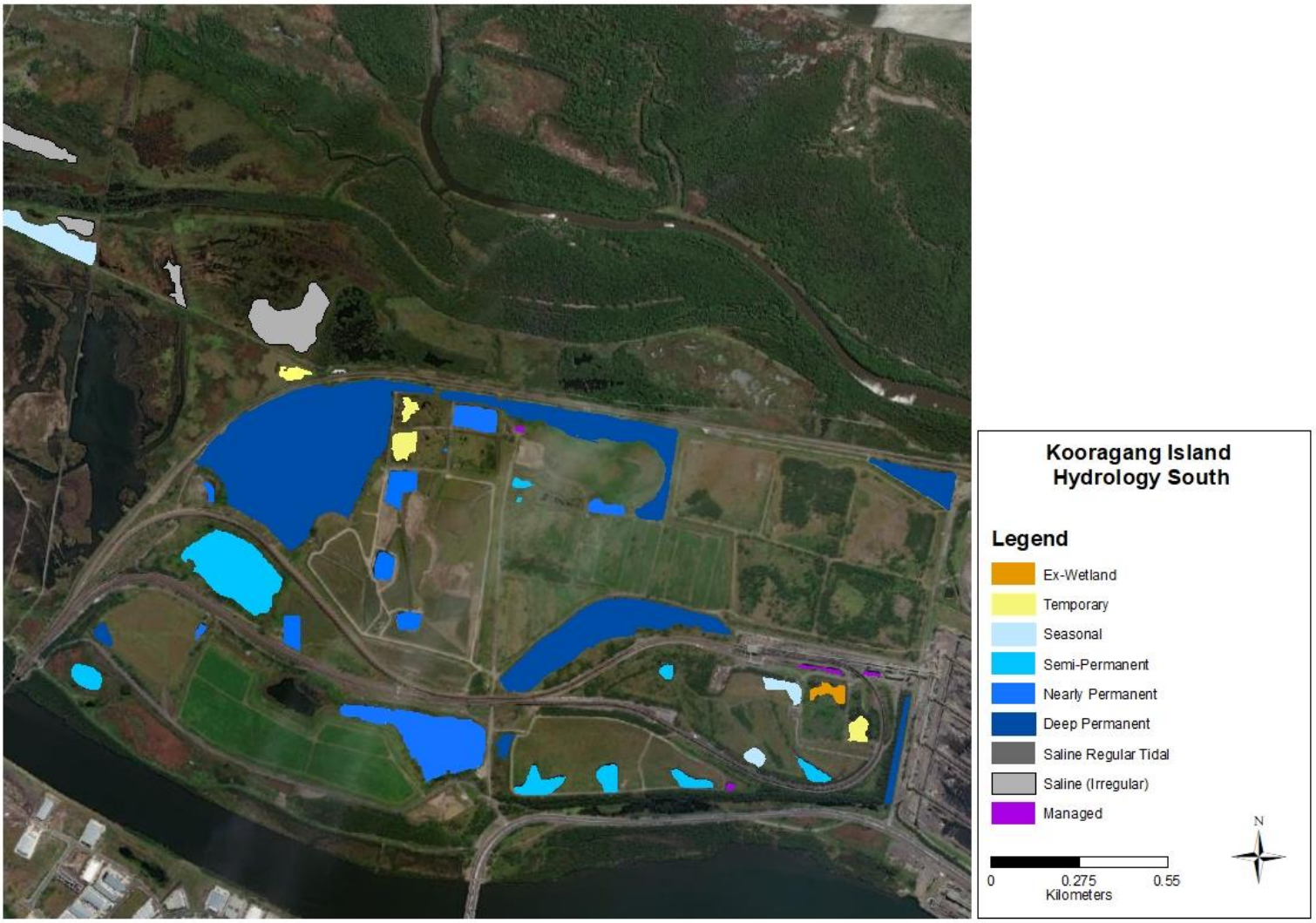


Figure 3.2.7: Close-up of wetland hydroperiod in the Industrial Zone of Kooragang Island. See text for explanation of categories. Note the diversity of hydroperiod categories for wetlands around K29 and the Rail-loop (c.f. habitat mosaic)

Gambusia distribution

Wet conditions over the past several years, including the arrival of a La Niña event in 2020-21, have provided highly suitable conditions for *Gambusia* to spread between wetlands due to flooding events and the lack of pond drying. For example, the 2021-22 season saw a nearly 50% increase in wetlands infested with *Gambusia* compared to a low of approximately 10% two seasons previously. However, the current season has seen periods of lower-than-expected rainfall and some pond drying, which has meant that there has not been such a large increase in infestation when compared to the previous season.

Gambusia is present across all zones on Kooragang Island (Figure 3.2.8), with lower rates of infestation in the Central and Industrial Zones, partly the result of the presence of constructed ponds that have remained *Gambusia* free. There are currently 44 ponds with *Gambusia* present (Table 3.2.5), compared to 43 sites in 2021, 7 sites in 2020, 13 sites in 2019, 16 sites in 2018 and 24 in 2017. This reverse in trend since 2020 is likely due to the limited amount of pond drying as these have been wet years. In the current season, the fish has disappeared from 15 ponds, likely the result of their ephemerality and drying during periods of low rainfall, and appeared in K29 after a period where none were detected (possibly a result of low density). Within the Industrial Zone, *Gambusia* was detected in 14 wetlands, many of which are permanent ponds where the fish has been present for several years. K128 is the only recently constructed pond on the Industrial Zone where *Gambusia* has colonised, likely as a result of its proximity to K105 'deep pond' which has a high density of fish. Areas with low pond infestation include constructed ponds in Area two (K124-126), K10S (K121-123), and K10N (K111-114), which has likely contributed to them having consistent indication of successful breeding over the past 2-3 seasons. In general, a much lower percentage of constructed ponds (15%) have *Gambusia* when compared to natural ponds (49%).

Main surveys (85 sites)		
Construction	'natural'	constructed
Gambusia	19	7
no *Gambusia*	20	39

Main surveys (85 sites)			
Zone	Northern	Central	Southern
Gambusia	8	4	14
no Gambusia	10	21	28

Table 3.2.4: Summary of *Gambusia* status by wetland type and Zone, for the dataset of 'main surveys' (i.e. sites surveyed multiple times) of 85 sites.

All surveys (130 sites)		
Construction	natural	constructed
Gambusia	21	23
no *Gambusia*	31	51

All surveys (130 sites)			
Zone	Northern	Central	Southern
Gambusia	25	5	14
No *Gambusia*	32	22	28

Table 3.2.5: Summary of *Gambusia* status by wetland type and Zone for all surveys (130 survey sites), i.e. including sites that were surveyed only once.

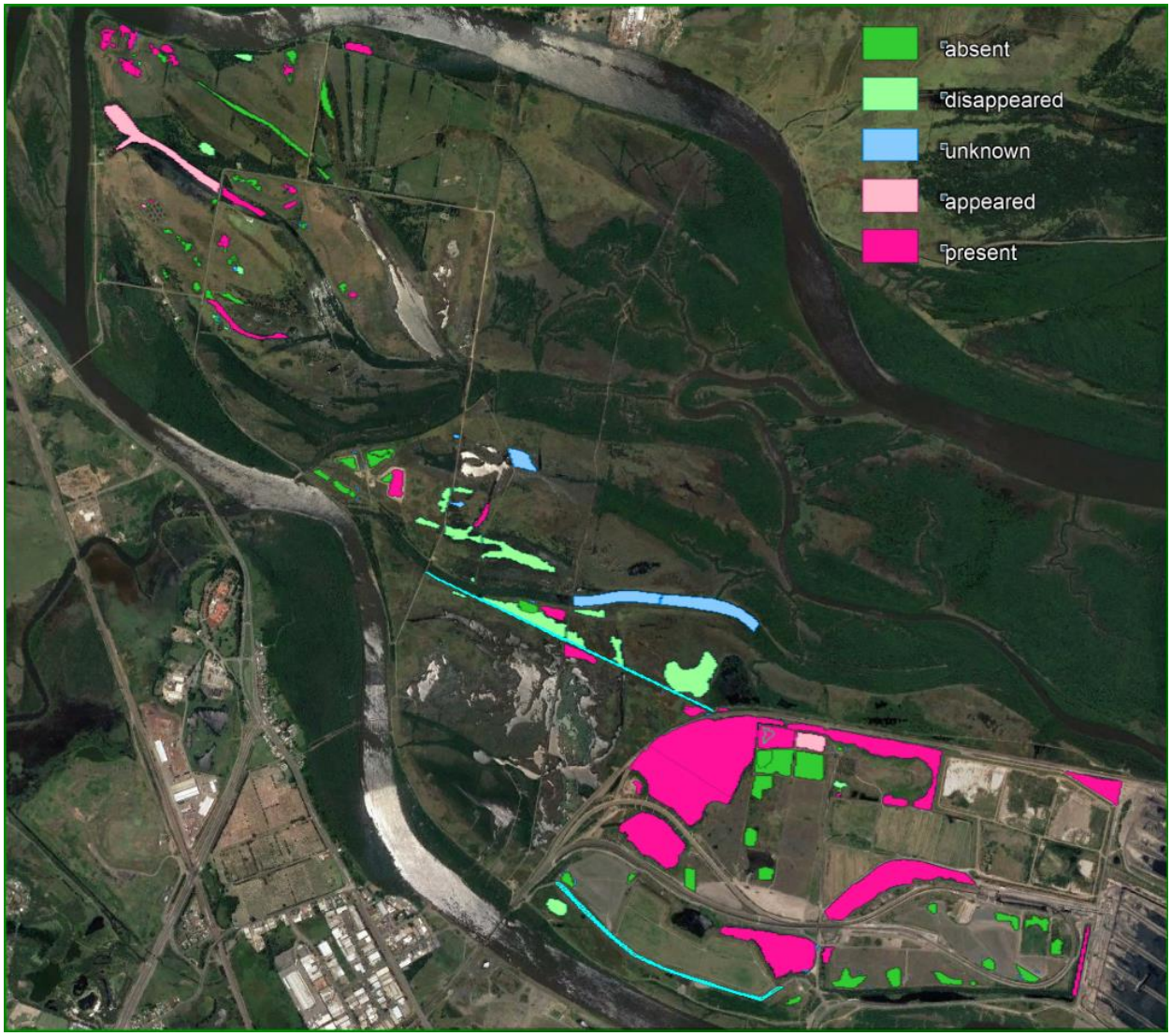


Figure 3.2.8: Distribution of *Gambusia* across Kooragang Island by the end of the 2022-23 breeding season

3.3. Distribution of *Litoria aurea* across Kooragang Island

The distribution of *L. aurea* across Kooragang Island is shown using:

i. Search Sensitivity, showing the number of frogs detected per unit search effort – it is thus a proxy measure of density or relative abundance (although it is affected by detectability).
ii. Demographic data, showing absolute numbers detected during standardised visual encounter surveys (VES).
iii. Demographic data differs from search sensitivity data in that it indicates the actual number of *L. aurea* detected during primary VES. It also show a demographic breakdown of those survey numbers. While VES surveys are standardised and timed for each wetland, many *L. aurea* are detected outside of the primary VES.

Frogs were widely distributed across southern Kooragang, particularly across wetlands within the Industrial Zone (following a standard seen in previous seasons). Ponds with large numbers of *L. aurea* detected included K23 and BHP-14B in the Central Zone, and K126 in Area 2 of the Industrial Zone. High search sensitivity values were obtained across the Industrial Zone (Figure 3.3.1 and Figure 3.3.2), including at K118, K127, and K128, as well as K23 in the Central Zone. These data indicate that several ponds/regions hold key importance for the population, particularly in Area 2 and Bellfrog Way. Significantly lower animal densities were obtained for the Northern Zone, which are findings similar to previous seasons. Ponds with the highest search sensitivity values in the North included NCIG-7.2 and NCIG-4.9. In total, 63 out of 130 ponds surveyed across the Island had search sensitivity values at or near 0, indicating few or no detections.

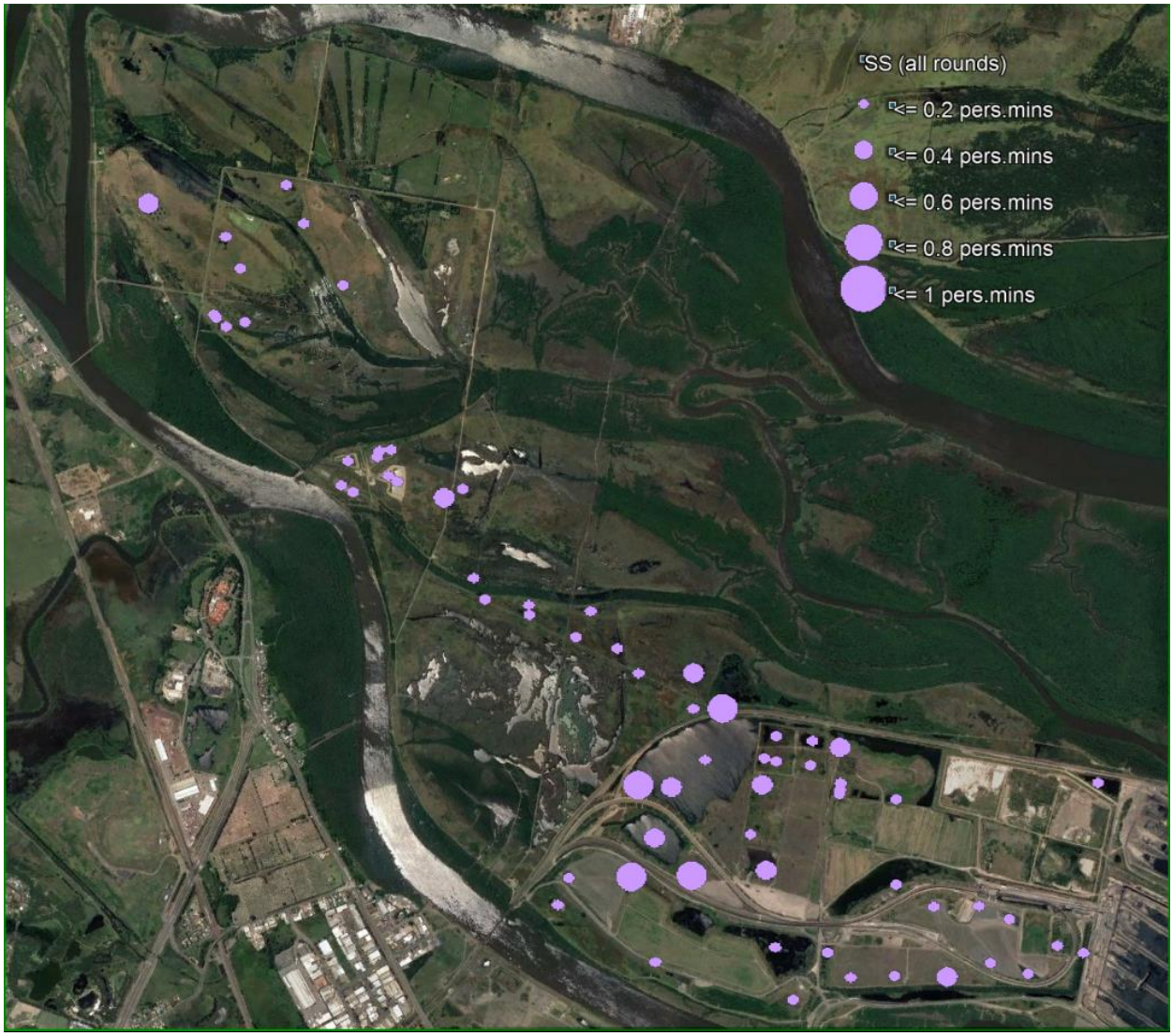


Figure 3.3.1: Search sensitivity (frogs detected per person.minute) across all wetlands surveyed in 2022-23.

Figure 3.3.2: Search sensitivity (frogs detected per person.minute) across wetlands surveyed as part of 'whole island' monitoring in 2022-23 for the 'main' survey rounds: Round 1 (above) and Round 2 (below)

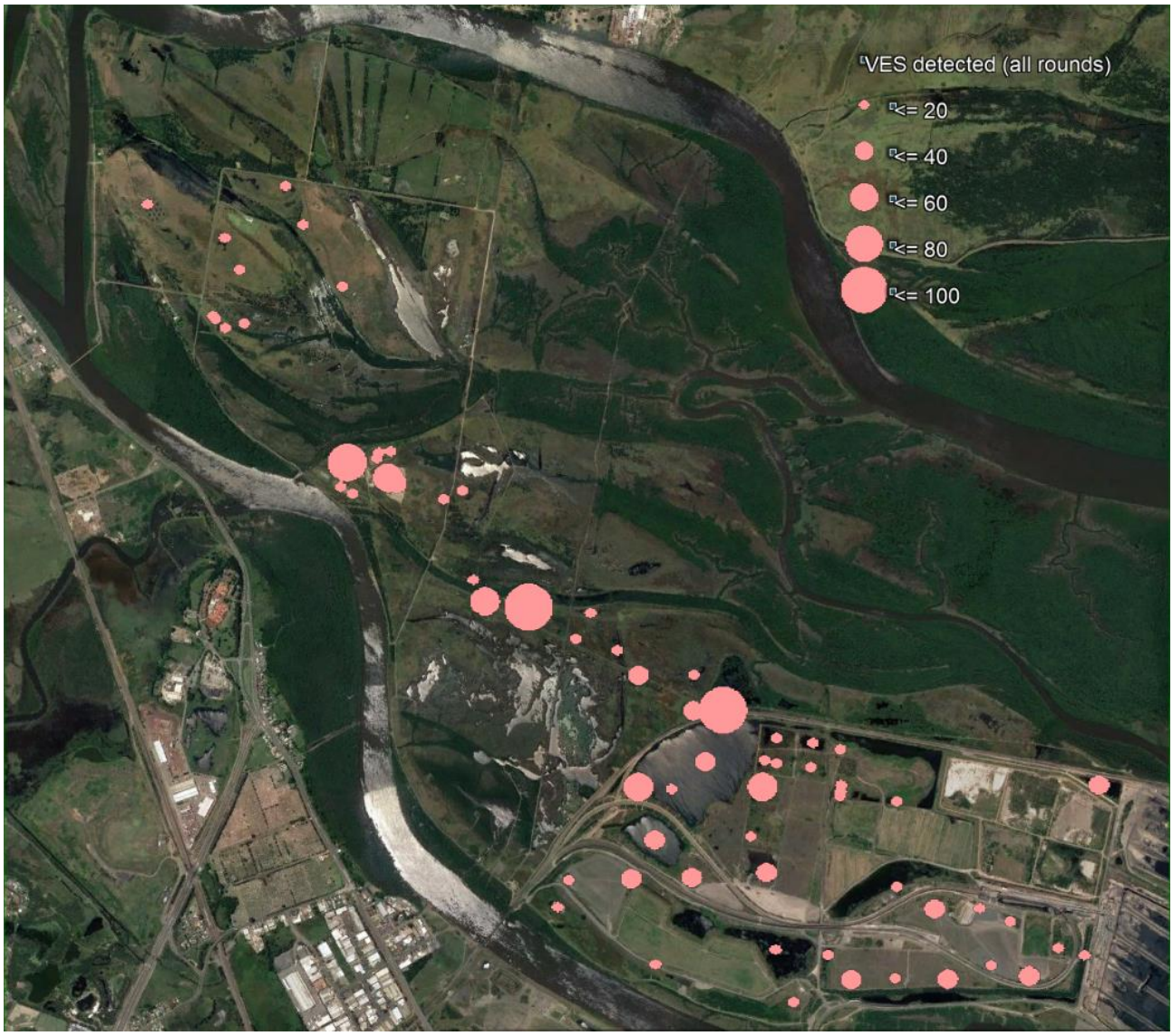


Figure 3.3.3: Detections during VES surveys across wetlands surveyed as part of 'whole island' monitoring in 2022-23, pooled across the principal survey rounds.

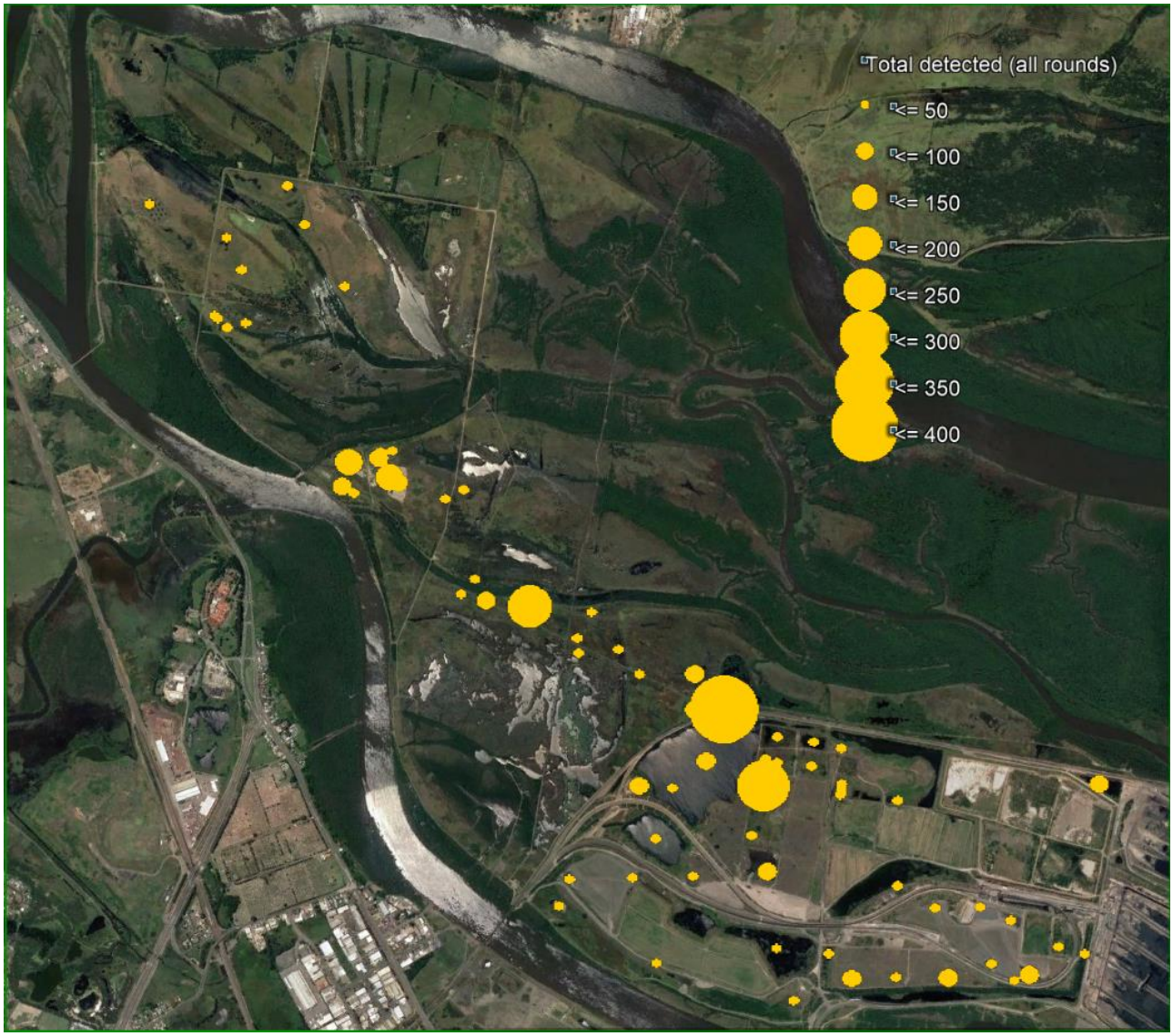


Figure 3.3.4: Total detections across wetlands surveyed as part of 'whole island' monitoring in 2022-23, pooled across all surveys.

Table 3.3.1: Spatial summary of *L. aurea* distribution, breeding indicators, and *Gambusia* distribution for the 2022-23 survey season. *L. aurea* detections show counts of individuals recorded across the season; breeding indicators show presence/absence at each individual wetland.

Zone	Wetland	Search effort	VES detected	Total detected	Search Sensitivity	*Gambusia*	Calling	Tadpoles	Mets	Xsmall juvs	Small juvs
Northern	NCIG-1.1	79	0	0	0.00	Present	0	0	0	0	0
	NCIG-1.2	8	0	0	0.00	Absent	0	0	0	0	0
	NCIG-1.3	56	0	0	0.00	Absent	0	0	0	0	0
	NCIG-1.4	20	0	0	0.00	Present	0	0	0	0	0
	NCIG-2.1	20	0	0	0.00	Present	0	0	0	0	0
	NCIG-2.2	19	0	0	0.00	Present	0	0	0	0	0
	NCIG-2.3	12	0	0	0.00	Present	0	0	0	0	0
	NCIG-2.4	20	0	0	0.00	Absent	0	0	0	0	0
	NCIG-8.19a	30	0	0	0.00	Present	0	0	0	0	0
	NCIG-8.19b	18	0	0	0.00	Present	0	0	0	0	0
	NCIG-8.19c	20	0	0	0.00	Present	0	0	0	0	0
	NCIG-8.19d	10	0	0	0.00	Present	0	0	0	0	0
	NCIG-8.20	19	0	0	0.00	Present	0	0	0	0	0
	K3	80	0	0	0.00	Present	0	0	0	0	0
	K4	68	0	0	0.00	Disappeared	0	0	0	0	0
	NCIG-3.1	60	0	0	0.00	Absent	0	0	0	0	0
	NCIG-3.3	20	0	0	0.00	Present	0	0	0	0	0
	NCIG-3.4	16	0	0	0.00	Absent	0	0	0	0	0
	NCIG-3.5	16	0	0	0.00	Present	0	0	0	0	0
	NCIG-3.1-2	20	0	0	0.00	Absent	0	0	0	0	0
	K5	64	0	0	0.00	Present	0	0	0	0	0
	K15	20	0	0	0.00	Absent	0	0	0	0	0
	K18	20	0	0	0.00	Absent	0	0	0	0	0
	K16	21	0	0	0.00	Absent	0	0	0	0	0
	K6	20	0	0	0.00	Absent	0	0	0	0	0
	K7	54	0	0	0.00	Disappeared	0	0	0	0	0
	K2	80	0	0	0.00	Present	0	0	0	0	0
	K17	10	0	0	0.00	Absent	0	0	0	0	0
	K19	20	0	0	0.00	Absent	0	0	0	0	0
	K8	20	0	0	0.00	Absent	0	0	0	0	0
	K1	19	0	0	0.00	Absent	0	0	0	0	0
	NCIG-T13	11	0	0	0.00	Present	0	0	0	0	0
	NCIG-T14	10	2	2	0.20	Absent	0	0	0	0	0
	NCIG-T15	8	0	0	0.00	Present	0	0	0	0	0
	NCIG-6.1	12	0	0	0.00	Absent	0	0	0	0	0
	NCIG-6.2	14	0	0	0.00	Absent	0	0	0	0	0
	NCIG-6.6	5	0	0	0.00	Absent	0	0	0	0	0
	NCIG-6.3-5	10	0	0	0.00	Absent	0	0	0	0	0
	K7A	20	0	0	0.00	Present	0	0	0	0	0
	K27	19	0	0	0.00	Absent	0	0	0	0	0
	K58A	12	0	0	0.00	Absent	0	0	0	0	0

Zone	Wetland	Search effort	VES detected	Total detected	Search Sensitivity	*Gambusia*	Calling	Tadpoles	Mets	Xsmall juvs	Small juvs
	K58B	81	10	12	0.12	Present	1	0	0	0	0
	NCIG-4.6	20	3	3	0.15	Present	0	0	0	0	0
	NCIG-4.7	73	0	0	0.00	Present	0	0	0	0	0
	NCIG-4.8	20	0	0	0.00	Present	0	0	0	0	0
	NCIG-4.9	76	8	9	0.11	Absent	0	0	0	0	0
	NCIG-4.10	20	4	5	0.20	Absent	0	0	0	0	0
	NCIG-4.11	20	0	0	0.00	Present	0	0	0	0	0
	NCIG-4.1-4	40	0	0	0.00	Absent	0	0	0	0	0
	NCIG-5.1	56	7	8	0.13	Disappeared	1	0	0	0	0
	NCIG-5.2	10	0	0	0.00	Unknown	0	0	0	0	0
	NCIG-5.5	10	0	0	0.00	Absent	0	0	0	0	0
	NCIG-5.8	10	1	1	0.10	Present	0	0	0	0	0
	NCIG-5.3-4	9	0	0	0.00	Absent	0	0	0	0	0
	NCIG-5.6-7	10	0	0	0.00	Present	0	0	0	0	0
	NCIG-7.1	68	2	2	0.03	Disappeared	0	0	0	0	0
	NCIG-7.2	58	3	3	0.05	Absent	0	0	0	0	0
	NCIG-7.3	65	1	1	0.02	Disappeared	0	0	0	0	0
Central	K9	60	0	0	0.00	Disappeared	0	0	0	0	0
	K9A/B	95	20	22	0.21	Disappeared	1	0	0	0	0
	BHP-1A	632	38	70	0.06	Absent	1	1	1	1	1
	BHP-1B	649	40	97	0.06	Present	0	0	0	1	1
	BHP-2A	995	16	58	0.02	Absent	1	0	1	1	1
	BHP-2B	440	0	11	0.00	Absent	1	0	1	1	1
	BHP-2C	510	15	40	0.03	Absent	0	0	1	1	1
	BHP-3A	843	69	149	0.08	Absent	1	1	0	1	1
	BHP-4A	218	2	21	0.01	Absent	0	0	0	1	1
	BHP-4B	628	13	64	0.02	Absent	0	1	1	1	1
	BHP-4C	441	0	0	0.00	Absent	0	0	0	0	0
	K10	55	0	0	0.00	Disappeared	0	0	0	0	0
	K25	20	0	0	0.00	Present	0	0	0	0	0
	K26	60	0	0	0.00	Disappeared	0	0	0	0	0
	K48	60	7	11	0.12	Disappeared	0	0	0	0	0
	K9C	60	1	1	0.02	Disappeared	0	0	0	0	0
	K11	30	0	1	0.00	Absent	1	0	0	0	0
	K13	120	5	6	0.04	Disappeared	0	0	0	0	0
	BHP-14B	807	82	207	0.10	Absent	1	1	1	1	1
	BHP-14A	150	0	0	0.00	Absent	0	0	0	0	0
	BFW Trnsct W	514	60	71	0.12	-	0	0	0	1	1
	K20A	60	4	16	0.07	Disappeared	1	0	0	0	0
	K20B	60	9	14	0.15	Disappeared	0	0	0	0	0
	K20C	30	0	3	0.00	Present	1	0	0	0	0
	K21	30	1	2	0.03	Absent	0	0	0	0	0
	K63	30	10	91	0.33	Absent	1	0	0	1	1
	BFW Trnsct E	526	26	34	0.05	-	0	0	0	0	0
	K22	184	21	71	0.11	Present	0	0	0	1	1
	K23	191	81	362	0.42	Present	0	0	0	1	1

Zone	Wetland	Search effort	VES detected	Total detected	Search Sensitivity	*Gambusia*	Calling	Tadpoles	Mets	Xsmall juvs	Small juvs
Southern	K105A	210	24	77	0.11	Present	1	0	0	1	1
	K105AS	80	18	24	0.23	Present	1	0	0	0	1
	K105B	75	24	34	0.32	Present	1	0	0	0	0
	K128	95	41	53	0.43	Present	1	0	0	0	0
	K127	60	36	37	0.60	Absent	1	1	0	0	0
	K124	181	37	86	0.20	Absent	1	0	1	1	1
	K125	162	8	25	0.05	Absent	1	0	0	0	0
	K126	187	44	285	0.24	Absent	1	0	1	1	1
	C1	30	1	1	0.03	Absent	0	1	1	0	0
	K106A	59	0	0	0.00	Absent	0	0	0	0	0
	K106B	56	1	1	0.02	Absent	0	0	0	0	0
	NP-W4	60	8	13	0.13	Absent	0	0	0	0	1
	NP-W5	193	15	17	0.08	Present	1	0	0	0	1
	NP-E4	56	10	14	0.18	Absent	0	0	0	0	0
	K29	60	12	20	0.20	Appeared	1	0	0	0	0
	K103	60	0	0	0.00	Present	0	0	0	0	0
	K31	30	2	3	0.07	Present	0	0	0	0	0
	K33	10	1	1	0.10	Absent	0	0	0	0	0
	K34	65	1	1	0.02	Absent	0	0	0	0	0
	K42	57	2	2	0.04	Present	0	0	0	0	0
	K104	159	31	61	0.19	Present	1	0	0	0	0
	K100A	180	3	13	0.02	Present	0	0	0	0	0
	K102	55	11	12	0.20	Present	0	0	0	0	0
	K111	236	32	59	0.14	Absent	1	1	0	0	1
	K112	42	2	5	0.05	Absent	1	0	0	0	0
	K113	46	1	1	0.02	Absent	0	0	0	0	0
	K114	202	22	35	0.11	Absent	0	0	0	1	1
	C4	21	3	3	0.14	Absent	0	0	0	0	0
	C5	11	0	1	0.00	Absent	0	0	0	0	0
	K108	66	7	8	0.11	Absent	0	0	0	1	0
	K108B	30	0	0	0.00	Absent	0	0	0	0	0
	C2	39	0	0	0.00	Absent	0	0	0	0	0
	K121	186	31	47	0.17	Absent	1	1	1	1	0
	K122	117	12	20	0.10	Absent	1	0	0	0	1
	K123	120	34	52	0.28	Absent	0	0	0	0	0
	C3	12	0	0	0.00	Absent	0	0	0	0	0
	K36	91	1	2	0.01	Present	0	0	0	0	0
	K49B	58	1	1	0.02	Present	0	0	0	0	0
	K129	24	3	3	0.13	Absent	1	0	0	0	0
	K117	66	12	12	0.18	Absent	0	0	0	0	0
	K118	61	28	46	0.46	Absent	0	0	0	0	1
	K46	62	3	4	0.05	Disappeared	0	0	0	0	0
	Minyan Rd	89	17	23	0.19	-	0	0	0	0	0

3.4. Demographics

Proportions of juveniles, adult males, and adult females

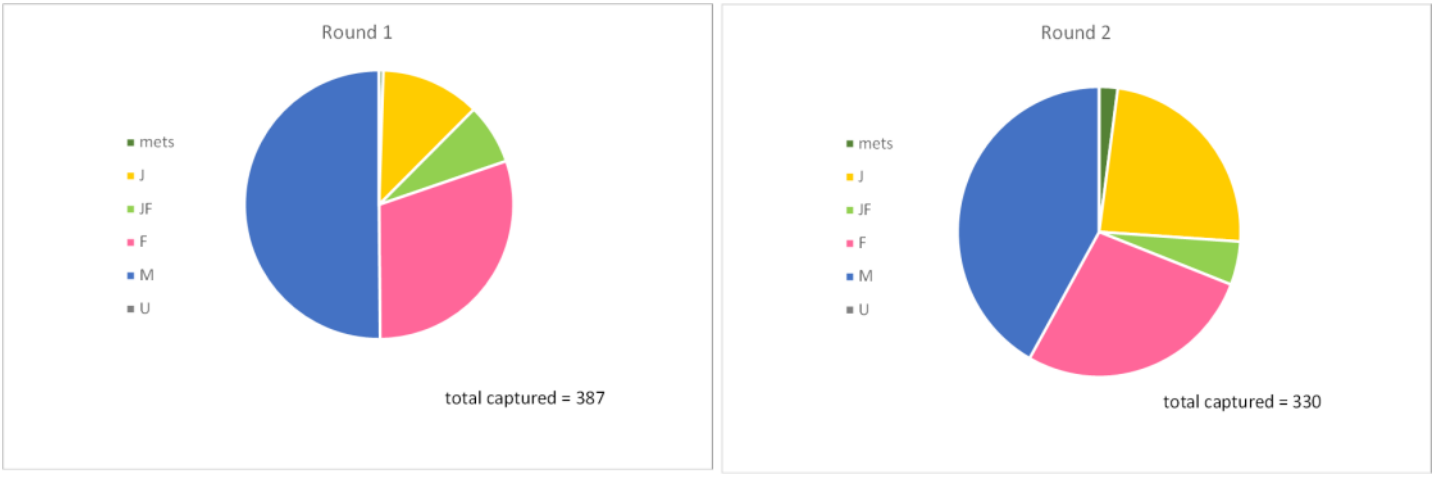


Figure 3.4.1: Summary demographics of all captured *L. aurea* (i.e. VES surveys, including recaptures and non-tagged individuals) for primary rounds. Mets, metamorphs; M, adult males; J, juveniles; JF, subadult females; F, adult females; U, animals of unknown demography.

The number of *L. aurea* captured in Round 1 and 2 was roughly equivalent (Figure 3.4.1). In both rounds, the majority of captures were adult males, making up a half of captures in Round 1 and more than a third in Round 2. In both rounds, adult females made up a quarter of all captures. The number of metamorph and juvenile captures were smaller in Round 1 compared to Round 2, but small in general for both rounds, suggesting that there wasn't a large breeding event this season. This is in contrast to previous seasons where juveniles made up more than half of all captures in some rounds.

Unique individuals

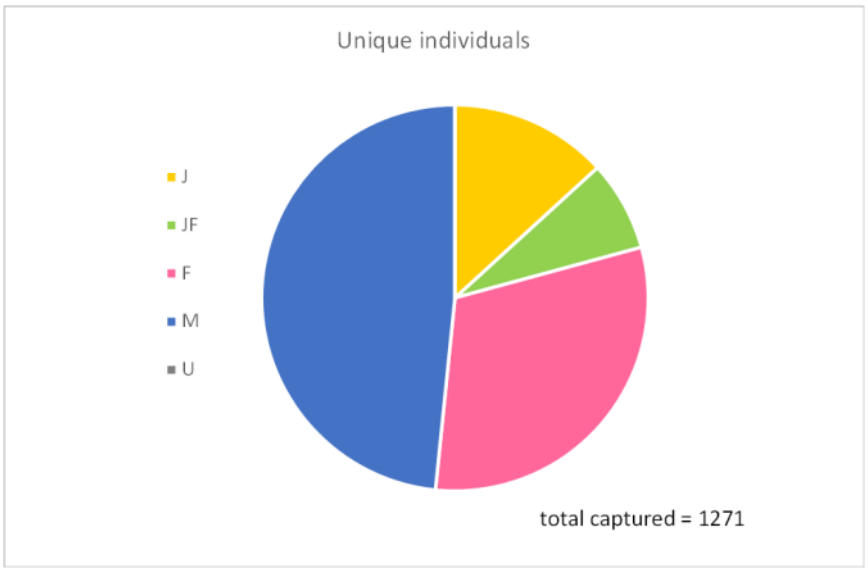


Figure 3.4.2: Demographic make-up of uniquely identifiable *L. aurea* individuals across the entire survey season

Unique individuals are identified on the basis of PIT tags and can only be ascertained from captured frogs. Figure 3.4.2 shows that, similar to previous seasons, a large proportion of these were adult males, and that there were more adult females than sub-adult females. Only a small proportion of unique individuals were juveniles, indicating that only a small number of juveniles were captured and above chippable size.

Size classes and cohorts of captured frogs

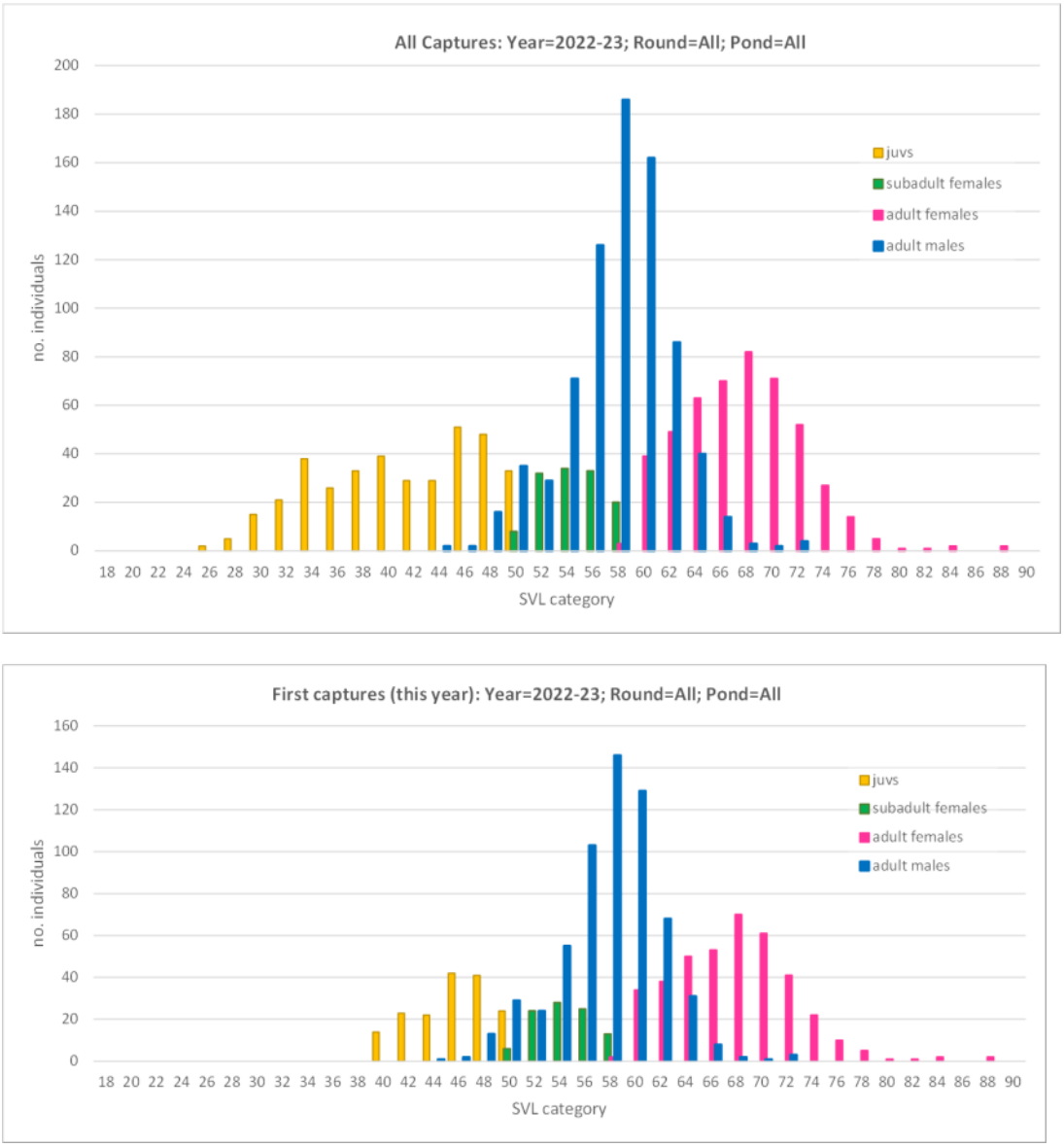


Figure 3.4.3: Frequency distribution of different sized animals captured during VES surveys. Size is measured by snout-vent length (SVL), and size categories are measurements 'binned' into 2 mm groups, i.e. the frequency of animals 56 mm > SVL >= 58 mm is shown in the column labelled '58'. **Top**; all captures where demographic data was recorded. **Below**: 'First captures' shows only unique PIT tagged individuals (generally, SVL > 40 mm), i.e. with recapture data removed.

In Figure 3.4.3, the difference between 'all captures' and 'first captures' indicates; (1) recaptured individuals (for SVL > 40 mm), and (2) the number of captured juveniles that were too small to mark with PIT tags. As with previous seasons, the largest number of adult captured were male, with a size distribution centred around 44-72 mm SVL. Adult females were generally larger than adult males, with their size distribution centred around 58-84 mm SVL. Of particular interest is the small number of very large adult females detected, up to 88 mm, suggesting they were of a much older age. Only a relatively small portion of captures were juveniles, with few of sufficient size to be tagged.

All captures, by round

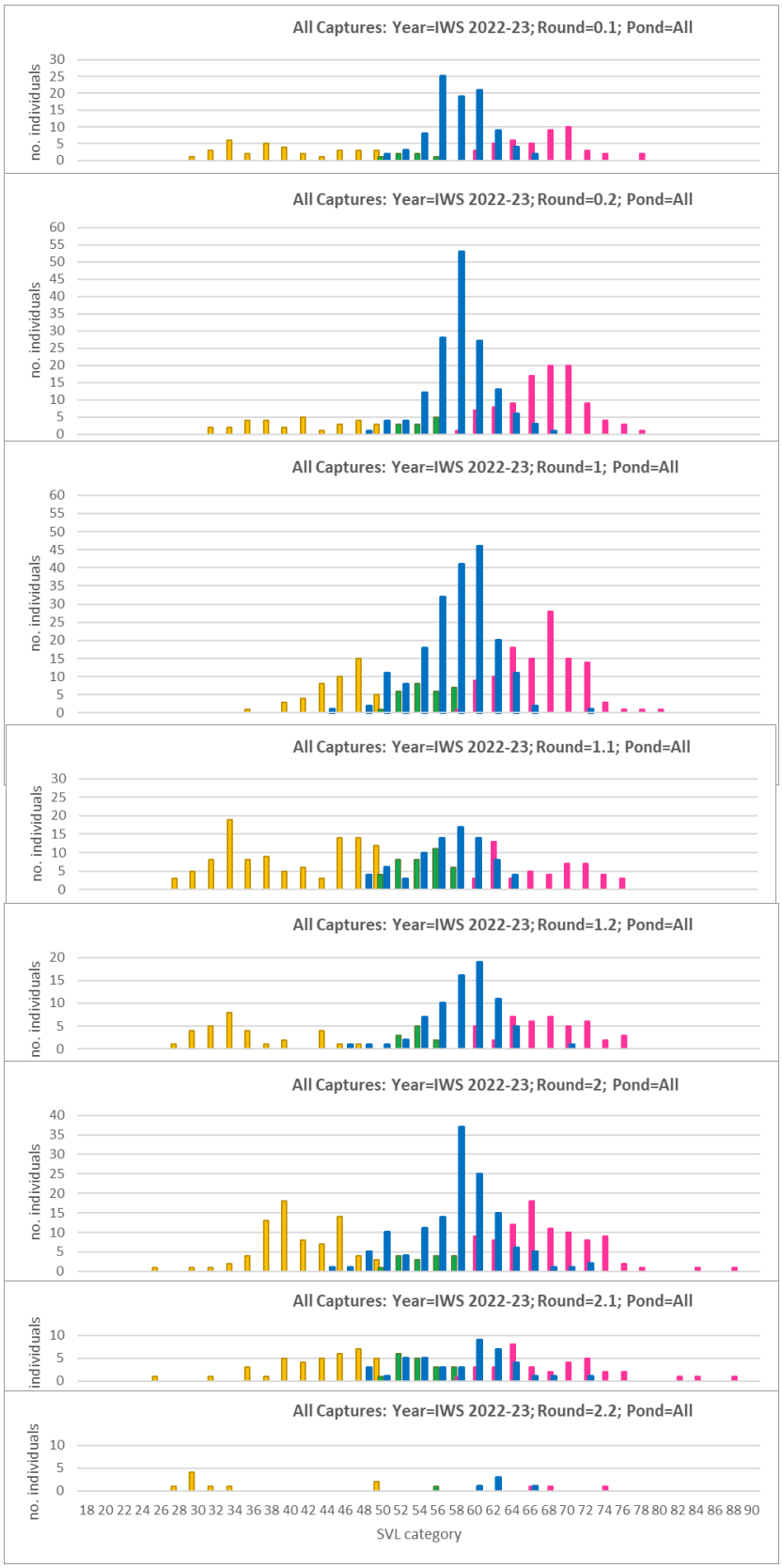


Figure 3.4.4: Frequency distribution of size classes, showing all captures for each survey round (VES).

When the size data of animals is broken down per round, the distribution of juvenile frog sizes visually reflects cohorts of animals of similar age that arise throughout the season. Two distinct juvenile cohorts are apparent in Figure 3.4.4. One cohort was detected early in the season (Round 0.1), likely reflecting offspring that spawned in the previous season. The second cohort was initially detected in Round 1.1, likely spawned at the start of this current season. The increasing size of juvenile frogs from both cohorts can be seen in subsequent rounds, indicating their maturation over time and subsequent recruitment into the adult population. It is also possible that a third cohort was detected late in the season in Round 2.2, suggesting additional breeding in the middle/later in the season.

The size distribution of adult males, females, and sub-adult females were similar between all rounds. As expected, there were increases in adult numbers during the main rounds 1 and 2, likely due to the larger number of ponds surveyed. Fewer individuals were captured after the second main round, particularly in Round 2.2, which would suggest an expected decline in overall activity at ponds during the later months of the season.

Northern Zone

Few animals were captured in the Northern Zone across the entire season. When captures did occur, it was from ponds nearer to the Central Zone in the School House subregion and were only adult males and females; there were no captures of pre-adult individuals. Some northern ponds were primarily or only occupied by adult females, including ponds in NCIG stages 4, 5 and 7. **This included individuals at the larger end of the size distribution for the female sex, which suggests the presence and survival of older individuals in the Northern Zone**. The only indication of breeding activity in the Northern Zone was calling at two sites (NCIG 5.1 and K58B).

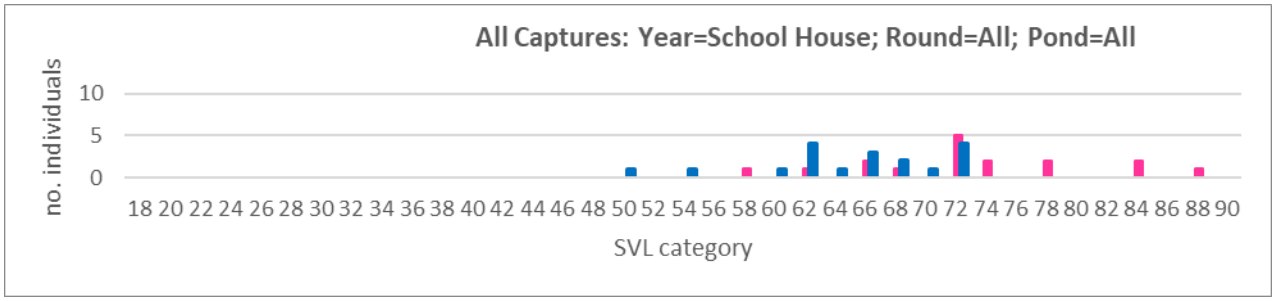


Figure 3.4.5: Combined frequency distribution of size classes for sites in the School House region (Northern Zone)

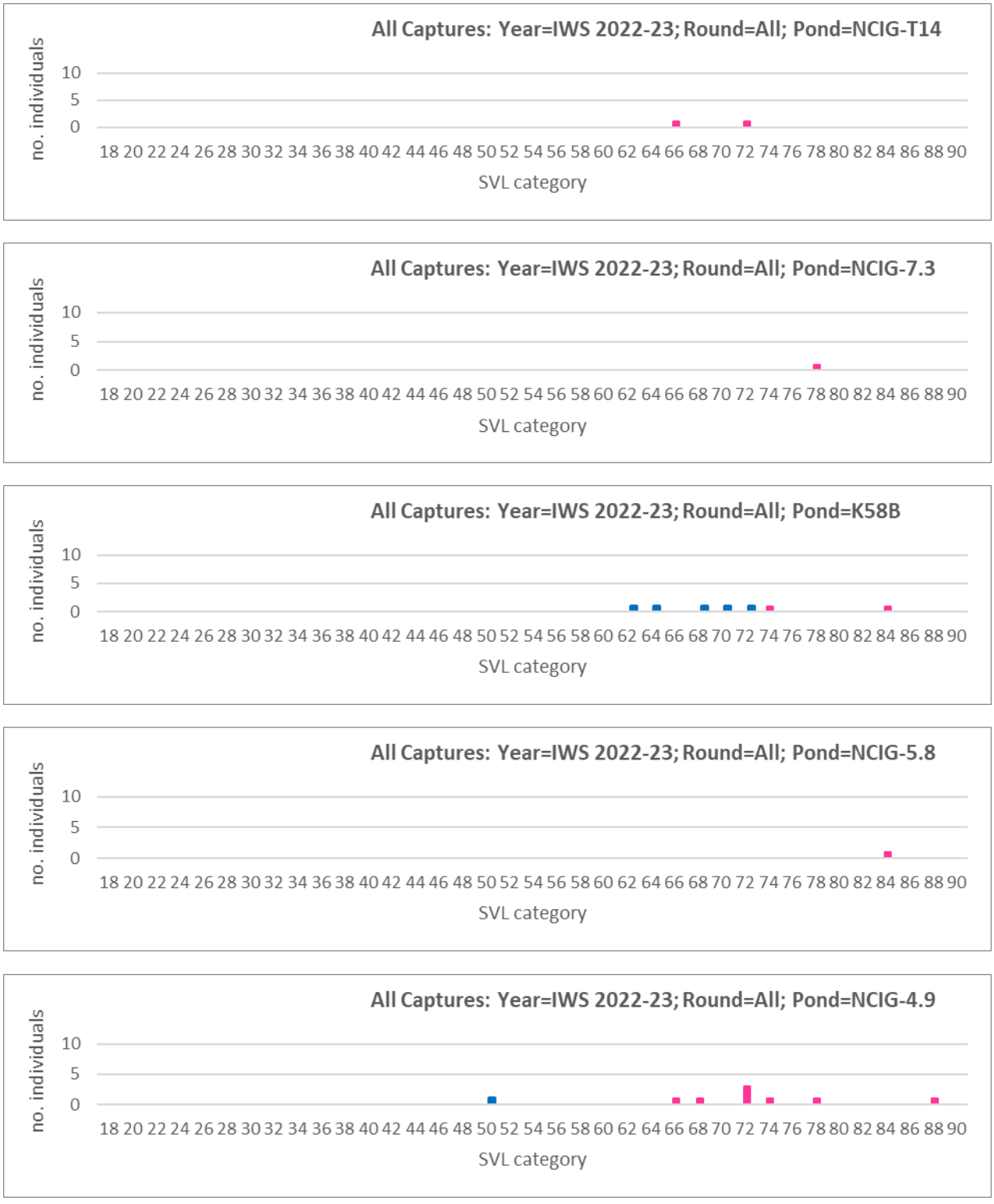


Figure 3.4.6: Size/demography for wetlands in the School House region.

Central Zone

Cobbans Creek Region

The Cobban's Creek Region lies within the Central Zone of the island and is primarily composed of the BHP- CHEMP wetlands. In general, the size distribution and comparative number of adult males to females followed the general trend observed across the island (Figure 3.4.7). Juveniles were captured in this sub-region, including in BHP-1B and 3A (Figure 3.4.8). Interestingly, there was less of a discrepancy in the number of adult males versus females captured at BHP-1B, which is also the pond where a comparatively larger number of juveniles were detected within the subregion. Metamorphs and small juveniles were detected at five BHP ponds (1A, 2A, 2B, 2C, and 4B), indicating widespread breeding activity and successful metamorphosis across this region.

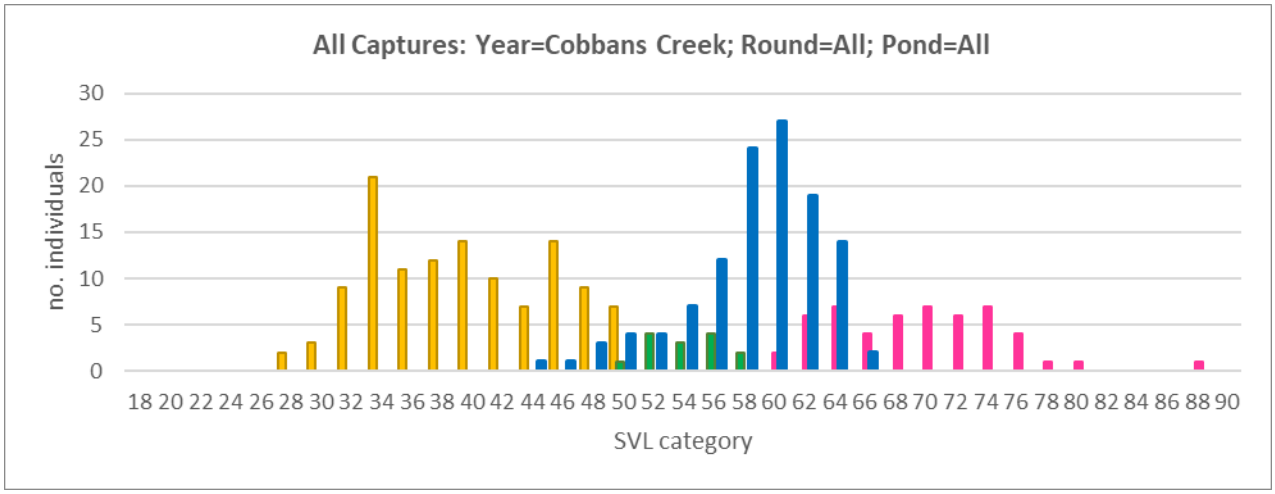


Figure 3.4.7: Combined frequency distribution of size classes for sites in the Cobban's Creek Region (Central Zone)

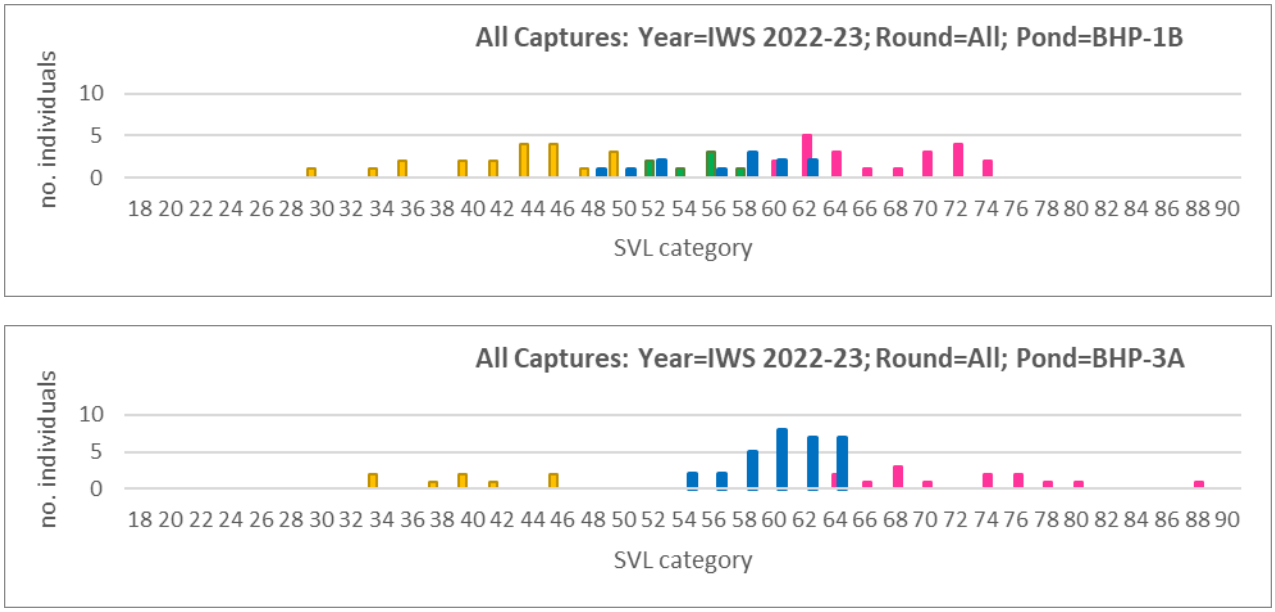


Figure 3.4.8: Size/demography for wetlands in the Cobban's Creek Region.

Bellfrog Way Region

The Bellfrog Way Region makes up the remaining portion of the Central Zone. It is evident that a much larger populations exists within this area of the Central Zone (Figure. 3.4.9). Juveniles were captured here at K23, which is a permanent waterbody that is also considered an overwintering refuge for adults, as well as at BHP-14B (Figure 3.4.10). These two ponds are consistently breeding strongholds for *L. aurea* within the Central Zone. Indeed, metamorphs were detected at BHP-14B, while small juveniles were detected at BHP-14B and K23. Small juveniles were also detected in the neighbouring ponds K22 and K63, suggesting breeding activity across the region this season.

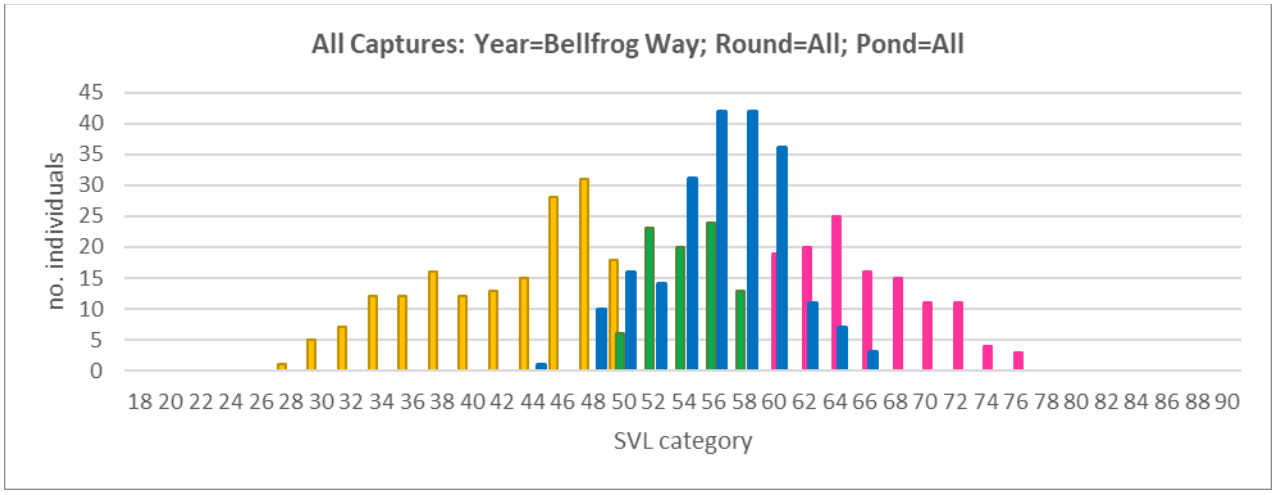
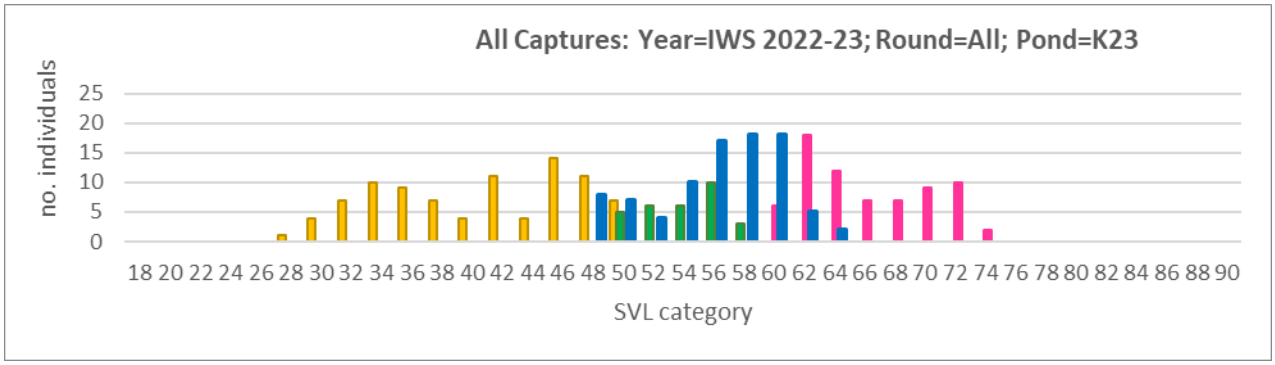


Figure 3.4.9: Combined frequency distribution of size classes for sites in the Bellfrog Way Region (Central Zone)



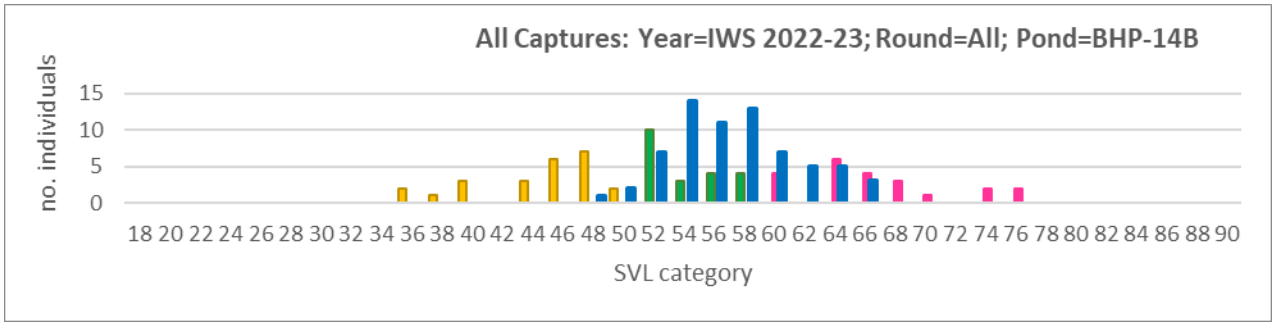


Figure 3.4.10: Size/demography for wetlands in the Bellfrog Way Region.

Industrial Zone

Northern Industrial Zone Region

The northern portion of the Industrial Zone has a higher incidence of *Gambusia* infestation when compared to the southern portion. Nevertheless, indications of breeding were detected across several main areas (Figure 3.4.11). In particular, the newly constructed ponds in this zone, particularly those within Area 2, have become important breeding sites for the species, perhaps as they are sites free of *Gambusia*.

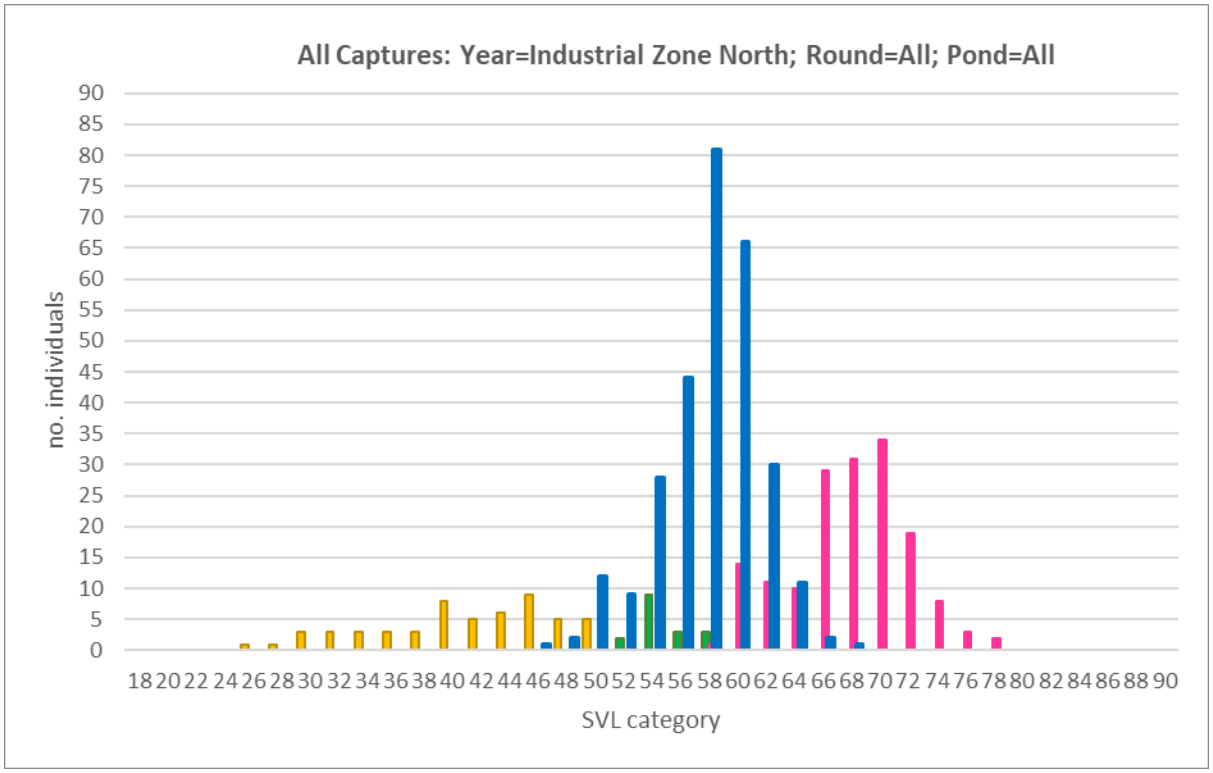


Figure 3.4.11: Combined frequency distribution of size classes for sites in the Northern Industrial Zone Region (Industrial Zone)

'Deep pond' was originally a single very large wetland in the North-west part of the Industrial Zone; it sits on the original substrate of the island (rather than on artificial substrate, as is the case with some other wetlands), and appears to be a remnant of the natural wetlands in this part of Kooragang that were present prior to substantial alteration by human activity. Following the completion of the NCIG infrastructure, this wetland was split into a larger northern part (K105A), and a smaller southern part (K105B). Both K105A and K105B showed similar captures for adult males and females, yet juveniles were only detected in K105A (Figure 3.4.12a). The presence of juveniles could indicate that breeding occurred at this site despite the presence of *Gambusia*, although dispersal from neighbouring ponds is also possible. There were no direct indications of breeding, such as tadpoles or metamorphs, but calling was recorded at both ponds.

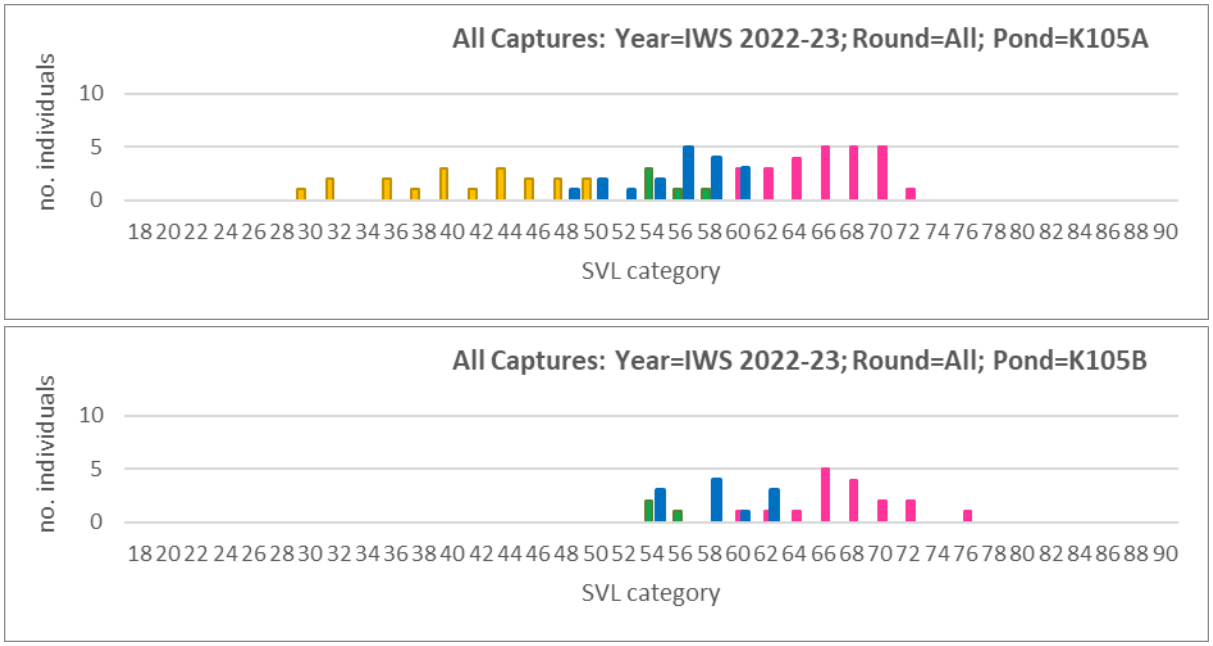


Figure 3.4.12a: Size/demography for the Big-pond wetlands in the Northern Industrial Zone Region.

K127 and K128 are newly constructed wetlands in close proximity to the K105 wetlands, which were built in areas of terrestrial habitat previously referred to as the 'wedge' and 'peninsula'. Calling was detected at both sites, and tadpoles detected at K127, yet no juveniles were detected at either (Figure 3.4.12b). The lack of direct evidence of breeding at K128 could be due to the presence of *Gambusia*, while K127 is *Gambusia* free and likely a key breeding site within the Deep-pond local area. Both ponds showed similar characteristics in terms of occupation, with adults of both sexes captured.

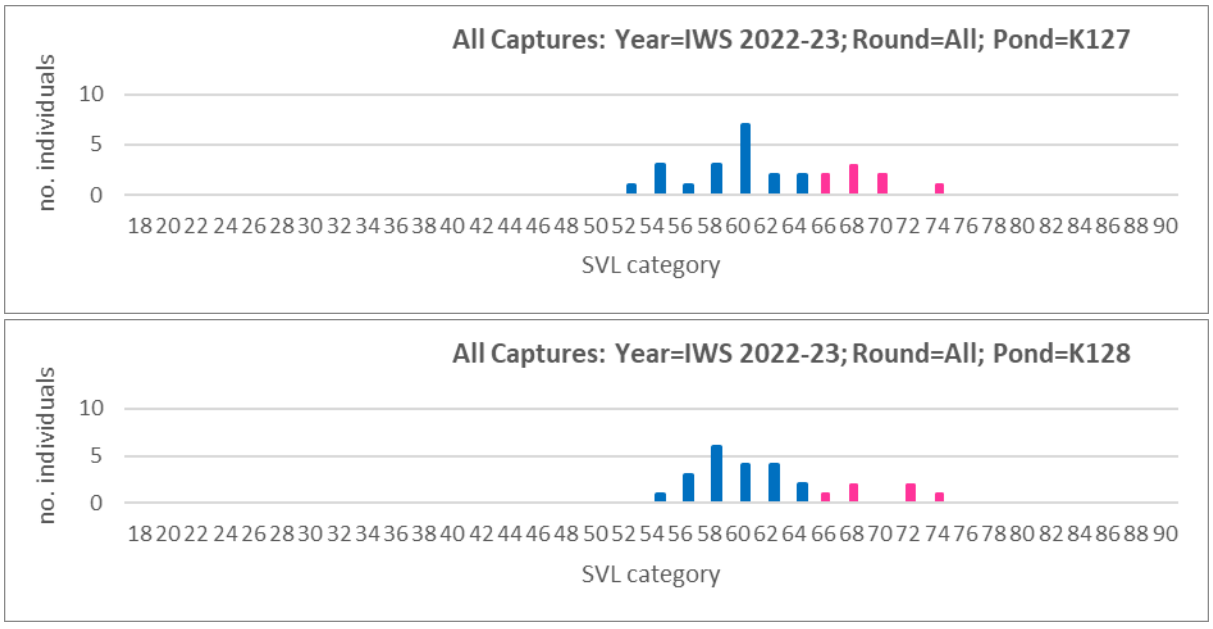


Figure 3.4.12b: Size/demography for constructed wetlands in the 'wedge' and 'peninsula' in the Northern Industrial Zone Region.

K124 and K126 are newly constructed ponds in proximity to K105A and are referred to as Area 2. These ponds are some of the only ones not infested by *Gambusia* in the Northern Industrial Zone and have shown high occupation and breeding in several years. This season, calling, metamorphs and juveniles were detected at both sites, indicating successful breeding in Area 2. It is apparent that K126 supports a relatively larger population of adults when compared to K124 (Figure 3.4.12c).

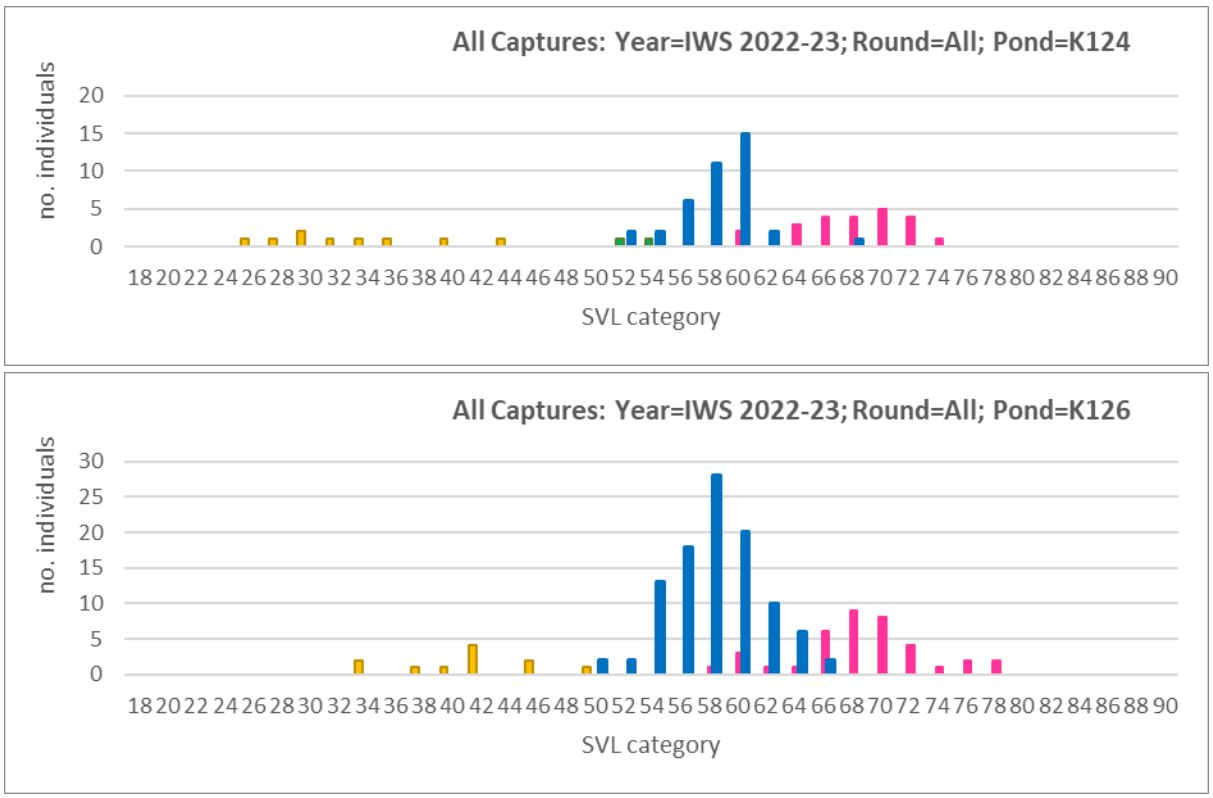


Figure 3.4.12c: Size/demography for Area 2 wetlands in the Northern Industrial Zone Region.

The number of *L. aurea* captured at K29 was low (Figure 3.4.12d), following a trend of declining numbers since 2015-16. However, the inability to survey the entire wetland area due to wall instability may be impacting these findings, and search sensitivity (where detections are measured per unit search effort) for the Northern Ponds subregion remain strong (See Section 3.9). Despite the presence of *Gambusia*, calling and juveniles were detected. The abundance at K29 is similar to neighbouring ponds, such as the firepits W4 and W5. The low presence of juveniles in all of these ponds may show dispersal from other sites within the region following metamorphosis.

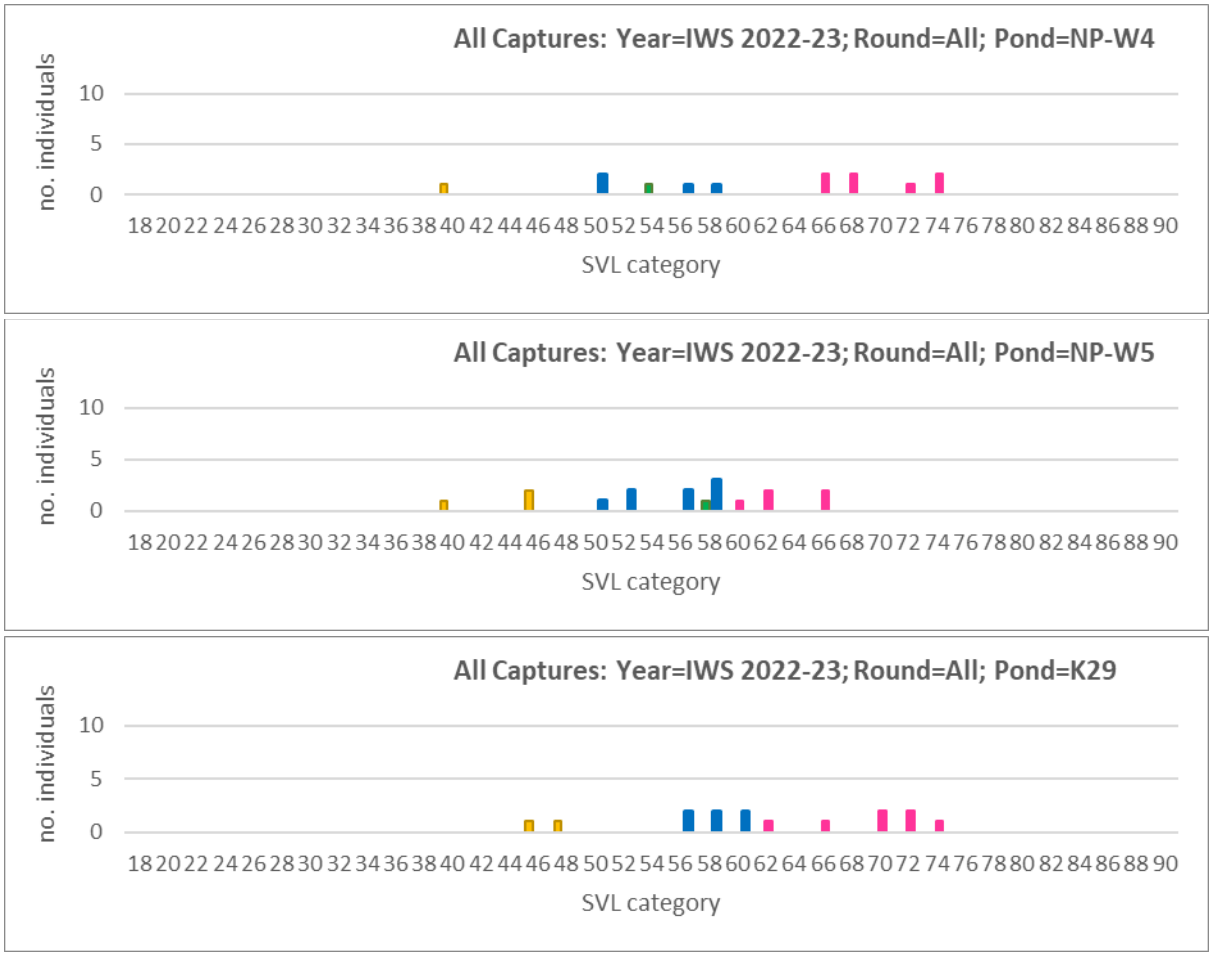


Figure 3.4.12d: Size/demography for Northern pond wetlands in the Northern Industrial Zone Region.

K104 is a relatively isolated pond in the Northern Industrial Zone but has been a site of large breeding events in the past. The pond continues to support both adult males and females (Figure 3.4.12e). Despite the presence of *Gambusia*, calling and juveniles were detected, suggesting that breeding may have occurred at this wetland.

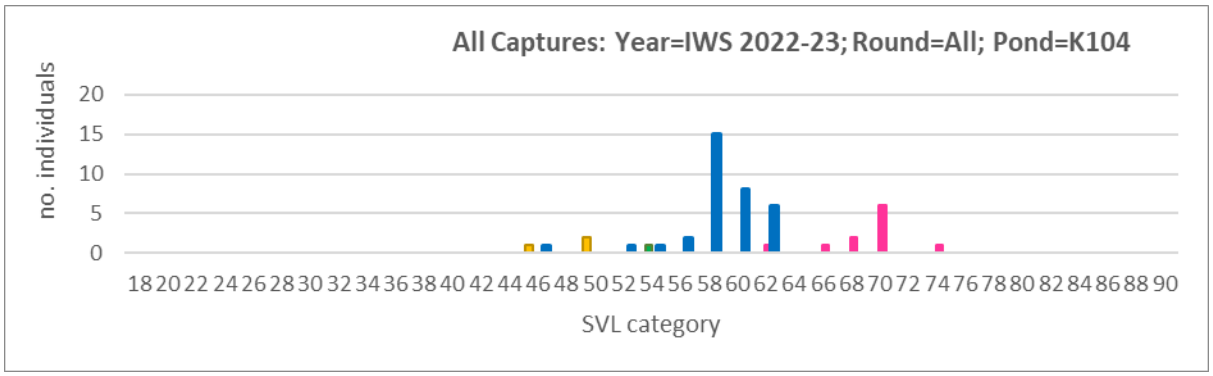


Figure 3.4.12e: Size/demography for K104 in the Northern Industrial Zone Region.

Southern Industrial Zone Region

A number of wetlands across the southern region of the Industrial Zone have historically supported important numbers of *L. aurea*. Several ponds specifically designed for *L. aurea* have recently been constructed in this zone, which remain free from *Gambusia*.

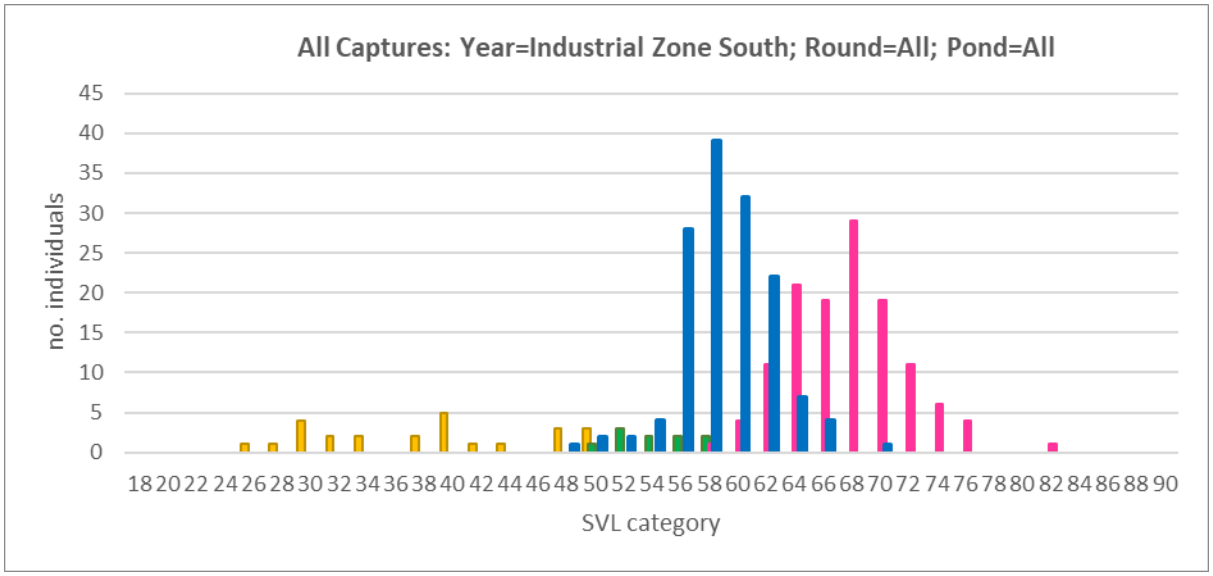


Figure 3.4.13: Combined frequency distribution of size classes for sites in the Southern Industrial Zone Region.

K100A is a deep, permanent wetland alongside Windmill Road, which contains *Gambusia* in very high densities. As in previous years, comparatively more adult females were captured than adult males. However, this pond has seen a marked decline in occupation. While it is not a pond where breeding usually occurs, it is considered an important refuge for adults, with the low numbers of males and females a concern (Figure 3.4.14a). Movement data indicates that many individuals present at this wetland in the previous season have moved to other wetlands across the Southern Zone.

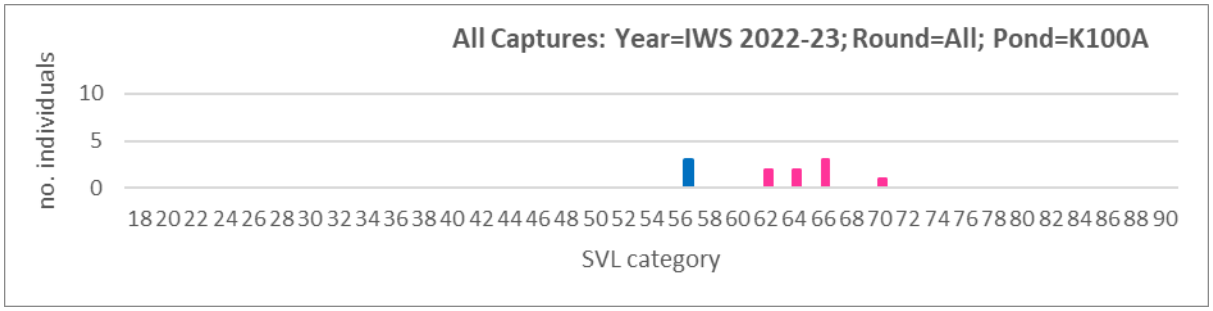


Figure 3.4.14a: Size/demography for K100A in the Southern Industrial Zone region.

The HDC constructed wetlands within the rail loop are all *Gambsuia*-free and continue to support a healthy population of *L. aurea* (Figure 3.4.14b). In previous years, K111 in particular has been a site of high occupation and breeding but has since seen a decrease in both this season. Calling and juveniles were detected at K111 and K114, as well as tadpoles at K111, indicating breeding continues to occur every season in the rail loop.

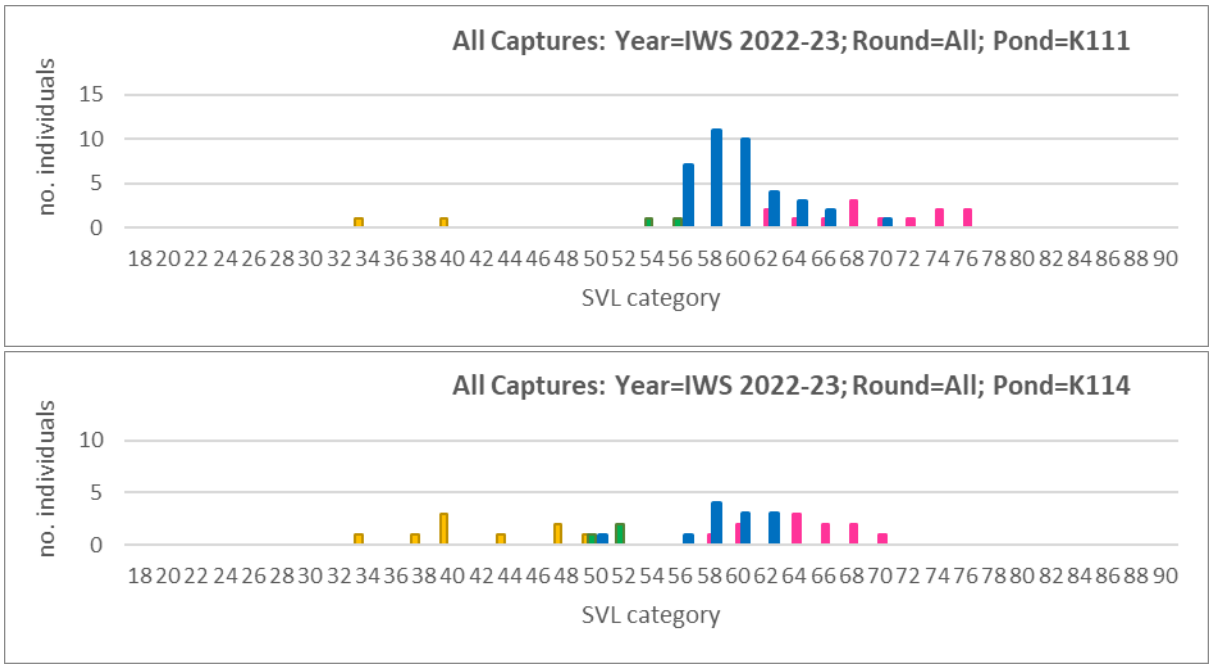


Figure 3.4.14b: Size/demography for HDC wetlands in the Southern Industrial Zone Region.

K121, K122, and K123 were constructed in 2016-17 and are located in the *K10 South* subregion, adjacent to the Rail-loop. They have greatly increased the amount of *Gambusia* free aquatic habitat in that area. The majority of captures in each of these ponds were adult males and females (Figure 3.4.14c). There appears to be lower occupation in K122 compared to the other ponds, but it seems to support adult females. Juveniles were detected in K121 and K122, as well as tadpoles and metamorphs in K121, indicating breeding in *K10 South*. It appears that K121 holds a relatively bigger population of frogs compared to K122 and K123.

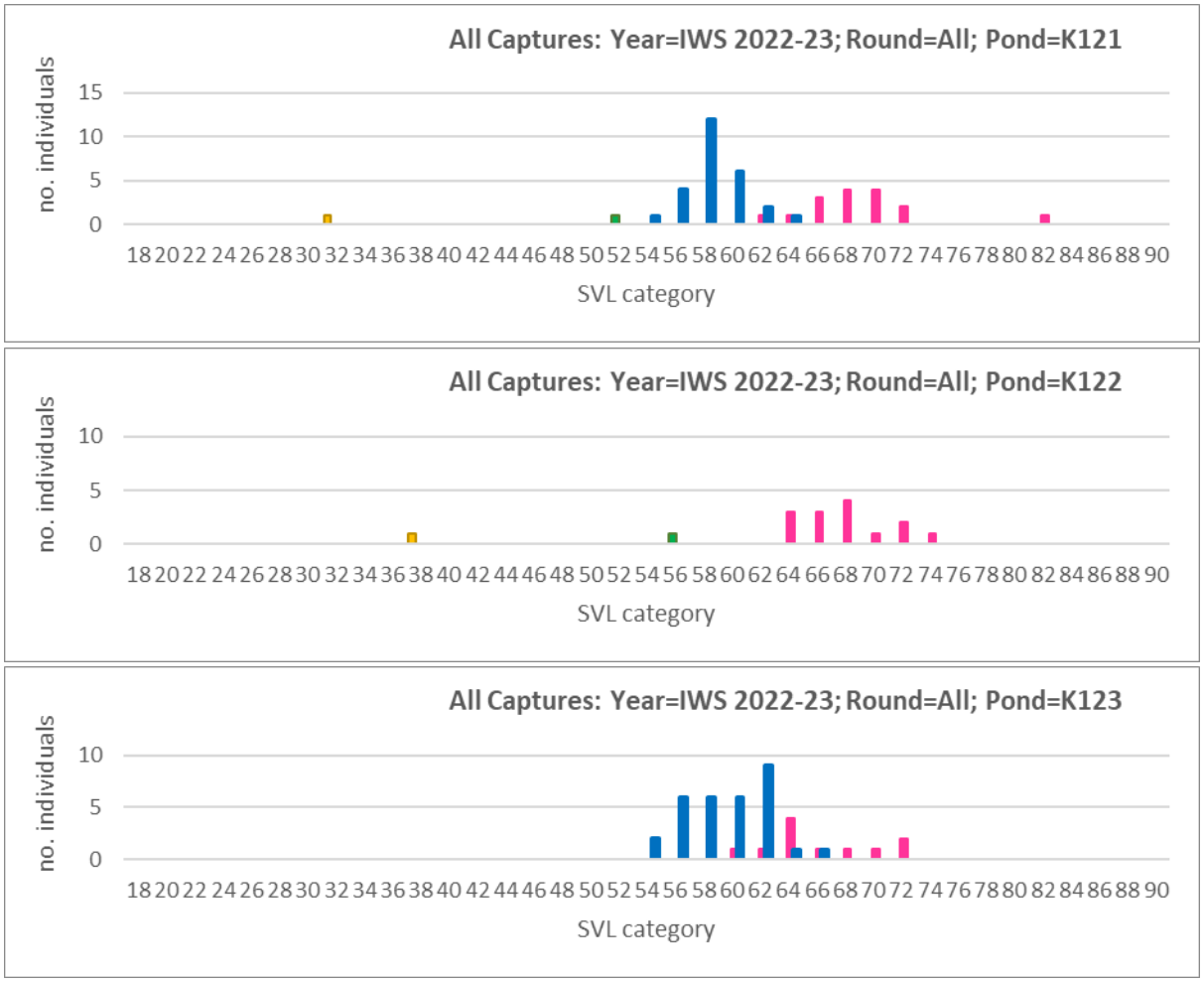


Figure 3.4.14c: Size/demography for K10S wetlands in the Southern Industrial Zone Region.

K118 remains *Gambusia* free and has relatively high occupation compared to the neighbouring K117 which has *Gambusia* (Figure 3.4.14d). Small juveniles were detected at K118, suggesting breeding did occur at this site. This season, we detected a large number of adults dispersing between ponds in the area along Minyan Road after a significant rainfall event. Dispersal is triggered by rainfall yet terrestrial movement such as the one detected here is rarely detected due to the difficulty in surveying this habitat type.

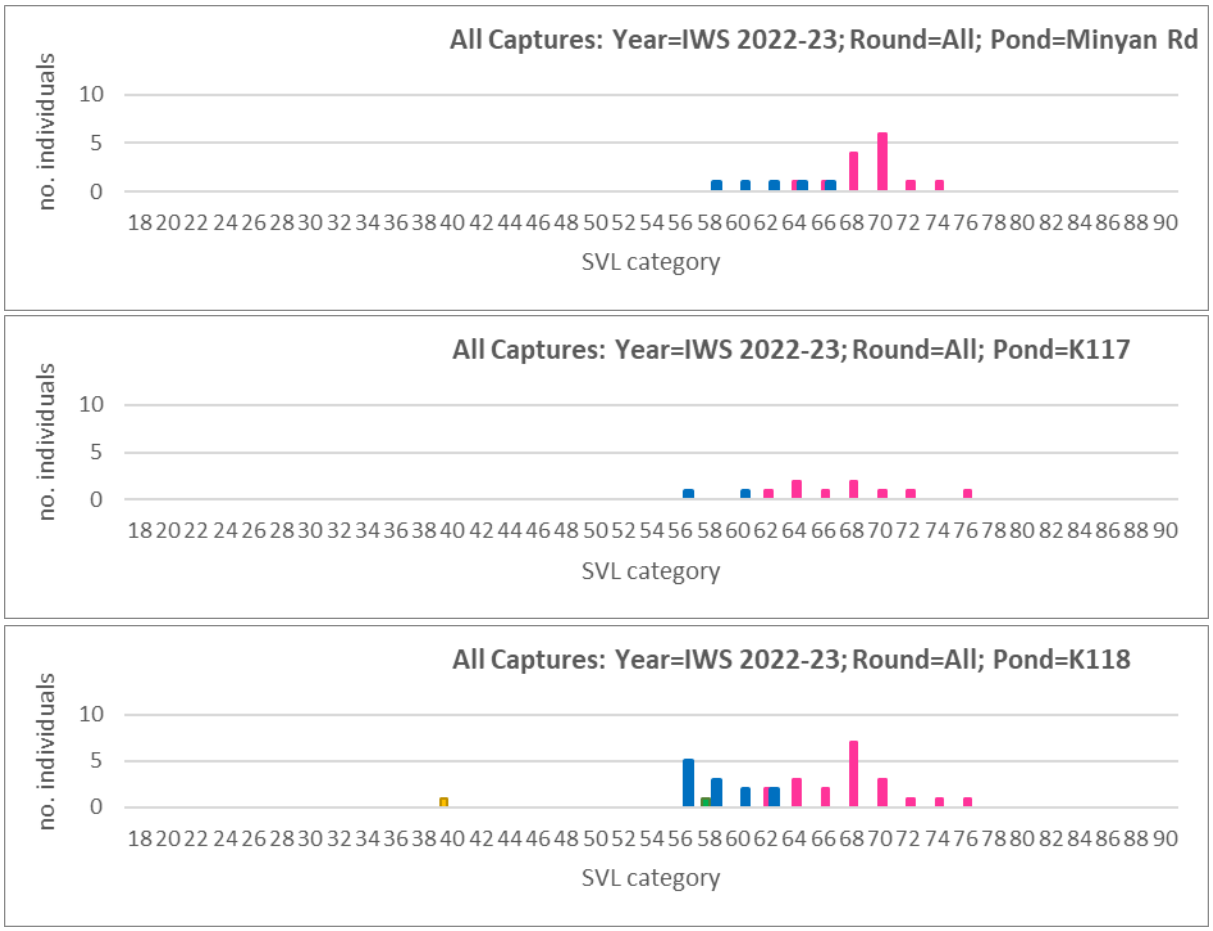


Figure 3.4.14d: Size/demography for K117 and K118 and the connecting Minyan Road in the Southern Industrial Zone Region.

Multi-year demographics

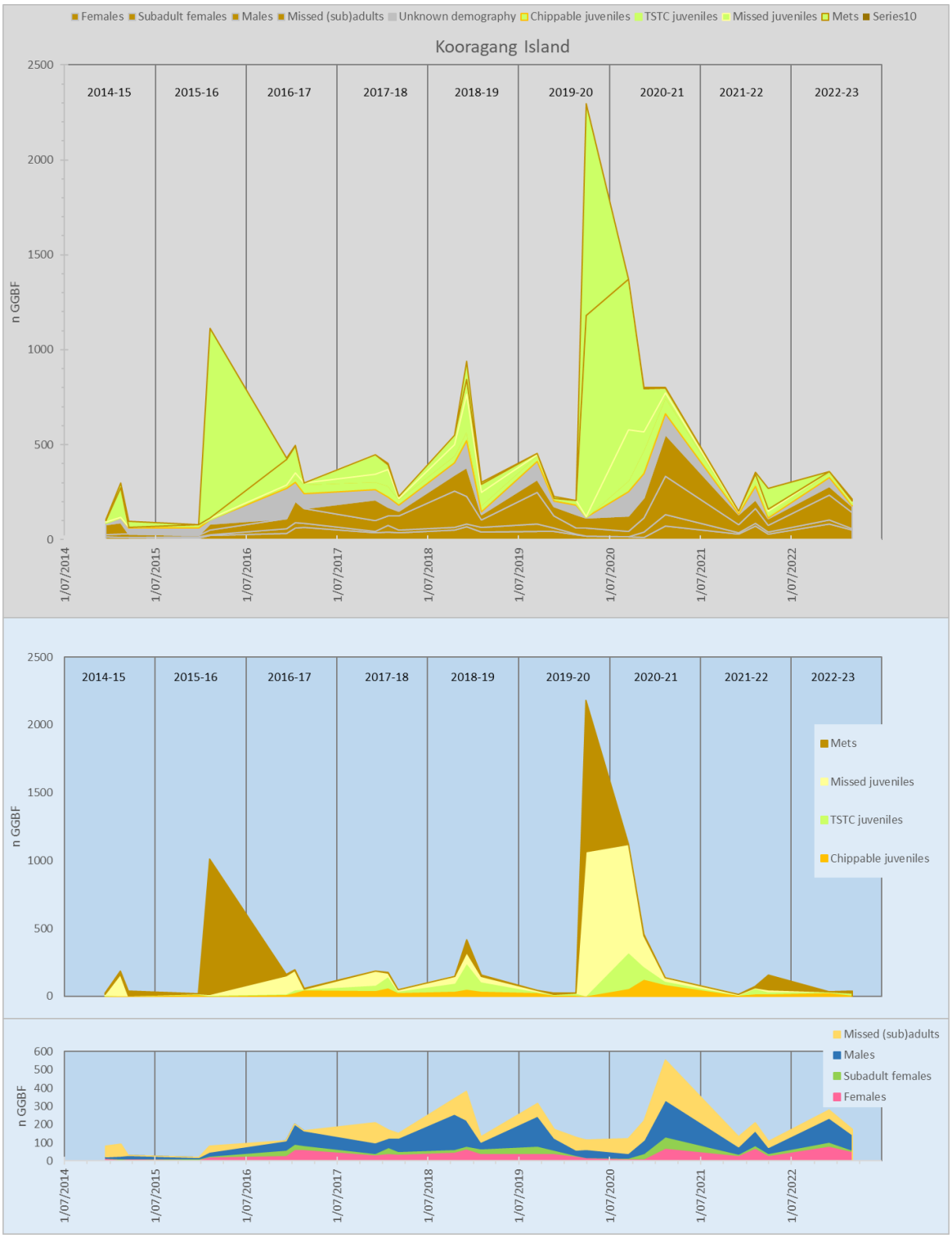


Figure 3.4.15: Demographic composition of *L. aurea* detected as part of the IWS program, from the 2014-15 to the 2022-23 season. Numbers are for animals detected during VES in each main survey round. The top figure highlights juvenile (green) and subadult/adult (brown) classes, with animals of unknown demography (because they were seen but not captured) in grey. The middle figure highlights the different juvenile classes, while the lower figure shows the subadult/adult classes.

The number of adults detected within the breeding season has fluctuated over the IWS program (Figure 3.4.15). In general, there has been an increase from a low in the first two years (2014 and 2015), a decline in 2020 and another increase since then, with numbers between the low periods fluctuating but remaining relatively stable. The period between the first and second low points in 2014/2015 and 2020 suggests that the population was increasing in size, likely as a result of habitat construction on the island. The second low in 2020 was likely caused by drought over 2019, which included fires that devastated large portions of the island. Despite such an extreme weather disturbance, it is positive to see that numbers rose immediately post fires, indicating some degree of resilience within the island population. In particular, despite relatively low overall numbers in 2022-23, the number of adult females is high – since adult females are particularly important for population viability, this is an important point to note.

The most dramatic difference between years is observed in the juvenile population. Two spikes in 2015-16 and 2019-20 are indicative of mass breeding events in those years, which is not unusual for a species with boom-and-bust population dynamics. It must be noted that juveniles have been detected in all survey years, indicating breeding has been successful in all years of the program to date. This is critical given the high mortality caused by chytrid infection that reduces adult lifespan, with yearly breeding allowing for continual recruitment into the adult population to replenish individuals lost to the pathogen.

3.5. Longitudinal data: Persistence and movement

An important component of the Island Wide Survey dataset is the longitudinal study facilitated by routine tagging of captured >40 mm SVL *L. aurea*. Multiple captures of tagged individuals provide insight into survivorship and movement, which has implications for the health of the population into the future. There have been more than 22, 000 captures of nearly 14, 500 unique, tagged individuals over the program duration (Table 3.5.1). Recapture rates are proximately 30% for each demographic.

Table 3.5.1: Summary of longitudinal dataset for the Kooragang *L. aurea* population since 2011.

	All frogs	J	JF	F	M
n captures	22,669	6,125	2,309	5,049	8,819
n unique individs	14,495	4,701	1,422	2,864	5,278
n animals recaptured	4,451	1,543	458	820	1,588
p recapture	0.31	0.33	0.32	0.29	0.30

Persistence is used to describe the length of time that individual *L. aurea* are detected following initial capture and tagging. It is a measure of survivorship, but is not equivalent to age as individuals are at least 40 mm SVL before they can be tagged (approx. 6 – 12 months in age), and are often larger. However, it does indicate the annual probability for survival. We have found that persistence is low on Kooragang Island, with most marked animals never recaptured. When recapture does occur, the time between first and last capture of most animals is less than a year (Figure 3.5.1, Table 3.5.2), suggesting that most animals do not survive past a year. Indeed, survivorship for more than 1 year is approximately only 8-9% of all recaptured individuals.

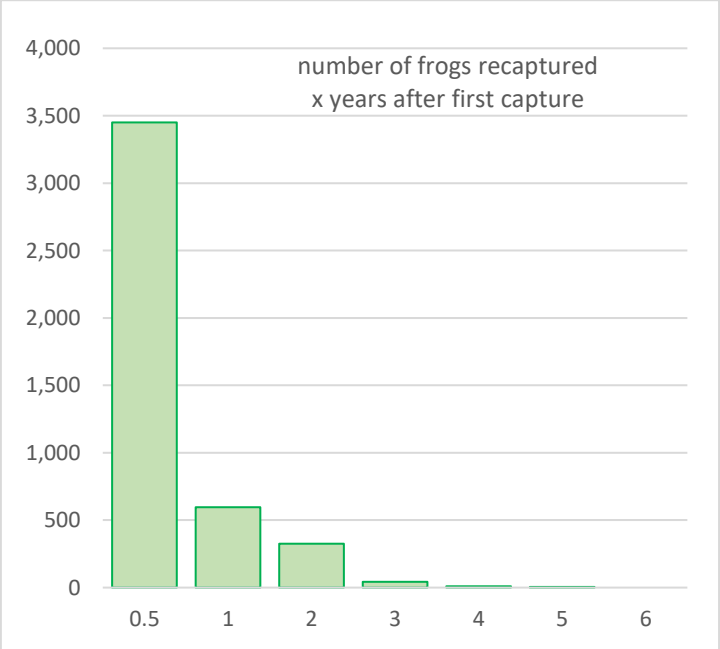


Figure 3.5.2: Persistence of *L. aurea* individuals.

Most recaptured frogs are found in the same wetland where they were first captured. This not unexpected, as the majority of animal recaptures occur within the same year as initial capture where there is less time for movement to occur. However, as the time between first and last capture increases, the probability of a frog moving increases, from 20% when the span is less than a year to 78% after a span of four years (Table 3.5.2).

Table 3.5.2: Frequency of movements compared with persistence, for *L. aurea* between 2011-23.

years from first, last capture	n frogs in class	n in class that moved	% moved
0.5	3,451	688	0.20
1	596	177	0.30
2	325	117	0.36
3	44	23	0.52
4	9	7	0.78
5	4	2	0.50
6	0	0	

A majority of movements are less than 0.25 km, although movements of more than 2 km have been recorded (Table 3.5.3). Overall, between 18% and 33% of recaptured frogs have moved between wetlands, with adult females having the highest probability of detected movement.

Table 3.5.3: Frequency of movements of varying distances for *L. aurea* between 2011-23.

distance (kms)	n movements	J	JF	F	M
0.25	801	83	63	276	364
0.5	225	10	17	102	84
1	114	2	4	50	55
2	32	4	1	11	15
>2	7	1	1	2	3

Table 3.54: Likelihood of detected movement for different demographic classes of *L. aurea* between 2011-23.

	All	J	JF	F	M
p movement/all frogs	0.07	0.06	0.06	0.09	0.07
p movement/recaps	0.23	0.18	0.19	0.33	0.24

Some frogs are recaptured multiple times, and several of these individuals show multiple movements between consecutive captures within and between years (Table 3.5.5). Most of these multi-movements are detected in the subregions with high sampling intensity, such as the BHP-CHEMP wetlands in the Central Zone, and the Area 2 wetlands in the Industrial Zone.

Table 3.5.5: Frequency of multiple movements of *L. aurea* between 2011-23.

n movements	n individuals	J	JF	F	M	n movements
1	795	224	66	201	300	795
2	165	36	17	50	60	330
3	39	9	3	14	13	117
4	14	3	1	4	6	56
5	2	0	0	1	1	10
>5	0	0	0	0	0	0
	1015	**272**	**87**	**270**	**380**	**1308**

Noteworthy clusters of movement in 2022-23 occurred along Bellfrog Way, from K22-23 to wetlands in the Southern Zone (K105A and Area 2), within Area 2 and between Area 2 and surrounding subregions (Deep Pond, Northern Ponds, and *K10*), within the wetlands of K10N and K10S and between these and other wetlands, and from K100A to an array of other wetlands, the furthest being Area 2 and Minyan Rd (Tabel 3.5.6). The completion of the capping at the Eastern Ponds resulted in a reduction in surveys and detections in that area in the 2022-23 season when compared to previous seasons. With work at the site now completed, the pattern that arises in the forthcoming 2023-24 season will be of particular interest.

Table 3.5.6. Movement of recaptured *L. aurea* individuals between wetlands, and within/between wetland mosaics.

Movement category	2011-2020	2020-21	2021-22	2022-23	Overall count
NCIG within stage	34	0	0	0	34
NCIG CHEMP/other Northern (between stages)	14	1	0	3	18
Northern Zone/Central Zone	9	1	0	0	10
BHP CHEMP	346	3	19	7	375
BHP CHEMP/other Central Zone	5	0	1	1	7
K9/Other Central Zone	0	0	1	0	1
Bellfrog Way	9	0	6	11	26
K22/K23	84	0	4	2	90
K22-23/other	1	0	0	1	2
Central Zone/Southern Zone	5	0	0	0	5
K22-23/Southern Zone	15	1	0	2	18
K22-23/Area 2	0	0	0	2	2
Area 2/other	2	0	2	2	6
K105A/Area 2	0	0	1	1	2
Area 2	0	0	0	4	4
Area 2/Northern Ponds	0	0	0	2	2
Northern Ponds	30	1	1	0	32
K105A/Northern Ponds	37	1	0	3	41
Northern Ponds/other	7	0	0	0	7
K10/Area 2	0	0	1	1	2
K100A-Area 2	0	0	0	3	3
K100A-K10S	1	0	0	4	5
K100A-K10N	3	0	4	1	8
K100A-other	3	0	1	1	5
K100A/Eastern Ponds	2	3	4	0	9
K100A/other	0	1	0	0	1
K10N/Eastern Ponds	1	304	53	0	358
K10N/K10S	1	0	1	4	6
K10N	1	34	38	4	77
K10S	4	0	0	2	6
K10S/other	3	0	0	0	3
NCIG & central/other	5	1	0	0	6
K104/other	2	0	0	0	2
K36/other	2	0	0	0	2
K46/Other	3	0	0	0	3
K2	0	0	0	2	2
Total	**629**	**351**	**137**	**63**	**1180**

Large numbers of shorter movements have been detected in three main areas (Figure 3.5.1): the BHP-CHEMP wetlands, the region of the Northern Ponds / K105A / K22-23, and in *K10N*. The detection of multiple movements of individuals has also been concentrated in these core areas (Figure 3.5.4). These concentrations reflect two related processes; (1) good habitat mosaics in those three areas, and (2) high intensities of survey effort.

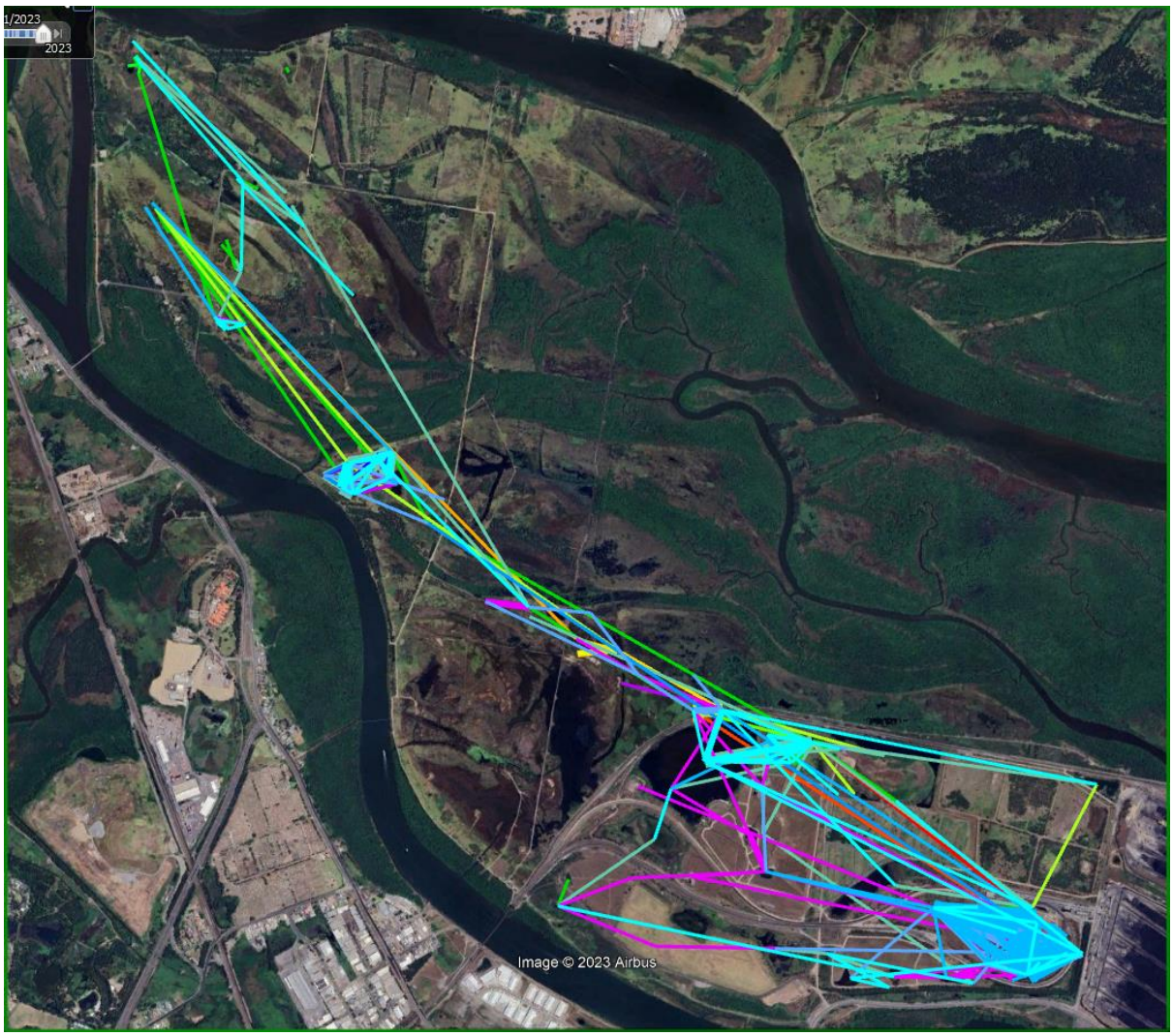


Figure 3.5.1: Detected movements of *L. aurea* in Kooragang Island, 2011-23. Each colour indicates movements detected in different years.

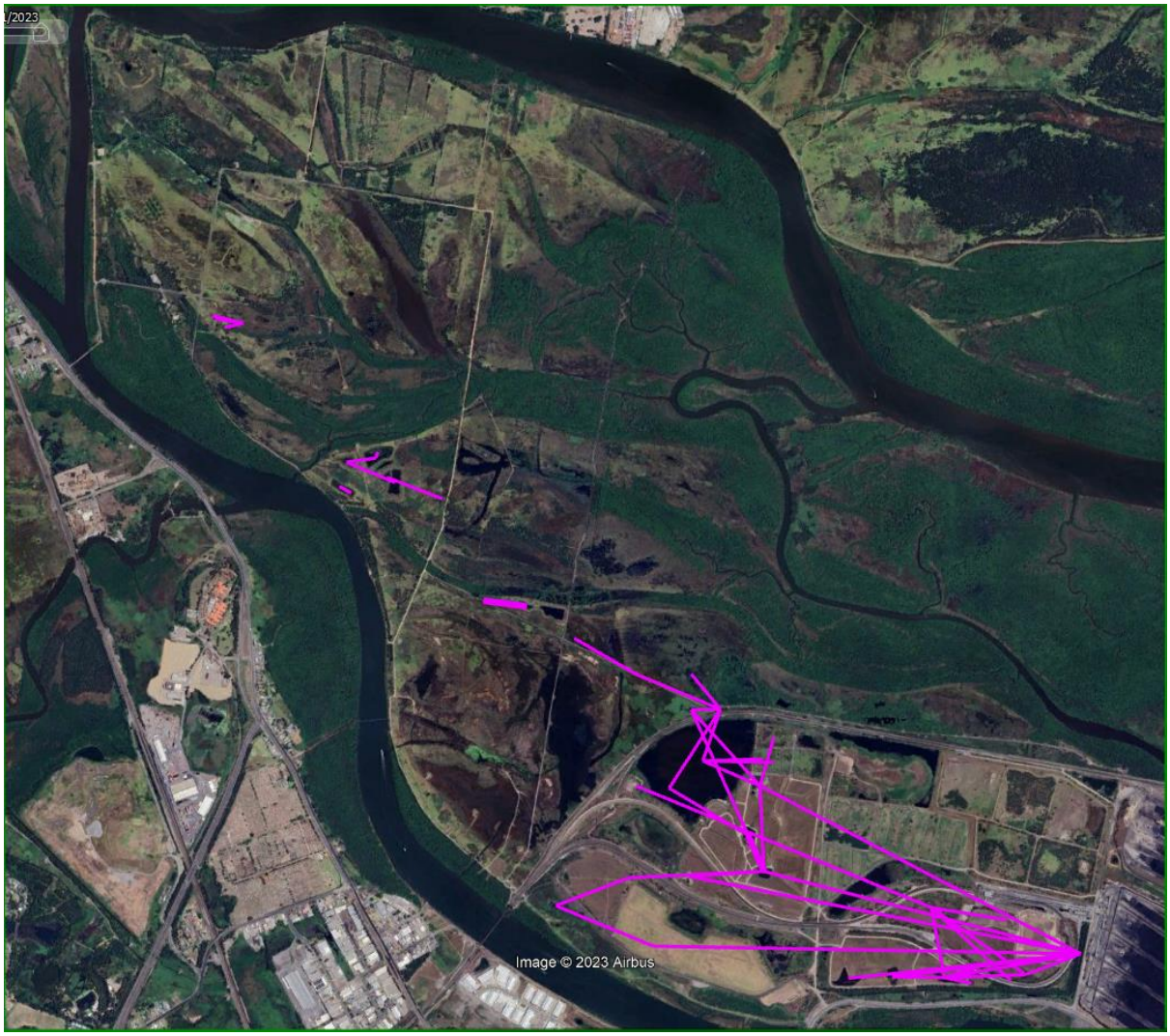


Figure 3.5.2: Detected movements of *L. aurea* in Kooragang Island in 2022-23.

In the current season, a majority of movements occurred within and between the North and South of the Industrial Zone. There was limited movement between Zones, except for evidence of connectivity between K22/23 and Deep Pond/Area 2. Movement was also detected between the Area 2 ponds and several other subregions within the Industrial Zone, suggesting it has further improved connectivity within this area of the island given its central locality in the Southern Zone. Long distance movements were detected between K100A and several sites within the Industrial Zone, providing support for the suggestion that *L. aurea* will move from 'refuges' like K100A to habitats that provide suitable breeding conditions within season.

There was no detection of movement between the Central and Northern Zones. While this has been detected in previous seasons, it is a rare occurrence and suggests that additional habitat mosaics between these two zones will be required to improve connectivity of the island's sub-populations.

Changes in the total number of movements of individuals detected over time and the distances travelled are both likely to increase with study length. Detection probabilities also increase with sampling intensity, which has increased from 2016 onwards. Nonetheless, it is apparent that the construction of the BHP-CHEMP wetlands has increased connectivity between wetlands in the North and along Bellfrog Way. Similarly, the construction of habitat in the Industrial Zone, namely Area 2, K10N and K10S has dramatically improved connectivity within that local area (Figure 3.5.3) and to some extent, the Industrial Zone has become a habitat mosaic onto itself. Despite some connectivity between K104 and other wetlands, it remains particularly isolated in the Industrial Zone yet remains an important site as large breeding events do occur here. Long distance movements have been detected since the earliest years of the IWS program, and the construction of intermediate habitat such as the BHP-CHEMP wetlands may act as 'pit stops' that improve survival during such dispersal events.

Figure 3.5.3: Detected *L. aurea* movements on Kooragang Island between 2011-15 (top), 2015-19 (middle), and 2019-23 (bottom). Each colour indicates movements in different periods.

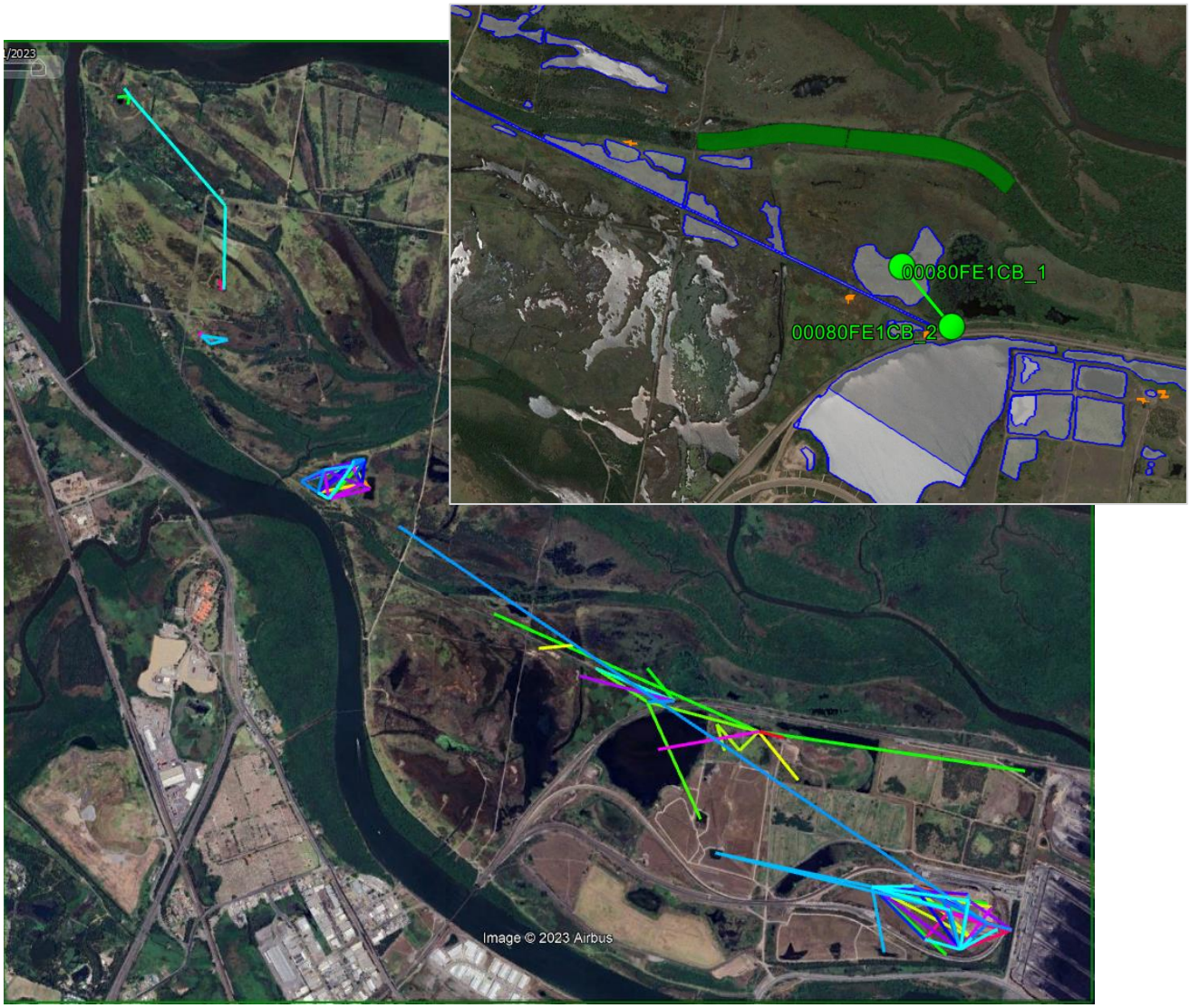


Figure 3.5.4: Detection of multiple movements of *L. aurea* in Kooragang Island, 2011-23. Each colour indicates movements by one individual. **Inset**: Movement of an adult female (PIT# 00080FE1CB) between K23 and K63 in 2022-23.

Intensive tagging of individuals over long periods provides invaluable insights into behaviour and ecology. For example, we have long assumed that the ephemeral wetland at K63 (which is surrounded by saltmarsh and mangrove) provides breeding/foraging habitat for the adult *L. aurea* that are often found at the refuge wetland K23. In the last two seasons one adult female has been detected at K23 (summer 2021-22), K63 (autumn 2022), and then back at K23 (summer 2022-23). Observations such as this provide a unique insight into *L. aurea* biology.

3.6. Breeding

Table 3.6.1. Tally of ponds with indications of breeding activity across island zones during the 2022-23 season.

Zone	Calling	Tadpoles	Mets	Xsmall juvs	Small juvs
Northern	2	0	0	0	0
Central	13	0	6	13	13
Southern	16	4	4	6	10

It is apparent that breeding activity is widely detected across both the Central and Industrial Zones, with little indication of activity in the Northern Zone (Table 3.6.1).

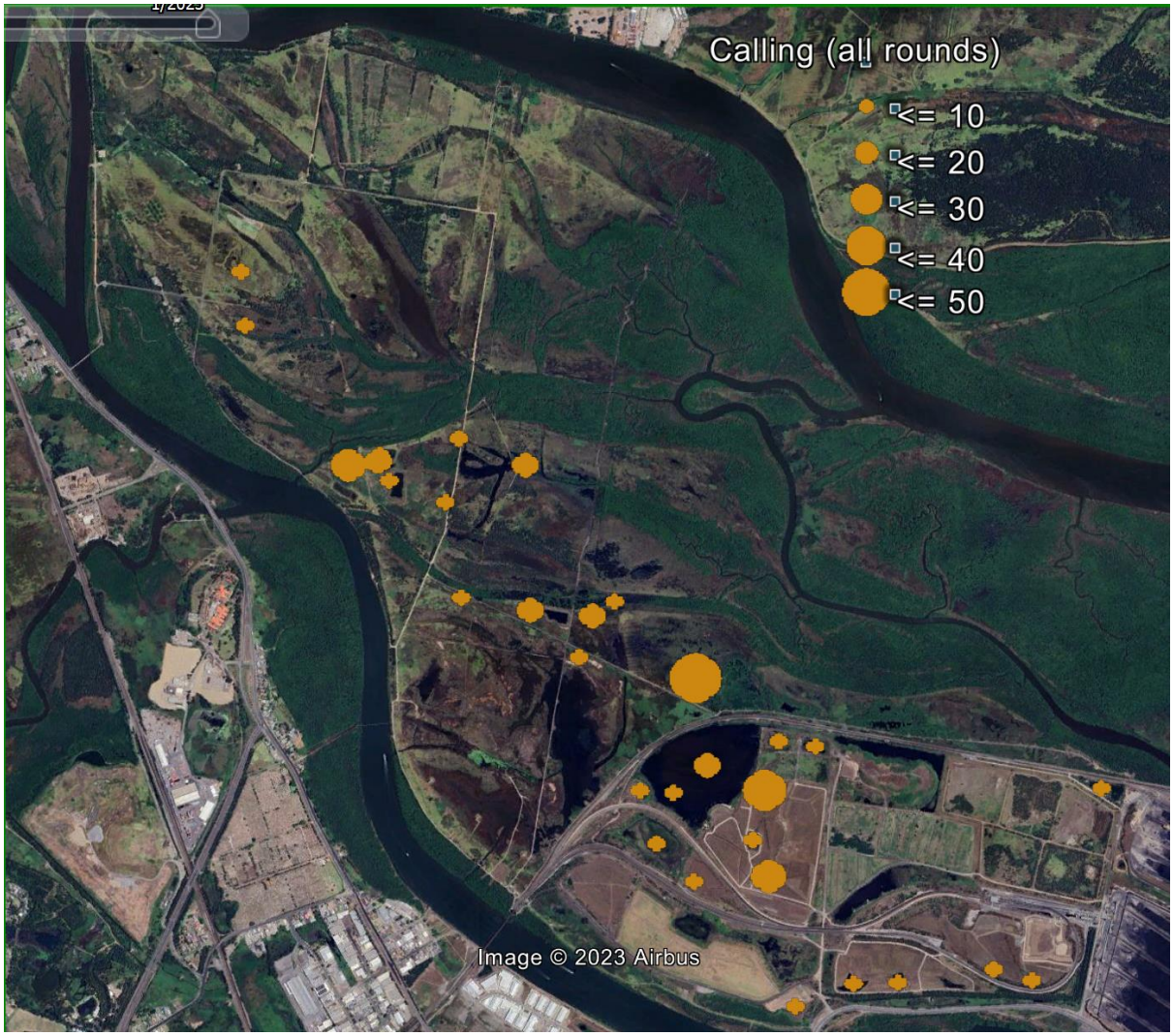


Figure 3.6.1: *L. aurea* breeding (i.e., calling) during the 2022-23 survey season.

While calling does not suggest breeding has or will occur at a pond, it does provide evidence that ponds are being selected by *L. aurea* to possibly engage in such activities. As with previous seasons,

there was limited evidence of calling in the Northern Zone, occurring at only two wetland sites, both within the Millam's Pind subregion (Figure 3.6.1). In contrast, calling was detected at significantly more subregions and sites within the Central Zone (13 ponds) and Industrial Zone (16 ponds). Areas of particularly high calling activity included the Ramsar Road, Deep Pond, and Area 2 subregions. Calling was primarily concentrated within the first half of the breeding season. A notable feature of the 2022-23 season was the detection of calling in mangroves through the Central Zone, including near Teal Track, K20A, and K63. These observations were made early in the season, following Spring rainfall; potentially, a lens of freshwater on top of the saline water stimulated calling behaviour by male *L. aurea* in those locations.

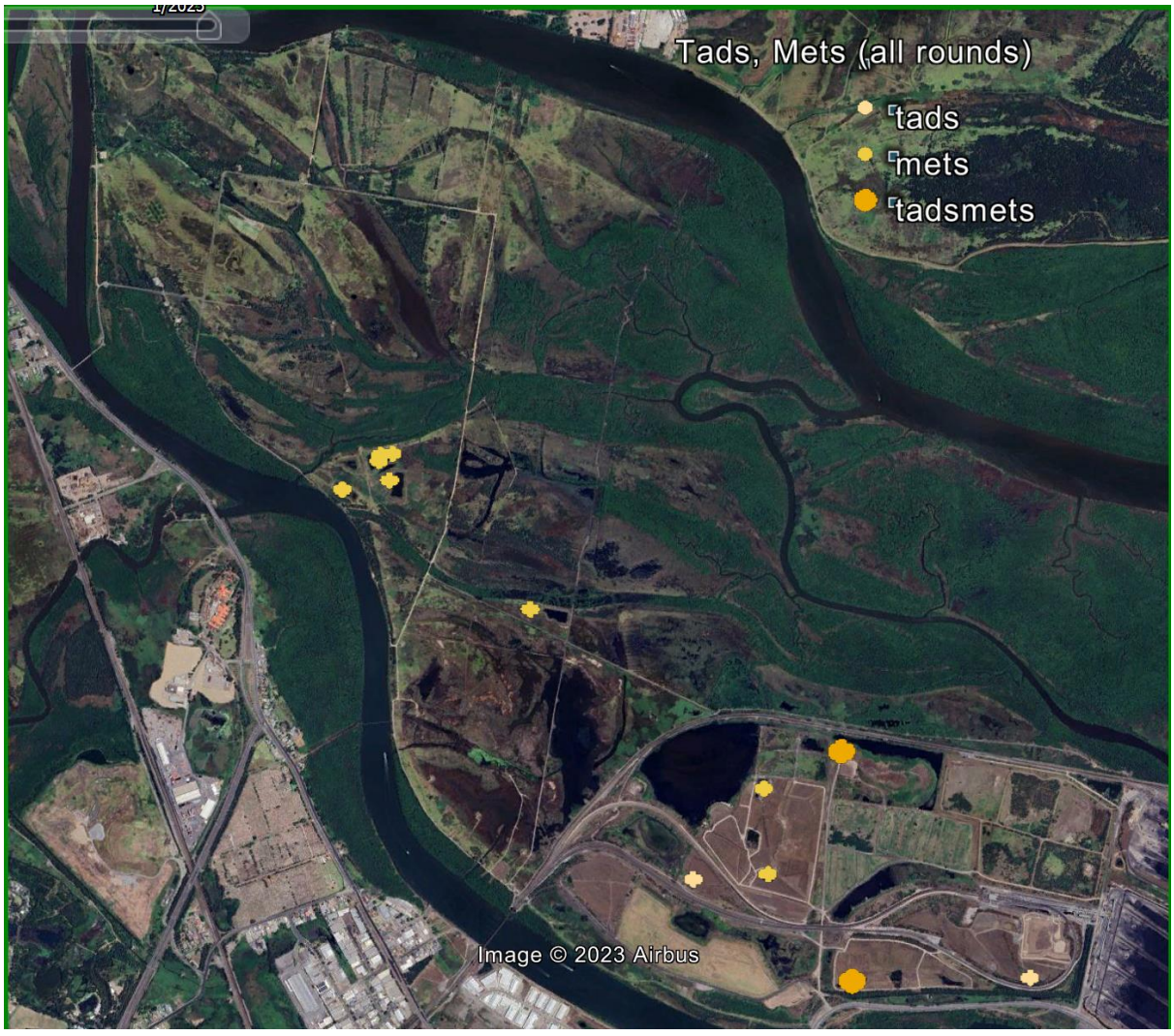


Figure 3.6.2: *L. aurea* breeding (i.e., detection of tadpoles and metamorphs) during the 2022-23 survey season.

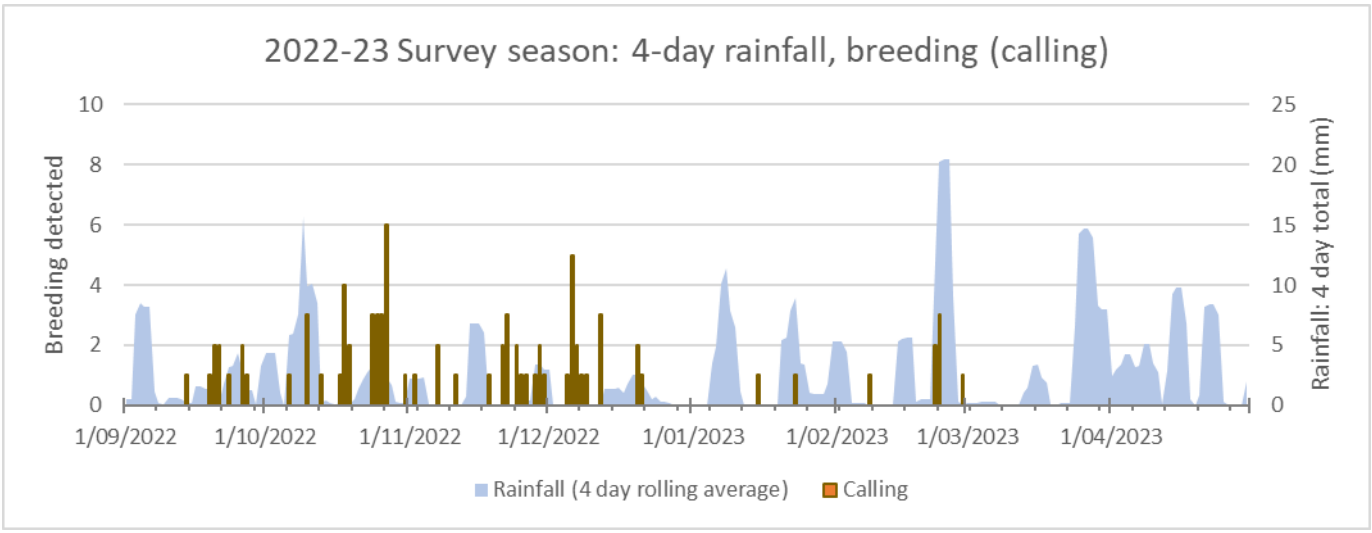
A difficulty with detecting *L. aurea* tadpoles is that positive identification in the field is difficult. Tadpoles were only detected within the Industrial Zone (Figure 3.6.2). In particular, tadpoles were detected at four wetland sites in Round 1 and 2, including those within the Area 2, Northern Ponds, and Rail Loop subregions that are dominated by constructed ponds free of *Gambusia*.

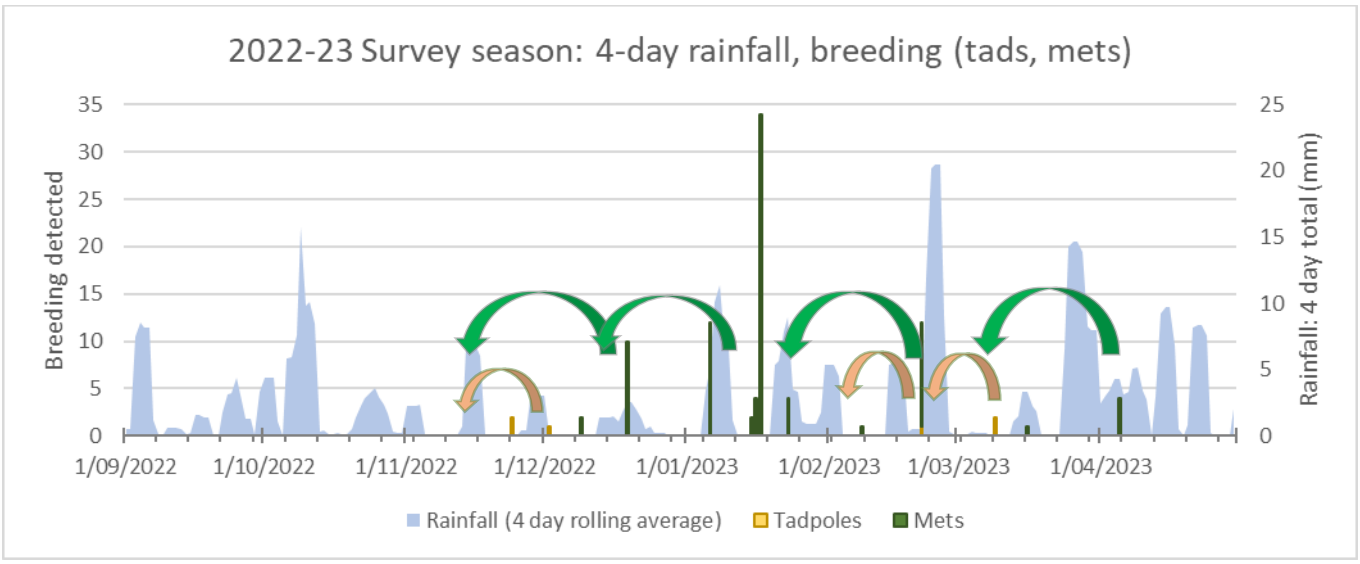
Litoria aurea metamorphs can be reliably identified in the field and usually (but not always) indicate breeding has occurred in the wetland where they were observed. Metamorphs are known to disperse over terrestrial habitat and so do not always indicate breeding at a specific wetland; but if present in large numbers then breeding can be confidently said to have occurred at the site of detection. Metamorphs were detected primarily at wetlands within the Central Zone (6 ponds all of which were BHP ponds) and the Industrial Zone (4 ponds within the Rail loop and Area 2 subregions). The largest numbers of metamorphs were seen in two wetlands in the Central Zone (BHP-1A and BHP-4B). There were no detections of tadpoles or metamorphs in the Northern Zone (Figure 3.6.2). A majority of metamorphs were detected between Round 1 and 2.

Tadpoles and metamorphs were detected primarily in wetlands classified as permanent (i.e., 'nearly permanent' or 'deep permanent' hydroperiod categories detailed in **Section 3.2**), except for BHP-4B, K121 and K111 which are semi-permanent, demonstrating that *L. aurea* are not necessarily limited to ephemeral wetlands for breeding. Tadpoles and metamorphs were only found at sites that did not contain *Gambusia*. A notable result was the detection of tadpoles and metamorphs at the C1 clusters, the first confirmed recording of such instance at any cluster pond.

Juvenile frogs are, of course, mobile and do not provide a reliable indication that breeding as occurred in a specific wetland; however, large numbers of small juveniles (SVL < 30 mm) in a wetland are suggestive of a cohort of frogs that have spawned at that location. Large numbers (≥ 10) of very small juveniles were detected only in three wetlands in the Central Zone, including K23 (which has *Gambusia*), BHP-4A, and BHP-4B (which are *Gambusia* free) (Figure 3.6.3). Most extra small and small juveniles were detected in the second half of the season.

Figure 3.6.3: *L. aurea* breeding (i.e., detection of extra small and small juveniles) during the 2022-23 survey season. 'Xsmall' juveniles have SVL < 35 mm; 'Small' juveniles have 35 < SVL < 40 mm.





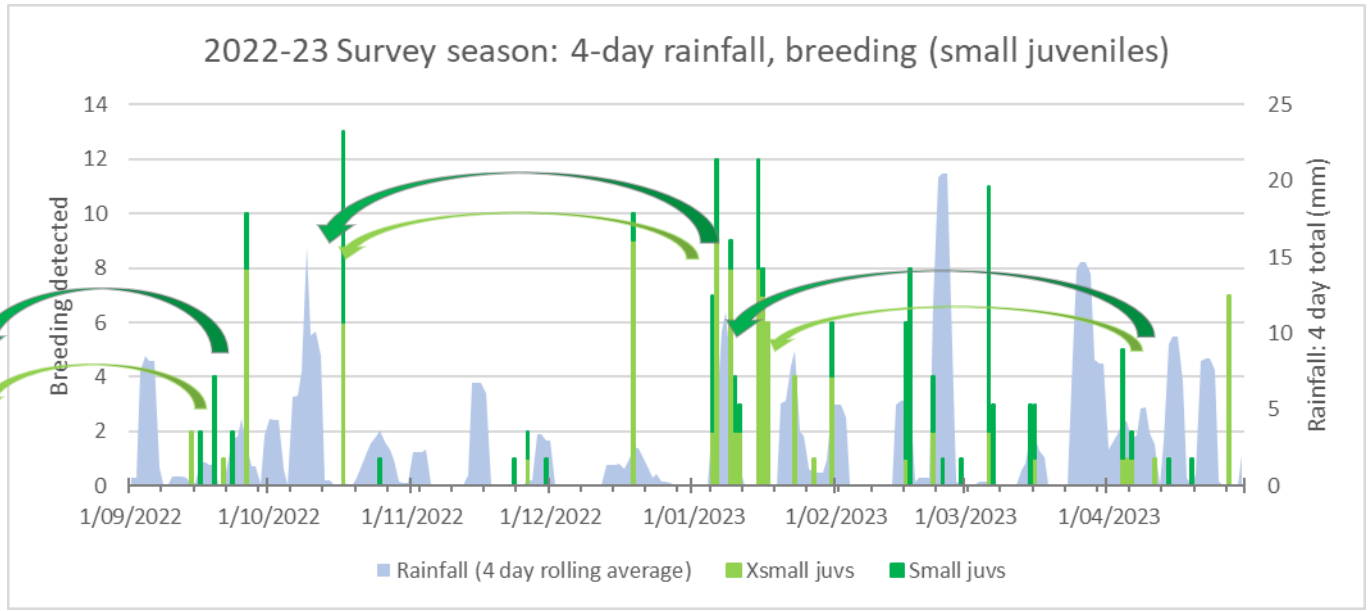


Figure 3.6.4: Survey nights and nights where calling was heard (top), detections of tadpoles and metamorphs (middle), and detections of small juveniles (bottom), correlated with rainfall. Arrows

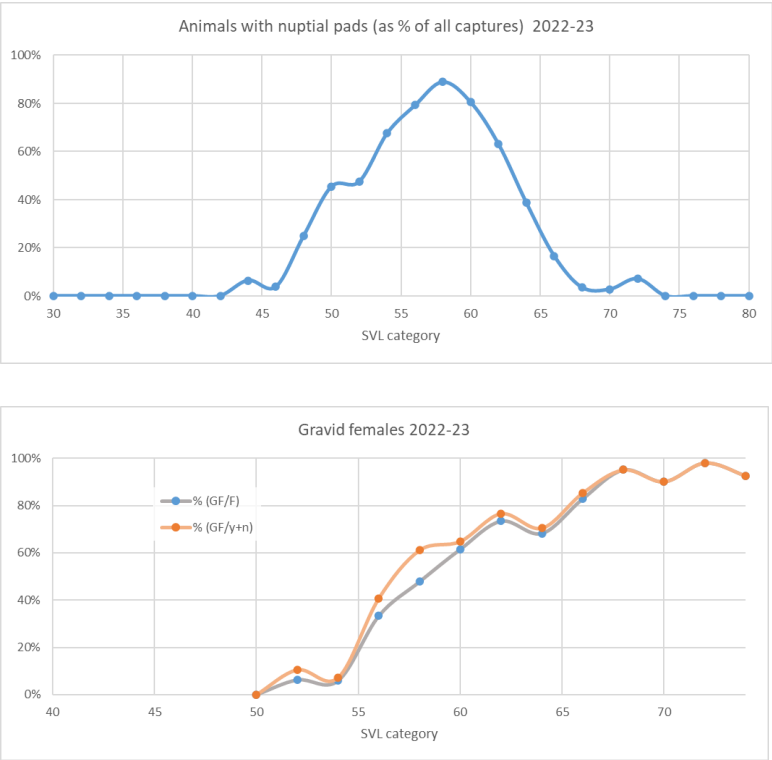
indicate potential laying dates for animals detected as tadpoles (brown arrows), metamorphs (dark green), very small ('Xsmall'; SVL < 35 mm; light green) and small (35 < SVL < 40 mm; dark green in bottom chart) juveniles. Numbered arrows related to potential cohorts outlined in the text.

The presence of *L. aurea* offspring at various stages of development provides information on when spawning most probably occurred during the breeding season. Metamorphosis in *L. aurea* happens within a relatively short time frame and detection of metamorphs generally indicates spawning 4-5 weeks earlier (although this can extend to 6 weeks or more in spring or autumn, when temperatures are lower). The detection of tadpoles provides a less precise indication of spawning time but can still be correlated with rain events. What is interesting to note is that tadpoles and/or metamorphs were detected in every month from November through to April this season (Figure 3.6.4), suggesting that there were multiple, small bouts of breeding across most of the breeding season.

The detection of very small ('Xsmall'; SVL < 35 mm) and small (35 < SVL < 40 mm) juveniles indicate cohorts resulting from periods of spawning in the current and previous breeding seasons. In particular:

1. Juveniles detected in early in the season prior to Round 1 likely spawned in the previous season (2021-22) and overwintered as tadpoles.
2. Juveniles detected in Round 2 in the second half of the season likely spawned in the first half of the season during Spring rainfall.
3. Juveniles detected after Round 2 likely spawned in the middle of the season.

Size at reproductive maturity



The size at which male and female *L. aurea* can be considered reproductively mature is a key part of demographic analysis and has important implications for life history. Based on data from previous seasons, we use 49 mm SVL to indicate the onset of sexual maturity in males, and 58 mm SVL for females (Section 2.6).

Data from the 2022-23 season (Figure 3.6.5) is broadly consistent with these thresholds. Half of all individuals at 50 mm SVL have nuptial pads. Some 40% of females at 56 mm SVL appear to be gravid, suggesting this threshold for adult females may be conservative.

Figure 3.6.6: Proportion of *L. aurea* with visible nuptial pads at different sizes (top), and proportion of females that show signs of gravidity (i.e. visible egg masses in the oviducts). See text and Section 2.6 for discussion.

3.7. Habitat

Table 3.7.1: Broad microhabitat categories of *L. aurea* captures, pooled across the 2022-23 season.

Structures groups	n
tree	69
emergent	1,114
water	324
ground	263
man-made	3
ground vegetation	126
shrub	73

Litoria aurea individuals were predominantly detected on emergent aquatic vegetation (Table 3.7.1); especially the reed plants *Phragmites*, *Juncus* and *Typha* (Table 3.7.2). Individuals were also frequently found in the water, most often floating at the surface in amongst algae, or on the ground, most often on exposed rocks. Individuals were occasionally found in trees such as *Acacia* and *Casuarina*.

Table 3.7.2: Detailed microhabitat of *L. aurea* captures, pooled across the whole 2022-23 season.

	Structure name	n
tree	Casuarina (she-oak)	8
	Acacia (wattle)	19
	branch	1
	dead branch	37
	mangrove	3
	tree (unspecified)	1
emergent	Baumea (twig rush)	23
	Bolboschoenus (river bulrush)	70
	Juncus (spiny rush)	140
	Phragmites (common reed)	166
	Schoenoplectus (softstem bulrush)	58
	Typha (cumbungi bulrush)	657
water	algae	147
	Azolla (water fern)	10
	duckweed	1
	flooded grass	7
	Nymphaea (waterlily)	1
	water	158
ground	bank	35
	gravel	18
	ground	25
	mud	12
	road	45
	rock	123
	sand-bag	5

	Structure name	n
man-made	Fence	1
	post	1
	tub	1
ground vegetation	Bidens (black-jack)	6
	Conyza (fleabane)	1
	Cyperus (umbrella grass)	10
	Foeniculum (fennel)	17
	grass	70
	Hydrocotyle (dollarweed)	6
	Lomandra (mat-rush)	2
	Paspalum (water couch)	1
	Senecio madagasc. (fireweed)	1
	Verbena (purple top)	4
	weed (unspecified)	8
shrub	Chrysanthemoides (bitou)	1
	Cortaderia (pampas)	57
	Lantana	10
	nightshade	1
	Oxalis (woodsorrel)	1
	Rubus (blackberry)	1
	shrub (unspecified)	1
	Westringia (coastal rosemary)	1

3.8. Population Modelling

CMR surveys

Usually, we aim to conduct Capture-Mark-Recapture (CMR) surveys at three focal wetlands each breeding season. The results of these surveys are subsequently analysed by Robust modelling to obtain estimates of *L. aurea* population size at these selected sites. In previous seasons, focal ponds have been K22/23, K29, and K104. In the current season, ponds selected for CMR were K22-23, K100A, and K126 (Table 3.8.1).

Table 3.8.1: Surveys, captures, final recapture rates, and naïve population estimates at the three sites where CMR surveys were conducted. Final recapture is shown for last night of each survey (see text for explanation of calculation). Naïve population estimate is calculated as <total animals marked to date> x (<animals captured on final night>/<recaptured animals on final night>).

Wetland	Primary period dates	Survey Round	n. secondary surveys	*L. aurea* captures (total; unique)	Final recap. rate (%)	Naïve population estimate
K126	24-26 Oct 2022	0.2	3	195; 99	32%	143
K22-23	9-11 Jan 2023	1.1	3	200; 94	61%	98
K100A	7-9 Nov 2022	0.2	3	7; 4	50%	4

A large number of frogs were captured at K126 and K22-23 during CMR surveys, with final recapture rates ranging between 30-60%. In contrast, few animals were captured at K100A (Table 3.8.1), with these few animals recaptured over multiple nights, suggesting that the population at this site was very close to zero. As a result, robust modelling could not be performed on the K100A data. The most parsimonious robust model for K126 and K22-23 had the apparent survival parameter time-independent and no-immigration present, while the capture probability parameter was time-dependent for K126 and time-independent for K22-23 (Table 3.8.2).

Table 3.8.2: Candidate set of models, ranked by ascending ΔAICc, used to estimate apparent survival probability (ϕ), capture (p) /recapture (c) probability, and number of uncaptured individuals in each wetland population (f0) of *L. aurea* at the CMR sites on Kooragang Island. In the best ranked models, net emigration (G") was set to zero. (.) indicates that the value of a parameter was constant, (t) that it varied with time, and (sess) that it varied between primary sessions but was fixed for secondary sessions within each primary session.

Rank	Model	No. of parameters	AIC_c	ΔAIC_c	weight (*w*)
K126					
1	ϕ(.) G'(.) G"=0 p=c(t) f0(sess)	7	-324.715	0.000	0.253
2	ϕ(.) G'(.) G"=0 p=c(.) f0(sess)	5	-324.563	0.151	0.234
3	ϕ(.) G'=G"(.) p=c(t) f0(sess)	8	-322.544	2.171	0.085
K22-23					
1	ϕ(.) G'(.) G"=0 p=c(.) f0(sess)	5	-324.477	0.000	0.330
2	ϕ(.) G'(.) G"=0 p=c(t) f0(sess)	7	-322.348	2.129	0.114
3	ϕ(.) G'=G"(.) p=c(.) f0(sess)	6	-322.308	2.168	0.111

Table 3.8.3: Population estimates for the wetlands surveyed using Capture-Mark-Recapture, analysed by Robust Modelling. Results from a selection of the best models as ranked by AICc scores (c.f. Table 3.8.2) are presented. N-hat values are population estimates for each wetland, listed by each model for each round.

Rank	Model	N-hat (population size)	95% confidence limits	
			Lower	Upper
K126				
1	ϕ(.) G'(.) G"=0 p=c(t) f0(sess)	96.1	94.5	103.2
2	ϕ(.) G'(.) G"=0 p=c(.) f0(sess)	96.3	94.6	103.5
3	ϕ(.) G'=G"(.) p=c(t) f0(sess)	96.1	94.5	103.2
K22-23				
1	ϕ(.) G'(.) G"=0 p=c(.) f0(sess)	124.7	124.7	124.7
2	ϕ(.) G'(.) G"=0 p=c(t) f0(sess)	124.3	112.3	146.8
3	ϕ(.) G'=G"(.) p=c(.) f0(sess)	124.7	112.6	147.5

The top-ranking models for K22-23 and K126 provided consistent estimates, with the range of the 95% confidence levels reasonably narrow for all population estimates. Values from the top three robust models were averaged to calculate population estimates for each site (Table 3.8.3). The average population estimate for K126 was 96 individuals (ranging between 95 and 103 individuals). The estimate obtained for K22-23 much larger, at 125 individuals (ranging between 117 and 140 individuals).

Island population estimates

The first step in producing a whole-island estimate of *L. aurea* numbers is to determine the proportion of frogs inhabiting each wetland that are detected during a Visual Encounter Survey, as only a portion of all animals at a pond will ever be detected in a survey. This is achieved by using the population estimates from the CMR wetlands to calculate a conversion factor (1/<proportion detected in VES>) that can be used to estimate the total number of *L. aurea* at each surveyed wetland, based on the number of frogs detected in each VES. For example, a conversion factor value of 6.4 means that for every one animal of chippable size detected during VES of a particular pond, we expect that an additional 5.4 remained undetected. The conversion factor should only consider 'taggable' frogs detected during the VES, as population estimates are only based on individuals of chippable size (at least 40 mm SVL).

Several conversion factors are considered when estimating population size:

1. **Min-lower**: the minimum value of the <detected/population> ratio, using the lower estimate of population size.
2. **Mean-lower**: the mean value of the <detected/population> ratio, using the lower estimate of population size.
3. **Mean-N-hat**: the mean value of the <detected/population> ration, using the preferred ('N-hat') estimate of population size.
4. **Mean-upper**: the mean value of the <detected/population> ratio, using the upper estimate of population size.
5. **Max-upper**: the maximum value of the <detected/population> ratio, using the upper estimate of population size.

These conversion factor values are then applied to the VES detection data in order to generate estimates of overall population size in each survey round. These min and max values, once applied to the VES data, provide min and max estimated population size boundaries which the true population size likely falls within.

Table 3.8.4: Conversion factors (calculated as <population estimate> / <number detected in VES>) for the two CMR wetlands with sufficient populations for modelling. 'min', 'mean', and 'max' relate to the minimum, mean, and maximum values for that ratio respectively, as a result of different VES counts at each wetland during each round. 'lower', 'N-hat', and 'upper' relate to the range of population estimates calculated for each wetland using robust modelling (see Table 3.3.3). Combining these two dimensions of variation produces a range of estimates for the conversion factor (see text for discussion). The 'pooled' row shows values combined from all CMR surveys; the other rows show the values for each specific CMR wetland. Note that the VES counts used to calculate the factors include *L. aurea* of unknown demography.

	Conversion factor (= 'Detection ratio") (VES_detected -> CMR population_estimate)				
Wetland	min-lower	mean-lower	mean-N-hat	mean-upper	max-upper
Pooled	3.9	5.4	**5.4**	5.6	7.6
K22/23	4.1	6.2	**6.2**	6.2	7.7
K126	4.1	4.6	**4.6**	5.0	5.6

Table 3.8.5: Conversion factors (see Table 3.8.4 for explanation) for previous seasons, compared with the 2022-23 season. Data is for the 'pooled' values of each season (see Table 3.8.4). Note that in 2019-20, 2015-16, and 2014-16 (marked with *) pooled values across other seasons were used to provide the population estimates shown in Figure 3.8.1-3.8.5.

	Conversion factor (VES detected - CMR pop. estimate)				
	min-lower	mean-lower	mean-N-hat	mean-upper	max-upper
2022-23	3.86	5.36	5.40	5.57	7.58
2021-22	4.95	6.97	7.75	9.43	16.87
2020-21	4.57	6.05	7.24	9.19	14.40
*2019-20	*4.39*	*5.87*	*6.93*	*8.89*	*15.76*
2018-19	3.54	4.80	5.79	7.48	13.37
2017-18	4.16	5.78	6.86	8.79	19.58
2016-17	4.74	5.76	6.99	9.55	14.56
*2015-16	*4.39*	*5.87*	*6.93*	*8.89*	*15.76*
*2014-15	*4.39*	*5.87*	*6.93*	*8.89*	*15.76*
Pooled (2016-22)	4.39	5.87	6.93	8.89	15.76

Based on a pooled conversation factor (Table 3.8.5), it is highly likely that the total population across all sites surveyed in Round 1 was between the min-lower and max-upper limits (i.e. between 1441 and 2301 individuals), and probable that the population was between the mean-lower and mean-upper limits (i.e., between 1822 and 1885 individuals), with an estimated population size of approximately 1833 individuals. In Round 2, is highly likely that total population was between 1142 and 1850 individuals, and probable that it was between 1457 and 1508 individuals, with a mean estimate of approximately 1467 individuals (Table 3.8.6).

Table 3.8.6: Estimates of total population size across all surveyed wetlands for each of the main survey rounds in the 2022-23 Season, based on VES counts that include *L. aurea* of unknown demography (i.e. detected but not captured) and not identifiable to age-sex class). Columns show the range of estimates for each round per the categories shown in Tables 3.8.4 and 3.8.5. Rows shown the surveyed wetlands categorised by core/non-core (i.e. regularly surveyed wetlands vs irregularly surveyed), CHEMP vs non-CHEMP wetlands, and Constructed vs non-constructed; the long-term patterns of these categories are shown in Figure 3.8.1 to 3.8.5.

Wetland category	min-lower	mean-lower	mean-N-hat	mean-upper	max-upper	n wetlands
Round 1						
IWS core	982	1262	**1269**	1304	1605	45
IWS core, non CHEMP	839	1081	**1087**	1116	1375	23
IWS core, CHEMP	143	181	**182**	188	230	22
IWS non-core	459	560	**564**	581	696	12
CHEMP	143	181	**182**	188	230	23
non CHEMP	832	1051	**1057**	1084	1320	34
Constructed	711	879	**885**	912	1102	32
Non-Constructed	730	943	**948**	973	1199	25
Total	1441	1822	**1833**	1885	2301	**57**
Round 2						
IWS core	890	1150	**1156**	1186	1462	43
IWS core, non CHEMP	596	777	**781**	800	989	24
IWS core, CHEMP	294	372	**375**	387	473	19
IWS non-core	189	228	**230**	239	287	13
CHEMP	299	377	**380**	392	480	20
non CHEMP	629	809	**813**	834	1025	36
Constructed	491	611	**616**	637	774	28
Non-Constructed	588	767	**771**	788	975	28
Total	1142	1457	**1467**	1508	1850	**56**

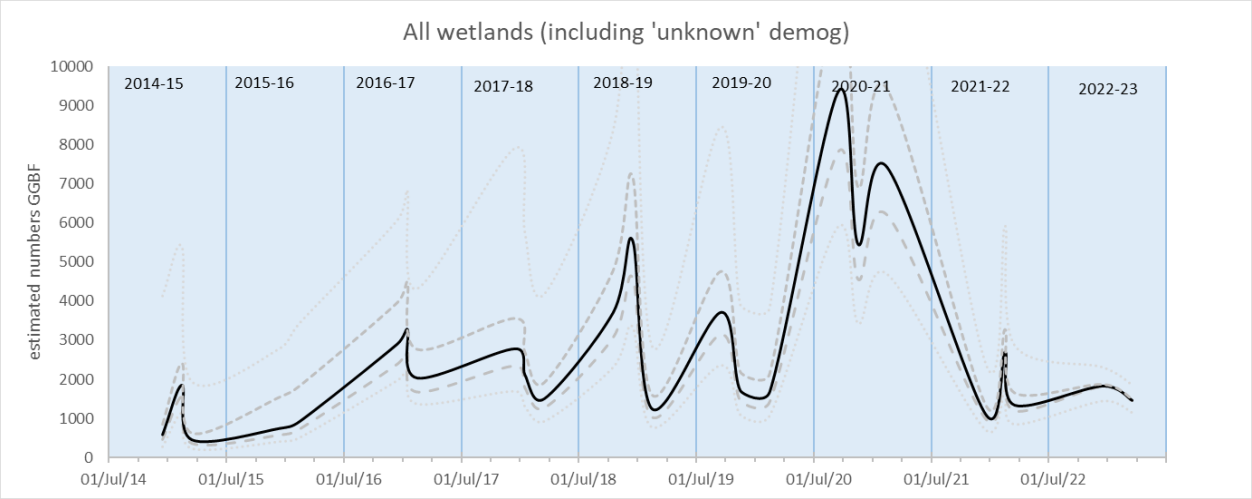


Figure 3.8.1: Population estimates based upon Capture-Mark-Recapture surveys, Robust modelling, and VES surveys during 'main' survey rounds, from 2014 to 2022. The dark line corresponds to the 'mean-N-hat' estimates in Table 3.8.6; dashed and dotted lines are the lower and upper range of estimates. The VES survey counts used to produce the estimates include *L. aurea* detections of unknown age-class.

When comparing yearly estimates across the IWS program, it is apparent that the baseline population on Kooragang Island is approximately 1,000- 2, 500 individuals (> 40 mm SVL) (Figure 3.8.1). The population saw a positive trend from 2016-19, reaching a high in 2020-21 that was the result of a mass breeding event in February-March 2020 leading to an increase in juvenile numbers (an inflation that is not truly reflective of the adult population). The population has since returned to baseline after this 'boom' and has remained relatively stable over the past two seasons.

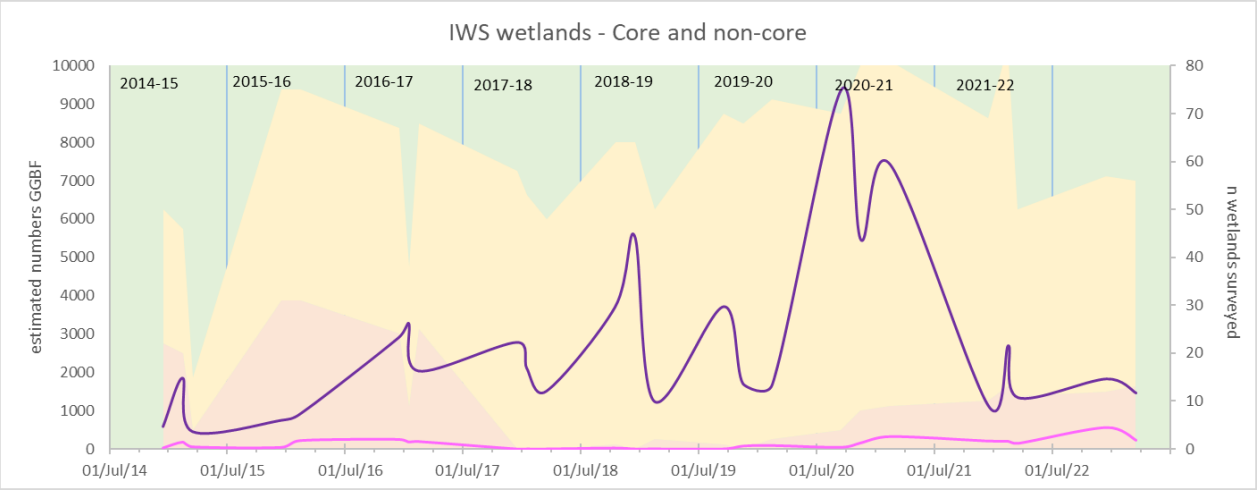


Figure 3.8.2: Population estimates ('mean-N-hat' as per Figure 3.8.1), summarised for 'core' (regularly surveyed – purple line) and 'non-core' (occasionally surveyed – pink line) wetlands. The number of wetlands in each category is shown by the shaded areas; yellow and pink for core and non-core wetlands respectively.

A small portion of the island population occurs in non-core wetland sites that are occasionally surveyed (Figure 3.8.2), suggesting that there are likely additional sites on the island that may be important for the species for occupation and/or breeding. However, our findings indicate that the ponds regularly surveyed as part of the program capture an overwhelming majority of the population.

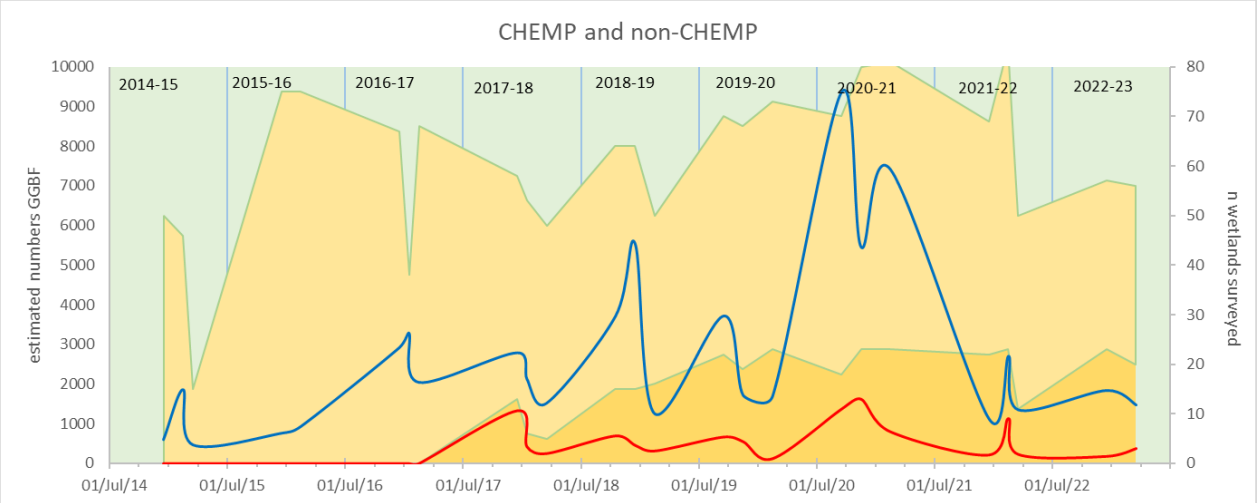


Figure 3.8.3: Population estimates ('mean-N-hat' as per Figure 3.8.1), summarised for 'CHEMP' and 'non-CHEMP' wetlands (red and blue lines respectively). The number of wetlands in each category is shown by the shaded areas; darker brown for CHEMP wetlands and lighter brown for non-CHEMP.

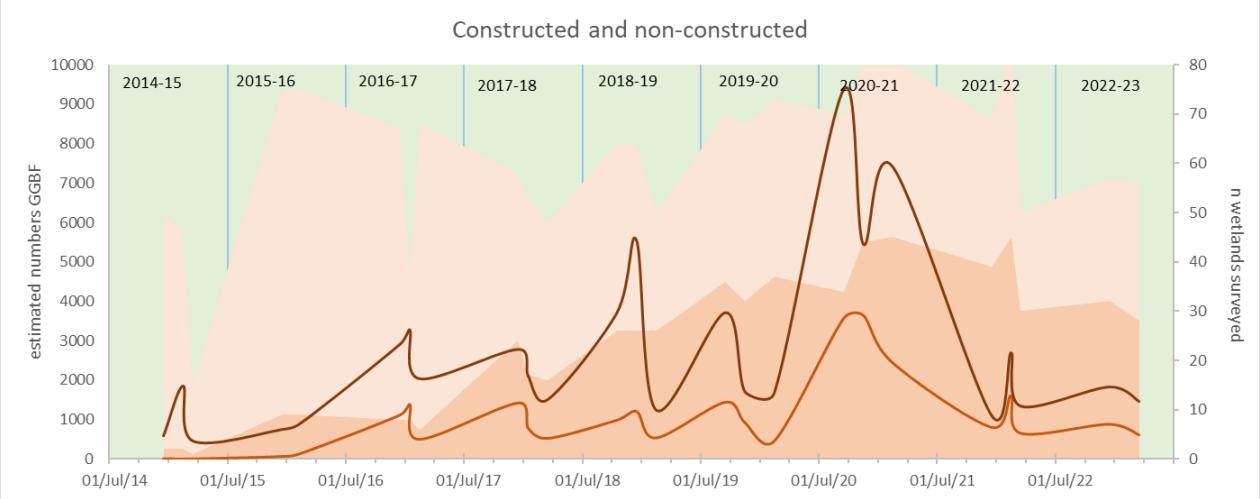


Figure 3.8.4: Population estimates ('mean-N-hat' as per Figure 3.8.1), summarised for 'constructed' and 'non-constructed' wetlands (orange and brown lines respectively). The number of wetlands in each category is shown by the shaded areas; darker pink for constructed wetlands and lighter pink for non-constructed.

A larger portion of the total population occur within the CHEMP wetlands compared to the non-CHEMP wetlands (Figure 3.8.3), which is a trend that has occurred every year of the program. Nearly a half of the population was located at constructed wetlands this season (Figure 3.8.4), similar to findings last season, indicating that these man-made aquatic sites are providing the necessary resources for long-term and consistent *L. aurea* occupation and usage.

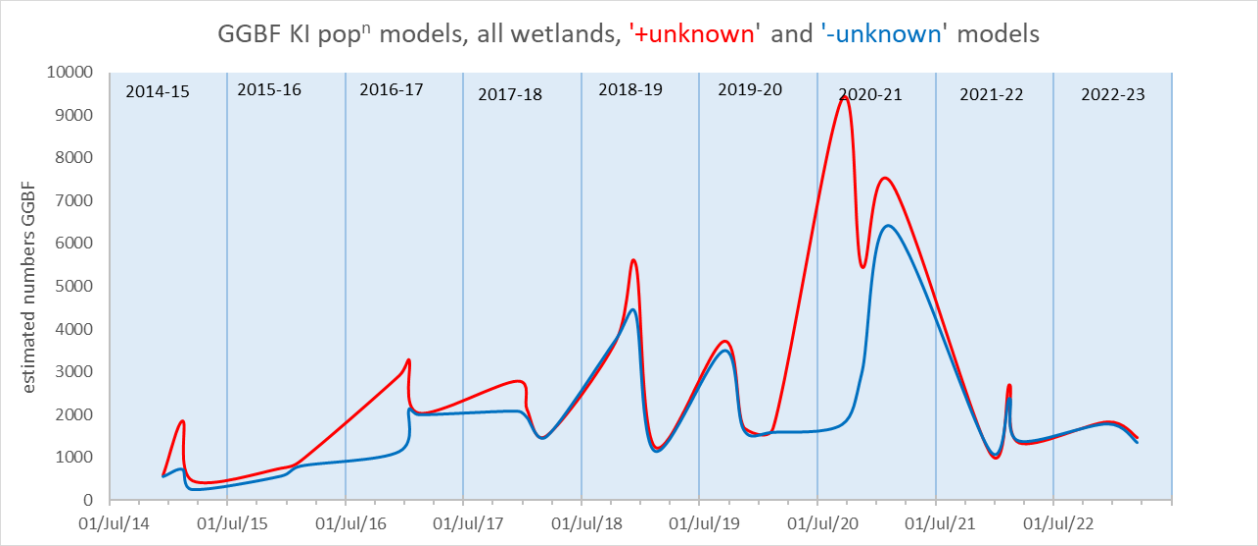


Figure 3.8.5: Population estimates ('mean-N-hat' as per Figure 3.8.1) based on VES data that **includes** *L. aurea* of unknown age-sex class (red line; data as per Figure 3.8.1 and Table 3.8.6), compared with data that **does not include** those unknown *L. aurea* in VES counts (blue line).

There are several assumptions inherent in these population estimates; that the CMR surveyed wetlands are representative of the >80 regularly surveyed wetlands across the island; that the regularly surveyed wetlands contain a significant part of the Kooragang island *L. aurea* population; and that the main survey rounds take place at biologically relevant times. Additional assumptions involve demographic categories used to estimate population size: as explained above, we use counts of animals >40 mm SVL as the basis for the estimates presented here. However, some detections do not allow a reliable estimate or measurement of body size; these 'unknown demography' animals can be included or not included in the population models with equal justification. The data shown in Figures 3.8.1 to 3.8.4 includes those 'unknown' animals; in Figure 3.8.5 the model data that **includes** (red line) and **does not include** (blue line) those animals are shown. In years where large numbers of animals are detected following mass breeding events (e.g. 2016, 2020) there is a notable difference between the resulting estimates (mainly as a result of many juveniles being seen but not captured). However, across the last two seasons the estimates are similar for both models, as most detected *L. aurea* are either captured or positively identified as being <40 mm SVL.

3.9. Multi-year occupancy

To provide a spatio-temporal context for occupancy of Kooragang Island by *L. aurea*, data from 2014-22 (i.e. nine complete seasons) was analysed with respect to zones and their subregions, as outlined in **Section 2.2**:

1. **Zone**: splitting the island into three large-scale regions.
2. **Subregion**: bounded by rail-lines, roads, and creeks, at a scale of up to ~1 km.

The following charts show data from survey counts, broken down by these four criteria. Survey count data is summarised according to:

i. **VES detected** (number of *L. aurea* detected during primary VES surveys)
ii. **Total detected** (number of *L. aurea* detected during all surveys)
iii. **Search sensitivity** (a proxy for density; the number of animals detected in VES divided by search effort)

Raw survey counts are not subject to the various assumptions inherent in estimating populations from robust modelling, and can therefore provide an additional and useful perspective on spatio-temporal trends in occupancy. However, they are a product of both occupancy and search effort; thus, in interpreting the counts to understand occupancy, it is important to take into account search effort. The landscape of Kooragang Island is not constant, and search effort and detectability has changed from year to year as new wetland habitats are created, and some old ones go through vegetative and hydrological changes.

For the data presented here, no single table provides a complete picture of *L. aurea* occupancy. Rather, the data for **VES Detected**, **Total Detected**, and **Search Sensitivity** should be viewed together. Large wetlands may contain large numbers of frogs (high values of **VES Detected** and **Total Detected**) at low or medium densities (lower values of **Search Sensitivity**). Conversely, small wetlands may contain high densities of frogs but with low overall numbers.

The search effort (measured in person.minutes) of VES surveys across the last nine seasons is shown in Table 3.9.1. Search effort has generally been higher each season in the Industrial Zone compared to the remaining zones. This is due to the relatively large number of ponds in this area, which continues to increase as a result of the construction of *L. aurea* habitat as part of remediation works. However, more search effort occurred in the Central Zone compared to the Southern Zone in the current season, attributed to intense surveys conducted for Lynne Matthew's PhD project at the BHP ponds. Similar to previous years, less search effort occurred in the Northern Zone. There have also been some changes in VES search effort, following the reduction in the total number of main survey rounds conducted each season from three to two (to allow for search effort in terrestrial habitats), and so the following tables show data for two rounds – early Summer and early Autumn – each year. Search effort remains relatively consistent and well distributed across the island as a whole (Figure 2.5.2).

VES detections in the Central and Industrial Zones have slightly increased compared to the previous season but remain lower than a high that occurred in 2020-21 (Table 3.9.1). This is likely attributed to the lower number of juvenile detections outside of mass breeding years. Detections in the Northern Zone were much higher than for the previous season and the highest they have been since 2018-19.

Table 3.9.1: Search Effort, number of *L. aurea* detected in VES, and Search Sensitivity for the IWS program since 2014-15, tabulated by island Zone. Data shown is for **2 main rounds** per year. Search Sensitivity is the number of animals detected in VES divided by search effort, and thereby accounts for variation in search effort between locations and rounds.

Search effort	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Zone									
Northern	938	1598	1027	610	2076	761	1171	918	780
Central	1901	3052	2403	1429	1428	2171	3003	1839	3761
Southern	3123	4230	3364	3628	4232	4773	5094	2068	2304
VES Detected	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Zone									
Northern	4	4	0	4	60	25	25	9	29
Central	61	83	52	283	143	89	453	259	267
Southern	308	1115	676	391	1039	323	1177	241	348
Search Sensitivity	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Zone									
Northern	0.00	0.00	0.00	0.01	0.03	0.03	0.02	0.01	0.04
Central	0.03	0.03	0.02	0.20	0.10	0.04	0.15	0.14	0.07
Southern	0.10	0.26	0.20	0.11	0.25	0.07	0.23	0.12	0.15

Similar to previous years, the Industrial Zone had the highest search sensitivity values, more than double that of the Central Zone and nearly four times that of the Northern Zone (Table 3.9.2). In this Zone, search sensitivity values have slightly increased from the previous season for most subregions, including a dramatic increase at KIWEF *K2*. The highest values were obtained for the subregions Deep Pond, Area 2, and KIWEF *K2*. Search Sensitivity appears to have declined in the Central Zone compared to the previous two seasons, showing a negative trend. The sharpest declines have been in the Ramsar Road West and Bellfrog Way West subregions, yet values have increased in the Bellfrog Way SE subregion where they are the highest they've been since the program commenced. In the Northern Zone, search sensitivity is also the highest it's been since the start of the program, although this is primarily only a result of detections in the Millam's Pond subregion.

Table 3.9.2: Search Sensitivity for the various subregions of each Zone (Northern Zone subregions in shades of pink, Central Zone in shades of grey, Southern Zone in orange-yellow-green-blues). Data as for Table 3.9.1, i.e. based on two main survey rounds per year.

Search Sensitivity	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Scott's Point	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.00	0.00
Riverside park	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00
Wet meadow	0.01	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.02
Millam's Pond	0.00	0.00	0.00	0.03	0.05	0.06	0.03	0.02	0.08
Ramsar Road West	0.00	0.04	0.01	0.29	0.13	0.05	0.16	0.17	0.04
Ramsar Road East	0.03	0.01	0.00	0.00	0.00	0.06	0.08	0.04	0.03
Bellfrog Way West	0.02	0.00	0.00	0.01	0.03	0.01	0.33	0.20	0.11
Bellfrog Way NE	0.03	0.01	0.00	0.00	0.00	0.01	0.00	0.07	0.08
Bellfrog Way SE	0.03	0.05	0.06	0.20	0.13	0.00	0.19	0.12	0.26
Deep pond	0.00	0.03	0.22	0.17	0.43	0.08	0.34	0.23	0.26
KIWEF K5 (Area 2)	-	-	-	-	-	-	0.06	0.19	0.22
Northern Ponds	0.12	1.57	0.27	0.16	0.15	0.07	0.12	0.06	0.11
KIWEF K7	0.09	0.01	0.09	0.04	0.03	0.04	0.09	0.03	0.03
Delta Ponds	0.74	0.26	0.11	0.17	0.11	0.03	0.20	0.12	0.15
NCIG rail central & east	0.00	0.02	0.21	0.09	0.20	0.07	0.43	0.14	0.10
Rail loop (K10N)	0.04	0.03	0.54	0.03	0.13	0.09	0.22	0.15	0.14
Rail loop SW (K10S)	0.00	0.00	0.10	0.05	0.33	0.10	0.33	0.14	0.18
NCIG rail south	0.00	0.00	0.14	0.06	0.17	0.03	0.31	0.04	0.03
KIWEF K2	0.04	0.00	0.05	0.08	0.07	0.04	0.18	0.05	0.26
Cormorant Road	0.00	0.00	0.05	-	-	-	-	-	-

In the Northern Zone, there has been an increase in detections since a steady decline from 2018-19 (Table 3.9.3). As with previous years, a majority of detections in this zone have been in the Millam's Pond subregion. There have been few detections in the more northern subregions of this zone, such as Scott's Point and Riverside Park, where zero frogs have been detected in the past two years. In the Central Zone, the Ramsar Road West subregion has continued to have a high number of detections that has remained steady since 2017-18, while much fewer detections continue to occur in Ramsar Road East.

In the current season, there was a decline in detections in Bellfrog Way West from a high in 2021-22, however detections are still high compared to all other years. The Bellfrog Way NE subregion has seen a doubling in detections since the previous season and is the highest since the program began. Similarly, detections in the Bellfrog Way SE subregion have shown a positive trend since a low in 2019-20, and are the highest they've been since 2016-17.

In the Southern Zone, numbers are lower than in previous years such as 2019-20, which is due to the large breeding event recorded in that year that does not truly reflect adult detections. The Area 2 subregion has seen an increase in detections since completion of closure works in 2020-21; the constructed ponds in the region have become key breeding sites for the species in that part of the Industrial Zone. Detections in Deep Pond remain steady since last year but low compared to earlier seasons, likely due to the limited surveying of K105B which cannot be accessed unless during specific times of the year when the trainline shutdowns. There was a relatively high number of detections in

the south-west of the Industrial Zone, particularly at K118 in the KIWEF *K2* subregion. There have been fewer detections this year in the Rail Loop compared to previous seasons, likely due to the reduction in repeat surveys that occurred in 2019 and 2020 during remediation of the Eastern Ponds. However, both Rail loop subregions (*K10N* and *K10S*) had relatively high numbers of total detections and remain key breeding and refuge sites for the species in the South-east of the Southern Zone.

Table 3.9.3: Total numbers of *L. aurea* detected summed for the various subregions of each Zone (see Table 3.9.2), for **all survey rounds** of the IWS dataset.

Subregion	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Scott's Point	0	0	0	3	3	3	6	0	0
Riverside park	0	0	0	0	0	1	3	0	0
Wet meadow	5	3	0	1	8	7	6	0	2
Millam's Pond	0	1	0	7	91	77	20	25	44
Ramsar Road West	1	28	3	405	322	556	593	635	597
Ramsar Road East	12	6	2	0	0	13	25	28	31
Bellfrog Way West	4	2	7	2	5	14	97	521	286
Bellfrog Way NE	12	5	8	0	5	12	1	55	162
Bellfrog Way SE	433	223	463	330	100	76	289	189	433
Deep pond	2	5	99	308	748	808	823	139	188
KIWEF K5 (Area 2)	-	-	-	-	91	3116	20	69	439
Northern Ponds	246	1047	1513	967	464	157	233	76	77
KIWEF K7	76	10	94	26	15	46	100	8	7
Delta Ponds	209	860	725	566	728	135	79	65	61
NCIG rail central & east	0	13	103	99	167	535	363	137	25
Rail loop (K10N)	66	36	387	108	121	888	959	1417	112
Rail loop SW (K10S)	0	0	16	89	326	1117	345	86	124
NCIG rail south	11	2	58	45	81	91	90	24	7
KIWEF K2	2	0	17	91	38	38	128	82	85
Cormorant Road	0	2	6	-	-	-	-	-	-

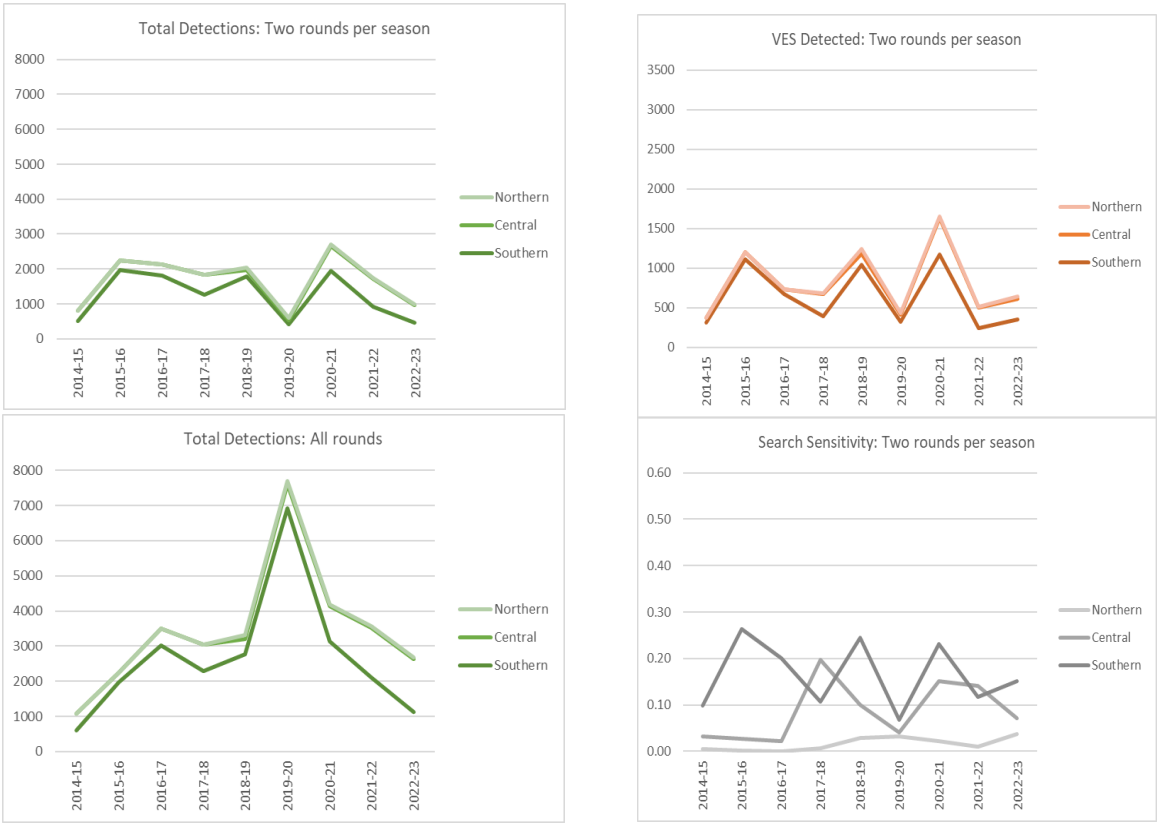


Figure 3.9.1: Left**:** Total detected *L. aurea* across the three Zones from 2014-2015; data shows numbers detected during two main survey rounds each season (above), and across all survey rounds (below). The spike in the lower chart for 2019-20 is a result of the large breeding event at the end of the season, which occurred after the main survey rounds had been completed. Right: VES Detected (top) and Search Sensitivity (below) data for *L. aurea* surveys across the three Zones from 2014-2015. Data shown is as for Table 3.9.1, i.e. for two main survey rounds per season.

Very high numbers of *L. aurea* were detected late in the 2019-20 (see 'Total Detected' charts), resulting in the large peaks of estimated population size in 2020 seen in Figures 3.8.1 to 3.8.5. However, results from the main two survey rounds (early summer and early autumn) do not show this peak; instead, they indicate that population numbers in 2020 were low (recall that 2019-20 was a prolonged dry/drought period). Baseline population numbers have varied between 300 and 1500 *L. aurea* detected in VES, and the 2022-23 numbers lie within this range – although closer to the lower limit. Similarly, data for Search Sensitivity for 2022-23 lies within the range seen in earlier seasons. Overall, the population size is low, but not usually so; but demographic data indicates that the number of adults, especially adult females, is high (Figure 3.4.15).

4. Discussion

Conservation biology of *L. aurea* on Kooragang Island

1. **Population size**: Averaging model estimates from capture-mark-recapture data indicates that between five and seven *L. aurea* individuals with SVL ≥ 40 mm are generally present for every one individual detected during VES. Based on this ratio, and the number of VES detections obtained across wetland sites during island-wide surveys this year, the *L. aurea* population of Kooragang Island is currently standing at approximately 1,500 - 2,000 individuals. This falls within the baseline population size estimated for the island over the past nine years, which is 1,000-2,500, and has remained relatively stable for the past two seasons after a 'boom' year in 2020-21 where a population spike resulted from a mass breeding event. This season, nearly half of the population was located at constructed wetlands, which is similar to last year, indicating that these man-made aquatic sites are providing the necessary resources for long term and consistent *L. aurea* occupation and usage.

2. **Demography**
   a. Age/sex class structure: For those frogs where age/sex class was identified, less than a third of individuals detected in each round were metamorphs or juveniles. Of the individual adults captured and identified, approximately two-thirds were male. These proportions are broadly consistent with the pattern from recent seasons.

      Two distinct juvenile cohorts were identified in the demographic data this season. One cohort was detected early in the season (Round 0.1), likely reflecting offspring that spawned in the previous season. The second cohort was initially detected in Round 1.1, likely spawned at the start of the current season. It is also possible that a third cohort was detected late in the season in Round 2.2, suggesting additional breeding in the second half of the season. However, based on tadpole and metamorph data, it is likely that there were many small bouts of breeding across most of the season.

   b. Recruitment: only 6 wetlands within the Industrial Zone held tadpoles and/or metamorphs at some point during the 2022-23 breeding season. These were all HDC constructer ponds, including at Area 2 in the northern section, and K10N and K10S in the southern section. Interestingly, breeding was also detected at a cluster pond (C1) despite being considered only as permanent refuge for adults. Breeding events were also recorded at 6 wetlands in the Central Zone, all of which were BHP-CHEMP wetlands. This finding strongly highlights the importance of constructed, *Gambusia* free ponds on breeding for the island population.

      Tadpoles and metamorphs were detected primarily in wetlands classified as permanent (i.e., 'nearly permanent' or 'deep permanent' hydroperiod categories detailed in Section 3.2), except for BHP-4B, K121 and K111 which are semi-permanent, demonstrating that *L. aurea* are not necessarily limited to ephemeral wetlands for breeding. The lack of breeding at temporary sites may be due to the dry conditions that breeding adults were exposed to throughout portions of the season.

   c. Reproductively mature females: Using 58 mm as the threshold for the onset of female reproductive maturity means about one third of adult individuals on Kooragang Island are female; 392 unique PIT tagged females were detected across the 2022-23 season.

This number is similar to the corresponding data from previous seasons and indicates that the effective population size of *L. aurea* on Kooragang Island is sufficient for at least the immediate persistence of the population. Note that the low percentage of recapture events between years suggest that few individuals are making it to multiple breeding periods. This is cause for concern for two reasons: i) females generally take longer to reach sexual maturity than males, and ii) just two consecutive years of poor recruitment is predicted to have a strong negative effect on population size. However, the proportion of adult females in the population is currently strong.

3. Survey rounds and weather

Round 0.1 (13th to 30th September). This was a smaller, targeted survey of 22 ponds within the Central and Industrial Zones. Large numbers of adults (>20) were detected at K23, K126, and K104. Few adults were detected at the BHP ponds, although calling was detected at BHP-3A. Calling was also detected along Bellfrog Way at K63, K20A, and BHP-14B, as well as in the Industrial Zone at Area 2, the Rail-loop, and K104. A small number of juveniles (<5) were recorded across 7 ponds, while a large number (>10) was detected at K23. Presumably, these individuals were spawned during rain in autumn and overwintered as tadpoles, given that no tadpoles or metamorphs were detected in this round. Only a small amount of rainfall was recorded during this period (37 mm), occurring over three rainfall events.

Round 0.2 (1st October to 20th November). This was a smaller, targeted survey of 23 ponds within the Central and Industrial Zones. Large numbers of adults (>20) were detected at K23 in the Central Zone, as well as K121, K124 and K126, constructed ponds in the Industrial Zone. Few adults were detected at the BHP ponds, although calling was detected at three ponds. Calling was detected at six sites along Bellfrog Way in the Central Zone, as well as in Area 2, the Rail-loop, K29, and Bigpond in the Industrial Zone. A small number of juveniles (<5) were recorded across 4 ponds, while a large number (>10) were detected at K23 and K126. Presumably, these individuals were spawned during rain in autumn and overwintered as tadpoles, given that no tadpoles or metamorphs were detected in this round. There were three discrete periods of high rainfall of more than 20 mm during this round (total 127 mm).

Round 1 (21st November to 12th December). This was the first main round this season, with surveys conducted across all three island zones (78 wetland sites). Large numbers of adults (>20) were detected near Bigpond (K127), the Rail-loop (K123), and at the BHP ponds (BHP-3A). Calling was detected at four BHP ponds, 3 ponds along Bellfrog Way, and 11 ponds across the Industrial Zone. Juveniles were detected in low numbers (<10) across 14 ponds. Metamorphs were detected in Area 2 at K126, and tadpoles at K111 in the Rail-loop and K127 near Big-Pond, suggesting breeding occurred in the Industrial Zone earlier in the season. This round occurred during a period of little rainfall (total 14 mm), primarily over one rainfall event at the end of November.

Round 1.1 (13th December to 15th January). This was a small round that targeted 12 wetland sites within the Central Zone, primarily the BHP ponds, as well as K22-23 and BHP-14B along Bellfrog Way. Large numbers of adults (>20) were detected at K23, K22, and BHP-14B. Few adults were detected at the BHP ponds, although calling was detected at 3 sites here. Further calling was also detected at BHP-14B. Juveniles were detected at 11 of the 12 sites, including in large numbers (>10) along Bellfrog Way at K23, and at two BHP ponds (BHP-4A and BHP-4B). Metamorphs were only detected at BHP-4B, indicating breeding occurred earlier in the season.

This round occurred during a period of moderate rainfall (total 64 mm), primarily confined to one rain rainfall event in early January.

Round 1.2 (16 January to 14 February). This was a small, targeted round where 19 wetlands were surveyed in the Central and Industrial Zones. Large numbers of adults (>20) were detected at two sites (BHP-14B and K123). Juveniles were detected in small numbers (<5) at 9 ponds, primarily within the BHP site, while large numbers (>10) were detected at BHP-1A. Calling was only detected at two sites (BHP14B and K124). Metamorphs were detected at 6 sites, including at the BHP ponds in the Central Zone and in the Industrial Zone at the Area 2 pond K124, suggesting breeding activity in the middle of the season. This round occurred during a period of relatively high rainfall (total 83 mm), including three main rainfall events over 20 mm.

Round 2 (15th February to 26th March). This was the second and final main round of the season, with surveys conducted across all three island zones (77 wetland sites). Large numbers of adults (>20) were only detected at K9A/B within the Central Zone. The most northern that calling was detected was at K58B. Calling was also detected at the K9 ponds in the Central Zone, and in Area 2 of the Industrial Zone. Juveniles were detected at 25 sites, with a large number (>10) detected at BHP-1B. Tadpoles were detected at C1 and K121, while metamorphs were detected at two sites (C1 and BHP-2A), suggesting breeding took place in the middle of the season in the Central and Industrial Zones. This round occurred during a period of relatively high rainfall (total 160 mm), although rainfall was primarily focused over a single rain event at the end of February and again at the end of the survey round.

Round 2.1 (27th March to 26th April). This was a large round, with 78 wetland sites surveyed across all three Island zones. Only small numbers of adults were detected in this round, with the only large population (>20) detected at K23. No calling was detected this round, suggesting breeding activity had concluded for the season. Juveniles were detected in low numbers at 12 sites, including within the BHP site and along Bellfrog Way in the Central Zone, as well as Big Pond and Area 2 in the Industrial Zone. Juveniles were detected in the recently constructed K108 site, which suggests the site has already started to be colonised after being excluded for several years by fencing. Metamorphs were only detected in the Industrial Zone at K121, which likely spawned earlier in the year (Jauary-Febuary). This round occurred over a period of high rainfall (total 142 mm) distributed over five rainfall events.

Round 2.2 (27th April to 31st May). This was a small round that targeted ponds within the Rail-loop of the Industrial Zone. Only small numbers of adults and juveniles were detected (< 6), and no calling or metamorphs were detected. This round occurred over a period of moderate rainfall (total 95 mm) restricted to two rainfall events in April.

4. Longitudinal data

a. Persistence: As with previous seasons, persistence is low with most marked animals never recaptured. Of those that are, most are recaptured within six months of first capture, and only 10% are recaptured more than 12 months from first capture.

b. Movement: As with previous seasons, most detected movements were in the Southern (Industrial) Zone, although the largest number of movements along Bellfrog Way were detected in the 2022-23 season. A large number of movements were also detected in the Southern Industrial Zone, exceeding (for the first time) movements detected in the Northern Industrial Zone. Movements involving K22-23 provided connectivity between the Central and Southern Zone, further highlighting the importance of these wetlands.

Connectivity between the Northern and Central Zones remains poor, with no such movements detected in this season.

In previous seasons, the construction of wetlands has led to increased detections of movement in the surrounding area in the years following, emphasising the potential of constructed wetlands to improve habitat connectivity for *L. aurea*. Examples include the BHP-CHEMP habitats and the capping at *K10 North* and *K10 South*. In this season, a large number of movements involved the wetlands within and surrounding Area 2, indicating that the completion of that capping work two seasons prior is also having a positive effect on connectivity through the middle part of the Southern Zone.

A large number of movements from K100A to other wetlands were detected this season, in contrast to the low number of *L. aurea* detected at K100A in 2022-23. This wetland is understood to be an important 'refuge' habitat and in previous seasons has displayed high levels of occupancy. Whether the pattern of movement away from it is related to climatic conditions (*L. aurea* are expected to disperse away from refuge habitats during suitable conditions), an improved mosaic of habitats across the Southern Industrial Region, or recently completed capping works at the Eastern Ponds is uncertain.

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5. Landscape use

a. Distribution: Similar to previous years, the Industrial Zone had the highest search sensitivity values, more than double that of the Central Zone and nearly four times that of the Northern Zone. In this zone, search sensitivity values have slightly increased from the previous season for most subregions, including a dramatic increase at KIWEF K2. The highest values were obtained for the subregions Deep Pond, Area 2 and KIWEF K2. There have been fewer detections this year in the Rail Loop compared to previous seasons, likely due to the reduction in repeat surveys that occurred in 2019 and 2020 during remediation of the Eastern Ponds. However, both Rail loop subregions had relatively high numbers of total detections and remain key breeding and refuge sites for the species in the South-east of the Southern Zone.

Search Sensitivity appears to have declined in the Central Zone compared to the previous two seasons, showing a negative trend. The sharpest declines have been in the Ramsar Road West and Bellfrog Way West subregions, yet values have increased in the Bellfrog Way SE subregion where they are the highest they've been since the program commenced. Ponds with large numbers of *L. aurea* detected included K23 and BHP-14B.

Both densities and absolute numbers remain comparatively low in the Northern Zone. However, they have increased compared to previous seasons before 2018-19, likely due to the construction of the NCIG-CHEMP wetlands. Numbers in the Milliam's Pond subregion are reasonably high and this appears to be a consistent signal across recent seasons. The NCIG-CHEMP habitats at Stage 4, 5, and 7 have been primarily responsible for this increase. While it is evident a population persists in this zone, it is small and may become extinct without further habitat changes to improve both occupancy and breeding.

b. Landscape factors affecting distribution, abundance, and recruitment:

***Gambusia*:** breeding only occurred in wetlands where *Gambusia* was absent. In previous seasons, breeding has occurred at sites where the fish is present, albeit not at high densities. Currently, it is unknown to what degree breeding adults are able to perceive the presence of the fish and avoid potential oviposition sites where they are present. The fact that most breeding occurs away from these sites would be indicative of this capacity. The presence of breeding at some sites where the fish is present may suggest that successful breeding and then offspring development can occur in the presence of the fish, although likely dependent on fish density. This is an important finding, as management strategies to remove the fish (which may not be feasible for large waterbodies and expensive) may not be needed. Instead, strategies that maintain densities at low levels could be equally effective. In any case, the fact that adults are avoiding fish-present sites is an issue as it means these potentially optimal breeding sites are unusable, thereby disrupting the effectiveness of habitat mosaics.

Gambusia is currently present at 44 ponds, compared with 43 sites in 2021, 7 sites in 2020, 13 sites in 2019, 16 sites in 2018 and 24 in 2017. This reverse in trend since 2020 is likely due to the limited amount of pond drying that occurred during the winter period and throughout the breeding season, given high amounts of rainfall. However, *Gambusia* did disappear from 15 ponds in the current season, likely the result of their ephemerality and drying during periods of low rainfall. This is a clear benefit of dry conditions, on the caveat that subsequent rainfall at some point replenishes water levels for breeding to occur. Strategies to manage *Gambusia* on the island should take advantage of this situation, ensuring that the fish does not re-invade sites where they are now absent.

Specific management issues relevant to research partners

6. **Habitat corridor mitigation strategy**: Occupancy and connectivity across the southern part of the Industrial Zone has been as high or higher than that in the Northern Zone for some time now (Figure 3.5.3, Table 4.6.1). This strategy can be considered successful.

Table 4.6.1: Season sensitivity across the different regions of Kooragang island from 2014-15 to 2022-23. Note that search sensitivity across the southern part of the Industrial Zone has equalled or exceeded the levels in the northern part across the last four seasons.

Region	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Hunter North River	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.00	0.00
School House	0.01	0.00	0.00	0.01	0.04	0.04	0.02	0.02	0.06
Cobbans Creek	0.03	0.03	0.00	0.27	0.12	0.05	0.15	0.15	0.04
Bellfrog Way	0.03	0.03	0.03	0.08	0.07	0.01	0.15	0.13	0.11
Industrial Zone North	0.22	0.59	0.18	0.15	0.28	0.06	0.18	0.12	0.15
Industrial Zone South	0.01	0.01	0.23	0.06	0.21	0.07	0.28	0.12	0.15

7. **Rail infrastructure mitigation strategy**: As with previous seasons, detections of movements across rail infrastructure (Figure 3.5.1, 3.5.2) and high abundance at wetlands enclosed by that infrastructure (Figure 3.3.1, 3.3.2, Table 3.9.2) indicates that rail infrastructure likely has little if any affect upon *L. aurea* subpopulations.

8. **Constructed wetland strategy**: Over the last decade, there have been several phases of artificial wetland construction across the island:
   i. The 'cluster ponds' installed by PWCS; in both the northern and southern regions of the Industrial Zone.
   ii. The HDC wetlands constructed as part of closure works in the southern region of the Industrial Zone,
   iii. The NCIG CHEMP wetlands in the Northern Zone of the island, and
   iv. The BHP CHEMP wetlands in the Central Zone of the island.

   Each of these phases are now occupied by *L. aurea* at some level. Altogether, these constructed wetlands appear to support nearly half of the island's *L. aurea* population (Figure 3.8.4).

Table 4.8.1: Summary of *L. aurea* occupancy and breeding, *Gambusia* infestation, and salinity levels for the various types of constructed wetland on Kooragang Island. See text for discussion.

		L. aurea detections			Breeding indicators					Gambusia		Salinity
Wetland type	Search Effort	VES	Total	Search Sens	Calling	Tadpoles	Mets	Xsmall juvs	Small juvs	**absent**	present	ppt
"Natural"	3236	311	899	0.10	14	0	0	5	5	31	21	3.2
Cluster pond	113	15	16	0.13	0	1	1	0	0	5	0	0.3
NCIG Trial pond	29	2	2	0.07	0	0	0	0	0	1	2	0.8
NCIG CHEMP	1069	29	32	0.03	1	0	0	0	0	19	18	0.5
NCIG operational pond	0	0	0	-	0	0	0	0	0	0	0	
HCCDC sedimentation pond	1666	303	720	0.18	8	3	3	4	6	13	0	0.2
BHP CHEMP	6313	299	781	0.05	5	4	6	9	9	9	2	1.5
Opportunistic Pit	428	77	100	0.18	3	0	0	0	2	3	2	0.4
Terrestrial	1129	103	130	0.09	0	0	0	1	1	0	0	

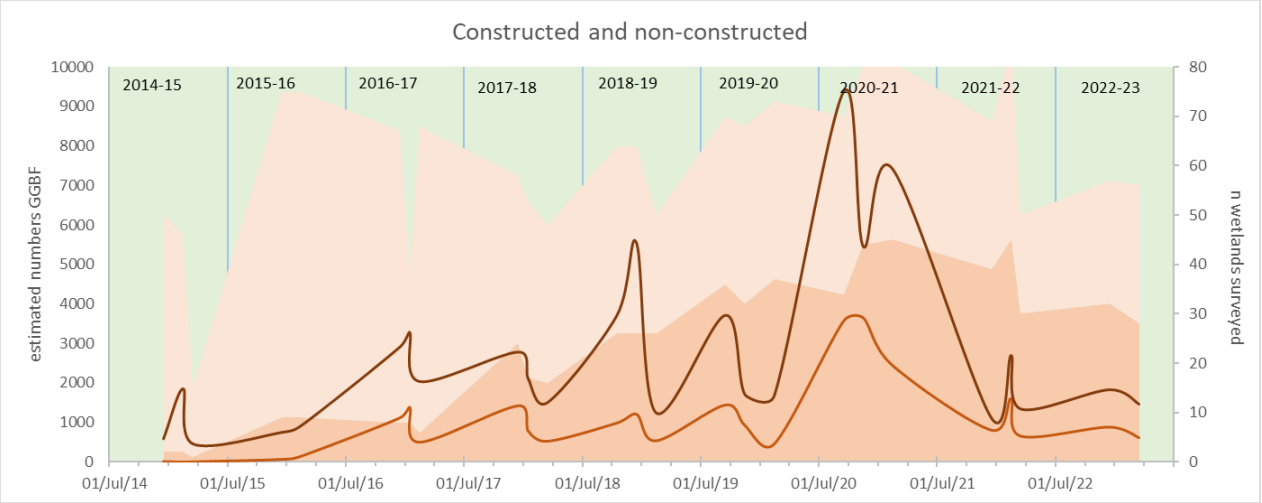

Figure 3.8.4: Population estimates ('mean-N-hat' as per Figure 3.8.1), summarised for 'constructed' and 'non-constructed' wetlands (orange and brown lines respectively). The number of wetlands in each category is shown by the shaded areas; darker pink for constructed wetlands and lighter pink for non-constructed.

Cluster ponds – following the fires in January 2019 that caused extensive damage to the C1 cluster ponds and the surrounding area, these ponds were repaired through the addition of additional tanks in May 2020. The additional tanks now have good occupancy and even contained *L. aurea* tadpoles and metamorphs in late summer. Conversely, the number of *L. aurea* detected at the C2 cluster ponds has been decreasing in recent years. Occupancy at C3, C4 and C5 were also low. The reasons for such low occupancy are not clear but might relate to increased availability of habitat in nearby wetlands. Cluster ponds may play an important role in an 'early succession' phase and during dry conditions, and be less important at other times; the occurrence of confirmed breeding at C1 is important. Additional sets of cluster ponds will be constructed over coming years and monitoring of these will be important.

HCCDC 'capped' wetlands – These now total 14 wetlands (K111-114, K117-118, K121-123, K124-128) and continue to be occupied by *L. aurea*. The recent addition of wetlands across Area 2 (K124-126) has evidently improved occupancy and connectivity across the central part of the Southern Zone. The detection of tadpoles, metamorphs and/or juveniles at K124 and K126 indicates that this wetland design allows them to become breeding sites for *L. aurea* within one or two seasons, consistent with previous finding at K111-114, K117-118, and K121-123. Overall, the HDC wetlands continue to underlie the increased abundance of adult *L. aurea,* extent of breeding habitat, and wetland connectivity in the southern region of the Industrial Zone. Their success supports the findings of previous studies on bell frogs (e.g. Heard et al., 2018) that show the addition of new, well-designed constructed wetlands is more effective at increasing survival compared to attempts to improve existing habitat.

NCIG CHEMP - Abundance at the NCIG CHEMP wetlands has historically been low, and despite an increase from 2017 to 2020, numbers in the most recent seasons remain low (Table 3.9.3), with occupancy mainly within the Millam's Pond subregion (Stages 4, 5, & 7) and no *L. aurea* detected in the Scott's Point or Riverside subregions (Stages 1, 2, 3, 8). Nonetheless, *L. aurea* do remain present in the Northern Zone and this is largely due to occupancy of the NCIG-CHEMP wetlands. The Northern Zone subpopulation remains a concern.

BHP CHEMP – Occupancy at these wetlands has been high for six seasons now and remains strong. Most of these wetlands are in the Ramsar Rd West subregion and have been well occupied over the

IWS program (Table 3.9.3). In the last three seasons, BHP-14B (located in the Bellfrog Way subregion) has shown strong levels of occupancy and in the 2022-23 had the highest occupancy of any of the BHP-CHEMP wetlands. Breeding activity also occurred across many of these ponds

Table 3.9.3: Total numbers of *L. aurea* detected summed for the various subregions of each Zone (see Table 3.9.2), for **all survey rounds** of the IWS dataset.

Subregion	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Scott's Point	0	0	0	3	3	3	6	0	0
Riverside park	0	0	0	0	0	1	3	0	0
Wet meadow	5	3	0	1	8	7	6	0	2
Millam's Pond	0	1	0	7	91	77	20	25	44
Ramsar Road West	1	28	3	405	322	556	593	635	597
Ramsar Road East	12	6	2	0	0	13	25	28	31
Bellfrog Way West	4	2	7	2	5	14	97	521	286
Bellfrog Way NE	12	5	8	0	5	12	1	55	162
Bellfrog Way SE	433	223	463	330	100	76	289	189	433
Deep pond	2	5	99	308	748	808	823	139	188
KIWEF K5 (Area 2)	-	-	-	-	91	3116	20	69	439
Northern Ponds	246	1047	1513	967	464	157	233	76	77
KIWEF K7	76	10	94	26	15	46	100	8	7
Delta Ponds	209	860	725	566	728	135	79	65	61
NCIG rail central & east	0	13	103	99	167	535	363	137	25
Rail loop (K10N)	66	36	387	108	121	888	959	1417	112
Rail loop SW (K10S)	0	0	16	89	326	1117	345	86	124
NCIG rail south	11	2	58	45	81	91	90	24	7
KIWEF K2	2	0	17	91	38	38	128	82	85
Cormorant Road	0	2	6	-	-	-	-	-	-

A notable feature of the various constructed wetlands is their low occupancy by *Gambusia* – with the exception of the NCIG CHEMP ponds (Table 4.8.1). However, salinity levels are lower than for the 'natural' preexisting wetlands (with the exception of the BHP CHEMP); some interaction with chytrid infection loads can be expected from this.

Closing Statement

Litoria aurea was once both a common species and widespread in its distribution in NSW. This suggests an historical ability to occupy wide ranging habitats with frequent seasonal breeding or large breeding events. The seasonal surveys conducted across Kooragang Island over the last decade are testament to this ecology and biology, with individuals detected in almost all wetlands at one time or another provided they contain water, irrespective of the presence of the predatory *Gambusia* fish. The coastal climatic influences on Kooragang Island lead to dynamic environmental conditions and *L. aurea* matches their movement and breeding in response to a complex relationship between seasonal rainfall patterns, wetland physiognomy and *Gambusia* density. The mosaic of natural and created wetlands across Kooragang Island is likely playing a significant role in securing the persistence of this population in the presence of both invasive predators and disease, as well as buffering the impacts of shifting climate patterns such as increased frequency of extended dry periods by ensuring permanent wetlands exist as refuge sites.

The population at Kooragang Island remains highly significant for the species overall, and although abundance is lower than in some recent years, the underlying demographics indicate the population is healthy. *Litoria aurea* displays many of the features of a 'boom and bust' amphibian; the present situation is perhaps better described as a 'lull' between 'boom' events, rather than a 'bust'. With a number of recent wet seasons, the spread of *Gambusia* across the island is relatively high, and chytrid load is likely to also be high – each of these are understood to reduce the population numbers of *L. aurea*. As drier seasons are expected, the response of the population is expected to be generally positive.

Active management of the population is primarily though the management of habitat, and the addition of constructed wetlands across the island has largely been effective in maintaining and strengthening abundance and distribution, particularly in the Central and Southern Zones. Immediate challenges for managers include the use of constructed wetlands to improve occupancy in the Northern Zone, and maintaining the existing habitat mosaics in the Central and Southern Zones. With the expected onset of drier conditions across Eastern Australia in 2023-24, managers should identify the challenges and opportunities that come with these; primarily, the need for refuge aquatic habitats in each of the habitat mosaics as the system dries out, and the opportunity to eliminate Gambusia from key wetlands as water volumes decrease.

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(* indicates previous reports for the island-wide monitoring programme)

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Appendix D – KIWEF Datalogger Download Monitoring – March 2023 (Robert Carr & Associates, April 2023)

RCA ref 11766f-402/0
Client ref HDC291

9 May 2023

Hunter and Central Coast Development Corporation
Level 5, 26 Honeysuckle Drive
NEWCASTLE NSW 2300

Attention: Grant Moylan
CC: Mike Bardsley

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Engineering Geology
Environmental Engineering
Hydrogeology
Construction Materials Testing
Environmental Monitoring
Noise & Vibration
Occupational Hygiene

KIWEF DATALOGGER DOWNLOAD MONITORING
FACTUAL REPORT – ROUND 13 (JANUARY 2023)

RCA Australia (RCA) has been engaged by Hunter and Central Coast Development Corporation (HCCDC) to undertake Datalogger Monitoring at Kooragang Island Waste Emplacement Facility (KIWEF), Newcastle NSW.

Dataloggers were collected and downloaded by RCA personnel on 25th January 2023, 24th February 2023 and 17th March 2023 from locations shown on **Drawing 1**, **Attachment A**. It is noted that this was later than scheduled due to inclement weather and organising site access.

A total of 103mm of rain had been recorded at the Newcastle Nobby's BOM station during the quarter prior to sampling (25th October 2022 to 24th January 2023).

All twelve (12) wells were successfully accessed at this round. Nine (9) loggers including the barologger (SWDP-103) were collected, and loggers were absent in four (4) wells.

Data were successfully downloaded from the barologger and four (4) out of the eight (8) loggers which were collected from Easement Pond South, SW K7, SW Pond 11 and SW K7B, respectively. Among them, data from Easement Pond South logger, SW K7 and SW K7B were only available between 9th June 2022 to 4th November 2022.

A summary of relevant information, including well and water physical characteristics, data logger condition and programming, and any other relevant observations were recorded by RCA during the monitoring round are summarised in **Attachment B**.

Graphical charts of the barometric corrected water level (mAHD), electrical conductivity (EC) data, rainfall (BOM data for Nobbys Head) and EC chytrid protection threshold levels (as advised by HCCDC) were produced by RCA and are presented in **Attachment C**.

A summary of EC chytrid protection threshold levels (as advised by HCCDC) are detailed in **Table 1**.

Table 1 *Salinity Thresholds (as advised by HCCDC)*

No Chytrid Protection	Chytrid Protection Threshold[1]	GGBF Tadpole Health Threshold[2]	GGBF Adult Health Threshold[3]
0-1,650 µS/cm	1,650 µS/cm	2,900 µS/cm	4,100 µS/cm
1. EC levels below the Threshold present an increased risk of mortality resulting from Chytrid Fungus. 2. EC levels above the Threshold indicate conditions unsuitable for GGBF tadpole survival. 3. EC levels above the Threshold indicate conditions unsuitable for GGBF adult habitat.			

A copy of all electronic data files including Solinst XLE program files, Microsoft Excel CSV data files, barometric corrected data files, and Microsoft Excel Worksheets showing graphs have been supplied to HCCDC electronically.

Yours faithfully
RCA AUSTRALIA

Kenny Yan
Environmental Scientist

Attachment A

Drawing

Railway Pond
SW Pond 11
Railway
Deep Pond A
SW K7
SW K7 B
Deep Pond B
SWDP4
SWSMEC-K2
K114
Easement Pond South
SWDP103
B-021
Cormorant Road
Hunter River

Locality Plan
N.T.S.

LEGEND

Approximate data logger unit location

Aerial image taken from Nearmap, 15 December 2021
(used in accordance with commercial licence)

0 100 200 300 400
metres

N

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DATA LOGGERS
KOORAGANG ISLAND WASTE EMPLACEMENT FACILITY

CLIENT	Hunter & Central Coast Development Corporation			RCA Ref	11766f-402/0
DRAWN BY	KY	SCALE	1 : 8000 (A3)	DRAWING No 1	REV 0
APPROVED BY	FB	DATE	09/05/2023	OFFICE	NEWCASTLE

CDT-DWG-A3H-001/1

Attachment B

Summary of data

RCA summary of data logger information for KIWEF

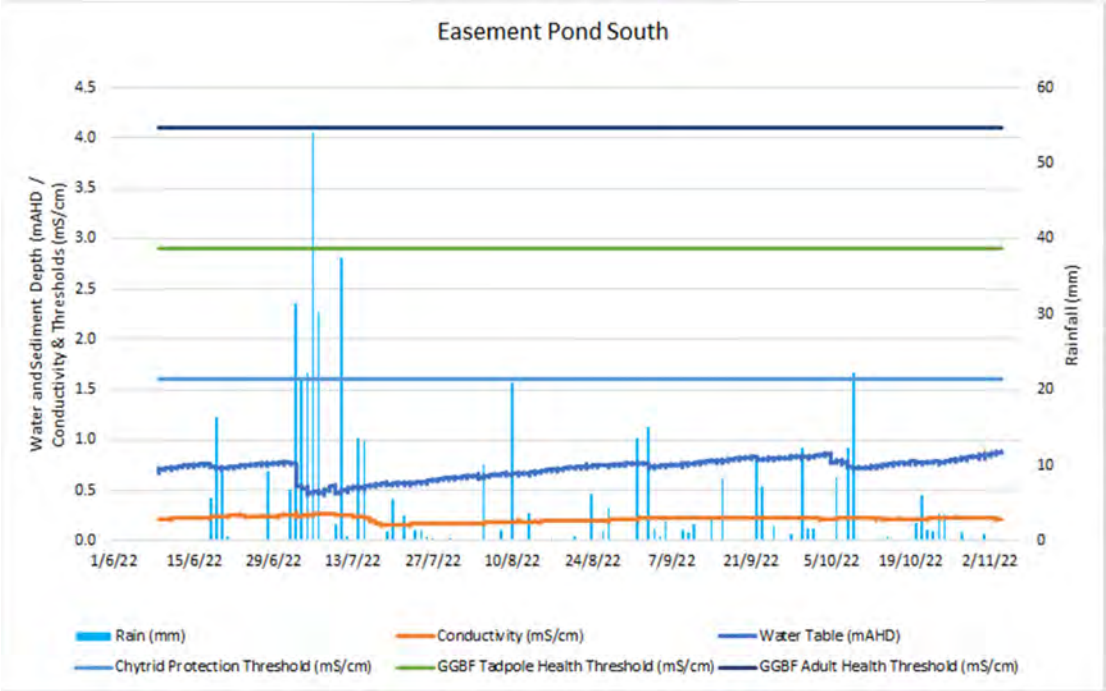
Logger Name/ Location	Logger Serial Number	Model	GPS (UTS/UPM)	Date of collection	*Surveyed T.O.P (mAHD)	Top of Pipe to Water Level (m)	Water to Sediment (m)	Top of Pipe to Data Logger Tip (m)	Water level above logger	Logger presence	Logger data download	Notes
SWDP-103	1072536	Solinst Levelogger 3001 LT F30/M10	0381402, 6361958	24.02.2023	2.901	1.25	0.30	1.44	0.18	Yes	No	Unable to download
Easement Pond South	2097139	Solinst Levelogger 3001 LTC F30/M10	0381614, 6361855	25.01.2023	--	1.37	0.30	1.68	0.25	Yes	Yes	No data after 4.11.2022
SWDP4	1072543	Solinst Levelogger 3001 LTC F30/M10	0381778, 6362349	24.02.2023	--	1.22	0.46	NA	NA	No	No	No logger
SWSMEC-K2	121071565	Solinst Levelogger 3001 LTC F30/M10	0380330, 6362216	17.03.2023	2.032	0.85	0.29	NA	NA	No	No	No logger
B-02L	121071574	Solinst Levelogger 3001 LTC F30/M10	0382825, 6361856	24.02.2023	--	1.08	0.69	1.64	0.79	Yes	No	Unable to download
Deep Pond B	1076043	Solinst Levelogger 3001 LTC F30/M10	0380871, 6362461	17.03.2023	--	1.26	0.18	1.34	0.08	Yes	No	Unable to download
K114	1068452	Solinst Levelogger 3001 LTC F30/M10	0382129, 6362224	24.02.2023	--	1.30	0.54	NA	NA	No	No	No logger
Deep Pond A	1071594	Solinst Levelogger 3001 LTC F30/M10	0381238, 6362908	24.02.2023	--	1.15	0.44	NA	NA	No	No	No logger
SW K7	1076842	Solinst Levelogger 3001 LTC F30/M10	0381670, 6362757	24.02.2023	--	0.85	0.57	1.27	0.25	Yes	Yes	--
SW Pond 11	2097130	Solinst Levelogger 3001 LTC F30/M10	0381482, 6363035	24.02.2023	2.106	0.97	0.58	1.30	0.48	Yes	Yes	--
Railway Pond	1071610	Solinst Levelogger 3001 LTC F30/M10	0381625, 6363051	17.03.2023	2.053	1.00	0.19	0.95	-0.05	Yes	No	Unable to download
SW K7B	1076867	Solinst Levelogger 3001 LTC F30/M10	0381772, 6362754	24.02.2023	--	0.63	0.68	0.87	0.22	Yes	Yes	--

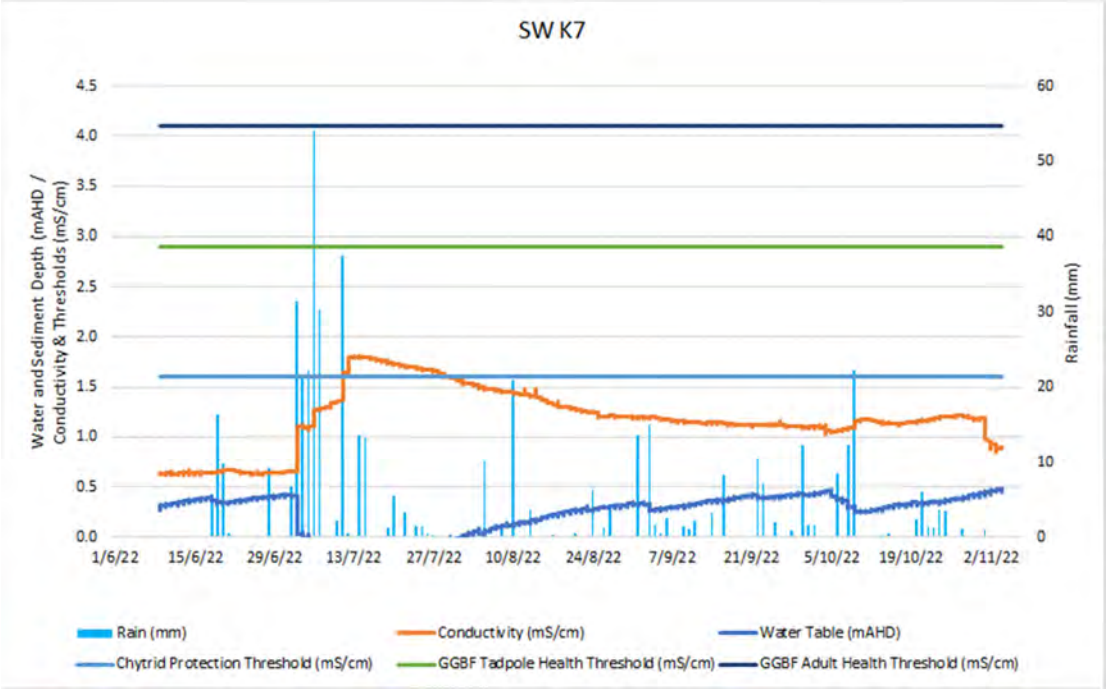
* Surveyed AHD proved by Daly Smith

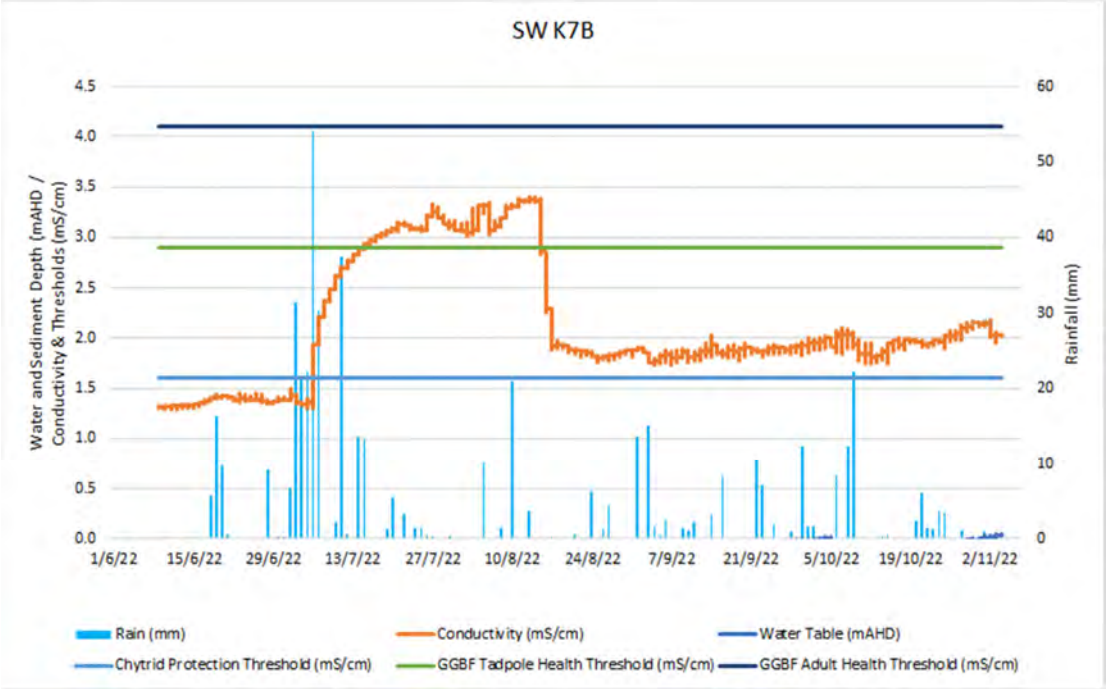
Site Barologger (SWDP-103)	12059754	Solinst Barolgger 3001 LT/M15	0381402, 6361958	24.02.2023	--					Yes	Yes	--

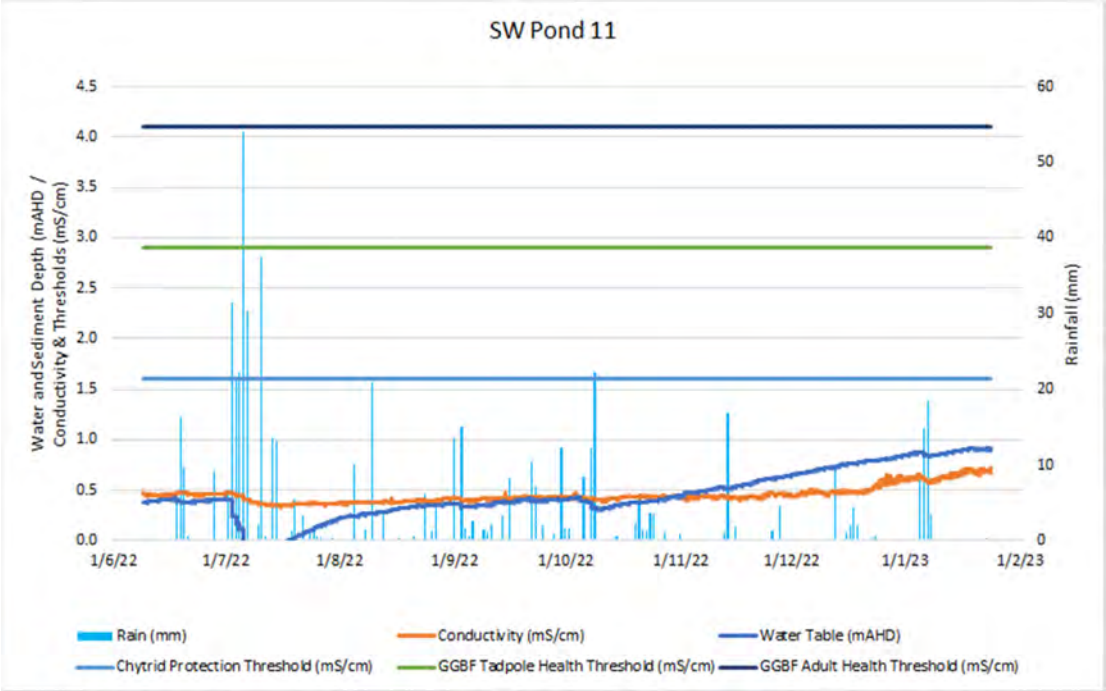
Attachment C

Water level charts


Easement Pond South
Water and Sediment Depth (mAHD / Conductivity & Thresholds (mS/cm)
Rainfall (mm)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
60
50
40
30
20
10
0
1/6/22
15/6/22
29/6/22
13/7/22
27/7/22
10/8/22
24/8/22
7/9/22
21/9/22
5/10/22
19/10/22
2/11/22
Rain (mm)
Conductivity (mS/cm)
Water Table (mAHD)
Chytrid Protection Threshold (mS/cm)
GGBF Tadpole Health Threshold (mS/cm)
GGBF Adult Health Threshold (mS/cm)


SW K7
Water and Sediment Depth (mAHD / Conductivity & Thresholds (mS/cm)
Rainfall (mm)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
60
50
40
30
20
10
0
1/6/22
15/6/22
29/6/22
13/7/22
27/7/22
10/8/22
24/8/22
7/9/22
21/9/22
5/10/22
19/10/22
2/11/22
Rain (mm)
Conductivity (mS/cm)
Water Table (mAHD)
Chytrid Protection Threshold (mS/cm)
GGBF Tadpole Health Threshold (mS/cm)
GGBF Adult Health Threshold (mS/cm)


SW K7B
Water and Sediment Depth (mAHD / Conductivity & Thresholds (mS/cm)
Rainfall (mm)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
60
50
40
30
20
10
0
1/6/22
15/6/22
29/6/22
13/7/22
27/7/22
10/8/22
24/8/22
7/9/22
21/9/22
5/10/22
19/10/22
2/11/22
Rain (mm)
Conductivity (mS/cm)
Water Table (mAHD)
Chytrid Protection Threshold (mS/cm)
GGBF Tadpole Health Threshold (mS/cm)
GGBF Adult Health Threshold (mS/cm)


SW Pond 11
Water and Sediment Depth (mAHD / Conductivity & Thresholds (mS/cm)
Rainfall (mm)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
60
50
40
30
20
10
0
1/6/22
1/7/22
1/8/22
1/9/22
1/10/22
1/11/22
1/12/22
1/1/23
1/2/23
Rain (mm)
Conductivity (mS/cm)
Water Table (mAHD)
Chytrid Protection Threshold (mS/cm)
GGBF Tadpole Health Threshold (mS/cm)
GGBF Adult Health Threshold (mS/cm)

Appendix E – KIWEF Annual Groundwater & Surface Water Monitoring 2023 (GHD, November 2023)

KIWEF Groundwater and Surface Water Monitoring Event

October 2023

Hunter & Central Coast Development Corporation

08 December 2023

→ **The Power of Commitment**

Project name		KIWEF groundwater monitoring and monitoring network rationalisation					
Document title		KIWEF Groundwater and Surface Water Monitoring Event | October 2023					
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S4	0	M. Veciana	A Monkley		A Monkley		08/12/23

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1 Introduction

GHD Pty Ltd (GHD) was commissioned by Hunter & Central Coast Development Corporation (HCCDC) to undertake the annual groundwater and surface water monitoring at the Kooragang Island Waste Emplacement Facility (KIWEF) located off Cormorant Drive, Kooragang Island, NSW (the Site). The Site comprises several lots including Part Lot 7, Lot 10, Lot 11, and Part Lot 14 of DP11194525. The Site's location is presented in Figure 1 of Appendix A.

HCCDC has commenced preparations for the handover of KIWEF to the Port of Newcastle (per the 2014 long-term lease of Newcastle Port), which includes the development of a Post-Closure Landfill Management Plan (PCLMP). To facilitate an efficient transfer of control to Port of Newcastle, HCCDC have agreed to commission the KIWEF annual groundwater and surface water monitoring event for 2023, which is a requirement under the Surrender Notice (SN1111840 to EPL 6437) as outlined in Section 5 Environmental monitoring (Part c and d).

1.1 Purpose of this report

The purpose of this report is to outline the results of groundwater and surface water sampling and analysis of the KIWEF 2023 Annual Water Monitoring Event.

1.2 Scope of works

The scope of works for this monitoring program include:

– Preparation of a Sampling, Analysis and Quality Plan (SAQP) for this monitoring event.
– Completion of a monitoring event involving gauging and sampling of 50 groundwater monitoring wells and five surface water (SW) monitoring locations as per the Surrender Notice (SN1111840 to EPL 6437).
– Submission of groundwater and surface water samples for laboratory analysis as per the Surrender Notice (SN1111840 to EPL 6437), (ammonia (NH_3), phenols, cyanide (CN-total, weak acid dissociable (CN-WAD) and CN-free), polycyclic aromatic hydrocarbon (PAH) and heavy metals (hexavalent chromium (Cr VI), molybdenum (Mo) and lead (Pb)).
– Preparation of this Annual Monitoring Report summarising the results of the 2023 monitoring event.

1.3 Limitations

This report: has been prepared by GHD for Hunter & Central Coast Development Corporation and may only be used and relied on by Hunter & Central Coast Development Corporation for the purpose agreed between GHD and Hunter & Central Coast Development Corporation as set out in section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than Hunter & Central Coast Development Corporation arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

If this report is required to be accessible in any other format, this can be provided by GHD upon request and at an additional cost if necessary.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services, and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

GHD has prepared this report on the basis of information provided by Hunter & Central Coast Development Corporation and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

2 Field work

2.1 General

The October 2023 monitoring event at the KIWEF was undertaken between 9 to 13 October 2023 by suitably qualified GHD environmental scientists.

Sampling and analysis was undertaken in accordance with ASTM D6771–02, Standard practice for low-flow purging and sampling for wells and devices used for groundwater quality investigations, ASTM International and the appropriate sections of Australian Standard AS 5667 - 1998 Water Quality Sampling, including:

– Part 1 Guidelines on the design of sampling programs, sampling techniques and the preservation and handling of samples.
– Part 4 Guidance on the sampling of lakes, natural and man-made.
– Part 6 Guidance on the sampling of rivers and streams.
– Part 11 Guidance on the sampling of groundwater.

2.2 Sample locations

All monitoring wells were inspected for any signs of damage and blockages. Table 2.1 shows a list of the monitoring wells and surface water IDs that were included in this sampling event and the locations are presented in Figure 1, Appendix A. Any damage to the monitoring wells were documented and reported to HCCDC during the monitoring event.

Table 2.1 Sampling location summary

Aquifer	Monitoring Well ID
Groundwater - Fill	336A, 344A, E61S, GHD01N, K10/2, K10/2N, K5/4, K5/5N, K5/6N, K7/1, K7/4N, K8/5E.
Groundwater - Shallow Estuarine	336B, 344B, BH21S (replacement well for K3/1W), BHe29S, E61D, GHD01S, K10/2NN, K11/1, K11/2E, K11/3E, K12/10E, K12/1W, K12/6, K12/7, K12/9, K5/6NN, K7/2S, K7/4S, K8/5W, K9/2W, K9/3S, K9/4E, NCIG1 (replacement well for K12/3W).
Groundwater - Deep Estuarine	K11/1S, K11/2W, K11/3W, K12/10, K12/1E, K12/4N, K12/7E, K12/9E, K5/5S, K5/6S, K7/2N, K9/2E, K9/3N, K9/4W, NCIG2 (replacement well for K12/3N).
Surface Water	KS1/3, KS10/1, KS12/6, KS2/1, KS7/1

A total of eight groundwater monitoring wells were not sampled during this monitoring event for the reasons outlined in Table 2.2.

Table 2.2 List of groundwater monitoring wells not sampled

Aquifer	Well ID	Observation
Fill	K5/5N	Dry
	K5/4	Dry
	E61S	Dry
	K8/5E	Dry
Shallow Estuarine	K12/10E	Blocked
	K12/6	No access
Deep Estuarine	K12/9E	Signage was found but the well could not be located.
	K12/4N	Not found
	K11/2W	The well overflowed halfway through sampling due to gas generation (source unknown). No samples were collected for NH_3, PAH and dissolve heavy metals (Cr VI, Pb and Mo).

2.3 Groundwater sampling methodology

The groundwater sampling methodology employed during this monitoring event is summarised in Table 2.3.

Table 2.3 Groundwater sampling methodology

Item	Description
Date of fieldwork	9 to 13 October 2023
Work clearance	JSEA including daily pre-work assessment and hazard identification.
Technical guideline	ASTM D6771–02, Standard practice for low-flow purging and sampling for wells and devices used for groundwater quality investigations, ASTM International. Australian Standard 5667:1998 Water Quality – Sampling, Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples (AS 5667.1:1998). Australian Standard 5667:1998 Water Quality – Sampling, Part 11: Guidance on the Sampling of Groundwater (AS 566.11:1998).
Gauging	Groundwater monitoring wells were gauged using an oil/water interface probe to measure standing water levels (SWL). Field sampling sheets are included in Appendix G and calibration records in Appendix H.
Field chemistry	Field measurements were taken using a calibrated water quality meter and flow through cell, with measurements of temperature, pH, electrical conductivity (EC), dissolved oxygen (DO) and oxidation-reduction potential (redox) recorded.
Sampling	Groundwater sampling was conducted using low flow techniques (peristaltic pump for wells < 10 m below ground level (mbgl) deep, micro purge sample pump for wells >10 mbgl deep). Groundwater for dissolved metal analysis was filtered in the field using 0.45-micron filters.
Sample handling and transport	Following collection, groundwater samples were immediately placed and stored in a cool, dark environment (esky) prior to being forwarded to the analytical laboratory within the specified holding times along with a Chain of Custody (CoC) form in Appendix F.
Decontamination	Prior to and following the collection of each groundwater sample, all non-disposable sampling equipment underwent decontamination including: – Washing of equipment with phosphate-free detergent (Decon Neutracon). – Rinsing of equipment with fresh water.
Sample analysis	Groundwater samples were analysed for NH_3, phenols, CN (total, WAD and free), PAH and dissolved heavy metals (Cr VI, Mo and Pb). Some groundwater monitoring wells were exempted in the general analytical suite as listed below: – Phenols analysis was not required for the following wells: • Fill: K10/2, K10/2N, K5/4, K5/5N, K7/4N, K8/5E. • Shallow Estuarine: K10/2NN, K7/4S, K9/2W, K9/4E. • Deep Estuarine: K5/5S, K9/2E, K9/4W. – Cyanide (Total) analysis was not required for the following wells: • Fill: K10/2, K10/2N, K5/5N. – Molybdenum (dissolved) analysis was not required for the following wells: • Fill: K5/4, K5/5N, K5/6N. • Shallow Estuarine: K5/6NN, K7/2S, K9/4E. • Deep Estuarine: K5/5S, K5/6S, K7/2N, K9/4W. – Lead (dissolved) analysis was not required for the following wells: • Fill: K5/4, K5/5N, K5/6N, K7/4N. • Shallow Estuarine: K5/6NN, K7/2S, K9/4E; K7/2S, K9/2W. • Deep Estuarine: K5/5S, K5/6S, K7/2N, K9/2E, K9/4W. Laboratory results are summarised in Appendix B and certificates of analysis and CoC included in Appendix F.
Quality assurance and quality control (QA/QC)	QA procedures and QC sampling were implemented during the monitoring event. Further details are described in Appendix D.
Waste disposal	Purged groundwater was discharged to the ground within the vicinity of the groundwater well.

2.4 Surface water sampling methodology

The surface water sampling methodology employed during this monitoring event is summarised in Table 2.4.

Table 2.4 Surface water sampling methodology

Item	Description
Dates of fieldwork	– 9 to 13 October 2023
Work clearance	JSEA including daily pre-work assessment and hazard identification.
Technical guideline	Australian Standard 5667:1998 Water Quality – Sampling: – Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples (AS 5667.1:1998). – Part 4: Guidance on the sampling of lakes, natural and man-made. – Part 6: Guidance on the sampling of rivers and streams.
Field chemistry	Field measurements were taken using a calibrated water quality meter with measurements of temperature, pH, EC, DO and redox recorded.
Sampling	Surface water sampling was conducted using a reach pole with a dedicated sampling bottle attached, which was lowered into the water body to allow a sample to be collected from below the surface. Field sampling sheets are included in Appendix G and calibration records in Appendix H.
Sample handling and transport	Following collection, surface water samples were immediately placed and stored in a cool, dark environment (esky) prior to being forwarded to the analytical laboratory within the specified holding times along with a CoC form in Appendix F.
Sample analysis	Surface water samples were analysed for NH_3, phenols, CN (total, WAD and free), PAH and total heavy metals (Cr VI, Mo and Pb). Laboratory results are summarised in Appendix B and certificates of analysis and CoC included in Appendix F.
Quality assurance and quality control (QA/QC)	QA procedures and QC sampling were implemented during this monitoring event. Further details are described in Appendix D.

3 Quality assurance/quality control

3.1 Overview

The Data Quality Objectives (DQOs) for the investigations are based on guidance presented in:

– NEPC (2013) National Environmental Protection (Assessment of Site Contamination) Measure 1999 (NEPM) – Schedule B2, Guideline on Site Characterisation.

The DQOs establish a framework for contamination investigations, which incorporates a seven stepped continuum that defines the problem at the Site. A series of stages then optimises the design of the investigation.

The DQOs for the investigation are presented in the following steps.

Step 1 – State the problem

HCCDC is required to conduct an annual groundwater and surface water monitoring event at KIWEF as outlined in Section 5 Environmental Monitoring (Part c and d) of the Surrender of a Licence Notice (No 1111840) issued by the NSW EPA.

Step 2 – Identification of the decisions

To address the problem outlined in Step 1, the following decisions were required to achieve the task objective:

– What were the water quality conditions, chemical concentrations and field parameters for surface water and groundwater within KIWEF?
– Were there any significant changes in water quality conditions, chemical concentrations and field parameters compared to historical results?

Step 3 – Inputs to the decisions

Data to be input to the decision-making process includes:

– Information from previous sampling events.
– Field observations and groundwater and surface water quality data obtained during this annual monitoring event.

Step 4 – Define the study boundaries

– The spatial boundaries for the investigation area were identified as the lateral extent of the sampling locations as shown in Figure 1 (Appendix A).
– Temporal boundaries are surface water and groundwater data obtained during the 2023 monitoring event to historical data collected since 1999.

Step 5 – Site decision rule

Concentrations of contaminants were compared with the criteria discussed in Section 4 and historical concentrations.

In order to decide whether the data obtained were precise, accurate, reliable, and reproducible for the Site at the time of the monitoring event, field, and laboratory quality control (QC) and quality assurance (QA) procedures were utilised throughout the sampling event with all sampling work carried out in accordance with standard industry practices. QA/QC results were compared to nominal acceptance limits (as outlined in in Step 6).

Step 6 – Specify the tolerable limits on decision errors

Two types of decision errors are considered possible:

– Sampling errors occur during the sampling program that results in data that was not representative of the site conditions.

– Measurement errors occur during sample collection and analysis that leads to drawing inaccurate conclusions from the data.

To minimise the potential for decision errors, the following data quality indicators (DQIs) were evaluated, namely completeness, comparability, representativeness, precision, and accuracy. These are summarised below:

– Data Representativeness - expresses the degree which sample data accurately and precisely represents a characteristic of a population or an environmental condition. Representativeness is achieved by collecting samples in an appropriate pattern across the Site, and by using an adequate number of sample locations to characterise the Site. Consistent and repeatable sampling techniques and methods will be utilised throughout the sampling.

– Completeness - defined as the percentage of measurements made which are judged to be valid measurements. The completeness goal is set at there being sufficient valid data generated during the study. If there is insufficient valid data, then additional data are required to be collected.

– Comparability - is a qualitative parameter expressing the confidence with which one data set can be compared with another. Comparability is achieved through maintaining a level of consistency in techniques used to collect samples and ensuring analysing laboratories use consistent analysis techniques and reporting methods.

– Accuracy - measures the bias in a measurement system. Accuracy can be undermined by such factors as field contamination of samples, poor preservation of samples, poor sample preparation techniques and poor selection of analysis techniques by the analysing laboratory. Accuracy is assessed by reference to the analytical results of laboratory control samples, laboratory spikes, laboratory blanks and analyses against reference standards.

– Precision - measures the reproducibility of measurements under a given set of conditions. The precision of the data is assessed by calculating the Relative Percent Difference (RPD) between duplicate sample pairs.

$$RPD(\%) = \frac{|C_o - C_d|}{C_o + C_d} \times 200$$

Where Co = Analyte concentration of the original sample

Cd = Analyte concentration of the duplicate sample

– GHD will adopt a nominal acceptance criterion of 50% RPD for field duplicates and splits for organics and 30% for inorganics. However it is noted that this will not always be achieved, particularly in heterogeneous conditions or at low analyte concentrations.

Step 7 – Optimise the design for obtaining data

Samples were collected as per the methodology outlined Sections 2.3 and 2.4.

QA procedures were used, and QC samples collected to allow evaluation of DQIs. Details of quality control procedures followed during the course of sampling are provided in Appendix D.

4 Assessment criteria

Analytical results for KIWEF have historically been assessed using the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* ANZECC/ARMCANZ 2000 (ANZECC) guidelines for the protection of 95% marine aquatic ecosystems (with the exception of some parameters where a 99% protection level was recommended), due to the slightly to moderately disturbed and tidal nature of the Hunter River. The historical assessment criteria is presented in Table B1 to B3 in Appendix B.

It is noted that the water quality guidelines have been revised with the Australian and New Zealand Guidelines 2018 (ANZG 2018). The 2023 monitoring results have been also compared to the 95% marine default guidelines (DGV) values. Where criteria have not been updated in ANZG (2018), ANZEC 2000 values have been adopted. and are presented in Tables 1 to 4 in Appendix C.

5 Results and discussion

5.1 Analytical results

The historical results and current monitoring analytical results are presented in Appendix B and Appendix C respectively. The groundwater and surface water samples that exceeded the ANZG (2018) DGVa (or were outside the range for pH) are summarised in Table 5.1.

Table 5.1 Summary of sample locations exceeding the guidelines

Analyte	Sampling points
Groundwater	
pH	pH<6.5 Fill: K7/1 Deep: K9/2E, K9/3N, K11/1S, K11/2W, K12/10 pH>9 Fill:K10/2N, 344A Shallow: K8/5W, BH21S
Electrical conductivity	Fill: 336A, 344A, GHD01N, K10/2, K10/2N, K5/6N, K7/1, K7/4N. Shallow: 336B, 344B, BH21S, BHe29S, E61D, GHD01S, K10/2NN, K11/1, K11/2E, K11/3E, K12/1W, K12/7, K12/9, K5/6NN, K7/2S, K7/4S, K8/5W, K9/2W, K9/3S, K9/4E, NCIG1. Deep: K11/1S, K11/2W, K11/3W, K12/10, K12/1E, K12/7E, K5/5S, K5/6S, K7/2N, K9/2E, K9/3N, K9/4W, NCIG2.
NH_3 - N	Fill: K10/2N, K7/4N, K7/1, 336A. Shallow: K10/2NN, K11/3E, K12/9, K7/2S, K8/5W, K9/3S, K9/4E, BHe29S, GHD01S, E61D, 344B, BH21S, NCIG1. Deep: K11/1S, K11/3W, K12/10, K12/1E, K12/7E, K9/2E, K9/3N, K9/4W, K7/2N, NCIG2.
CN - Total	Fill: K5/6N, K7/4N, K7/1, GHD01N. Shallow: K7/2S, K8/5W, K9/3S, GHD01S, BH21S. Deep: K11/3W, K5/5S, K7/2N.
Cr VI (Dissolved)	Shallow: K7/4S.
Mo	Fill: K10/2N, K7/1, GHD01N. Shallow: K9/2W, BH21S.
Anthracene	Shallow: K8/5W, BH21S.
Fluoranthene	Shallow: K8/5W, BH21S.
Naphthalene	Fill: K7/1. Shallow: K10/2NN, BH21S.
Phenanthrene	Fill: K7/1. Shallow: K8/5W, BH21S.
Surface Water	
Electrical conductivity	KS12/6, KS2/1, KS1/3, KS7/1, KS10/1.
NH_3 - N	KS12/6, KS7/1.
CN - Total	KS7/1.
Mo	KS2/1, KS7/1.
Pb	KS12/6, KS2/1, KS1/3, KS7/1.

The limit of reporting (LORs) for Cr VI, PAH (including phenanthrene, anthracene, fluoranthene and benzo(a)pyrene), CN-total and CN-free exceeded the ANZG (2018) DGV. The LOR for samples E61D and its duplicate FD07 for Pb were raised to 0.01 mg/L due to the high salinity of the samples which caused matrix interference during the analysis. Given that the results were generally consistent with historical detections, it was unlikely that concentrations below these LORs represent actual exceedances of the criteria. Hence, values less than the LOR and where the LOR was above the assessment criteria, have not been considered as an exceedance for the purpose of this report (and therefore have not been included in Table 5.1).

5.2 Comparison to historical results

Groundwater and surface water monitoring results were compared to historical data. Generally most analytes were within the historical ranges with the exception of the following:

Fill Aquifer

– K10/2 reported the lowest NH_3 concentrations compared to historical results.

Shallow Estuarine Aquifer

– GHD01S reported NH_3 concentrations above the historical maximum concentration. This well also reported the highest concentration of Total CN since 2009.
– BH21S and K10/2NN reported naphthalene concentrations above the historical maximum concentrations. It is noted that K10/2NN reported naphthalene concentrations above the adopted assessment criteria for the first time since monitoring.
– K5/6NN reported the lowest NH_3 concentrations compared to historical results.

Deep Estuarine Aquifer

– K12/10 and K12/7E reported NH_3 concentrations above the historical maximum concentration. It is noted that K12/10 reported NH_3 concentrations eight times more than the historical maximum.
– K5/5S reported the lowest NH_3 concentrations compared to historical results.
– K9/2E, K9/3N, and K7/2N reported the lowest pH values compared to historical results.
– K7/2N reported the lowest phenols concentration compared to historical results.

Surface Water

– KS7/1 recorded NH_3 and Pb concentrations above historical maximum concentration. This location reported Pb concentrations above the adopted assessment criteria for the first time since monitoring.

Trend analysis was carried out for individual parameters to determine the presence or absence of statistically significant water quality trends. This analysis was carried out using Mann-Kendall testing (P=0.05 to denote statistical significance) using GSI's Mann-Kendall Toolkit1. The Toolkit interprets trends using methodology specified in United States Air Force Center for Engineering and the Environment's (AFCEE's) Monitoring and Remediation Optimization System (MAROS)2. Specifically, significant trends are identified at a 95 percent confidence level and probable trends are identified at a 90 percent significance level. A minimum data set of five rounds was required for accuracy to complete the Mann Kendall trend analysis.

A summary of wells that were monitored this round with significant to probable trends are provided in Table 5.2. The Mann-Kendall Analysis are provided in Appendix I.

Table 5.2 Summary of monitoring wells with significant trends

Analyte	Significant Trend	Probable Trend
Groundwater		
pH	Fill: Decreasing - K10/2, K5/6N, K7/4N, K7/1, Increasing – K10/2N Shallow: Decreasing K10/2NN, K11/1, K12/9, K9/2W, K9/4E, GHD01S Deep: Decreasing - K12/10, K12/4N, K12/7E, K9/2E, K9/3N	Fill: Decreasing – 344A Deep – Decreasing – K12/E
Electrical conductivity	Fill: Decreasing - K5/4, K5/5N, K5/6N, K7/4N, GHD01N Shallow: Decreasing - K10/2NN, K11/1, K11/2E, K11/3E, K5/6NN, K7/2S, K7/4S, K8/5W, K9/2W, K9/4E, BHe29S Deep: Decreasing - K11/1S, K11/2W, K11/3W, K12/1E, K12/4N, K12/9E, K5/5S, K5/6S, K9/3N, K9/4W. Increasing – K7/2N	Fill: Decreasing – K8/5E, K10/2 Shallow: Decreasing - K12/7 336B, 344B Deep – Decreasing – K12/10. Increasing – K9/2E
NH_3 - N	Fill: Increasing - K7/4N, K8/5E. Decreasing – K7/1, GHD01N Shallow: Increasing - K7/2S, K9/3S, BHe29S, E61D, 344B, BH21S. Decreasing - K10/2NN, K11/1, K11/2E, K12/7, K6/6NN, K8/5W, K9/4E Deep: Increasing - K12/7E, K9/2E, NCIG2. Decreasing K12/10, K5/5S, K5/6S	Shallow: Increasing - K7/4S, K9/2W, NCIG1
Free CN		Shallow: Decreasing – K5/6NN, GHD01S
Weak Acid Dissociable CN		Fill: Decreasing – K8/5E
CN - Total	Fill: Decreasing – K5/4, K5/5N, K5/6N, K7/4N, K8/5E Shallow: Decreasing – K5/6NN, K8/5W, K9/2W, K9/3S, K9/4E Deep: Increasing - K7/2N. Decreasing – K12/4N, K5/5S, K5/6S	Fill: Decreasing – K10/2N Shallow: Decreasing – K12/7, K12/9, K7/4S Deep – Decreasing - K12/10, K12/7E, K9/4W
Cr (VI)		Fill: Decreasing – K5/6N Shallow: K9/3S
Mo	Fill: Decreasing - K7/1, Increasing - 344A Shallow: Increasing - K11/1, K11/3E, K9/3S. Decreasing – K8/5W, BHe29S, GHD01S Deep – Decreasing – K9/2E	Fill: Decreasing – K10/2 Shallow: Decreasing – K12/10E, K9/2W
Pb	Fill: Decreasing – K7/1, GHD01N	Shallow: Increasing BH21S
Anthracene		Fill: Decreasing – K5/6N Shallow- Decreasing – k7/2S
Acenaphthene	Shallow: Increasing - K8/5W. Decreasing – GHD01S	Shallow: Decreasing – K7/2S Deep- Decreasing- K94W
Acenaphthylene	Shallow: Decreasing – GHD01S, K10/2NN Fill – Decreasing K9/3N	Shallow: Decreasing – K8/5W
Chrysene		Shallow: Decreasing – K12/1W, K7/2S
Fluoranthene	Fill: Decreasing – K10/2, K5/6N, Shallow: Decreasing – K12/1W, K92W	Fill: Decreasing – K5/4 Shallow: Increasing - K8/5W. Decreasing – K7/2S
Fluorene	Shallow: Increasing - K8/5W	Shallow: Decreasing GHD01S

Analyte	Significant Trend	Probable Trend
Naphthalene	Fill: - Decreasing – K5/5N Shallow: Increasing - K10/2NN. Decreasing GHD01S Deep – Decreasing K7/2N	Shallow: Decreasing K9/2W, E61D
Phenanthrene	Fill: Decreasing – K10/2, K5/6N Shallow: Increasing K8/5W	
Pyrene	Fill: Decreasing – K10/2 Shallow: Increasing - K8/5W. Decreasing – K12/1W, K92W	Fill: Decreasing – K8/5E Shallow: Decreasing – K7/2S
Benza(a)anthracene		Shallow: Decreasing – K12/1W
Benzo(b)&(k) fluoranthene		Deep: Increasing K12/10
Benzo(a)pyrene		Shallow: Decreasing – K12/1W, K92W, Increasing – K9/4E
Total PAH	Fill: Decreasing – K10/2, K5/6N Shallow: Increasing - K10/2NN, K8/5W. Decreasing – K12/1W, GHD01S Deep – Decreasing – K9/3N, K7/2N	Shallow: Decreasing – K11/2E, E61D Deep – Decreasing K12/9E, K5/6S
Surface Water		
pH	Decreasing - KS10/1	
Electrical conductivity	Decreasing - KS10/1, KS12/6, KS2/1, KS1/3	
NH_3 - N	Decreasing – KS12/6	
Phenols	Decreasing – KS1/3	
Total Cr		Decreasing – KS12/6
Total CN	Decreasing - KS10/1	Decreasing – K12/6
Total Mo		Decreasing – KS1/3
Total Pb	Decreasing KS10/1	

6 Conclusions and Recommendations

GHD was commissioned by HCCDC to undertake the 2023 annual groundwater and surface water monitoring event at the KIWEF. Based on the information contained within this report and subject to the limitations in Sectio 1.3, the following conclusions have been made:

A number of exceedances were reported for the KIWEF 2023 monitoring event however most results were within historical ranges with the exception of the following:

– Shallow Estuarine Aquifer - NH_3 at GHD01S and naphthalene at BH21S and K10/2NN reported concentrations above the historical maximum concentration.
– Deep Estuarine Aquifer - K12/10 and K12/7E reported NH_3 concentrations above the historical maximum concentration.
– Surface Water -KS7/1 recorded NH_3 and Pb concentrations above historical maximum concentration.

In addition to the exceedances the following trends were also observed:

– Fill Aquifer - K10/2 reported the lowest NH_3 concentrations compared to historical results.
– Shallow Estuarine Aquifer - K5/6NN reported the lowest NH_3 concentrations compared to historical results.
– Deep Estuarine Aquifer - NH_3 at K5/5S, pH values at K9/2E, K9/3N, and K7/2N and phenols at K7/2N reported the lowest concentrations compared to historical results.
– Surface Water - KS7/1 recorded NH_3 and Pb concentrations above historical maximum concentration. This location reported Pb concentrations above the adopted assessment criteria for the first time since monitoring.

On finalisation of closure works, it is recommended that current monitoring program is reviewed and rationalised (for both contaminants of concern and locations) to reflect the changes to the KIWEF status and to meet post closure management requirements. It is recommended that as part of the monitoring program review a trend analysis report is prepared to inform the program rationalisation.

In accordance with the PCLMP it is recommended that baseline trigger values (80th percentile for contaminants of concern and 20th percentile and 80th percentile for pH and EC) are calculated for each monitoring location. This will allow future monitoring results and trends to be assessed against the trigger pathways outlined in the PCLMP.

It is recommended that access to monitoring location K12/6 is improved and the blockage in well K12/10E is removed to allow for future monitoring. It is also recommended that wells K12/9E and K12/4N are located by a surveyor and replaced in the event that the wells cannot be found. Wells that have been reported as dry should be reviewed to determine if they need to be re-installed to intercept the relevant groundwater aquifer.

7 References

ANZECC & ARMCANZ (2000), *National water quality management strategy. Australian and New Zealand guidelines for fresh and marine water quality.*

ANZG (2018) *The Australian and New Zealand Guidelines for Fresh and Marine Water Quality*.

American Society for Testing and Materials (ASTM D6771–02), *Standard practice for low-flow purging and sampling for wells and devices used for groundwater quality investigations.*

Australian Standard (AS/NZS 5667.11:1998) *Water Quality Sampling - Part 1 Guidelines on the design of sampling programs, sampling techniques and the preservation and handling of samples*.

Australian Standard (AS/NZS 5667.11:1998) *Water Quality Sampling - Part 4 Guidance on the sampling of lakes, natural and man-made.*

Australian Standard (AS/NZS 5667.11:1998) *Water Quality Sampling - Part 6 Guidance on the sampling of rivers and streams.*

Australian Standard (AS/NZS 5667.11:1998) *Water Quality Sampling - Part 11 Guidance on the sampling of groundwater.*

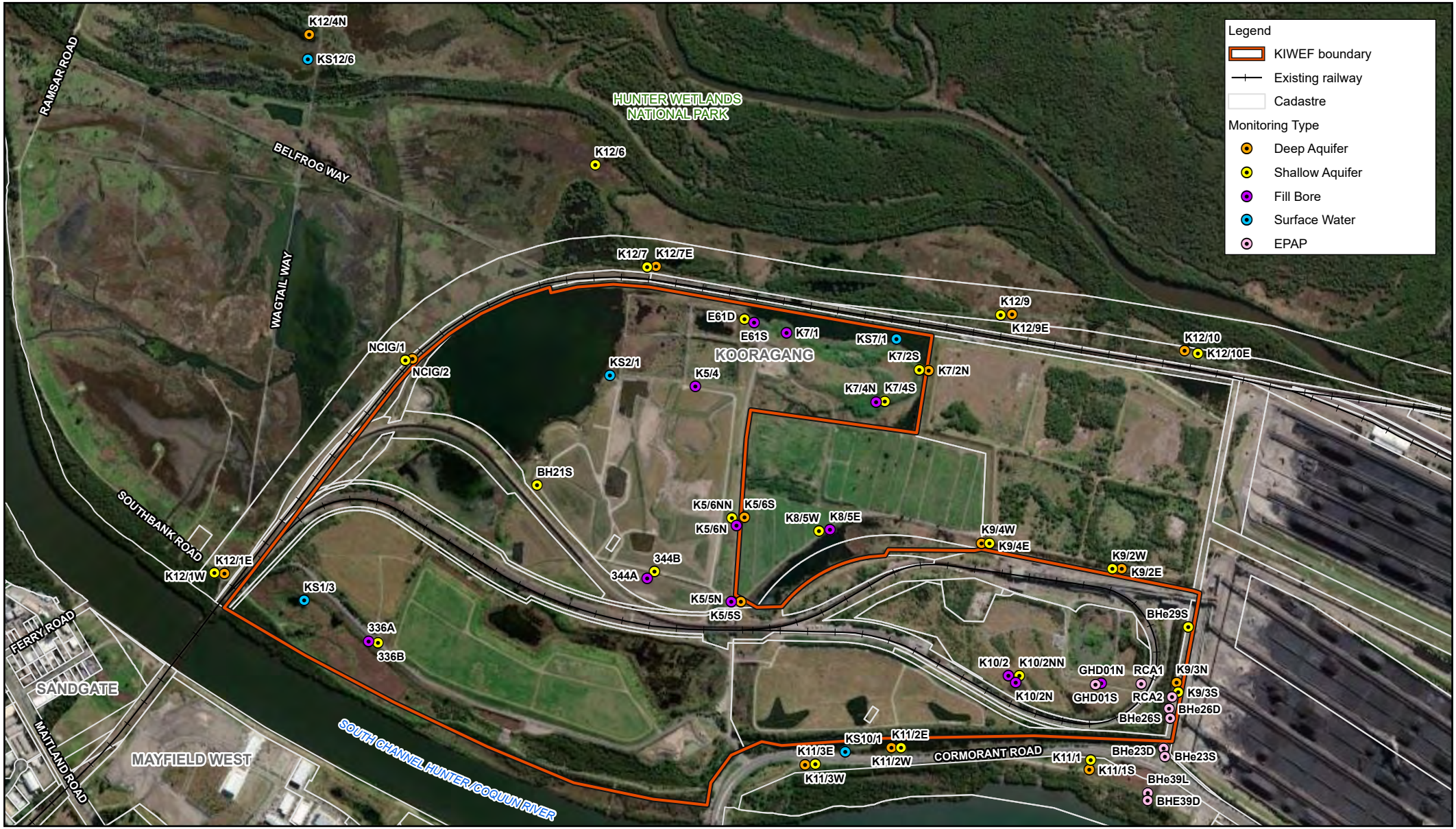
NEPC (2013) *National Environment Protection (Assessment of Site Contamination) Measure 1999* as amended 2013.

NSW EPA Environmental Protection License No. 6437.

Appendices

Appendix A

Figure



Paper Size ISO A4

0 0.1 0.2 0.3 0.4

Kilometres

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

Hunter and Central Coast Development Corporation
KIWEF 2023 Groundwater and Surface Water Monitoring

Project No. **12609961**
Revision No. **A**
Date **04/10/2023**

Sampling Point Locations

FIGURE 1

G:\22\12568155\GIS\Maps\12568155_TrendAnalysis2021_A.aprx
Print date: 14 Feb 2022 - 14:29

Data source: LPI: DTDB / DCDB, 2017; World Imagery: Maxar. Created by: fmackay

Appendix B

Historical Results Table

Table B-1: Monitoring Data: Fill Wells (1999-2023)

ANALYTES			pH	Conductivity	Ammonia	Phenols	Free Cyanide	Weak Acid Disociable Cyanide	Total Cyanide	Cr - Dissolved	Fe - Dissolved	Mn - Dissolved	Mo - Dissolved	Pb - Dissolved	Zn - Dissolved	Hg - Dissolved	Total PAHs	Naphthalene	Acenaphtylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)&(k)fluoranthene	Benzo(a)pyrene	Indeno(1.2.3-cd)pyrene	Dibenzo(ah)anthracene	Benzo(ghi)perylene	1-Methylnaphthalene	2-Methylnaphthalene
			pH units	µs/cm	mg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L
		ANZECC CRITERIA	8 to 8.4		0.91	400	0.004		0.004	0.0044		0.08 (L)	0.023 (L)	0.0044	0.015	0.1		70 (M)				0.2 (L)	0.4 (L)	1.4 (L)					0.2 (L)					
Sample ID	EPA ID	Date																																
K10/2	3	16-Mar-99	12.0	3300	3.2	10^			0.07	<0.01	<0.10	<0.01	0.01	<0.02	0.03	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K10/2	3	22-Jun-99	12.1	3700	2.7	22^			0.015	<0.001	<0.1	<0.001	0.02	<0.001	0.017	<0.1	1.00	0.7	<0.2	<0.2	<0.2	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.05		
K10/2	3	10-Sep-99	12.0	3300	1.7	19^			0.021	<0.01	<0.1	<0.01	0.02	<0.02	0.03	<0.05	0.90	0.6	<0.2	<0.2	<0.2	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2			
K10/2	3	10-Dec-99	12.0	3200	0.8	12^			0.24	<0.01	<0.1	<0.01	0.02	<0.05	<0.01	<0.05	2.84	0.89	0.08	0.34	0.39	0.65	0.13	0.21	0.15	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05			
K10/2	3	14-Mar-00	12.1	3600	2.5	16^			0.03	<0.01	0.15	0.65	<0.01	<0.05	0.03	<0.05	2.90	0.6	<0.2	0.3	0.2	1	<0.2	0.4	0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K10/2	3	7-Jun-00	12.2	3300	1.9	16^	<0.005		<0.005	<0.01	<0.10	<0.01	0.04	<0.05	<0.01	0.05	1.20	0.2	<0.2	<0.2	<0.2	0.5	<0.2	0.3	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K10/2	3	6-Sep-00	12.1	3400	1.8	11^	<0.20		<0.20	<0.01	<0.10	<0.01	0.03	<0.002	0.03	<0.05	5.70	0.5	<0.2	<0.2	0.2	2	<0.2	2	1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K10/2	3	6-Dec-00	11.8	2500	2.1	18^	<0.005		<0.005	<0.01	<0.1	<0.01	0.03	0.005	0.26	<0.05	0.50	<0.2	<0.2	<0.2	<0.2	0.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K10/2	3	6-Mar-01	11.7	2100	2.4	13^	<0.1		0.055	<0.005	<0.05	<0.005	0.031	<0.005	<0.01	0.07	1.10	0.1	<0.1	0.1	0.1	0.3	<0.1	0.3	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K10/2	3	5-Sep-01	12.0	3200	1.8	8^	<0.005		<0.005	<0.01	<0.1	<0.005	<0.01	<0.002	<0.005	0.08	1.00	0.1	<0.1	0.1	0.1	0.3	<0.1	0.2	0.2	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K10/2	3	4-Mar-02	11.9	3200	2.4	4^	0.05		0.018	<0.01	<0.1	<0.01	<0.01	<0.002	<0.005	<0.05	<0.8	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K10/2	3	14-Oct-02	11.8	2700	2.08	10	<0.005		<0.005	<0.001	<0.05	<0.001	0.025	<0.001	0.013	0.05	1.60	0.1	<0.1	<0.1	<0.1	0.6	<0.1	0.5	0.4	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K10/2	3	15-Apr-03	11.7	2000	3.11	10	<0.005		<0.005	<0.005	<0.05	<0.005	0.019	<0.005	0.18	<0.05	0.70	0.2	<0.1	<0.1	<0.1	0.2	<0.1	0.2	0.1	<0.1	<0.1	<0.2	<0.01	<0.1	<0.1	<0.1		
K10/2	3	17-Nov-03	11.8	2860	2.6	<50			0.185	<0.01	0.03	0.002	0.023	<0.001	0.009	<0.1	0.90	<0.1	<0.1	<0.1	<0.1	0.4	<0.1	0.3	0.2	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K10/2	3	29-Mar-04	12.2	2850	1.12	<10			0.019	<0.01	<0.05	<0.001	0.009	<0.001	<0.002	<0.05	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K10/2	3	27-Sep-04	12.0	31200	2.04	<7			0.09	<0.01	<0.1	<0.001	0.01	0.017	0.01	<0.1	3.60	0.2	<0.1	<0.1	<0.1	1.3	<0.1	1.2	0.8	<0.1	0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K10/2	3	31-Mar-05	11.0	2004	1.38	<50			0.088	0.022	0.14	0.002	0.014	<0.001	<0.005	<0.1	14.57	6	<0.1	0.1	0.2	2.8	<0.1	2.2	1.5	0.2	0.3	<0.2	0.07	<0.1	<0.1	<0.1		
K10/2	3	13-Sep-05	11.3	2540	0.178	<50			0.152	<0.010	<0.05	0.007	0.016	<0.001	<0.005	<0.1	9.47	0.4	<0.1	<0.1	0.1	2.8	0.1	2.8	1.8	0.2	0.3	<0.2	0.07	<0.1	<0.1	<0.1		
K10/2*	3	9-Mar-06	11.59	3310	2.62	70			0.134	<0.010	0.07	0.018	0.019	<0.001	0.02	<0.1	3.60	<0.1	<0.1	0.2	0.2	1.4	<0.1	1.1	0.7	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K10/2	3	6-Sep-06	11.29	2790	1.90	<50			0.0885	<0.010	0.07	0.004	0.01	0.002	0.007	<0.1	3.5	0.6	<0.1	<0.1	<0.1	1.1	<0.1	1.3	0.9	<0.1	0.2	<0.2	<0.05	<0.1	<0.1	<0.1		
K10/2	3	9-Mar-07	11..59	3310	2.62	70			0.134	<0.010	0.07	0.018	0.019	<0.001	0.02	<0.1	3.60	<0.1	<0.1	0.2	0.2	1.4	<0.1	1.1	0.7	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K10/2	3	22-Sep-07	6.3	1112	0.694	<50			<0.0040	<0.010	0.1	0.006	0.01	<0.001	0.014	<0.1	0.70	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	0.3	0.2	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K10/2	3	11-Mar-08	11.2	1860	1.09	<50			0.0568	<0.01	<0.05	<0.001	0.008	<0.001	<0.005	<0.1	3.8	1.1	<0.1	0.9	0.9	0.5	<0.1	0.2	0.2	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K10/2	3	10-Sep-08	Inaccessible																															
K10/2	3	5-Mar-09	12.1	3700	1.28	<50			0.212	<0.01	<0.05	<0.001	0.011	<0.001	<0.005	<0.1	2.5	1.6	<0.1	<0.1	<0.1	0.4	<0.1	0.3	0.2	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K10/2	3	14-Sep-09	11.4	2130	0.113	<50			<0.004	<0.01	<0.05	<0.001	0.016	<0.001	<0.005	<0.1	2.0	1.8	<0.1	<0.1	<0.1	0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K10/2	3	11-Apr-12	10.8	830	0.29		<0.005	<0.01		<0.005			0.008	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K10/2	3	13-Feb-13	13.4	2900	0.98		<0.005	0.02					0.008	0.002			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K10/2	3	9-Dec-13	9.3	1780	0.07		<0.005	0.03					0.03	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K10/2	3	2-Nov-15	11.7	2310	0.72	-	<0.004	<0.004	<0.004	<0.01	-	-	0.009	0.003	-	-	7.1	<1.0	<1.0	<1.0	<1.0	2.3	<1.0	2.8	2	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0		
K10/2	3	15-Apr-16	11.68	2216	0.16	<0.05	NA	<0.004	<0.004	<0.005	-	-	0.016	<0.001	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<0.5	<1.0	<1.0	<1.0		
K10/2	3	18-Apr-17	9.85	620	0.68	-	<0.004	<0.004	<0.004	<0.005			0.014	<0.001	-	-	6.9	0.4	<0.1	<0.1	<0.1	3.3	0.1	1.8	1.1	<0.1	0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K10/2	3	11-Jul-19	5.29	4601	0.051	-	<0.004	<0.004	-	<0.005			0.007	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K10/2	3	30-Jun-20	6.71	724	0.13	-	<0.004	<0.004	-	<0.005			0.009	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K10/2	3	07-Jul-21	9.57	11844	0.016	-	-	-	-	<0.005			0.005	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K10/2	3	01-Jul-22	7.43	362.8	0.04	-	-	-	-	<0.005			0.034	<0.001			<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K10/2	3	12-Oct-23	7.6	477	0.02		<0.005	<0.005		<0.005			0.006	<0.001			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K10/2N	4	14-Dec-99	8.1	13600	8.9	<1^			0.07	<0.01	<0.1	0.45	<0.01	<0.05	0.01	0.08	1.38	<0.05	<0.05	<0.05	0.09	0.32	0.27	0.14	0.18	0.08	0.08	0.14	0.08	<0.05	<0.05			
K10/2N	4	14-Mar-00	8.1	16500	8.6	47^			0.06	<0.01	<0.1	0.48	<0.01	<0.05	0.15	<0.05	2.70	0.4	<0.2	<0.2	0.3	1	<0.2	0.3	0.3	<0.2	0.4	<0.2	<0.2	<0.2	<0.2	<0.2		
K10/2N	4	7-Jun-00	8.3	12200	7.8	220^	0.04		0.05	<0.01	<0.10	0.23	<0.01	<0.05	0.03	<0.05	2.20	0.4	<0.2	0.3	0.2	0.9	<0.2	0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K10/2N	4	6-Sep-00	8.4	9500	6.7	120^	0.055		0.096	<0.01	<0.10	0.13	<0.01	0.006	0.04	<0.05	2.50	0.4	<0.2	0.2	<0.2	0.9	<0.2	0.3	0.3	0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K10/2N	4	6-Dec-00	8.2	11700	6.3	96^	0.024		0.041	<0.01	<0.1	0.17	<0.01	0.002	0.01	<0.05	2.40	<0.2	<0.2	<0.2	<0.2	0.7	<0.2	0.2	0.3	<0.2	0.3	0.2	0.2	0.2	<0.2	0.3		
K10/2N	4	6-Mar-01	8.1	11700	6.6	10^	0.034		0.091	<0.005	0.07	0.318	0.005	<0.005	<0.01	<0.05	1.60	0.3	<0.1	0.1	<0.1	0.6	<0.1	0.2	0.2	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1		
K10/2N	4	5-Sep-01	8.7	6500	5	18^	0.058		0.067	<0.01	<0.1	0.047	<0.01	<0.002	<0.005	0.06	3.00	0.3	<0.1	0.1	0.1	0.5	<0.1	0.3	0.3	0.2	0.2	0.4	0.2	0.2	<0.1	0.2		
K10/2N	4	4-Mar-02	8.5	6400	4.6	<1^	<0.03		0.09	<0.01	<0.1	0.08	<0.01	0.004	0.029	<0.05	0.10	<0.1	<0.1	<0.2	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K10/2N	4	14-Oct-02	9.2	4000	4.54	<10	<0.005		0.05	0.01	<0.05	0.038	0.022	<0.001	0.044	0.05	0.20	<0.1	<0.1	0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K10/2N	4	15-Apr-03	8.8	4200	4.01	<10	<0.005		0.083	<0.005	<0.05	0.068	0.014	<0.005	0.14	<0.05	<0.755	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.01	<0.1	<0.1	<0.1		
K10/2N	4	17-Nov-03	8.7	3510	1.88	<50			0.115	<0.01	0.04	0.08	0.013	0.01	0.006	<0.1	<0.755	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K10/2N	4	29-Mar-04	9.3	3620	3.75	<10			0.045	<0.01	<0.05	0.051	0.021	<0.001	<0.002	<0.00005	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K10/2N	4	27-Sep-04	8.3	4960	4.06	<7			0.074	<0.01	<0.1	0.069	0.012	0.002	<0.005	<0.1	5.18	0.3	<0.1	0.3	0.3	1.4	<0.1	0.5	0.7	0.3	0.4	0.4	0.28	0.1	<0.1	0.2		
K10/2N	4	31-Mar-05	9.3	2300	3.47	<50			0.1	<0.010	<0.05	0.009	0.023	0.004	0.01	<0.1	6.23	0.4	<0.1	0.3	0.3	1.5	<0.1	0.5	0.7	0.2	0.4	0.2	0.13	<0.1	<0.1	0.1		
K10/2N	4	13-Sep-05	8.7	2330	1.21	<50			0.143	<0.010	0.09	0.017	0.025	0.004	0.02	<0.1	6.28	0.5	<0.1	0.2	0.3	1.4	0.1	0.4	0.4	0.2	0.3	0.3	0.18	<0.1	<0.1	0.2		
K10/2N*	4	9-Mar-06	8.7	2760	3.29	<50			0.132	<0.010	0.08	0.026	0.022	0.002	0.043	<0.1	0.10	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K10/2N	4	6-Sep-06	8.9	1847	8.2	95			0.0895	<0.010	0.84	0.044	0.024	0.093	0.448	<0.1	14.91	1.6	<0.1	1	1.2	4.7	0.3	1.5	1.8	0.8	1.4	1	0.61	<0.1	0.2	0.4		
K10/2N[2]	4	9-Mar-07	8.72	2760	3.29	<50			0.132	<0.010	0.08	0.026	0.022	0.002	0.043	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K10/2N	4	22-Sep-07	8.80	1298	2.45	<50			0.0142	<0.010	0.05	0.006	0.014	<0.001	0.006	<0.1	0.7	0.2	<0.1	<0.1	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K10/2N	4	11-Mar-08	9.30	747	1.81	<50			0.0828	<0.01	0.07	0.009	0.016	<0.001	0.016	<0.1	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K10/2N	4	10-Sep-08																																
K10/2N	4	5-Mar-09	9.9	13950	1.93	<50			0.055	<0.01	<0.05	0.004	0.023	<0.001	0.005	<0.1	3.68	0.6	<0.1	0.3	0.2	0.8	0.1	0.6	0.5	0.2	0.1	0.2	0.08	<0.1	<0.1	<0.1		
K10/2N	4	15-Sep-09	9.3	1540	2.71	<50			0.018	<0.01	<0.05	0.007	0.021	<0.001	0.034	<0.1	1.1	0.4	<0.1	0.3	0.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K10/2N	4	22-Dec-10	8.0	1600	2.9		0.11	0.007		<0.005			0.017	<0.001			<1.76	<0.1	<0.1	0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1
K10/2N	4	11-Apr-12	9.1	8	1.9		0.017	<0.01		<0.005			0.011	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K10/2N	4	13-Feb-13	10.7	1810	2.9		<0.005	0.02					0.018	0.004			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K10/2N	4	9-Dec-13	9.4	314	2.6		<0.005	0.02					0.019	0.004			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K10/2N	4	2-Nov-15	11.7	2308	0.73	-	<0.004	<0.004	<0.004	<0.01	-	-	0.011	0.002	-	-	16.2	<1.0	<1.0	<1.0	<1.0	4.7	<1.0	**5.8**	4.1	<1.0	1	<1.0	0.6	<1.0	<1.0	<1.0		
K10/2N	4	Blocked																																
K10/2N	4	7-Jul-21	9.6	1184	1.8	<50	<0.004	<0.004	0.021	<0.005			0.029	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	1.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K10/2N	4	1-Jul-22	8.2	21.8	0.48	<50	<0.004	<0.004	-	<0.005			0.008	<0.01			<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K10/2N	4	12-Oct-23	9.3	1,075	1.4		<0.005	0.025		<0.005			0.024	<0.001			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K5/4	1	16-Mar-99	11.6	2600	2.1	24^			0.04	<0.01	0.28	<0.01	<0.01	<0.02	<0.01	0.07	2.00	2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K5/4	1	21-Jun-99	11.7	2500	1.9	23^			0.038	<0.001	<0.01	0.001	0.01	<0.001	0.016	<0.1	0.50	0.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.05		
K5/4	1	9-Sep-99	11.9	3200	2.7	33^			0.2	<0.01	<0.01	<0.01	0.01	<0.02	<0.01	0.14	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K5/4	1	9-Dec-99	11.9	3100	1.6	38^			4.5	<0.01	<0.1	<0.01	0.01	<0.05	<0.01	<0.05	1.54	0.31	0.05	0.31	0.22	0.35	0.09	0.11	0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2		
K5/4	1	14-Mar-00	8.7	1100	0.1	<1^			<0.01	<0.01	<0.01	<0.1	0.01	<0.01	<0.05	0.03	1.60	<0.05	0.3	<0.2	0.6	0.3	0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K5/4	1	7-Jun-00	12.0	3000	2.5	33^	<0.005		<0.005	<0.01	<0.10	<0.01	0.04	<0.05	<0.01	<0.05	2.10	0.3	<0.2	<0.2	0.7	0.9	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K5/4	1	6-Sep-00	11.9	3200	2.5	14^	<0.20		<0.20	<0.01	<0.10	<0.01	0.02	<0.002	<0.01	<0.05	1.80	<0.2	<0.2	0.6	0.5	0.7	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K5/4	1	6-Dec-00	11.8	3100	2.3	25^	<0.005		<0.005	<0.01	<0.1	<0.01	<0.01	0.008	<0.01	<0.05	1.90	<0.2	<0.2	0.6	0.3	0.8	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.2	<0.2	<0.2	<0.2		
K5/4	1	6-Mar-01	11.9	3000	2	19^	<0.1		<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.01	<0.05	0.80	<0.1	<0.1	0.2	0.2	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K5/4	1	5-Sep-01	11.8	3000	2.6	23^	0.07		<0.07	<0.01	<0.1	<0.005	<0.01	<0.002	<0.005	0.08	0.80	<0.1	<0.1	0.2	0.2	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/4	1	4-Mar-02	10.0	1200	0.5	<1^	<0.03		0.031	<0.01	<0.1	<0.01	<0.01	<0.002	<0.005	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/4	1	9-Oct-02	11.5	2600	2.4	30	<0.005		0.015	0.002	<0.05	0.005	0.008	<0.001	0.052	0.07	0.20	0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/4	1	16-Apr-03	11.6	7000	2.34	20	<0.005		0.014	<0.005	<0.05	0.057	0.006	<0.005	0.039	<0.05	1.44	0.3	<0.1	0.1	0.2	0.4	<0.1	0.2	0.2	<0.1	<0.1	<0.2	0.04	<0.1	<0.1	<0.1		
K5/4	1	17-Nov-03																																
K5/4	1	30-Mar-04	9.6	13010	1.12	10			0.011	<0.01	<0.05	<0.001	<0.001	0.012	0.064	<0.05	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/4	1	28-Sep-04	8.5	1070	0.04	<21			0.221	<0.01	<0.1	0.214	0.011	<0.001	<0.005	<0.1	1.05	<0.1	<0.1	<0.1	<0.1	0.3	<0.1	0.2	<0.1	0.1	0.1	0.3	0.05	<0.1	<0.1	<0.1		
K5/4	1	31-Mar-05	8.3	994	0.234	<50			0.031	0.104	<0.05	0.124	0.003	<0.001	<0.005	<0.1	3.50	0.6	<0.1	<0.1	<0.1	0.6	0.2	0.4	0.4	0.2	0.2	0.3	0.1	<0.1	<0.1	<0.1		
K5/4	1	12-Sep-05	10.2	1530	1.87	<50			0.194	<0.010	0.1	0.024	0.006	0.003	0.047	0.2	4.95	1.2	<0.1	<0.1	<0.1	0.8	0.2	0.5	0.5	0.2	0.3	0.4	0.15	<0.1	<0.1	0.1		
K5/4*	1	7-Mar-06	8.7	1084	0.177	108			0.0365	<0.010	<0.05	0.011	0.006	<0.001	0.008	<0.1	0.10	0.2	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/4	1	6-Sep-06	10.8	1432	1.07	<50			0.13	<0.010	0.06	0.004	0.004	<0.001	0.01	<0.1	0.60	0.2	<0.1	<0.1	<0.1	0.3	<0.1	0.2	0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/4[2]	1	7-Mar-07	8.69	1084	0.18	108			0.0365	<0.010	<0.05	0.011	0.006	<0.001	0.008	<0.1	0.3	0.2	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/4	1	27-Sep-07	9.60	976	1.24	<50			<0.0040	<0.010	<0.05	0.007	0.002	<0.001	0.008	<0.1	0.2	0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K5/4	1	11-Mar-08	7.50	1020#	0.02	<50			0.0051	<0.01	<0.05	0.004	0.002	<0.001	0.012	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K5/4	1	8-Sep-08	8.93	870	0.02	<50			<0.004	<0.01	<0.05	0.009	0.002	<0.001	0.009	<0.1	0.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/4	1	7-Mar-09	7.7	761	0.02	<50			<0.004	<0.01	<0.05	0.006	0.002	<0.001	0.006	<0.1	7	6.1	<0.1	0.4	0.3	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K5/4	1	14-Sep-09	10.7	1070	2.63	<50			0.007	<0.01	<0.05	0.001	0.004	<0.001	<0.005	<0.1	8.1	8	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K5/4	1	23-Dec-10	11.4	2000	0.79		0.27	<0.004	0.006	<0.005	-	-	-	-	-	-	<1.80	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1
K5/4	1	10-Apr-12	11.64	1460	1.1		0.005	<0.01	0.027	<0.005	-	-	-	-	-	-	<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K5/4	1	20-Feb-13		855	0.05		0.005	<0.01	0.027	<0.005	-	-	-	-	-	-	<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K5/4	1	5-Dec-13	7.7	684	0.01	90	<0.005	<0.01	0.009		-	-	-	-	-	-	<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K5/4	1	29-Oct-15	7.4	1050	0.11	<1.0	<0.004	<0.004	<0.004	<0.01	-	-	-	-	-	-	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0		
K5/4	1	06-Apr-16	8.45	986	0.051	-	<0.004	<0.004	<0.004	<0.005	-	-	-	-	-	-	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0		
K5/4	1	07-Apr-17	7.03	903	<0.005	-	<0.004	<0.004	<0.004	<0.005			-	-	-	-	NIL (+)VE	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/4	1	12-Jul-19	5.75	1050	>0.005	-	<0.004	<0.004	<0.004	<0.005			-	-			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/4	1	13-Jul-21	6.41	9.9	0.021	-	<0.004	<0.004	<0.004	<0.005			-	-			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	1.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/4	1	24-Jun-22	6.73	3.9	0.084	-	<0.004	<0.004	<0.004*	<0.005			-	-			<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		

Table B-1: Monitoring Data: Fill Wells (1999-2023)

ANALYTES			pH	Conductivity	Ammonia	Phenols	Free Cyanide	Weak Acid Disociable Cyanide	Total Cyanide	Cr - Dissolved	Fe - Dissolved	Mn - Dissolved	Mo - Dissolved	Pb - Dissolved	Zn - Dissolved	Hg - Dissolved	Total PAHs	Naphthalene	Acenaphtylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)&(k)fluoranthene	Benzo(a)pyrene	Indeno(1.2.3-cd)pyrene	Dibenzo(ah)anthracene	Benzo(ghi)perylene	1-Methylnaphthalene	2-Methylnaphthalene
			pH units	µs/cm	mg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L
ANZECC CRITERIA			**8 to 8.4**		**0.91**	**400**	**0.004**		**0.004**	**0.0044**		**0.08 (L)**	**0.023 (L)**	**0.0044**	**0.015**	**0.1**		**70 (M)**				**0.2 (L)**	**0.4 (L)**	**1.4 (L)**					**0.2 (L)**					
K5/5N	5	7-Jun-00	9.5	1800	0.9	16^	0.03		0.03	<0.01	<0.10	<0.01	0.02	<0.05	<0.01	<0.05	6.10	4	0.3	0.3	1	0.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K5/5N	5	7-Sep-00	9.5	1700	0.3	6^	0.008		0.012	<0.01	<0.10	<0.01	0.01	<0.002	<0.01	<0.05	0.60	0.2	<0.2	0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K5/5N	5	7-Dec-00	9.1	1300	0.1	<1^	0.006		0.006	<0.01	<0.1	<0.01	0.01	<0.002	<0.01	<0.05	0.30	<0.2	<0.2	<0.2	<0.2	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K5/5N	5	8-Mar-01	8.7	750	0.1	<1^	0.008		0.008	0.008	<0.05	<0.005	0.009	<0.005	<0.01	<0.05	<0.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K5/5N	5	6-Sep-01	9.2	1600	0.2	<1^	<0.005		0.019	<0.01	<0.1	0.006	<0.01	<0.002	<0.005	0.06	0.30	<0.1	<0.1	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/5N	5	4-Mar-02	9.1	1600	0.1	<1^	<0.03		0.022	<0.01	<0.1	<0.01	<0.01	<0.002	<0.005	<0.05	<0.8	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K5/5N	5	9-Oct-02	9.9	2600	4.18	<10	<0.005		0.018	0.002	<0.05	0.021	0.027	<0.001	0.005	<0.05	2.50	0.3	0.3	1.4	0.3	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/5N	5	16-Apr-03																																
K5/5N	5	10-Nov-03																																
K5/5N	5	31-Mar-04	8.7	16470	0.04	<10			0.024	<0.01	0.08	0.004	0.016	<0.001	<0.002	<0.05	0.70	0.3	<0.1	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/5N	5	27-Sep-04	9.2	1430	0.06	<7			0.013	<0.01	<0.1	<0.001	0.013	<0.001	<0.005	<0.1	0.70	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	0.1	<0.1	<0.1	<0.1		
K5/5N	5	31-Mar-05	7.8	995	0.094	<50			0.024	<0.010	<0.05	0.003	0.017	<0.001	<0.005	<0.1	0.50	0.2	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/5N	5	13-Sep-05	7.4	1621	0.026	<50			0.021	<0.010	<0.05	0.004	0.027	<0.001	0.009	<0.1	0.90	0.5	<0.1	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/5N	5	7-Mar-06	8.5	1523	<0.010	<50			0.0275	<0.010	<0.05	0.005	0.016	<0.001	0.008	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/5N	5	5-Sep-06	8.4	1356	0.035	<50			0.0069	<0.010	<0.05	0.001	0.015	<0.001	<0.005	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/5N	5	7-Mar-07	8.54	1523	<0.010	<50			0.0275	<0.010	<0.05	0.005	0.016	<0.001	0.008	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/5N	5	25-Sep-07	8.70	927	<0.010	<50			<0.0040	<0.010	<0.05	0.001	0.015	<0.001	0.01	<0.1	0.7	0.6	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K5/5N	5	11-Mar-08		-	-	-			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
K5/5N	5	10-Sep-08	8.95	807	<0.01	<50			0.016	<0.01	<0.05	0.002	0.012	<0.001	<0.005	<0.1	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/5N	5	5-Mar-09	8.5	1336	<0.01	<50			0.014	<0.01	<0.05	0.003	0.016	<0.001	<0.005	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K5/5N	5	9-Sep-09	8.4	1225	0.01	<50			0.008	<0.01	<0.05	0.001	0.013	<0.001	<0.005	<0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K5/5N	5	23-Dec-10	8.5	1200	0.01		<0.004	<0.004		<0.005							<1.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1
K5/5N	5	10-Apr-12	9.12	960	0.01		0.012	<0.01		<0.005							<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K5/5N	5	19-Feb-13	8.58	1050	0.14		<0.005	<0.01									<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K5/5N	5	3-Dec-13	8.6	710	<0.01		0.008	<0.01	0.018								<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K5/5N	5	3-Nov-15	8.74	673	<0.01	<1.0	<0.004	<0.004	0.007	<0.01	-	-	-	-	-	-	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2	<0.5	<1.0	<1.0	<1.0		
K5/5N	5	06-Apr-16	8.52	600	0.015	-	<0.004	<0.004	NA	<0.005	-	-	-	-	-	-	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2	<0.5	<1.0	<1.0	<1.0		
K5/5N	5	06-Apr-17	7.75	860	<0.005	-	<0.004	<0.004	0.008	<0.005			-	-	-	-	NIL (+)VE	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/5N	5	08-May-18	6.66	860	<0.005	-	<0.004	<0.004	-	<0.005			-	-				<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/5N	5	30-Jun-19	5.05	740	<0.005	-	<0.004	<0.004	<0.004	<0.005			-	-			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/5N	5	22-Jun-21	8.62	997	0.008	<50	<0.004	-	-	<0.005			-	-			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	1.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/5N	5	22-Jun-22	7.09	31	0.01	<50	<0.004	<0.004	-	<0.005			-	-			<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/6N	6	8-Jun-00	9.2	1100	0.1	<1^	<0.005		0.01	<0.01	<0.10	0.03	0.03	<0.05	<0.01	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K5/6N	6	7-Sep-00	9.4	2400	1.8	8^	0.013		0.025	<0.01	<0.10	0.05	0.02	<0.002	<0.01	<0.05	1.60	<0.2	<0.2	1	0.3	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K5/6N	6	7-Dec-00	9.0	1200	0.6	<1^	0.006		0.006	<0.01	<0.1	<0.01	<0.01	<0.002	<0.01	<0.05	1.60	<0.2	<0.2	0.5	0.4	0.7	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K5/6N	6	8-Mar-01	8.3	530	0.1	1^	<0.05		<0.005	0.011	<0.05	<0.005	0.006	<0.005	<0.01	<0.05	0.50	0.1	<0.1	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K5/6N	6	6-Sep-01	9.9	1400	2.1	65^	0.08		<0.08	<0.01	<0.1	0.009	<0.01	<0.002	<0.005	0.09	60.40	24	1.2	24	5.8	4.8	<0.1	0.4	0.2	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/6N	6	4-Mar-02	8.9	1500	0.9	39^	0.08		0.028	<0.01	<0.1	0.07	<0.01	<0.002	<0.005	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/6N	6	10-Oct-02																																
K5/6N	6	16-Apr-03	9.2	1400	1.53	<10	<0.005		0.01	<0.005	<0.05	0.01	0.019	<0.005	0.24	<0.05	<0.755	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.01	<0.1	<0.1	<0.1		
K5/6N	6	10-Nov-03																																
K5/6N	6	31-Mar-04	9.5	1540	1.46	50			0.022	<0.01	<0.05	0.037	0.012	<0.001	0.005	<0.05	117.10	43	1.2	43	14	13	1	1.2	0.7	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/6N	6	28-Sep-04	9.2	2290	2.17	<7			0.208	<0.01	<0.1	0.018	0.02	<0.001	<0.005	<0.1	5.50	0.4	0.2	4.2	0.2	0.3	0.2	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/6N	6	31-Mar-05	9.2	1517	1.54	<50			0.235	0.035	<0.05	0.01	0.014	<0.001	<0.005	<0.1	47.60	17.8	0.6	21.8	2.4	1.2	0.3	0.1	0.2	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/6N	6	12-Sep-05	10.0	2280	5.11	0.141			0.745	<0.010	<0.05	0.006	0.02	<0.001	0.006	<0.1	366.80	106	5.6	135	42.4	38.9	2.9	2.4	1.4	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/6N*	6	8-Mar-06	8.3	1204	0.616	<50			0.16	<0.010	<0.05	0.038	0.011	<0.001	<0.005	<0.1	7.20	<0.1	0.2	5.7	1	0.2	0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/6N	6	5-Sep-06	10.7	1797	2.69	60			0.413	<0.010	0.11	0.026	0.018	<0.001	0.006	0.2	13.50	7.7	0.3	10.8	1.7	0.9	0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/6N[2]	6	8-Mar-07	8.26	1204	0.62	<50			0.16	<0.010	<0.05	0.038	0.011	<0.001	<0.005	<0.1	7.2	<0.1	0.2	5.7	1	0.2	0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/6N	6	25-Sep-07	10.90	1436	4.57	123			0.0158	<0.010	<0.05	0.008	0.014	<0.001	<0.005	<0.1	178	64.5	3.8	58.1	17.4	16.2	1.6	1.3	0.6	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K5/6N	6	10-Mar-08	8.90	1264	1.01	<50			0.0495	<0.01	<0.05	0.026	0.012	<0.001	0.010	<0.1	3.2	<0.1	0.2	2.7	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K5/6N	6	8-Sep-08	9.88	970	0.75	<50			<0.004	<0.01	<0.05	0.011	0.006	<0.001	<0.005	<0.1	3.4	<0.1	0.2	3.3	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/6N	6	5-Mar-09	8.8	1384	0.91	<50			0.025	<0.01	<0.05	0.03	0.015	<0.001	<0.005	<0.1	4.4	0.4	0.2	3.4	0.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K5/6N	6	11-Sep-09	10.4	1484	3.55	<50			0.03	<0.01	<0.05	0.018	0.026	<0.001	0.005	<0.1	4.9	<0.1	0.3	4	0.5	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K5/6N	6	23-Dec-10	9.2	1300	1.6	0.02	0.2	0.004	0.029	<0.005							<1.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1
K5/6N	6	4-Apr-12	9.6	764	0.49	<10	<0.005	<0.01	0.022	<0.005							<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K5/6N	6	20-Feb-13	9.3	1160	0.76	<10	0.006	<0.01	0.056								<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K5/6N	6	3-Dec-14	8.6	899	0.72		<0.005	<0.01	0.015								<16	<1	<1	1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K5/6N	6	29-Oct-15	7.05	1310	1.44	<1.0	<0.004	<0.004	<0.004	<0.01	-	-	-	-	-	-	182	178	<1.0	2.6	<1.0	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0		
K5/6N	6	05-Apr-16	8.91	1000	1.7	<50	<0.004	<0.004	0.028	<0.005	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<0.5	<1.0	<1.0	<1.0		
K5/6N	6	06-Apr-17	8.31	1051	0.61	<50	<0.004	<0.004	0.008	<0.005			-	-	-	-	NIL (+)VE	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/6N	6	08-May-18	7.5	880	0.39	<50	<0.004	<0.004	0.011	<0.005			-	-			NIL (+)VE	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/6N	6	15-Jun-20	5.79	593	0.37	<50	<0.004	<0.004	0.008	<0.005			-	-			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/6N	6	22-Jun-21	8.87	678	0.32	<50	<0.004	<0.004	<0.004	<0.005			-	-			NIL (+)VE	<0.2	<0.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/6N	6	22-Jun-22	5.43	29.2	0.65	<50	<0.004	<0.004	0.011	<0.005			-	-			<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/6N	6	10-Oct-23	8.63	1,221	0.64	<50	<0.005	<0.005	0.011	<0.005							<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K7/4N	7	8-Jun-00	8.1	3100	4.2	<1^	0.09		0.09	<0.01	<0.10	0.2	0.04	<0.05	0.07	0.1	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K7/4N	7	6-Sep-00	7.8	3100	3.3	<1^	<0.20		<0.20	<0.01	<0.10	0.19	0.03	<0.002	<0.01	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K7/4N	7	6-Dec-00	8.0	3100	3.5	<1^	0.19		0.19	<0.01	<0.1	0.17	0.04	<0.002	<0.01	<0.05	0.40	<0.2	<0.2	0.2	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K7/4N	7	6-Mar-01	7.8	3000	3.8	1^	0.067		0.085	<0.005	0.06	0.29	0.04	<0.005	<0.01	<0.05	<0.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K7/4N	7	5-Sep-01	7.8	2900	3.5	<1^	0.038		0.177	<0.01	0.12	0.08	<0.01	<0.002	<0.005	0.11	1.30	0.3	<0.1	0.4	0.3	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K7/4N	7	4-Mar-02	7.9	3400	3.6	<1^	0.066		0.329	<0.01	0.17	0.16	<0.1	<0.002	<0.005	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K7/4N	7	10-Oct-02	8.1	3400	4.13	<10	0.007		0.228	0.004	0.07	0.27	0.044	<0.001	0.068	<0.05	0.10	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K7/4N	7	15 & 22/04/2003	7.8	2400	4.5	<10	<0.005		0.12	<0.005	<0.05	0.31	0.068	<0.005	0.140	<0.05	0.30	0.2	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.01	<0.1	<0.1	<0.1		
K7/4N	7	17-Nov-03	8.0	2380	3.58	<50			0.204	<0.01	0.12	0.211	0.069	<0.001	0.013	<0.1	<0.772	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K7/4N	7	30-Mar-04	7.9	2590	4.23	<10			0.138	<0.01	<0.05	0.117	0.002	<0.001	0.004	<0.05	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K7/4N	7	29-Sep-04	7.9	2800	5.01	<7			0.186	0.061	<0.1	0.255	0.061	<0.001	<0.050	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K7/4N	7	31-Mar-05	8.6	2430	4.85	<50	<0.0050		0.214	<0.010	<0.05	0.165	0.06	<0.001	<0.005	<0.1	0.10	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K7/4N	7	12-Sep-05	7.0	3210	3.08	<50	<0.0050		0.195	<0.010	0.07	0.164	0.063	<0.001	0.009	<0.1	0.10	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K7/4N	7	7-Mar-06	7.6	3300	4.54	<50			0.176	<0.010	0.14	0.279	0.138	<0.001	0.024	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K7/4N	7	6-Sep-06	7.4	2270	11.4	<50			0.228	<0.010	0.23	0.316	0.091	<0.001	0.005	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K7/4N	7	7-Mar-07	7.57	3300	4.54	<50			0.176	<0.010	0.14	0.279	0.138	<0.001	0.024	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K7/4N	7	27-Sep-07	7.80	2100	8.04	<50			0.128	<0.010	0.18	0.214	0.027	<0.001	0.021	<0.1	0.6	0.5	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K7/4N	7	11-Mar-08	7.60	3170#	13.30	<50			0.0777	<0.01	32.7	0.952	<0.001	<0.001	0.039	<0.1	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K7/4N	7	8-Sep-08	7.49	2290	8.21	<50			<0.004	<0.01	0.26	0.228	0.02	0.001	0.017	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K7/4N	7	6-Mar-09	7.1	2660	14	<50			0.123	<0.01	<0.05	0.283	0.022	<0.001	<0.005	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K7/4N	7	9-Sep-09	7.3	2270	12.7	<50			0.085	<0.01	0.23	0.28	0.02	<0.001	<0.005	<0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K7/4N	7	4-Apr-12	8.4	2090	5.3		<0.005	0.01	0.068	<0.005			0.013				501.5	480	1	11	2	2	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K7/4N	7	4-Dec-13	7.9	1490	9.1		<0.005	0.01	0.11								<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K7/4N	7	5-Nov-15	Well not located due to overgrowth																															
K7/4N	7	14-Jul-21	5.6	46.1	9.0	<50	<0.004	<0.004	0.023				0.015	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	1.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K7/4N	7	23-Jun-22	6.8	34.9	11.0	<50	<0.004	<0.004	0.18	<0.005			0.031	<0																				
K7/4N		11-Oct-23	7.8	2283.0	8.7		<0.005	0.007	0.10	<0.005			0.016				<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		

Table B-1: Monitoring Data: Fill Wells (1999-2023)

ANALYTES			pH	Conductivity	Ammonia	Phenols	Free Cyanide	Weak Acid Dissociable Cyanide	Total Cyanide	Cr - Dissolved	Fe - Dissolved	Mn - Dissolved	Mo - Dissolved	Pb - Dissolved	Zn - Dissolved	Hg - Dissolved	Total PAHs	Naphthalene	Acenaphtylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b&k)fluoranthene	Benzo(a)pyrene	Indeno(1.2.3-cd)pyrene	Dibenzo(ah)anthracene	Benzo(ghi)perylene	1-Methylnaphthalene	2-Methylnaphthalene
			pH units	µs/cm	mg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L
ANZECC CRITERIA			8 to 8.4		0.91	400	0.004		0.004	0.0044		0.08 (L)	0.023 (L)	0.0044	0.015	0.1		70 (M)						0.2 (L)	0.4 (L)	1.4 (L)				0.2 (L)					
K8/5E	2	17-Mar-99	11.9	7000	1.9	35^			0.04	<0.01	<0.10	<0.01	0.09	0.09	<0.01	<0.05	62.00	15	0.4	10	4	15	3	7	7	0.3	0.3	<0.2	<0.2	<0.2	<0.2	<0.2		
K8/5E	2	21-Jun-99	12.0	6700	1.7	22^			0.062	<0.001	<0.1	0.001	0.094	<0.001	0.013	<0.1	61.90	15	0.3	10	4	15	3	7	7	0.3	0.3	<0.2	<0.2	<0.2	<0.2	<0.05		
K8/5E	2	9-Sep-99	12.2	5800	0.8	11^			0.035	<0.01	<0.01	<0.01	0.05	0.09	<0.01	<0.05	38.20	9	0.2	6	2	10	2	5	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K8/5E	2	9-Dec-99	11.9	6100	0.8	18^			0.04	<0.01	<0.1	<0.01	0.1	0.05	<0.01	<0.05	85.76	3.3	0.7	14	8.82	30.6	5.7	11.1	11.2	0.21	0.13	<0.05	<0.05	<0.05	<0.05	<0.2		
K8/5E	2	14-Mar-00	11.7	4200	1.5	23^			0.02	<0.1	<0.1	<0.01	0.14	0.17	0.06	<0.05	13.20	<0.2	<0.2	0.9	<0.2	<0.2	0.6	0.4	10	0.3	0.7	0.3	<0.2	<0.2	<0.2	<0.2		
K8/5E	2	7-Jun-00	12.0	4800	1.7	18^	0.03		0.04	<0.01	<0.10	<0.01	0.1	0.27	<0.01	<0.05	46.40	10	0.4	0.4	4	15	3	6	7	0.3	0.3	<0.2	<0.2	<0.2	<0.2	<0.2		
K8/5E	2	6-Sep-00	11.8	5500	1.9	28^	0.024		0.035	<0.01	<0.10	<0.01	0.1	0.13	<0.01	<0.05	44.00	7	0.4	8	4	10	2	6	6	0.3	0.3	<0.2	<0.2	<0.2	<0.2	<0.2		
K8/5E	2	6-Dec-00				Dry																												
K8/5E	2	6-Mar-01				Dry																												
K8/5E	2	5-Sep-01	11.6	3400	1	18^	0.012		0.053	<0.01	<0.1	<0.005	<0.01	0.072	<0.005	<0.05	15.10	1.6	0.1	3.8	1.4	2.6	<0.1	2.2	3.4	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K8/5E	2	4-Mar-02	11.3	2800	1	9^	<0.03		0.099	<0.01	<0.1	<0.01	<0.01	0.052	<0.005	<0.05	3.00	<0.1	<0.1	1	<0.1	<0.1	<0.1	<0.1	2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K8/5E	2	10-Oct-02				Dry																												
K8/5E	2	15-Apr-03				Dry																												
K8/5E	2	17-Nov-03				Not Sampled - Dry 17/11/03																												
K8/5E	2	30-Mar-04	9.2	2810	0.63	<10			0.006	<0.01	0.13	0.207	0.091	0.097	0.107	<0.05	1.20	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1.2	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K8/5E	2	29-Sep-04	10.9	3930	0.83	<7			0.205	<0.01	<0.1	0.002	0.105	0.006	<0.050	<0.1	21.68	3.2	0.2	2.4	0.9	1.7	1	2.3	5.4	0.9	0.7	1.3	0.68	0.4	0.1	0.5		
K8/5E	2	30-Mar-05															-											0						
K8/5E	2	12-Sep-05	10.4	6370	0.614	<50			0.198	<0.010	0.09	0.008	0.101	0.002	0.006	<0.1	20.50	5.1	0.1	3.2	1.3	3.2	0.8	1.7	3.9	0.2	0.2	<0.2	<0.05	<0.1	<0.1	<0.1		
K8/5E	2	9-Mar-06															-																	
K8/5E	2	6-Sep-06	10.9	3950	1.32	51			0.0989	<0.010	0.12	0.007	0.149	0.01	0.006	<0.1	7.30	2.1	<0.1	1.8	0.9	1.2	0.4	0.5	2.3	0.1	0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K8/5E	2	9-Mar-07															-																	
K8/5E	2	25-Sep-07	11.20	4880	0.47	<50			0.028	<0.010	0.6	0.013	0.055	0.003	0.146	<0.1	10	1.9	<0.1	1.7	0.8	1.5	0.4	0.8	2.4	0.1	0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K8/5E	2	10-Mar-08	11.00	3970	0.40	73			0.0432	<0.01	20.1	6.89	0.072	0.014	0.052	<0.1	5	0.6	<0.1	0.7	0.2	0.3	0.2	0.5	2.3	0.1	0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K8/5E	2	10-Sep-08	9.53	4860	0.12	<50			0.016	<0.01	<0.5	0.05	0.022	<0.001	0.008	<0.1	3.9	1.6	<0.1	1.3	0.5	0.8	0.1	0.3	0.6	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K8/5E	2	6-Mar-09	9.7	4250	0.24	<50			0.096	<0.01	<0.5	0.002	0.05	0.003	<0.005	<0.1	0.4	<0.1	<0.1	0.2	<0.1	<0.1	<0.1	0.1	<0.1	0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K8/5E	2	9-Sep-09	10.5	4960	0.25	<50			0.066	<0.01	<0.005	0.006	0.048	0.002	<0.005	<0.1	11.7	2.6	<0.1	1.9	0.8	2	0.4	1.2	2.7	0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K8/5E	2	23-Dec-10	9.5	4200	0.82		0.046	0.01	0.054	<0.005			0.069	0.003			<10.58	1.2	<0.1	2.7	1.3	1	0.2	0.5	2.5	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1
K8/5E	2	4-Apr-12	10.7	5040	0.48		<0.005	<0.01	0.065	<0.005			0.039	0.022			<16	2	<1	2	<1	<1	<1	<1	2	<1	<1	<2	<1	<1	<1	<1		
K8/5E	2	20-Feb-13	10.2	3230	1.2		<0.005	0.01	0.081				0.04	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K8/5E	2	4-Dec-13	10.8	2660	0.95		0.007	0.01	0.031				0.022	0.01			18	<1	<1	1	<1	<1	<1	<1	2	<1	<1	<2	<1	<1	<1	<1		
K8/5E	2	03-Nov-15	10.68	2921	0.81	-	<0.004	<0.004	0.072	<0.01	-	-	0.039	<0.001	-	-	16.4	1.7	<1.0	4.4	2.8	3.9	<1.0	1.3	2.3	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0		
K8/5E	2	06-Apr-16	10.19	3039	1.2	-	<0.004	<0.004	0.12	<0.005	-	-	0.039	0.013	-	-	22	4	<1	6	3	4	<1	2	3	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0		
K8/5E	2	07-Apr-17	8.83	1046	2.5	<50	<0.004	<0.004	0.021	0.02			0.044	0.002	-	-	1.9	<0.2	<0.2	0.5	0.1	0.1	<0.1	0.1	1.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K8/5E	2	24-Jun-20	5.42	591	2.6	90	<0.004	<0.004	0.004	<0.005			0.057	<0.001			0.45	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.3	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K8/5E	2	23-Jun-21	4.97	2424	1.5	<50	<0.004	<0.004	0.017	<0.005			0.055	0.002			8	2.4	<0.1	1.7	0.8	1.2	0.3	0.4	1.2	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K8/5E	2	24-Jun-22	10.32	2668	0.98	<50	<0.004	<0.004	0.038	<0.005			0.034	<0.001			7.1	2.1	<0.1	1.4	0.6	1.2	<0.1	0.5	1.3	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K7/1		26-Mar-09	10.3	1039	0.13	<50			<0.004	<0.01	0.1	0.019	0.011	0.004	0.016	<0.1	3.76	0.7	<0.1	0.1	<0.1	0.8	0.1	0.6	0.5	0.2	0.2	**0.3**	0.16	<0.1	<0.1	0.1		
K7/1		7-Mar-09	7.8	948	4.6	<50			0.017	<0.01	<0.05	0.174	0.526	0.002	0.013	<0.1	88.3	84.1	0.1	1.8	0.8	0.8	0.1	0.3	0.2	<0.1	<0.1	**0.1**	<0.05	<0.1	<0.1	<0.1		
K7/1		15-Sep-09	9.0	1780	15.5	<50			0.053	<0.01	<0.05	0.145	1.07	0.001	0.015	<0.1	545.4	535	0.4	5	1.6	2.3	0.2	0.6	0.3	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K7/1		23-Dec-10	8.8	2300	15	<0.01	0.087	0.007	0.03	<0.005			1.2	0.003			<8.96	0.8	<0.1	2.6	1	1.3	0.2	0.7	0.5	0.2	0.1	**0.3**	0.19	0.1	<0.1	0.1	0.4	<0.1
K7/1		16-Apr-12	8.34	1860	11	<10	<0.005	<0.01	0.069	<0.005			1	0.002			13	<1	<1	4	<1	2	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K7/1		20-Feb-13	8.54	1610	7.8	<10	0.005	0.01	0.042								<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K7/1		4-Dec-13	8.11	1370	8.6		<0.005	<0.01	0.036				0.36	0.002			588	570	<1	7	2	3	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K7/1		29-Oct-15	7.13	1370	11.5	2.7	<0.004	<0.004	0.076	<0.01	-	-	0.64	<0.01	-	-	165	162	<1.0	2.2	<1.0	1.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0		
K7/1		11-Apr-16	8.53	1955	8.6	<0.05	<0.004	<0.004	0.26	<0.005	-	-	1.1	0.14	-	-	11	<1.0	<1.0	5	2	3	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<0.5	<1.0	<1.0	<1.0		
K7/1		07-Apr-17	7.72	1719	6.4	<50	<0.004	<0.004	0.034	<0.005			0.43	<0.001	-	-	100	96	0.2	3.9	1	1.5	<0.1	0.4	0.2	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K7/1		9/05/2018	6.63	1430	8.1	<50	<0.004	<0.004	0.07	<0.005			0.52	<0.001			170	170	<0.1	1.8	0.6	0.7	<0.1	0.2	0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K7/1		5/07/2019	8.42	2333	10	<50	<0.004	<0.004	0.051	<0.005			0.48	<0.001			270	270	0.3	3.6	1.1	1.6	<0.1	0.4	0.3	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K7/1		15/06/2020	6.55	2640	8.8	<50	<0.004	<0.004	0.1	<0.005			0.59	<0.001			330	320	0.4	5	1.5	1.9	<0.1	0.4	0.4	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K7/1		23/06/2021	5.81	1093	6.4	<50	<0.004	<0.004	<0.004	<0.005			0.38	<0.001			17	17	<0.1	0.4	<0.1	0.2	<0.1	0.2	0.2	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K7/1		23/06/2022	7.35	12.6	6.7	<50	<0.004	<0.004	0.038	<0.005			0.28	<0.001			4.6	3.8	<0.1	0.4	<0.1	<0.1	<0.1	0.2	0.2	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K7/1		10/10/2023	5.9	3,029	6.0	<50	<0.005	<0.005	0.074	<0.005			0.41	<0.001			420	410	<1	7	2	3	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
GHD01N		26-Mar-09	8.4	4790	0.97	<50			0.006	<0.01	0.21	0.241	0.131	0.017	0.086	<0.1	8.59	1.1	0.1	<0.1	0.6	2.1	0.2	0.8	1	0.5	0.6	**0.7**	0.39	0.2	<0.1	0.3		
GHD01N		18-Sep-09	8.2	3930	1.3	<50			0.013	<0.01	<0.05	0.332	0.188	0.001	0.009	<0.1	0.5	0.1	<0.1	<0.1	<0.1	0.2	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	0.06	<0.1	<0.1	<0.1		
GHD01N		22-Dec-10	8.0	4200	1.5	<0.01	<0.004	0.006	0.014	<0.005			0.19	0.001			<1.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1
GHD01N		11-Apr-12	8.9	2210	0.82	0.01	0.007	<0.01	0.23	<0.005		0.28	0.31	0.015			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
GHD01N		18-Apr-17	7.87	1123	0.067	<50	<0.004	<0.004	0.005	<0.005			0.034	0.002	<100	<100	NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
GHD01N		7-Jul-20	8.19	3142	0.46	<50	<0.004	<0.004	0.021	<0.005			0.11	0.006			0.29	<0.2	<0.1	<0.1	<0.1	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
GHD01N		7-Jul-21	5.85	85	0.22	<50	<0.004	<0.004	0.007	<0.005			0.13	0.034			0.64	0.3	<0.1	<0.1	<0.1	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
GHD01N		12-Oct-23	8.2	1,571	0.42	<50	<0.005	<0.005	0.046	<0.005			0.14	0.001			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
E61S		2-Mar-09	-	-	-	-			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
E61S		15-Sep-09	-	-	-	-			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
E61S		29-Oct-15	Well Dry																															
E61S		7-Apr-17	Well Dry																															
336A		6-Mar-09	7.2	2670	0.34	<50			<0.004	<0.01	0.07	0.071	<0.001	<0.001	<0.005	<0.1	1.3	1.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
336A		11-Sep-09	7.0	2580	1.18	<50			<0.004	<0.01	0.9	0.126	0.001	<0.001	<0.005	<0.1	12.7	12.6	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
336A		16-Apr-12	7.3	810	0.95	<10	<0.005	<0.01	<0.005	<0.005		0.075	0.002	0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
336A		22-Feb-13	7.7	2360	1.6	<10	<0.005	<0.01	<0.005				0.001	0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
336A		04-Nov-15	7.36	2629	2.25	<10	<0.005	<0.01	<0.005	<0.01	0.003	<0.001	<0.001	<0.001	<1.0	<1.0	<16	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0						
336A		06-Apr-17	7.11	1779	0.55	<50	<0.004	<0.004	<0.004	<0.005			0.002	<0.001	-	-	NIL (+)VE	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
336A		10-May-18	6.98	2380	0.58	<50	<0.004	<0.004	<0.004	<0.005			0.002	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
336A		11-Jul-19	6.04	19430	0.67	<50	<0.004	<0.004	<0.004	<0.005			0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
336A		09-Jun-20	6.41	2495	1.4	<50	<0.004	<0.004	<0.004	<0.005			0.002	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
336A		25-Jun-21	6.18	64.1	1.4	<50	<0.004	<0.004	<0.004	<0.005			0.004	<0.001			0.27	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
336A		28-Jun-22	7.23	15.1	0.83	<50	<0.004	<0.004	<0.004	<0.005			0.002	<0.001			<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
336A		09-Oct-23	7.21	5,756	1.7	<50	<0.005	<0.005	<0.004*	<0.005			<0.005	<0.0001			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
344A		23-Dec-10	10.8	1100	3.7	<0.01	<0.004	<0.004	<0.004	<0.005			<0.002	<0.001			<1.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1
344A		10-Apr-12	11.6	629	0.11		<0.005	<0.01	<0.005	<0.005			<0.001	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
344A		19-Feb-13	11.3	1330	0.3	<10	<0.005	<0.01	<0.005				0.002				<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
344A		3-Dec-13	10.8	809	0.13		<0.005	<0.01	0.015								<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
344A		10-May-18	10.17	930	0.14	<50	<0.004	<0.004	<0.004	<0.005			0.003	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
344A		12-Jul-19	9.7	1317	0.25	<50	<0.004	<0.004	<0.004	<0.005			0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
344A		24-Jun-21	5.26	83.9	0.62	<50	<0.004	<0.004	<0.004	<0.005			0.004	<0.001			0.17	<0.2	<0.1	<0.1	<0.1	1.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
344A		27-Jun-22	5.26	83.9	0.37	<50	<0.004	<0.004	0.012	<0.005			0.002	<0.001			<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
344A		9-Oct-23	11.08	1,639	0.57	<50	<0.005	<0.005	<0.004*	<0.005			<0.005	0.0002			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		

Shading — Value Exceeds 95% trigger value for marine waters as shown in Table 3.4.1 of the Australian and New Zealand Guidelines for Fresh and Marine water Quality 2000

Note

Ammonia guideline based on a pH of the receiving water body of 8.

Total PAH and Total Phenol calcuated as the sum of reported individual compounds.

Total PAH and Total Phenol PQL calculated as the sum of individual compound PQLs divided by 2.

(L) = Low Reliability Trigger Value

(M) = Moderate Reliability Trigger Value

Ammonia determination was as NO3 until April 2003, after which ammonia determination was as N.

Dissolved Chromium was reported until April 2003, after which hexavalent chromium was reported.

Blank indicates not analysed.

nd = not detected at GHDs March 04 detection levels.

Only sample locations that currently require sampling have an EPA ID number.

* Sample decanted and supernatant analysed for PAH.

PQL Raised due to matrix interference.

^ Value is for speciated phenol and not total phenols

*Wells reanalysed to lor LOR of 0.004 mg/L

Table B-**2**: Monitoring Data: Shallow Estuarine Wells (1999-20**23**)

Sample ID	EPA ID	Date	pH	Conductivity	Ammonia	Phenols	Free Cyanide	Weak Acid Disociable Cyanide	Total Cyanide	Cr VI - Dissolved	Fe - Dissolved	Mn - Dissolved	Mo - Dissolved	Pb - Dissolved	Zn - Dissolved	Hg - Dissolved	Total PAHs	Naphthalene	Acenaphtylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)&(k)fluoranthene	Benzo(a)pyrene	Indeno(1.2.3-cd)pyrene	Dibenzo(ah)anthracene	Benzo(ghi)perylene	1-Methylnaphthalene	2-Methylnaphthalene
ANALYTES			pH units	µs/cm	mg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L
ANZECC CRITERIA			8 to 8.4		0.91	400	0.004		0.004	0.0044		0.08 (L)	0.023 (L)	0.0044	0.015	0.1		70 (M)				0.2 (L)	0.4 (L)	1.4 (L)					0.2 (L)					
K10/2NN	9	13-Dec-99	7	33400	7.9	64^			0.84	<0.01	<0.1	1.3	<0.01	<0.05	0.03	<0.05	1.14	0.36	0.15	0.09	0.19	0.35	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		
K10/2NN	9	14-Mar-00	7	32700	8.5	<1^			0.07	<0.01	<0.1	0.74	<0.01	<0.05	0.14	<0.05	9.4	2	0.6	0.6	0.8	2	0.2	0.5	0.5	0.3	0.8	0.3	0.2	0.3	0.3	<0.2		
K10/2NN	9	7-Jun-00	7.1	31300	9.6	<1^	<0.005		<0.005	<0.01	<0.10	0.73	<0.01	<0.05	0.02	0.13	4	<0.2	2	2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K10/2NN	9	7-Sep-00	7.1	32900	8.4	<1^	<0.005		<0.005	<0.01	<0.10	0.64	<0.01	<0.002	<0.01	<0.05	28.5	4	10	1	2	5	0.5	1	1	0.9	1	0.6	0.5	0.7	0.3	<0.2		
K10/2NN	9	6-Dec-00	7	33000	8.7	<1^	<0.005		<0.005	<0.01	<0.1	0.61	<0.01	<0.002	<0.01	<0.05	2	<0.2	2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K10/2NN	9	7-Mar-01	6.8	32300	7.9	<1^	<0.005		<0.005	<0.005	<0.05	1.33	<0.005	<0.005	<0.01	<0.05	1	<0.1	1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K10/2NN	9	5-Sep-01	6.9	32500	8.4	<1^	<0.005		<0.005	<0.01	<0.1	0.31	<0.01	<0.002	<0.005	<0.05	1.1	0.1	1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K10/2NN	9	4-Mar-02	7.1	32400	8.9	1^	<0.005		<0.005	<0.01	<0.1	0.35	<0.01	0.014	<0.01	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K10/2NN	9	14-Oct-02	7.2	31000	10.2	<10	<0.005		<0.005	0.102	0.06	2.34	0.002	<0.001	0.044	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K10/2NN	9	15-Apr-03	7.1	16000	12	20	<0.005		<0.005	<0.005	<0.05	2.2	<0.005	<0.005	0.14	<0.05	0.4	0.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.01	<0.1	<0.1	<0.1		
K10/2NN	9	17-Nov-03	6.98	33900	9.24	<50			0.065	<0.01	0.51	1.27	<0.001	<0.001	0.014	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K10/2NN	9	31-Mar-04	7.1	31100	10.6	20			<0.005	<0.01	<0.05	1.35	0.001	<0.001	<0.002	<0.05	0.4	0.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K10/2NN	9	27-Sep-04	7.03	32800	10.3	<7			<0.005	<0.01	0.2	1.54	0.016	<0.001	<0.050	<0.1	7.52	2	1.2	0.2	0.4	1.3	<0.1	0.5	0.5	0.3	0.4	0.5	0.22	<0.1	<0.1	<0.1		
K10/2NN	9	31-Mar-05																																
K10/2NN	9	12-Sep-05	6.29	33400	8.61	<50			0.042	<0.010	0.09	1.23	0.004	<0.001	0.028	<0.1	129.45	69	4	1.7	3.8	11.2	1	2.8	3.6	1.7	2	2.1	1.35	0.5	0.2	0.8		
K10/2NN	9	9-Mar-06	6.63	22370	9.97	<50			0.0085	<0.010	0.57	1.23	<0.010	<0.010#	0.057	<0.1	0.1	1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K10/2NN	9	6-Sep-06	6.94	31800	19.7	<50			0.0179	<0.010	0.42	1.03	<0.001	0.001	0.019	<0.1	0.5	2	0.7	<0.1	0.1	0.3	<0.1	<0.1	0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K10/2NN	9	9-Mar-07	6.63	22370	9.97	<50			0.0085	<0.010	0.57	1.23	<0.010	<0.010#	0.057	<0.1	1.1	1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K10/2NN	9	22-Sep-07	6.7	25800	7.14	89			<0.0040	<0.010	0.54	1.04	<0.001	<0.001	0.016	<0.1	2.4	1.7	0.3	<0.1	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K10/2NN	9	11-Mar-08	7.6	25500	6.68	<50			0.0109	<0.01	0.09	1.2	<0.001	<0.001	0.009	<0.1	3.9	3.7	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K10/2NN	9	10-Sep-08																																
K10/2NN	9	5-Mar-09	7.69	34500	3.84	<50			<0.004	<0.01	<0.5	1.09	<0.001	<0.001	<0.005	<0.1	1.9	0.8	<0.1	<0.1	<0.1	<0.1	0.9	<0.1	<0.1	<0.1	0.2	<0.1	<0.05	<0.1	<0.1	<0.1		
K10/2NN	9	14-Sep-09	6.89	25000	6.83	<50			<0.004	<0.01	0.06	1.04	<0.001	<0.001	<0.005	<0.1	1.2	1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K10/2NN	9	9-Dec-13	6.8	27600	8.8		<0.005	<0.01	<0.005				<0.001	<0.001			31	16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1		
K10/2NN	9	2-Nov-15	6.67	24005	6.15	-	<0.004	<0.004	<0.004	<0.01	-	-	<0.001	<0.001	-	-	5.9	5.9	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0		
K10/2NN	9	15-Apr-16	6.85	22173	5.8	<0.05	<0.004	<0.004	<0.004	<0.005	-	-	<0.001	<0.001	-	-	2.1	2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<0.5	<1.0	<1.0	<1.0		
K10/2NN	9	11-May-18	6.87	19220	6.7	-	<0.004	<0.004	<0.004	<0.025	-	-	<0.001	<0.001	-	-	12	12	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K10/2NN	9	11-Jul-19	5.79	6140	4.6	-	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			14	14	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K10/2NN	9	29-Jun-20	5.98	21298	5.6	-	<0.004	<0.004	<0.004	<0.050			<0.001	<0.001			14	14	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K10/2NN	9	07-Jul-21	6.11	611	6.4	-	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			21	21	<0.1	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K10/2NN	9	01-Jul-22	6.87	20649	7.6	-	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			8.3	8.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K10/2NN	9	12-Oct-23	6.5	19,665	5.5		<0.005	<0.005	<0.005	<0.005			<0.005	<0.001			78	78	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K11/1	29	24-Jun-99	7.5	9300	1.2	<1^			0.005	<0.001	<1	0.731	<0.001	<0.001	0.009	<0.1	0.3	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K11/1	29	10-Sep-99	7.5	6500	0.9	<1^			0.007	<0.01	<0.1	0.51	<0.01	<0.02	0.01	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K11/1	29	10-Dec-99	7.5	5600	0.3	<1^			0.04	<0.01	<0.1	0.71	<0.01	<0.05	0.06	<0.05	0.38	<0.05	<0.05	0.13	0.09	0.16	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		
K11/1	29	14-Mar-00	7.7	6900	1	<1^			0.02	<0.01	<0.1	0.71	<0.01	<0.05	<0.01	<0.05	1.7	0.3	<0.2	0.6	0.3	0.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K11/1	29	8-Jun-00	7.8	8400	1.1	<1^	<0.005		<0.005	<0.01	<0.10	0.68	<0.01	<0.05	<0.01	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K11/1	29	7-Sep-00	7.4	8500	1.4	<1^	<0.005		<0.005	<0.01	<0.10	0.94	<0.01	<0.002	0.02	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K11/1	29	7-Dec-00	7.4	8600	1.4	<1^	<0.005		<0.005	<0.01	<0.1	0.94	<0.01	<0.002	<0.01	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K11/1	29	8-Mar-01	7.6	4600	0.9	<1^	<0.005		<0.005	<0.005	0.36	1.04	<0.005	<0.005	<0.01	<0.05	<0.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K11/1	29	6-Sep-01	7.5	5400	1.3	<1^	<0.005		<0.005	<0.01	0.24	0.46	<0.01	<0.002	<0.005	<0.05	0.3	0.2	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K11/1	29	4-Mar-02	7.5	4400	1.4	<1^	<0.005		<0.005	<0.01	0.24	0.66	<0.01	<0.05	<0.01	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K11/1	29	15-Oct-02	7.6	6800	1.82	<10	<0.005		0.006	0.011	0.26	1.71	<0.001	<0.001	0.057	<0.05	2.5	0.2	<0.1	<0.1	<0.1	0.2	<0.1	0.4	0.4	0.2	0.1	0.4	0.2	0.2	<0.1	0.2		
K11/1	29	15-Apr-03	7.6	2400	1	<10	<0.005		<0.005	<0.005	0.22	1.3	<0.005	<0.005	0.058	<0.05	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.01	<0.1	<0.1	<0.1		
K11/1	29	11-Nov-03	7.74	4080	0.62	<50			<0.005	<0.01	<0.01	1.06	<0.001	<0.001	0.005	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K11/1	29	31-Mar-04	7.7	4220	0.81	<10			<0.005	<0.01	<0.05	1.21	<0.001	<0.001	<0.002	<0.05	0.2	0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K11/1	29	28-Sep-04	7.42	4050	0.89	<7			0.014	<0.01	<0.1	0.711	0.006	<0.001	<0.050	<0.1	1.87	0.1	<0.1	<0.1	<0.1	0.1	<0.1	0.3	0.4	0.2	0.1	0.4	0.17	<0.1	<0.1	0.1		
K11/1	29	29-Mar-05	7.68	5200	0.805	<50	<0.0050		<0.0050	0.867	<0.05	1.26	0.003	<0.001	<0.005	<0.1	7.41	0.2	0.1	<0.1	<0.1	0.3	0.1	0.9	1.8	0.5	0.4	0.9	0.51	0.2	<0.1	0.3		
K11/1	29	7-Sep-05	7.18	5540	0.336	<50	<0.0050		<0.0050	<0.010	0.22	1.76	0.002	<0.001	0.006	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K11/1	29	3-Mar-06	6.93	2010	0.159	<50			<0.0050	<0.010*	0.5	1.75	<0.001	<0.001	0.006	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K11/1	29	5-Sep-06	7.22	3500	0.453	<50			0.0141	<0.010	0.68	1.5	<0.001	<0.001	0.053	<0.1	0.1	0.2	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K11/1	29	3-Mar-07	6.93	2010	0.159	<50			<0.0050	<0.010*	0.5	1.75	<0.001	<0.001	0.006	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K11/1	29	25-Sep-07	6.5	426	0.093	<50			<0.0040	<0.010	0.25	0.506	0.004	<0.001	0.005	<0.1	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K11/1	29	6-Mar-08	7.4	584	0.255	<50			<0.004	<0.01	0.37	0.703	0.002	<0.001	<0.005	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K11/1	29	11-Sep-08	7.19	755	0.13	<50			0.007	<0.01	0.26	0.822	<0.01	<0.002	0.012	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	0.07	<0.1	<0.1	<0.1		
K11/1	29	7-Mar-09	7	782	0.17	<50			<0.004	<0.01	1.58	0.731	0.004	<0.001	0.007	<0.1	0.4	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K11/1	29	14-Sep-09	7.73	836	0.19	<50			<0.004	<0.01	0.23	0.373	0.002	<0.001	0.009	<0.1	1.2	1.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K11/1	29	24-Dec-10	7.6	2800	0.62	20	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			<1.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1
K11/1	29	10-Dec-13	7.4	605	0.26	<10	<0.005	<0.01	0.007			0.43	0.004	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1		
K11/1	29	22-Apr-14	7.2	880	0.25	<10	<0.005	0.01	0.008			0.6	<0.001	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1		
K11/1	29	30-Oct-15	7.18	790	0.15	<1.0	<0.004	<0.004	<0.004	<0.01	-	-	0.002	<0.001	-	-	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0		
K11/1	29	05-Apr-16	6.02	398	0.036	<0.05	<0.004	<0.004	<0.004	<0.005	-	-	0.003	<0.001	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<0.5	<1.0	<1.0	<1.0		
K11/1	29	13-Apr-17	7.04	1437	0.37	<0.05	<0.004	<0.004	<0.004	<0.005	-	-	0.001	<0.001	-	-	NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K11/1	29	15-May-18	6.2	1210	0.23	<0.05	<0.004	<0.004	<0.004	<0.005	-	-	<0.001	<0.001	-	-	NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K11/1	29	16-Jul-19	6.2	1205	0.23	<0.05	<0.004	<0.004	<0.004	<0.005	-	-	0.001	<0.001	-	-	0.69	0.7	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K11/1	29	05-Jul-20	7.42	1722	0.4	<0.05	<0.004	<0.004	<0.004	<0.005			0.004	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K11/1	29	01-Jul-21	5.4	16	0.085	<50	<0.004	<0.004	<0.004	<0.005			0.003	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K11/1	29	06-Jul-22	5.82	148	0.29	<50	<0.004	<0.004	<0.004	<0.005			0.005	<0.001			0.19	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K11/1	29	13-Oct-23	7.3	1,052	0.05	<50	<0.005	<0.005	<0.005	<0.005			<0.005	<0.001			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K11/2E	31	10-Dec-99	7.2	11200	1.9	3^			0.06	<0.01	1.7	0.89	<0.01	<0.05	0.02	<0.05	1.12	0.16	<0.05	0.11	0.1	0.16	0.06	0.1	0.08	0.07	0.1	0.07	0.06	0.05	<0.05	<0.05		
K11/2E	31	14-Mar-00	7.3	10900	2.1	<1^			0.15	<0.01	0.66	0.62	<0.01	<0.05	0.04	<0.05	1.3	0.3	<0.2	0.5	0.2	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K11/2E	31	8-Jun-00	7.6	5800	1.5	1^	<0.005		<0.005	<0.01	0.23	0.44	<0.01	<0.05	0.04	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K11/2E	31	7-Sep-00	7.5	4600	1.2	<1^	<0.005		<0.005	<0.01	0.32	0.42	<0.01	<0.002	0.04	<0.05	0.4	<0.2	<0.2	0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K11/2E	31	7-Dec-00	7.3	4200	1.2	<1^	<0.005		<0.005	<0.01	<0.1	0.48	<0.01	<0.002	<0.01	<0.05	0.4	<0.2	<0.2	0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K11/2E	31	8-Mar-01	7.2	4500	1.6	4^	<0.005		<0.005	<0.005	19.2	1.49	<0.005	<0.005	<0.01	<0.05	0.3	<0.1	<0.1	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K11/2E	31	6-Sep-01	7.4	5500	1.5	<1^	<0.005		<0.005	<0.01	4.6	0.36	<0.01	<0.002	<0.005	0.05	0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K11/2E	31	4-Mar-02	7.3	4400	1.4	<1^	<0.005		<0.005	<0.01	5.9	0.46	<0.01	<0.05	<0.01	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K11/2E	31	14-Oct-02	7.8	3700	1	<10	<0.005		<0.005	0.013	1.55	0.58	0.002	<0.001	0.065	0.05	0.3	<0.1	<0.1	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K11/2E	31	15-Apr-03	6.8	2900	0.51	<10	<0.005		<0.005	<0.005	19	0.7	<0.005	<0.005	0.15	<0.05	0.44	0.2	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	0.04	<0.1	<0.1	<0.1		
K11/2E	31	10-Nov-03	7.29	3120	0.58	<50			<0.005	<0.01	11.9	0.902	0.002	<0.001	0.007	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K11/2E	31	31-Mar-04	7.51	2690	0.8	<10			<0.005	<0.01	0.25	0.603	<0.001	<0.001	<0.002	<0.05	0.3	0.1	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K11/2E	31	27-Sep-04	7.49	2290	0.48	<7			0.02	<0.01	<0.1	0.52	0.003	<0.001	0.008	<0.1	0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K11/2E	31	29-Mar-05	7.52	1669	0.585	<50			0.0088	0.144	<0.05	0.421	0.002	<0.001	<0.005	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K11/2E	31	7-Sep-05	7.24	2520	0.47	<50			0.03	<0.010	7.68	0.507	0.004	<0.001	<0.005	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K11/2E	31	3-Mar-06	7.01	2047	0.497	<50			0.011	<0.010*	6.22	0.449	0.002	<0.001	<0.005	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K11/2E	31	1-Sep-06	7.57	1644	0.614	<50			0.017	<0.010	7.49	0.386	0.002	<0.001	<0.005	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K11/2E	31	3-Mar-07	7.01	2047	0.497	<50			0.011	<0.010*	6.22	0.449	0.002	<0.001	<0.005	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K11/2E	31	21-Sep-07	7.3	1138	0.495	<50			<0.0040	<0.010	7.03	0.41	0.003	<0.001	0.01	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K11/2E	31	6-Mar-08	7	1145	0.812	<50			0.0103	<0.01	8.8	0.378	0.002	<0.001	0.013	<0.1	0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K11/2E	31	11-Sep-08	7.42	1650	0.34	<50			0.011	<0.01	7.98	0.398	<0.01	<0.002	0.008	<0.1	0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K11/2E	31	7-Mar-09	6.87	11660	1.11	<50			<0.004	<0.01	12.5	1.13	0.007	0.002	0.01	<0.1	4.58	1	<0.1	0.4	0.2	0.2	<0.1	0.7	0.7	0.3	0.2	0.6	0.28	<0.1	<0.1	<0.1		
K11/2E	31	8-Sep-09	7.19	2980	<0.5	<50			<0.004	<0.01	8.81	0.487	0.002	<0.001	<0.005	<0.1	0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K11/2E	31	24-Dec-10	7.4	2200	0.37	<10	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			<1.76	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1
K11/2E	31	2-Apr-12	8.31	0.012	0.32	<10	<0.005	<0.01	<0.005	<0.005			<0.005	0.012			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K11/2E	31	12-Feb-13	8.02	1.37	0.32	20	<0.005	<0.01	<0.005				<0.001	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K11/2E	31	6-Dec-13	7.4	1460	0.38	<10	<0.005	<0.01	<0.005				0.003	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1			
K11/2E	31	28-Oct-15	7.6	1300	0.28	<1.0	<0.004	<0.004	<0.004	<0.01			<0.001	<0.001			<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0		
K11/2E	31	28-Oct-15	7.6	1300	0.28	<1.0	<0.004	<0.004	<0.004	<0.01	-	-	<0.001	<0.001	-	-	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0		
K11/2E	31	05-Apr-16	7.21	897	0.059	<0.05	<0.004	<0.004	<0.004	<0.005	-	-	0.003	0.068	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<0.5	<1.0	<1.0	<1.0		
K11/2E	31	Not accesiible																																
K11/2E	31	10-May-18	6.58	1110	0.27	<0.05	<0.004	<0.004	<0.004	<0.005	-	-	<0.001	<0.001	-	-	NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K11/2E	31	10-Jul-19	6.58	777	0.27	<50	<0.004	<0.004	<0.004	<0.05			<0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K11/2E	31	10-Jun-20	7.14	1705	0.14	<50	<0.004	<0.004	<0.004	<0.01			0.003	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K11/2E	31	21-Jun-21	7.72	792	0.14	<50	<0.004	<0.004	<0.004	<0.005			0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K11/2E	31	21-Jun-22	7.12	24.3	0.18	<50	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K11/2E	31	12-Oct-23	7.4	915	0.01	<50	<0.005	<0.005	<0.005	<0.005			<0.005	<0.001			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		

Table B-2: Monitoring Data: Shallow Estuarine Wells (1999-2023)

ANALYTES			pH	Conductivity	Ammonia	Phenols	Free Cyanide	Weak Acid Dissociable Cyanide	Total Cyanide	Cr VI - Dissolved	Fe - Dissolved	Mn - Dissolved	Mo - Dissolved	Pb - Dissolved	Zn - Dissolved	Hg - Dissolved	Total PAHs	Naphthalene	Acenaphtylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)&(k)fluoranthene	Benzo(a)pyrene	Indeno(1.2.3-cd)pyrene	Dibenzo(ah)anthracene	Benzo(ghi)perylene	1-Methylnaphthalene	2-Methylnaphthalene
ANZECC CRITERIA			pH units	µS/cm	mg/L	µg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L
			8 to 8.4		0.91	400	0.004		0.004	0.0044		0.08 (L)	0.023 (L)	0.0044	0.015	0.1		70 (M)				0.2 (L)	0.4 (L)	1.4 (L)					0.2 (L)					
K11/3E	21	10-Dec-99	6.9	44100	0.7	2^			0.08	<0.01	8.4	1.2	<0.01	<0.05	<0.01	<0.05	0.18	<0.05	<0.05	<0.05	<0.05	0.13	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		
K11/3E	21	14-Mar-00	6.9	37700	1.9	<1^			0.02	<0.01	1.1	1.6	<0.01	<0.05	<0.01	<0.05	3	0.5	<0.2	1	0.6	0.9	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K11/3E	21	8-Jun-00	7	36300	2.1	<1^	<0.005		<0.005	<0.01	0.25	0.84	<0.01	<0.05	0.22	0.17	0.6	<0.2	<0.2	<0.2	0.3	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K11/3E	21	7-Sep-00	7	37700	1.4	<1^	<0.005		<0.005	<0.01	<0.10	0.62	<0.01	<0.002	<0.01	0.05	0.8	<0.2	<0.2	0.3	0.2	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K11/3E	21	7-Dec-00	6.8	36600	1.7	<1^	<0.005		<0.005	<0.01	<0.1	0.57	<0.01	<0.002	<0.01	<0.05	0.8	<0.2	<0.2	0.3	0.2	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K11/3E	21	8-Mar-01	6.9	32200	2.5	<1^	<0.005		<0.005	0.007	18.1	1.32	<0.005	<0.005	<0.01	<0.05	0.7	<0.1	<0.1	0.2	0.2	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K11/3E	21	6-Sep-01	7	31300	1.9	1^	<0.005		<0.005	<0.01	12	0.37	<0.01	0.003	<0.005	0.07	0.7	0.1	<0.1	0.2	0.1	0.3	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1		
K11/3E	21	4-Mar-02	7	26400	2.2	2^	<0.005		<0.005	<0.01	10	0.37	<0.01	0.005	<0.01	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1		
K11/3E	21	14-Oct-02	7.2	31000	1.35	<10	<0.005		<0.005	0.028	7.81	1.25	0.003	<0.001	0.081	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1		
K11/3E	21	15-Apr-03	7.1	20000	1.09	<10	<0.005		<0.005	<0.005	15.1	1.2	<0.005	<0.005	0.21	<0.05	<0.755	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.01	<0.1	<0.1	<0.1	<0.1		
K11/3E	21	11-Nov-03	7.03	32900	1.21	<50			<0.005	<0.01	0.5	0.667	0.002	<0.001	0.02	<0.1	0.3	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K11/3E	21	31-Mar-04	7.45	15320	2.98	<10			<0.005	<0.01	0.09	0.294	0.002	<0.001	<0.002	<0.05	0.4	0.3	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K11/3E	21	27-Sep-04	7.21	21200	3.58	0.042			0.042	<0.01	0.9	0.46	0.002	<0.001	<0.050	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K11/3E	21	29-Mar-05	7.52	10260	2.95	<50			0.092	<0.100	0.09	0.236	0.003	<0.001	<0.005	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K11/3E	21	7-Sep-05	6.87	31900	2.63	<50			0.09	<0.010	8.32	0.627	0.002	<0.001	<0.005	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K11/3E	21	3-Mar-06	6.48	19910	1.85	<0.050			<0.0050	<0.010*	5.14	0.395	0.002	<0.001	0.017	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K11/3E	21	1-Sep-06	7.01	16100	3.19	53			0.083	<0.010	9.8	0.489	<0.001	<0.001	0.018	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K11/3E	21	3-Mar-07	6.48	19910	1.85	<50			<0.0050	<0.010*	5.14	0.395	0.002	<0.001	0.017	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K11/3E	21	21-Sep-07	6.7	9040	2.19	<50			<0.0040	<0.010	4.23	0.387	0.003	<0.001	0.018	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1		
K11/3E	21	6-Mar-08	7.1	5860	2.48	<50			0.0869	<0.01	5.26	0.286	0.004	<0.001	0.007	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1		
K11/3E	21	11-Sep-08	6.89	7320	1.91	<50			0.047	<0.01	4.87	0.33	<0.01	<0.002	0.007	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K11/3E	21	7-Mar-09	6.58	8960	1.38	<50			<0.004	<0.01	6.61	0.343	0.003	<0.001	0.005	<0.1	0.4	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1		
K11/3E	21	14-Sep-09	7.4	7500	1.58	<50			<0.004	<0.01	5.11	0.424	<0.001	<0.001	0.037	<0.1	1.2	1.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1		
K11/3E	21	24-Dec-10	7.5	6800	2.2	<10	<0.004	<0.004	0.0065	<0.005			<0.001	<0.001	7.5		<1.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
K11/3E	21	2-Apr-12	7.76	3630	0.86	<10	<0.005	<0.01	<0.005	<0.005			<0.005	<0.005			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1		
K11/3E	21	13-Feb-13	8.3	7140	0.86	30	<0.005	<0.01	<0.005				0.003	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1		
K11/3E	21	6-Dec-13	7.2	2770	0.77	<10	<0.005	<0.01	<0.005				0.003	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1		
K11/3E	21	28-Oct-15	6.63	2700	0.94	<1.0	<0.004	<0.004	<0.004	<0.01	-	-	-	<0.001	-	-	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0	<1.0		
K11/3E	21	11-Apr-16	7.1	5694	0.25	<0.05	<0.004	<0.004	<0.004	<0.005	-	-	0.004	<0.001	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<0.5	<1.0	<1.0	<1.0	
K11/3E	21	13-Apr-17	7	2453	1.9	<0.05	<0.004	<0.004	<0.004	<0.005			0.004	<0.001	-	-	NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1		
K11/3E	21	16-May-18	Blocked																														
K11/3E	21	04-Jul-20	7.28	1906	5.2	<50	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1		
K11/3E	21	01-Jul-21	5.59	43	0.84	<50	<0.004	<0.004	<0.004	<0.005			0.002	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1		
K11/3E	21	28-Jun-22	6.93	10.2	5.6	<50	<0.004	<0.004	<0.004	<0.005			0.004	<0.001			<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1		
K11/3E	21	12-Oct-23	7	2,963	1.7	<50	<0.005	<0.005	<0.005	<0.005			<0.005	<0.001			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1		
K12/10E	46	6-Jun-00	6.7	64000	7.6	<1^	<0.005		<0.005	<0.01	2.5	3.1	<0.01	<0.05	<0.01	0.24	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/10E	46	5-Sep-00	6.7	68600	8	6^	<0.005		<0.005	<0.01	<0.10	3	<0.01	<0.002	<0.01	0.18	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/10E	46	5-Dec-00	6.8	70100	8.1	<1^	<0.005		<0.005	<0.01	<0.1	2.6	<0.01	0.006	0.03	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/10E	46	5-Mar-01	6.5	65700	7.3	2^	<0.005		<0.005	<0.005	68.9	4.75	<0.005	<0.005	0.025	0.07	0.4	<0.1	<0.1	0.1	0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K12/10E	46	4-Sep-01	6.9	69900	9.7	2^	<0.005		<0.005	<0.01	0.14	2.1	<0.01	<0.002	<0.005	0.08	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1		
K12/10E	46	4-Mar-02	6.9	68200	10	<1^	<0.005		<0.005	<0.01	<0.1	2	<0.01	0.004	<0.01	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1		
K12/10E	46	3-Oct-02	7	55000	8.6	<46	<0.005		<0.005	<0.02	56.6	9.08	<0.02	<0.02	0.067	0.09	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1		
K12/10E	46	11-Apr-03	7.3	28000	9.89	20	<0.005		<0.005	<0.02	<0.05	3.44	<0.02	<0.02	0.106	<0.05	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.01	<0.1	<0.1	<0.1	<0.1		
K12/10E	46	20-Nov-03	6.93	72700	9.7	<100	<0.005		0.062	<0.01	<0.01	3.21	0.006	<0.001	0.01	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K12/10E	46	29-Mar-04	6.75	58800	1.04	<10			<0.005	<0.01	16.2	0.906	0.001	<0.001	0.011	<0.05	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K12/10E	46	30-Sep-04	7.15	69700	14.3	<7			0.026	<0.01	<0.1	2.9	0.004	<0.001	<0.050	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K12/10E	46	30-Mar-05	7.13	61200	11.7	<50			0.0099	<0.100	<0.05	4.09	0.004	<0.001	<0.050#	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K12/10E	46	6-Sep-05	6.47	73100	9.29	240			0.08	<0.010	18.5	4.26	0.029	0.005	2.29	0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K12/10E	46	4-Sep-06	7.05	69100	11.4	932			0.0393	<0.010	4.96	3.77	<0.010#	<0.010#	<0.050#	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K12/10E	46	2-Mar-07	6.16	67000	13.2	82			0.078	<0.010	1.75	3.21	0.012	<0.010#	0.151	<0.1	0.47	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.2	<0.1	<0.1	<0.2	0.07	<0.1	<0.1	<0.1		
K12/10E	46	24-Sep-07	7	50500	8.63	120			<0.0040	<0.010	5.76	1.91	<0.010	<0.010	<0.050	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1		
K12/10E	46	3-Mar-08	7	40900	13.2	<50			0.0545	<0.01	<0.5	3.88	<0.01	<0.01	<0.05	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1		
K12/10E	46	9-Sep-08	7.02	70000	0.03	50			<0.004	<0.01	5.84	3.74	<0.01	<0.01	<0.05	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K12/10E	46	4-Mar-09	6.7	73	11.8	<150			<0.004	<0.01	<1	4.08	<0.1	<0.02	<0.05	<0.1	1	1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1		
K12/10E	46	16-Sep-09	6.81	54200	13.9	<50			<0.004	<0.01	9.94	4.2	<0.01	<0.0002	0.052	<0.1	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1		
K12/10E	46	23-Dec-10	6.9	>20000	11	<10	<0.004	<0.004	<0.004	<0.005			<0.001	<0.002			<1.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
K12/10E	46	29-Jun-12	7.36		11	<10	<0.005	<0.01	<0.005				<0.001	<0.001			16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1		
K12/10E	46	14-Feb-13	7.94	70400	8.9	<10	<0.005	<0.01	<0.005				0.001	<0.001			16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1		
K12/10E	46	5-Dec-13	6.8	76100	14	60	<0.005	<0.01	<0.005				<0.001	<0.001			16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1		
K12/10E	46	30-Oct-15	7.11	64690	0.86	5	<0.004	<0.004	<0.004	<0.01	-	-	<0.001	<0.001	-	-	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0	<1.0		
K12/10E	46	14-Apr-16	6.9	59636	0.33	<0.05	<0.004	<0.004	<0.004	<0.005	-	-	<0.001	<0.001	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<0.5	<1.0	<1.0	<1.0		
K12/10E	46	Lost																															
K12/10E	46	Destroyed																															
K12/10E	46	10-Jul-19	6.11	981	0.78	80	<0.004	<0.004	<0.004	<0.005			-	-			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1		
K12/10E	46	06-Jul-20	6.52	62066	1.4	<50	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1		
K12/10E	46	08-Jul-21	6028	50143	1.5	<50	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1		
K12/10E	46	29-Jun-22	6.95	47123	1.2	<50	<0.004	<0.004	<0.004*	<0.005			<0.001	<0.001			<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1		

Table B-2: Monitoring Data: Shallow Estuarine Wells (1999-2023)

ANALYTES			pH	Conductivity	Ammonia	Phenols	Free Cyanide	Weak Acid Disociable Cyanide	Total Cyanide	Cr VI - Dissolved	Fe - Dissolved	Mn - Dissolved	Mo - Dissolved	Pb - Dissolved	Zn - Dissolved	Hg - Dissolved	Total PAHs	Naphthalene	Acenaphtylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)&(k)fluoranthene	Benzo(a)pyrene	Indeno(1.2.3-cd)pyrene	Dibenzo(ah)anthracene	Benzo(ghi)perylene	1-Methylnaphthalene	2-Methylnaphthalene
			pH units	µs/cm	mg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L
ANZECC CRITERIA			**8 to 8.4**		**0.91**	**400**	**0.004**		**0.004**	**0.0044**		**0.08 (L)**	**0.023 (L)**	**0.0044**	**0.015**	**0.1**		**70 (M)**				**0.2 (L)**	**0.4 (L)**	**1.4 (L)**					**0.2 (L)**					
K12/1W	38	6-Jun-00	7.1	15500	0.5	<1^	<0.005		<0.005	<0.01	<0.10	0.45	<0.01	<0.05	0.03	0.07	34	<0.2	0.3	0.3	0.2	3	1	8	7	3	2	2	2	3	2	0.2		
K12/1W	38	5-Sep-00	7	15500	0.3	<1^	<0.005		<0.005	<0.01	<0.10	0.47	<0.01	<0.002	<0.01	<0.05	12.6	<0.2	<0.2	<0.2	<0.2	1	0.5	3	3	1	0.8	0.8	0.9	1	0.6	<0.2		
K12/1W	38	5-Dec-00	6.9	16900	0.2	<1^	<0.005		<0.005	<0.01	<0.1	0.73	<0.01	<0.002	<0.01	<0.05	5.2	<0.2	<0.2	0.2	<0.2	0.8	0.3	1	1	<0.2	0.7	0.3	0.4	0.5	<0.2	<0.2		
K12/1W	38	6-Mar-01	6.7	25700	0.2	<1^	<0.005		<0.005	<0.005	3.75	1.98	<0.005	<0.005	0.014	<0.05	1.1	<0.1	<0.1	0.2	<0.1	0.1	<0.1	0.5	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K12/1W	38	4-Sep-01	7	15300	0.4	<1^	<0.005		<0.005	<0.01	1.1	0.28	<0.01	<0.002	<0.005	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/1W	38	4-Mar-02	7	21600	0.1	<1^	<0.005		<0.005	<0.01	0.97	0.44	<0.01	<0.05	<0.01	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/1W	38	3-Oct-02	7.4	8600	0.03	<46	<0.005		<0.005	<0.02	0.16	0.529	<0.02	<0.02	0.129	<0.05	22.1	<0.1	0.1	0.1	<0.1	1	0.3	5	4.6	1.6	1.4	3	1.8	1.6	0.2	1.4		
K12/1W	38	15-Apr-03	6.7	19000	<0.01	<10	<0.005		<0.005	<0.005	2	0.81	<0.005	<0.005	0.084	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/1W	38	11-Nov-03	6.88	27000	0.02	<50			<0.005	<0.01	<0.01	1.05	0.004	<0.001	0.008	<0.1	2.48	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.7	0.7	0.2	0.2	0.3	0.18	0.1	<0.1	0.1		
K12/1W	38	26-Mar-04	6.87	18440	0.02	<10			<0.005	<0.01	<0.05	0.479	0.002	<0.001	<0.002	<0.05	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/1W	38	29-Sep-04	7.32	15900	0.19	<7			0.73	<0.01	<0.1	0.473	0.006	<0.001	<0.050	<0.1	38.56	<0.1	0.1	<0.1	0.1	2.5	0.8	8.2	8.3	3	2.2	5.6	3.36	1.6	0.4	2.4		
K12/1W	38	4-Apr-05	7.02	12500	0.304	<50			0.0878	<0.010	<0.05	0.407	0.003	<0.001	0.006	<0.1	16.52	<0.1	<0.1	<0.1	<0.1	0.7	0.3	3.4	3.4	1.2	1	2.2	1.32	0.7	0.1	0.8		
K12/1W	38	8-Sep-05	6.94	9120	0.292	<50			0.09	<0.010	1.97	0.435	0.003	<0.001	0.006	<0.1	0.47	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.2	<0.1	<0.1	<0.2	0.07	<0.1	<0.1	<0.1		
K12/1W*	38	7-Mar-06	6.65	25700	<0.010	<50			0.0332	<0.010	3.16	1.31	<0.010	<0.010#	<0.050#	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/1W	38	8-Sep-06	7.05	18690	0.142	<50			0.0612	<0.010	2.25	0.588	0.001	<0.001	0.028	<0.1	1.67	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.4	0.5	0.1	0.1	0.3	0.17	<0.1	<0.1	0.1		
K12/1W[2]	38	7-Mar-07	6.65	25700	<0.010	<50			0.0332	<0.010	3.16	1.31	<0.010	<0.010#	<0.050#	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/1W	38	24-Sep-07	6.9	7150	0.252	367			<0.0040	<0.010	1.84	0.296	0.004	<0.001	0.021	<0.1	0.58	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.3	<0.1	<0.1	<0.1	0.08	<0.1	<0.1	<0.1		
K12/1W	38	5-Mar-08	6.6	12990	0.277	180			0.113	<0.01	1.86	0.365	<0.001	<0.001	0.039	<0.1	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.2	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K12/1W	38	11-Sep-08	6.69	12660	0.23	<50			0.076	<0.01	1.5	0.302	<0.01	<0.002	0.005	0.0001	2.31	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.2	0.4	0.21	0.2	0.2	0.2		
K12/1W	38	4-Mar-09	6.86	14390	0.19	<50			<0.004	<0.01	<0.1	0.434	<0.01	<0.002	0.006	<0.1	0.9	0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K12/1W	38	10-Sep-09	7.15	7800	<0.1	<50			<0.004	<0.01	1.14	0.248	<0.01	<0.0002	<0.05	<0.1	0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K12/1W	38	22-Dec-10	7.5	14900	0.05	<10	<0.004	<0.004	<0.004	<0.005			<0.002	<0.001			<1.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1
K12/1W	38	14-Feb-13	7.7	24500	0.05	<10	<0.005	<0.01	0.005				0.004	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K12/1W	38	3-Dec-13	6.9	12700	0.03		<0.005	0.01	0.011				0.002	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K12/1W	38	03-Nov-15	7.38	22294	0.85	<1.0	<0.004	<0.004	<0.004	<0.01	-	-	<0.001	<0.001	-	-	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0		
K12/1W	38	19-Apr-17	8.14	13548	<0.005	<0.05	<0.004	<0.004	<0.004	<0.005			0.003	<0.001	-	-	NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/1W	38	17-May-18	6.67	14360	<0.005	<0.05	<0.004	<0.004	<0.004	<0.005			0.004	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/1W	38	11-Jun-20	7.91	35565	<0.005	<50	<0.004	<0.004	<0.004	<0.005			0.005	<0.002			NIL (+)VE	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K12/1W	38	06-Jul-21	7.3	6819	0.007	<50	<0.004	<0.004	<0.004	<0.01			<0.001	0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/1W	38	01-Jul-22	6.86	39.8	0.21	<50	<0.004	<0.004	<0.004	<0.005			0.003	0.001			<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/1W	38	11-Oct-23	7.1	16,648	0.05	<50	<0.005	<0.005	<0.004*	<0.005			<0.005	<0.001			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K12/3W	24	16-Mar-99	7.1	34900	2.5	<1^			0.01	<0.01	<0.10	1.3	<0.01	<0.02	<0.01	<0.05	2	2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/3W	24	22-Jun-99	7.1	35000	2.7	4^			0.006	0.001	<1	2.1	<0.001	<0.001	0.011	<0.1	0.7	0.7	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/3W	24	8-Sep-99	7	32600	2.2	<1^			0.006	<0.01	0.12	0.98	<0.01	<0.02	<0.01	0.16	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/3W	24	8-Dec-99	7.1	33600	1.1	<1^			0.04	<0.01	<0.1	1.5	<0.01	<0.05	<0.01	<0.05	0.22	<0.05	<0.05	0.13	0.09	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		
K12/3W	24	14-Mar-00	7.1	34200	2.6	<1^			0.01	<0.01	<0.1	1.9	<0.01	<0.05	<0.01	<0.05	1.9	<0.2	<0.2	0.8	0.5	0.6	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/3W	24	6-Jun-00	7.5	35400	2.4	<1^	<0.005		<0.005	<0.01	<0.10	1.4	<0.01	<0.05	<0.01	0.06	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/3W	24	5-Sep-00	7.2	35600	2.7	<1^	<0.005		<0.005	<0.01	<0.10	1.3	<0.01	<0.002	0.01	0.1	1.1	<0.2	<0.2	0.4	0.3	0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/3W	24	5-Dec-00	7.1	35400	2.6	<1^	<0.005		<0.005	<0.01	<0.1	0.94	<0.01	<0.002	<0.01	<0.05	1.2	<0.2	0	0.4	0.3	0.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/3W	24	6-Mar-01	7.2	34600	2.7	<1^	<0.005		<0.005	<0.005	12.9	2.07	<0.005	<0.005	0.011	<0.05	0.6	<0.1	<0.1	0.2	0.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K12/3W	24	4-Sep-01	7.2	33800	2.5	<1^	<0.005		<0.005	<0.01	5.2	0.83	<0.01	0.002	<0.005	0.05	0.5	<0.1	<0.1	0.1	0.1	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/3W	24	4-Mar-02	7.2	34400	2.6	<1^	<0.005		<0.005	<0.01	6	0.98	<0.01	<0.05	<0.01	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/3W	24	3-Oct-02	7.6	30000	3.48	<46	<0.005		<0.005	0.036	<0.05	7.48	<0.02	<0.02	0.292	<0.05	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/3W	24	11-Apr-03	7.6	21000	4.67	10	<0.005		<0.005	<0.02	1.39	2.51	<0.02	<0.02	0.099	<0.05	<0.755	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.01	<0.1	<0.1	<0.1		
K12/3W	24	12-Nov-03	7.02	43400	2.42	<50			<0.005	<0.01	0.9	1.74	<0.001	<0.001	0.017	<0.1	<0.755	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/3W	24	26-Mar-04	7.03	32200	2.54	<10			<0.005	<0.01	<0.05	1.83	<0.001	<0.001	<0.002	<0.05	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/3W	24	29-Sep-04	7.53	46000	5.81	<7			0.029	<0.01	<0.1	2.37	0.004	<0.001	<0.050	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/3W	24	30-Mar-05	7.21	55400	3.13	<50			0.0266	<1.00#	<0.05	2.25	0.003	<0.001	<0.050#	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/3W	24	8-Sep-05	6.72	35800	3.08	<50			0.05	<0.010	6.07	1.54	<0.001	<0.001	0.047	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/3W	24	6-Mar-06	6.91	31100	1.65	<50			0.026	<0.010	6.68	1.81	<0.010	<0.010#	<0.050#	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/3W	24	8-Sep-06	7.34	35400	3.81	<50			0.0174	<0.010	4.94	1.48	<0.001	<0.001	0.007	<0.1	0	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/3W	24	6-Mar-07	6.91	31100	1.65	<50			0.026	<0.010	6.68	1.81	<0.010	<0.010#	<0.050#	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/3W	24	27-Sep-07	6.9	38900	3.04	<50			<0.0040	<0.010	8.12	1.49	<0.010	<0.010	<0.050	<0.1	0.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K12/3W	24	5-Mar-08	7.1	28900	2.85	<50			0.0388	<0.01	11.6	1.59	<0.001	<0.001	0.019	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K12/3W	24	9-Sep-08	6.88	41500	3.02	50			0.049	<0.01	10.4	1.92	<0.01	<0.01	<0.05	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/3W	24	4-Mar-09	6.93	34400	2.36	<50			<0.004	<0.01	<0.1	1.34	<0.01	<0.002	<0.005	<0.1	0.6	0.6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K12/3W	24	10-Sep-09	7.29	36000	5.45	<50			<0.004	<0.01	6.81	0.571	<0.01	<0.0002	<0.05	<0.1	0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K12/3W	24	22-Dec-10	7.5	>20000	2.6	<10	<0.004	<0.004	<0.004	<0.005			<0.002	<0.001			<1.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1
K12/3W	24	3-Apr-12	7.8	46600	10	<10	<0.005	<0.01	<0.005	<0.005			<0.005	0.02			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K12/3W	24	14-Feb-13	8.0	31400	1	<10	<0.005	<0.01	<0.005				0.011	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K12/6	26	17-Mar-99	6.1	64700	0.7	<1^			0.06	<0.01	<0.10	0.19	<0.01	<0.02	0.03	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/6	26	21-Jun-99	5.9	51700	0.5	<1^			0.049	0.001	<0.10	3.11	0.001	<0.001	0.141	<0.1	0.3	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/6	26	8-Sep-99	5.7	48200	0.5	<1^			0.042	<0.01	140	1.8	<0.01	<0.02	0.07	0.21	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/6	26	8-Dec-99	6.3	52000	1.7	<1^			0.03	<0.01	64	2.5	<0.01	<0.05	0.02	<0.05	0.35	0.12	<0.05	0.08	0.07	0.08	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		
K12/6	26	7-Mar-00	6.3	41500	3.6	<1^			0.04	<0.01	<0.1	1.9	<0.01	<0.05	0.09	<0.05	1.5	<0.2	<0.2	0.4	0.2	0.5	<0.2	0.2	<0.2	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/6	26	6-Jun-00	6.1	40600	1.1	<1^	<0.005		<0.005	<0.01	38	1.4	<0.01	<0.05	0.03	0.45	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/6	26	5-Sep-00	5.9	45600	1.2	1^	<0.005		<0.005	<0.01	61	1.7	<0.01	<0.002	0.03	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/6	26	5-Dec-00	5.7	45300	1.3	<1^	<0.005		<0.005	<0.01	34	1.5	<0.01	<0.002	0.03	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/6	26	5-Mar-01	5.7	35800	1.1	<1^	<0.005		<0.005	<0.005	78.5	1.86	<0.005	<0.005	0.038	<0.05	<0.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K12/6	26	4-Sep-01	6.4	48400	2.2	<1^	<0.005		<0.005	<0.01	48	1	<0.01	0.002	<0.005	0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/6	26	4-Mar-02	6.1	46700	1.9	<1^	<0.005		<0.005	<0.01	55	0.97	<0.01	<0.05	<0.01	0.07	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/6	26	3-Oct-02	6.9	41000	2.87	<46	<0.005		<0.005	0.024	104	10.6	<0.001	<0.001	0.073	0.07	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/6	26	11-Apr-03	6.7	24000	1.78	20	<0.005		<0.005	<0.02	47.2	2.26	<0.02	<0.02	0.245	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/6	26	20-Nov-03	6.81	53700	0.213	<100	<0.005		<0.005	<0.01	4.23	1.85	0.014	<0.001	<0.005	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/6	26	26-Mar-04	6.53	40500	4.25	<10			<0.005	<0.01	0.86	2.56	0.003	<0.001	<0.002	<0.05	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/6	26	30-Sep-04	6.64	49000	3.99	<7			<0.005	<0.01	9	1.88	0.006	<0.001	<0.050	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/6	26	4-Apr-05	6.73	43900	3.53	<50			0.0115	<0.010	3.07	2.54	<0.001	0.003	0.224	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/6	26	6-Sep-05	6.62	50200	3.04	<50			0.124	0.02	49.7	2.44	0.034	<0.001	0.129	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/6	26	6-Mar-06	6.6	43320	9.02	94			0.14	<0.010	19.2	2	<0.010	<0.010#	0.074	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/6	26	8-Sep-06	7.46	50500	2.79	299			0.0287	<0.010	15	1.84	<0.010#	<0.010#	<0.050	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/6	26	6-Mar-07	6.6	43320	9.02	94			0.14	<0.010	19.2	2	<0.010	<0.010#	0.074	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/6	26	24-Sep-07	6.2	40300	3.23	74			0.01	<0.010	69.5	2.48	<0.010	<0.010	<0.050	<0.1	0.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K12/6	26	4-Mar-08	6.2	45600	4.1	378			0.0659	<0.01	70.4	2.9	<0.01	<0.01	0.053	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K12/6	26	5-Sep-08	7.03	56000	<0.01	440			<0.004	<0.01	83.4	2.78	<0.01	<0.01	<0.05	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/6	26	5-Mar-09	6.65	56300	1.66	80			<0.004	<0.01	<0.5	2.7	<0.01	<0.01	<0.05	<0.1	0.6	0.6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K12/6	26	10-Sep-09	7.2	41100	4.28	460			<0.004	<0.01	19.3	2.14	<0.01	<0.004	<0.05	<0.1	0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K12/6	26	10-Jan-11	7.5	>20000	0.13	<10	<0.004	<0.004	<0.004	<0.005			0.003	<0.001			<1.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1
K12/6	26	30-Oct-15	6.8	53240	3	<1.0	<0.004	<0.004	<0.004	<0.01	-	-	<0.010	<0.01	-	-	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0		
K12/6	26	20-Apr-16	6.81	40755	4.4	<0.05	<0.004	<0.004	<0.004	<0.005	-	-	<0.001	0.001	-	-	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0		
K12/6	26	09-May-17	8.3	16114	0.98	<0.05	<0.004	<0.004	<0.004	<0.05			0.001	<0.001	-	-	NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/6	26	18-May-18	8.3	32040	4.1	<0.05	<0.004	<0.004	<0.004*	<0.5			<0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		

Table B-2: Monitoring Data: Shallow Estuarine Wells (1999-2023)

ANALYTES			pH	Conductivity	Ammonia	Phenols	Free Cyanide	Weak Acid Dissociable Cyanide	Total Cyanide	Cr VI - Dissolved	Fe - Dissolved	Mn - Dissolved	Mo - Dissolved	Pb - Dissolved	Zn - Dissolved	Hg - Dissolved	Total PAHs	Naphthalene	Acenaphtylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)&(k)fluoranthene	Benzo(a)pyrene	Indeno(1.2.3-cd)pyrene	Dibenzo(ah)anthracene	Benzo(ghi)perylene	1-Methylnaphthalene	2-Methylnaphthalene
			pH units	µs/cm	mg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L
ANZECC CRITERIA			8 to 8.4		0.91	400	0.004		0.004	0.0044		0.08 (L)	0.023 (L)	0.0044	0.015	0.1		70 (M)				0.2 (L)	0.4 (L)	1.4 (L)					0.2 (L)						
K12/7	41	5-Jun-00	7.3	27900	3.4	<1^	<0.005		<0.005	<0.01	<0.10	2.2	<0.01	<0.05	<0.01	0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/7	41	4-Sep-00	7.2	28000	3	<1^	<0.005		<0.005	<0.01	<0.10	2.5	<0.01	<0.002	<0.01	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/7	41	4-Dec-00	7.1	29300	3.6	<1^	<0.005		<0.005	<0.01	<0.1	1.7	<0.01	<0.002	<0.01	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/7	41	5-Mar-01	7.1	26500	3.3	<1^	<0.005		<0.005	<0.005	8.88	3	0.01	<0.005	<0.01	<0.05	0.4	<0.1	<0.1	0.1	0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K12/7	41	3-Sep-01	7.3	19800	2.3	<1^	<0.005		<0.005	<0.01	3.1	1	<0.01	<0.002	<0.005	<0.05	0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/7	41	4-Mar-02	7.3	23500	3	<1^	<0.005		<0.005	<0.01	5.5	1.3	<0.01	<0.05	<0.01	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/7	41	3-Oct-02	7.5	15000	2.61	<46	<0.005		<0.005	<0.02	1.4	2.51	<0.02	<0.02	0.057	<0.05	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/7	41	11-Apr-03	7.7	5800	1.13	20	<0.005		<0.005	<0.02	0.43	1.2	<0.02	<0.02	0.147	<0.05	0.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/7	41	12-Nov-03	7.22	31800	2.78	<50			0.011	<0.01	2.4	1.45	0.005	<0.001	0.014	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/7	41	29-Mar-04	7.29	28200	3.1	<10			0.021	<0.01	<0.05	2.08	0.006	<0.001	<0.002	<0.05	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/7	41	30-Sep-04	7.11	35300	7.53	<7			<0.005	<0.01	<0.1	2.1	0.013	<0.001	<0.050	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/7	41	30-Mar-05	7.24	22000	2.92	<50			<0.0050	<0.10#	<0.05	1.75	0.014	<0.001	<0.005	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/7	41	6-Sep-05	7.21	13520	1.09	<50			0.127	<0.010	0.54	1.84	0.027	<0.001	0.108	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/7	41	6-Mar-06	7.1	24730	1.47	<50			0.059	<0.010	2.05	1.43	0.016	0.002	0.119	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/7	41	4-Sep-06	7.37	32700	3.53	<50			0.0435	<0.010	0.58	1.93	0.004	<0.001	0.017	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/7	41	6-Mar-07	7.1	24730	1.47	<50			0.059	<0.010	2.05	1.43	0.016	0.002	0.119	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/7	41	26-Sep-07	7	17040	2.08	<50			<0.0040	<0.010	1.41	1.14	0.025	<0.001	0.017	<0.1	0.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K12/7	41	4-Mar-08	6.8	34000	6.33	790			0.0385	<0.01	4.51	2.17	<0.01	<0.01	<0.05	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K12/7	41	9-Sep-08	6.84	41300	3.72	90			0.066	<0.01	2.7	2.02	0.01	<0.001	<0.005	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/7	41	4-Mar-09	7.41	8920	0.61	<50			<0.004	<0.01	0.13	1.03	0.056	<0.002	<0.005	<0.1	1	1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K12/7	41	16-Sep-09	7.14	29100	6.78	<50			<0.004	<0.01	5.59	3.3	<0.01	0.0047	<0.05	<0.1	0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K12/7	41	23-Dec-10	7.2	15500	1.9	<10	<0.004	<0.004	<0.004	<0.005			<0.002	<0.001			<1.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1
K12/7	41	27-Jun-12	7.87	6740	0.37	<10	<0.01	<0.01	<0.005				0.009	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K12/7	41	14-Feb-13	8.2	3410	0.91	<10	<0.005	<0.01	<0.005				0.011	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K12/7	41	5-Dec-13	7.4	3600	0.34	90	<0.005	<0.01	<0.005				0.009	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K12/7	41	15-Apr-16	7.12	26711	3.2	<0.05	<0.004	<0.004	<0.004	<0.005	-	-	<0.001	<0.001	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<0.5	<1.0	<1.0	<1.0		
K12/7	41	05-Apr-17	7.42	4941	0.46	<0.05	<0.004	<0.004	<0.004	<0.005			0.05	<0.001	-	-	NIL (+)VE	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/7	41	21-May-18	5.74	970	1.1	<0.05	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/7	41	09-Jul-19	5.95	954	<0.005	300	<0.004	<0.004	<0.004	<0.005			0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/7	41	23-Jun-20	6.54	25765	3.5	<50	<0.004	<0.004	<0.004	<0.005	-	-	0.009	<0.001	-	-	NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/7	41	09-Jul-21	6.12	793	<0.005	<50	<0.004	<0.004	<0.004	<0.005			0.002	0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/7	41	01-Jul-22	7.33	11214	0.25	<50	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/7	41	11-Oct-23	8.17	43,003	0.10	<50	<0.005	<0.005	<0.004*	<0.005			<0.005	<0.001			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K12/9	43	5-Jun-00	7	29800	2.7	<1^	<0.005		<0.005	<0.01	0.99	0.31	<0.01	<0.05	<0.01	0.12	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/9	43	4-Sep-00	6.9	29800	2.8	<1^	<0.005		<0.005	<0.01	0.3	0.28	<0.01	<0.002	<0.01	0.1	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/9	43	4-Dec-00	6.9	28600	2.8	<1^	<0.005		<0.005	<0.01	<0.1	0.27	<0.01	<0.002	0.02	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/9	43	5-Mar-01	7.5	28600	3.1	<1^	<0.005		<0.005	<0.005	8.2	0.554	<0.005	<0.005	<0.01	<0.05	<0.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K12/9	43	3-Sep-01	7	28400	3	<1^	<0.005		<0.005	<0.01	5.6	0.058	<0.01	<0.002	<0.005	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/9	43	4-Mar-02	6.9	27800	3	<1^	<0.005		<0.005	<0.01	6	0.09	<0.01	0.005	<0.01	0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/9	43	3-Oct-02	7.3	23000	3.1	<46	<0.005		<0.005	<0.02	6.76	0.694	<0.02	<0.02	<0.02	0.06	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/9	43	11-Apr-03	7.5	17000	3.1	10	<0.005		<0.005	<0.02	7.02	0.48	<0.02	<0.02	0.102	<0.05	0.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/9	43	12-Nov-03	7.12	28500	2.01	<50			0.006	<0.01	4.3	0.377	0.003	<0.001	0.01	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/9	43	29-Mar-04	6.97	29200	2.84	<10			<0.005	<0.01	7.73	0.443	0.002	<0.001	0.007	<0.05	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/9	43	30-Sep-04	6.86	28800	3.47	<7			0.012	<0.01	<0.1	0.427	0.004	<0.001	<0.050	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/9	43	30-Mar-05	7.03	36800	3.16	<50			0.0243	<0.100#	<0.05	0.41	0.004	<0.001	<0.050#	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/9	43	6-Sep-05	6.76	29000	2.53	<50			0.03	<0.010	7.04	0.498	0.037	<0.001	0.016	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/9	43	2-Mar-06	6.24	26900	2.86	<50			0.021	<0.010	7.74	0.479	0.004	<0.001	0.032	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/9	43	4-Sep-06	7.11	28100	2.33	<50			0.0209	<0.010	6.6	0.457	0.003	<0.001	0.007	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/9	43	2-Mar-07	6.24	26900	2.86	<50			0.021	<0.010	7.74	0.479	0.004	<0.001	0.032	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/9	43	26-Sep-07	6.8	18500	1.94	<50			<0.0040	<0.010	7.43	0.475	0.003	<0.001	0.015	0.0001	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K12/9	43	4-Mar-08	6.7	23500	2.92	<50			0.0169	<0.01	8.65	0.497	<0.01	<0.01	<0.05	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K12/9	43	9-Sep-08	6.81	26700	2.67	60			0.032	<0.01	9.64	0.52	0.004	<0.001	0.01	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/9	43	4-Mar-09	7.38	29000	4.71	<150			<0.004	<0.01	<0.1	0.477	<0.01	<0.002	<0.005	<0.1	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K12/9	43	16-Sep-09	6.93	22300	3.4	<50			<0.004	<0.01	7.18	0.49	<0.01	0.0002	<0.05	<0.1	0.4	0.2	<0.1	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K12/9	43	23-Dec-10	7.1	>20000	3.3	<10	<0.004	<0.004	<0.004	<0.005			<0.002	<0.001			<1.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1
K12/9	43	3-Apr-12	7.58	31100	2.4	<10	<0.005	<0.01	<0.005	<0.005			<0.005	<0.005			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K12/9	43	14-Feb-13	8	30200	1.7	<10	<0.005	<0.01	<0.005				0.003	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K12/9	43	30-Oct-15	6.9	32100	2.8	80	<0.005	<0.01	<0.005				0.002	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K12/9	43	14-Apr-16	6.9	42436	0.38	<0.05	<0.004	<0.004	<0.004	<0.005	-	-	<0.001	<0.001	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<0.5	<1.0	<1.0	<1.0		
K12/9	43	05-Apr-17	6.74	29127	2.8	<0.05	<0.004	<0.004	<0.004	<0.005			0.005	<0.001	-	-	NIL (+)VE	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/9	43	21-May-18	6.8	29100	0.22	<0.05	<0.004	<0.004	<0.004	<0.005			0.004	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/9	43	09-Jul-19	6	27470	1.1	90	<0.004	<0.004	<0.004	<0.025			<0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/9	43	07-Jul-20	6.28	53347	1.6	<50	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/9	43	09-Jul-21	6.41	779	2.7	<50	<0.004	<0.004	0.005	<0.005			0.003	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/9	43	11-Oct-23	6.71	32,841	1.4	<50	<0.005	<0.005	<0.004*	<0.005			<0.005	<0.001			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		

Table B-2: Monitoring Data: Shallow Estuarine Wells (1999-2023)

ANALYTES			pH	Conductivity	Ammonia	Phenols	Free Cyanide	Weak Acid Dissociable Cyanide	Total Cyanide	Cr VI - Dissolved	Fe - Dissolved	Mn - Dissolved	Mo - Dissolved	Pb - Dissolved	Zn - Dissolved	Hg - Dissolved	Total PAHs	Naphthalene	Acenaphtylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)&(k)fluoranthene	Benzo(a)pyrene	Indeno(1.2.3-cd)pyrene	Dibenzo(ah)anthracene	Benzo(ghi)perylene	1-Methylnaphthalene	2-Methylnaphthalene
			pH units	µs/cm	mg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L
ANZECC CRITERIA			8 to 8.4		0.91	400	0.004		0.004	0.0044		0.08 (L)	0.023 (L)	0.0044	0.015	0.1		70 (M)				0.2 (L)	0.4 (L)	1.4 (L)					0.2 (L)						
K3/1W	10	16-Mar-99	6.6	34100	0.9	2^			0.01	<0.01	4.1	1.4	<0.01	<0.02	<0.01	0.3	0.7	0.7	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
K3/1W	10	21-Jun-99	6.7	33500	1	<1^			0.039	0.001	8	2.02	0.01	<0.001	0.022	<0.1	0.3	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
K3/1W	10	9-Sep-99	6.7	32700	0.9	<1^			<0.005	<0.01	3.5	1.2	<0.01	<0.02	0.02	0.08	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
K3/1W	10	9-Dec-99	6.6	33000	0.8	1^			0.04	<0.01	7.9	1.6	<0.01	<0.05	<0.01	<0.05	<0.375	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
K3/1W	10	14-Mar-00	6.6	31900	0.8	<1^			0.01	<0.1	3.4	1.6	<0.01	<0.05	<0.01	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
K3/1W	10	6-Jun-00	6.7	31000	0.8	<1^	<0.005		<0.005	<0.01	14	1.2	<0.01	<0.05	<0.01	0.08	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
K3/1W	10	6-Sep-00	6.7	31000	0.8	<1^	<0.005		<0.005	<0.01	3	0.95	<0.01	<0.002	<0.01	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
K3/1W	10	6-Dec-00	6.7	30000	0.7	2^	<0.005		<0.005	<0.01	2.3	0.87	<0.01	<0.002	<0.01	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
K3/1W	10	7-Mar-01	6.6	29200	0.7	1^	<0.005		0.006	<0.005	27.2	1.68	<0.005	<0.005	<0.01	<0.05	<0.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
K3/1W	10	5-Sep-01	6.7	28700	0.8	<1^	<0.005		<0.005	<0.01	19	0.5	<0.01	0.002	<0.005	<0.05	<0.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
K3/1W	10	4-Mar-02	6.7	27700	0.7	1^	<0.03		<0.005	<0.01	19	0.52	<0.01	0.006	0.024	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1			
K3/1W	10	10-Oct-02																																
K3/1W	10	16-Apr-03	7.1	14000	0.63	<10	<0.005		<0.005	0.008	19.8	1.4	<0.005	<0.005	0.042	<0.05	<0.755	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.01	<0.1	<0.1	<0.1			
K3/1W	10	17-Nov-03	6.78	27700	0.8	<50			0.006	<0.01	0.05	1.37	0.001	<0.001	<0.005	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1			
K3/1W	10	31-Mar-04	6.72	21350	0.73	<10			<0.005	<0.01	<0.05	0.948	<0.001	<0.001	<0.002	<0.05	0.8	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	0.3	0.2	<0.1	0.1	<0.2	<0.05	<0.1	<0.1	<0.1			
K3/1W	10	30-Sep-04	7.23	3150	47.2	236			0.036	<0.01	0.4	1.35	0.325	<0.001	<0.050	0.2	9.4	7.3	<0.1	<0.1	0.2	0.7	<0.1	0.6	0.5	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	0.1			
K3/1W	10	31-Mar-05	5.94	2640	42.5	245			0.087	<0.010	1.14	1.4	0.18	<0.001	<0.005	<0.1	26.99	17.3	<0.1	<0.1	<0.1	1.2	0.3	1.6	1.4	0.3	0.3	0.6	0.29	0.1	<0.1	0.1			
K3/1W	10	13-Sep-05	6.48	2440	22.5	216			0.107	<0.010	5.88	1.04	0.107	0.01	0.292	<0.1	152.21	44.3	<0.1	1.2	2.1	11.9	2.6	18.6	16.4	0.6	6	13.6	5.91	1.7	0.3	2.5			
K3/1W	10	14-Mar-06	6.7	2519	55.2	318			0.01	<0.1	6.05	1.28	0.13	0.006	0.516	<0.1	8.54	12.7	<0.1	0.2	0.3	1.3	0.3	1.8	1.7	0.4	0.3	1.3	0.44	0.2	<0.1	0.3			
K3/1W	10	6-Sep-06	7.49	1980	1.06	326			0.363	<0.010	19.5	2.14	0.167	0.046	0.318	<0.1	78.9	16.5	0.4	1.9	2.4	17.1	3.5	28	24.6	<0.1	1.4	<0.2	<0.05	<0.1	<0.1	<0.1			
K3/1W	10	27-Sep-07	6.5	22980	0.64	<50			<0.0040	<0.010	20.6	1.04	<0.001	<0.001	0.023	<0.1	1.4	0.9	<0.1	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1			
K3/1W	10	11-Mar-08	6.8	28000#	1.94	388			0.0348	<0.01	14.8	1.09	<0.001	<0.001	0.024	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1			
K3/1W	10	8-Sep-08	7.43	913	7.34	460			0.045	<0.01	1.38	0.375	0.082	0.004	0.042	<0.1	8.04	3.5	<0.1	0.5	0.2	0.7	0.1	0.9	0.6	0.1	0.2	0.2	0.14	<0.1	<0.1	<0.1			
K3/1W	10	7-Mar-09	6.73	1897	2.87	<50			<0.004	<0.01	4.34	0.281	<0.001	<0.001	<0.005	<0.1	1.7	1.7	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1			
K3/1W	10	14-Sep-09	6.99	17450	13	<50			<0.004	<0.01	0.07	0.939	<0.001	<0.001	0.006	<0.1	2.3	2.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1			
K3/1W	10	23-Dec-10	7.1	18600	1.3	<10	<0.004	<0.004	0.004	<0.005			<0.002	<0.001			<1.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
K5/6NN	15	8-Jun-00	7.2	28100	3	2^	<0.005		<0.005	<0.01	<0.10	0.94	<0.01	<0.05	<0.01	<0.05	0.9	<0.2	<0.2	<0.2	0.4	0.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K5/6NN	15	7-Sep-00	7	26600	2.8	<1^	<0.005		<0.005	<0.01	<0.10	0.71	<0.01	<0.002	<0.01	<0.05	1.1	<0.2	<0.2	0.4	0.3	0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K5/6NN	15	7-Dec-00	6.9	25400	2.9	<1^	<0.005		<0.005	<0.01	<0.1	0.55	<0.01	<0.002	<0.01	<0.05	1.7	<0.2	<0.2	0.5	0.4	0.8	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K5/6NN	15	8-Mar-01	7	25000	3.1	4^	<0.005		0.006	<0.005	7.93	1.48	<0.005	<0.005	<0.01	<0.05	0.7	<0.1	<0.1	0.2	0.2	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K5/6NN	15	6-Sep-01	7.1	22600	3.1	<1^	0.007		0.009	<0.01	5.9	0.25	<0.01	<0.002	<0.005	0.05	1.3	0.4	<0.1	0.3	0.2	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/6NN	15	4-Mar-02	7	20400	3.7	2^	<0.005		0.011	<0.01	6.5	0.31	<0.01	<0.05	<0.01	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/6NN	15	9-Oct-02	7.3	16000	5.11	40	<0.005		0.01	0.037	8.55	1.17	<0.001	<0.001	0.067	0.07	2.2	0.1	<0.1	<0.1	<0.1	0.2	<0.1	0.5	0.4	0.2	0.2	0.3	0.1	0.1	<0.1	0.1		
K5/6NN	15	16-Apr-03	7.2	9400	2.21	<10	<0.005		0.013	0.005	8	0.66	<0.005	<0.005	0.096	<0.05	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.01	<0.1	<0.1	<0.1		
K5/6NN	15	10-Nov-03	7.1	13680	1.16	<50			0.015	<0.02	1.42	0.334	<0.001	<0.001	0.011	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/6NN	15	31-Mar-04	7.05	14020	2.83	<10			0.009	<0.01	4.89	0.286	<0.001	<0.001	0.005	<0.05	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/6NN	15	28-Sep-04	7.29	12100	3.3	<21			0.118	<0.01	<0.1	0.214	0.011	<0.001	0.006	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/6NN	15	31-Mar-05	7.33	10890	2.95	<50	<0.0050		<0.0050	0.148	0.11	0.203	0.002	<0.001	<0.005	<0.1	0.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/6NN	15	12-Sep-05	6.51	9840	2.88	<50	<0.0050		0.123	<0.010	3.57	0.228	0.046	<0.001	0.008	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/6NN	15	8-Mar-06	6.8	9220	2.75	<50			0.0735	<0.010	3.32	0.178	0.002	<0.001	<0.005	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/6NN	15	5-Sep-06	7.16	9250	2.81	<50			0.106	<0.010	3.69	0.21	0.002	<0.001	0.028	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/6NN	15	8-Mar-07	6.8	9220	2.75	<50			0.0735	<0.010	3.32	0.178	0.002	<0.001	<0.005	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/6NN	15	25-Sep-07	5.8	5490	3.84	125			0.0042	<0.010	4.89	0.843	0.002	<0.001	0.14	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K5/6NN	15	10-Mar-08	7.1	6350	2.55	333			0.0541	<0.01	4.33	0.572	0.002	<0.001	0.018	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K5/6NN	15	8-Sep-08	7.41	7720	2.52	<50			<0.004	<0.01	4.71	0.782	0.001	<0.001	0.007	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/6NN	15	5-Mar-09	6.32	1965	0.83	710			<0.004	<0.01	0.84	2.48	0.001	<0.001	0.005	<0.1	1.3	1.2	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K5/6NN	15	11-Sep-09	6.98	5650	3.23	<50			<0.004	<0.01	7.67	0.525	0.001	<0.001	<0.005	<0.1	31.5	31.3	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K5/6NN	15	23-Dec-10	6.9	6200	1.6		0.2		0.028	<0.005							<1.78	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
K5/6NN	15	4-Apr-12	7.65	5710	1.6	<10	<0.005	<0.01	<0.005	<0.005							<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1	
K5/6NN	15	20-Feb-13	7.4	5140	1.7	<10	<0.005	<0.01	<0.005	<0.005							<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1	
K5/6NN	15	4-Dec-14	6.9	4110	1		<0.005	0.01	0.006								<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1	
K5/6NN	15	29-Oct-15	8.71	1055	0.87	<1.0	<0.004	<0.004	<0.004	<0.01	-	-	-	-	-	-	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0		
K5/6NN	15	05-Apr-16	8.3	1900	1.7	<0.05	<0.004	<0.004	0.004	<0.005	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<0.5	<1.0	<1.0	<1.0		
K5/6NN	15	06-Apr-17	6.93	3989	0.9	<0.05	<0.004	<0.004	0.004	<0.005			-	-	-	-	NIL (+)VE	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/6NN	15	08-May-18	6.03	3660	0.55	<0.05	<0.004	<0.004	0.004	<0.005							NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/6NN	15	30-Jun-19	5.72	1352	0.74	<50	<0.004	<0.004	<0.004	<0.005			-	-			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/6NN	15	15-Jun-20	6.57	4342	0.85	<50	<0.004	<0.004	0.006	<0.01			-	-			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/6NN	15	22-Jun-21	6.88	3426	0.69	<50	<0.004	<0.004	<0.004	<0.005			-	-			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/6NN	15	22-Jun-22	6.29	75.9	0.72	<50	<0.004	<0.004	0.004	<0.005			-	-			<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/6NN	15	10-Oct-23	7.2	3,279	0.35	<50	<0.005	<0.005	<0.004*	<0.005							<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		

Table B-2: Monitoring Data: Shallow Estuarine Wells (1999-2023)

ANALYTES			pH	Conductivity	Ammonia	Phenols	Free Cyanide	Weak Acid Disociable Cyanide	Total Cyanide	Cr VI - Dissolved	Fe - Dissolved	Mn - Dissolved	Mo - Dissolved	Pb - Dissolved	Zn - Dissolved	Hg - Dissolved	Total PAHs	Naphthalene	Acenaphtylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)&(k)fluoranthene	Benzo(a)pyrene	Indeno(1.2.3-cd)pyrene	Dibenzo(ah)anthracene	Benzo(ghi)perylene	1-Methylnaphthalene	2-Methylnaphthalene
			pH units	µs/cm	mg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L
ANZECC CRITERIA			8 to 8.4		0.91	400	0.004		0.004	0.0044		0.08 (L)	0.023 (L)	0.0044	0.015	0.1		70 (M)				0.2 (L)	0.4 (L)	1.4 (L)					0.2 (L)					
K7/2S	11	16-Mar-99	6.9	28800	4	3^			<0.01	<0.01	<0.10	0.34	<0.01	<0.02	<0.01	0.18	0.8	0.8	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K7/2S	11	21-Jun-99	7	28700	4	<1^			0.007	<0.001	1	0.509	0.002	<0.001	0.02	<0.1	0.36	0.36	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K7/2S	11	10-Sep-99	6.9	28600	3.6	<1^			<0.005	<0.01	<0.01	0.31	<0.01	<0.02	0.01	<0.05	0.3	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K7/2S	11	9-Dec-99	6.8	29200	1.9	2^			0.09	<0.01	<0.1	0.43	<0.01	<0.05	<0.01	<0.05	1.08	0.37	<0.05	0.19	0.09	0.18	0.06	0.1	0.09	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		
K7/2S	11	14-Mar-00	6.9	28300	3.3	<1^			<0.01	<0.01	0.61	0.4	<0.01	<0.05	0.11	<0.05	0.5	0.3	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K7/2S	11	7-Jun-00	7	28300	3.6	<1^	<0.005		<0.005	<0.01	<0.10	0.29	<0.01	<0.05	<0.01	0.06	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K7/2S	11	6-Sep-00	7	28200	3	<1^	<0.005		<0.005	<0.01	<0.10	0.26	<0.01	<0.002	<0.01	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K7/2S	11	6-Dec-00	6.9	28000	2.8	<1^	<0.005		<0.005	<0.01	<0.1	0.18	<0.01	<0.002	0.03	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K7/2S	11	6-Mar-01	6.9	27400	3.1	1^	<0.005		<0.005	<0.005	7.9	0.488	<0.005	<0.005	<0.01	<0.05	0.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K7/2S	11	5-Sep-01	7	27500	3.6	<1^	<0.005		<0.005	<0.01	4.9	0.086	<0.01	<0.002	0.005	<0.05	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K7/2S	11	4-Mar-02	7	27500	3.1	3^	<0.005		<0.005	<0.01	5.2	0.13	<0.01	<0.05	<0.01	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K7/2S	11	10-Oct-02	7.4	27000	3.11	<10	<0.005		<0.005	0.007	2.58	0.35	0.004	<0.001	0.146	0.08	33.3	5.2	0.5	2	1.6	2.2	2.2	5.4	4.2	2	1.4	2.6	1.6	1.2	0.2	1		
K7/2S	11	15-Apr-03	7.3	14000	2.83	<10	<0.005		<0.005	0.007	4.54	0.44	<0.005	<0.005	0.11	<0.05	0.83	0.2	<0.1	0.2	0.1	0.1	<0.1	0.1	0.1	<0.1	<0.1	<0.2	0.03	<0.1	<0.1	<0.1		
K7/2S	11	17-Nov-03	7.28	24300	2.91	<50			0.118		0.05	0.41	0.005	<0.001	<0.005	<0.1	0.9	0.7	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K7/2S	11	30-Mar-04	7.38	23340	2.98	<10			<0.005	<0.01	<0.05	0.047	<0.001	<0.001	0.005	<0.05	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K7/2S	11	30-Sep-04	7.02	23200	3.76	<7			<0.005	<0.01	<0.1	0.253	0.027	<0.001	<0.050	<0.1	6.61	1.9	<0.1	0.6	0.3	0.6	0.2	0.9	0.7	0.3	0.2	0.4	0.21	0.1	<0.1	0.2		
K7/2S	11	31-Mar-05	7.73	4750	1.1	<50			0.016	0.012	0.98	0.855	0.003	<0.001	<0.050#	<0.1	1.2	1.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K7/2S	11	12-Sep-05	6.35	3980	13	34			0.259	<0.010	0.64	0.865	<0.001	<0.001	0.045	<0.1	791.7	759	0.8	11.5	3.8	2.1	0.3	0.4	0.4	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K7/2S*	11	7-Mar-06	7.21	4560	9.11	155			0.0272	<0.010	0.63	0.874	0.02	0.001	0.138	<0.1	46.09	1430	1.9	21.4	9.3	7.1	1	2	1.5	0.5	0.4	0.5	0.29	<0.2	<0.2	0.2		
K7/2S	11	6-Sep-06	7.02	4510	1.14	10.6			0.0522	<0.010	0.61	0.721	<0.001	<0.001	0.013	<0.1	19.21	1130	0.2	0.6	4.5	4.8	1.2	1	2.5	0.9	0.8	1.3	0.91	<0.1	0.1	0.6		
K7/2S	11	7-Mar-07	7.21	4560	9.11	155			0.0272	<0.010	0.63	0.874	0.02	0.001	0.138	<0.1	1476.09	1430	1.9	21.4	9.3	7.1	1	2	1.5	0.5	0.4	0.5	0.29	<0.2	<0.2	0.2		
K7/2S	11	27-Sep-07	6.2	14270	1.35	229			<0.0040	<0.010	3.01	0.205	0.004	<0.001	0.158	<0.1	5.58	1.7	<0.1	0.4	0.4	0.4	0.1	0.7	0.5	0.2	0.2	0.3	0.18	0.1	<0.1	0.1		
K7/2S	11	11-Mar-08	7.1	17300#	3.16	142			0.0244	<0.01	2.48	0.178	0.004	<0.001	0.011	<0.1	1.06	0.5	<0.1	<0.1	<0.1	0.1	<0.1	0.2	0.2	<0.1	<0.1	<0.1	0.06	<0.1	<0.1	<0.1		
K7/2S	11	8-Sep-08	6.66	13550	2.79	100			<0.004	<0.01	2.36	0.17	0.004	<0.001	0.069	<0.1	0.3	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K7/2S	11	6-Mar-09	6.7	14250	1.61	<50			<0.004	<0.01	<0.05	0.146	0.004	<0.001	<0.005	<0.1	8.37	2.1	<0.1	2.5	1.6	1.1	0.2	0.4	0.3	0.1	<0.1	<0.1	0.07	<0.1	<0.1	<0.1		
K7/2S	11	11-Sep-09	7.26	10810	4.18	<50			0.005	<0.01	0.87	0.17	0.003	<0.001	<0.005	<0.1	10.3	8.8	<0.1	0.7	0.5	0.2	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K7/2S	11	23-Dec-10	7.6	10900	2.4	<10	<0.004	<0.004	0.022	<0.005							<1.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1
K7/2S	11	21-Feb-13	7.5	8800	5.3	<10	<0.005	<0.01	0.019								23	8	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K7/2S	11	5-Dec-13	8.3	12100	3.5	60	<0.005	<0.01	0.008								<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K7/2S	11	5-Jul-19	6.74	1418	14	<50	<0.004	<0.004	0.014	<0.005			-	-			0.29	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K7/2S	11	15-Jun-20	5.98	8757	3.9	<50	<0.004	<0.004	0.01	<0.005			-	-			2	2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K7/2S	11	13-Jul-21	5.89	236.2	6.1	<50	<0.004	<0.004	<0.004	<0.005			-	-			0.29	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K7/2S	11	23-Jun-22	6.74	3570	20	<50	<0.004	<0.004	<0.004	<0.005			-	-			2.3	1	<0.1	<0.1	<0.1	0.2	<0.1	0.3	0.3	0.2	<0.1	0.3	<0.1	<0.1	<0.1	<0.1		
K7/2S	11	10-Oct-23	7.28	7,520	1.7	<50	<0.005	<0.005	0.015	<0.005							<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K7/4S	16	7-Jun-00	6.7	41800	1.4	<1^	<0.005		<0.005	<0.01	9	1.1	<0.01	<0.05	0.01	0.35	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K7/4S	16	6-Sep-00	6.7	42000	0.8	<1^	<0.005		<0.005	<0.01	8.2	0.77	<0.01	<0.002	0.03	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K7/4S	16	6-Dec-00	6.7	41500	0.9	<1^	<0.005		<0.005	<0.01	11	0.69	<0.01	<0.002	0.03	0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K7/4S	16	7-Mar-01	6.7	41000	1.2	<1^	<0.005		0.008	<0.005	35	1.61	<0.005	<0.005	0.011	<0.05	<0.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K7/4S	16	5-Sep-01	6.7	41200	0.7	<1^	<0.005		<0.005	<0.01	28	0.63	<0.01	0.002	<0.005	<0.05	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K7/4S	16	4-Mar-02	6.7	40500	0.7	<1^	<0.005		<0.005	<0.01	33	0.33	<0.01	0.016	<0.01	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K7/4S	16	10-Oct-02	7.4	20000	0.23	<10	<0.005		0.017	0.005	0.09	0.099	0.016	<0.001	0.051	<0.05	3.3	0.2	<0.1	<0.1	<0.1	0.5	<0.1	1	0.7	0.2	0.2	0.3	<0.1	0.1	<0.1	0.1		
K7/4S	16	15-Apr-03	7	18000	0.7	<10	<0.005		<0.005	0.013	<0.05	1.2	<0.005	<0.005	<0.005	<0.05	0.73	0.2	<0.1	0.2	0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	0.03	<0.1	<0.1	<0.1		
K7/4S	16	17-Nov-03	6.7	41500	0.29	<50			<0.005	0	30.9	1.36	0.003	<0.001	0.035	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K7/4S	16	30-Mar-04	6.87	42300	0.74	<10			<0.005	<0.01	32.2	0.025	<0.001	<0.001	0.004	<0.05	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K7/4S	16	29-Sep-04	7.09	42500	1.39	<7			0.015	<0.01	<0.1	0.882	0.22	<0.001	<0.050	<0.1	0.25	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	0.1	<0.1	0.05	<0.1	<0.1	<0.1		
K7/4S	16	31-Mar-05	6.74	38100	12	11.1			0.718	0.04	0.31	0.959	0.006	<0.001	<0.005	<0.1	2072.7	1910	3.3	36.9	18.7	16.8	3.9	7.6	5.5	<0.2	<0.2	7.4	<0.20	<0.2	<0.2	<0.2		
K7/4S	16	12-Sep-05	5.98	40100	1.2	<50			0.04	<0.010	33.6	0.84	0.002	<0.001	0.077	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K7/4S*	16	7-Mar-06	6.57	32600	0.452	<50			0.0135	<0.010	31.8	0.831	<0.010	<0.010#	<0.050#	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K7/4S	16	6-Sep-06	6.88	37100	5.22	<50			0.0276	<0.010	25.4	0.694	<0.001	<0.001	0.008	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K7/4S[2]	16	7-Mar-07	6.57	32600	0.452	<50			0.0135	<0.010	31.8	0.831	<0.010	<0.010#	<0.050#	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K7/4S	16	27-Sep-07	6.4	28600	0.765	<50			<0.0040	<0.010	27.9	0.74	<0.001	<0.001	0.041	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K7/4S	16	11-Mar-08	6.6	32000	0.618	<50			<0.004	<0.01	0.24	0.212	0.038	<0.001	0.013	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K7/4S	16	8-Sep-08	7.12	35400	0.56	<50			<0.004	<0.01	27.2	0.763	<0.01	<0.01	<0.05	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K7/4S	16	6-Mar-09	6.33	31700	0.61	<50			<0.004	<0.01	<0.5	0.608	<0.001	<0.001	0.018	<0.1	9.7	2.7	<0.1	3.4	1.9	1.3	0.2	0.1	0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K7/4S	16	9-Sep-09	6.63	28400	<0.5	<50			<0.004	<0.01	23	0.618	<0.001	<0.001	0.018	<0.1	6.8	1.8	<0.1	2.6	1.5	0.8	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K7/4S	16	23-Dec-10	6.9	19000	0.81		<0.004	<0.004	<0.004	<0.005			<0.002				<1.77	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1
K7/4S	16	4-Apr-12	8.52	9070	5.9		<0.005	<0.01	0.009	<0.005			<0.005				18	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K7/4S	16	4-Dec-13	7	27700	0.8		<0.005	<0.01	<0.005				0.001				<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K7/4S	16	5-Nov-15	Well not located due to overgrowth																															
K7/4S	16	Well lost																																
K7/4S	16	14-Jul-21	5.98	820	0.69	<50	<0.004	<0.004	<0.004	<0.005			<0.001	0.001			0.29	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K7/4S	16	23-Jun-22	6.86	219.1	0.63	<50	<0.004	<0.004	<0.004	<0.005			0.003	<0.001			<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K7/4S	16	11-Oct-23	6.5	18,725	0.56		<0.005	<0.005	<0.004*	0.010			<0.005	<0.001			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K8/5W	12	16-Mar-99	9.9	42900	8.5	48^			0.11	<0.01	<0.10	0.01	<0.01	<0.02	<0.01	<0.05	466.6	55	0.8	160	90	120	15	15	10	0.5	0.3	<0.2	<0.2	<0.2	<0.2	<0.2		
K8/5W	12	22-Jun-99	10.1	38300	9.2	91^			0.16	<0.001	<1	0.01	0.06	<0.001	0.01	<0.1	466.9	45	0.9	160	95	120	15	20	10	0.6	0.4	<0.2	<0.2	<0.2	<0.2	<0.2		
K8/5W	12	10-Sep-99	10	35000	8.4	95^			0.43	<0.01	<0.01	0.01	0.05	<0.02	<0.01	<0.05	546.9	55	1	190	110	140	15	20	15	0.5	0.4	<0.2	<0.2	<0.2	<0.2	<0.2		
K8/5W	12	9-Dec-99	9.9	34800	5	13^			2.8	<0.1	<0.1	0.01	0.06	<0.05	0.02	<0.05	354.29	42.8	6.28	106	74.5	94	11.1	11.1	7.08	0.84	0.38	0.08	0.07	0.06	<0.05	<0.05		
K8/5W	12	14-Mar-00	10.1	32000	9.9	13^			0.11	<0.01	<0.1	<0.01	0.02	<0.05	<0.01	<0.05	846.6	85	8	300	160	200	30	35	25	1	2	0.2	0.2	0.2	<0.2	<0.2		
K8/5W	12	7-Jun-00	10.1	28800	11	98^	<0.005		<0.005	<0.01	<0.10	<0.01	0.06	<0.05	<0.01	0.2	366.7	60	3	2	110	140	15	20	15	1	0.7	<0.2	<0.2	<0.2	<0.2	<0.2		
K8/5W	12	6-Sep-00	10.1	28400	11	1^	<0.20		<0.20	<0.01	<0.10	<0.01	0.02	<0.002	<0.01	<0.05	389.3	35	3	120	80	100	15	20	15	0.8	0.5	<0.2	<0.2	<0.2	<0.2	<0.2		
K8/5W	12	6-Dec-00	10.1	26000	10	12^	<0.005		<0.005	<0.01	<0.1	<0.01	0.05	<0.002	<0.01	0.05	788.5	60	2	280	130	260	20	20	15	0.3	1	<0.2	<0.2	0.2	<0.2	<0.2		
K8/5W	12	6-Mar-01	10.2	23500	10	1^	<0.05		<0.005	<0.005	<0.05	0.006	0.018	<0.005	<0.01	<0.05	520.9	53	0.2	180	110	130	17	18	12	0.4	0.3	<0.1	<0.1	<0.1	<0.1	<0.1		
K8/5W	12	5-Sep-01	10.2	14700	8.2	12^	0.018		0.036	<0.01	<0.1	<0.005	<0.01	<0.002	<0.005	<0.05	486.5	41	<0.1	150	100	130	15	28	17	1.6	1.2	1.2	0.6	0.5	<0.1	0.4		
K8/5W	12	4-Mar-02	10.4	11900	7.8	11^	0.04		0.026	<0.01	<0.1	<0.01	<0.01	<0.05	<0.01	<0.05	527	190	120	150	19	28	19	1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K8/5W	12	10-Oct-02	10.1	11000	8.87	50	<0.005		0.035	0.003	<0.05	0.005	0.014	<0.001	0.032	0.06	941.9	100	0.2	300	200	250	20	40	30	1	0.4	0.2	0.1	<0.1	<0.1	<0.1		
K8/5W	12	15-Apr-03	10	9200	8.66	60	<0.005		0.036	<0.005	<0.05	0.013	0.056	<0.005	0.043	<0.05	672	57	<1	210	140	180	20	35	26	2	2	<2	<1	<1	<1	<1		
K8/5W	12	17-Nov-03	10.5	10380	7.75	<50			0.16	<0.01	0.02	0.001	0.082	<0.001	<0.005	<0.1	368.5	33.8	0.4	125	74.4	98.8	14.2	13	8.4	0.3	0.2	<0.2	<0.05	<0.1	<0.1	<0.1		
K8/5W	12	30-Mar-04	10.43	10770	6.21	80			0.079	<0.01	<0.05	0.161	0.006	0.036	0.053	<0.05	371	38	<0.1	130	87	86	12	11	7	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K8/5W	12	29-Sep-04	8.02	13900	5.73	<7			0.081	<0.01	<0.1	0.332	0.053	<0.001	<0.050	<0.1	155.06	0.1	<0.1	85.4	39.4	23.2	1.3	2.8	2.5	0.2	0.1	<0.2	0.06	<0.1	<0.1	<0.1		
K8/5W	12	31-Mar-05	9.75	9820	5.78	<50			0.112	<0.010	0.05	0.009	0.068	<0.001	<0.005	<0.1	188.02	23.5	0.3	57.2	49.4	31.6	4.4	7	5.1	0.9	0.4	0.5	0.22	<0.1	<0.1	<0.1		
K8/5W	12	12-Sep-05	8.92	8210	3.9	<50			0.142	<0.010	0.08	0.021	0.051	<0.001	0.006	<0.1	217.93	30.7	0.3	76	47.9	39.8	3.7	4.7	3.5	0.3	0.2	0.3	0.13	<0.1	<0.1	<0.1		
K8/5W*	12	9-Mar-06	8.07	12580	4.51	<50			0.0943	<0.010	<0.05	0.171	0.033	<0.001	0.008	<0.1	257.5	0.6	0.4	118	68	59.2	4.6	4.5	2.8	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K8/5W	12	6-Sep-06	9.04	10160	4.12	<50			0.0571	<0.010	0.06	0.03	0.041	<0.001	<0.005	<0.1	326.8	38.6	0.3	142	82.5	78.2	8.7	9.2	6	0.2	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K8/5W[2]	12	9-Mar-07	8.07	12580	4.51	<50			0.0943	<0.010	<0.05	0.171	0.033	<0.001	0.008	<0.1	258.1	0.6	0.4	118	68	59.2	4.6	4.5	2.8	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K8/5W	12	25-Sep-07	10.6	5640	2.35	<50			0.0224	<0.010	<0.50	0.046	0.028	<0.001	<0.005	<0.1	256.7	27.8	0.6	86.5	50	57.3	7.9	9.4	5.1	0.3	0.2	<0.1	<0.05	<0.1	<0.1	<0.1		
K8/5W	12	10-Mar-08	9.2	5920	3.21	<50			0.0503	<0.01	<0.05	0.007	0.03	<0.001	0.006	<0.1	332.1	41.2	0.5	108	63	68.7	10.8	12.2	7.7	0.3	0.2	<0.1	<0.05	<0.1	<0.1	<0.1		
K8/5W	12	10-Sep-08	10.24	5990	2.72	<50			0.065	<0.01	<0.5	0.01	0.028	<0.001	0.007	<0.1	741.26	77.2	0.4	244	152	191	15.9	21.5	14.3	1	0.6	0.3	0.16	<0.1	<0.1	<0.1		
K8/5W	12	6-Mar-09	10.04	6040	2.94	<50			0.057	<0.01	<0.5	0.005	0.038	<0.001	<0.005	<0.1	403.91	48.1	0.4	138	86.1	96.1	10.4	13.4	10	0.8	0.3	0.2	0.11	<0.1	<0.1	<0.1		
K8/5W	12	9-Sep-09	10.42	5730	1.72	<50			0.007	<0.01	0.022	0.004	0.022	<0.001	<0.005	<0.1	348.57	31	0.4	114	71.8	90.5	11.4	16.4	10.8	1.3	0.6	0.2	0.17	<0.1	<0.1	<0.1		
K8/5W	12	23-Dec-10	9.8	5100	3		0.04	0.01	0.057	<0.005			0.029	<0.001			533.33	35	1.1	160	130	150	17	20	13	<0.6	<0.3	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1
K8/5W	12	4-Apr-12	10.5	4000	1.6		<0.005	<0.01	0.046	<0.005			0.019	<0.005			466	43	1	150	100	120	12	22	14	<1	<1	<2	<1	<1	<1	<1		
K8/5W	12	20-Feb-13	10.7	4510	3.1		<0.005	0.01	0.035				0.016	<0.001			0.466	<0.001	<0.001	0.21	0.1	0.11	0.012	0.018	0.011	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001		
K8/5W	12	4-Dec-13	10.2	4560	2.9		<0.005	<0.01	0.042				0.016	<0.001			699.5	67	<1	240	160	170	<1	24	15	<1	<1	<2	<1	<1	<1	<1		
K8/5W	12	3-Nov-15	10.7	3750	1.82	-	<0.004	<0.004	0.031	<0.01	-	-	0.018	<0.001	-	-	450	30.6	<1.0	140	96.2	129	13.3	23.2	16	1.3	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0		
K8/5W	12	08-Apr-16	10.6	3568	0.23	-	<0.004	<0.004	0.066	-	-	-	0.024	0.004	-	-	530	35	<1	250	140	38	15	28	19	1	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0		
K8/5W	12	07-Apr-17	10.7	2948	4.1	-	<0.004	<0.004	0.026	<0.005			0.015	<0.001	-	-	460	27	<0.1	140	110	130	17	20	13	0.3	0.3	<0.2	<0.1	<0.1	<0.1	<0.1		
K8/5W	12	16-May-18	10.54	3140	**3.9**	<50	<0.004	<0.004	0.02	<0.005			0.037	<0.001			510	32	<1	220	100	120	12	16	10	<1	<1	<2	<1	<1	<1	<1		
K8/5W	12	04-Jul-19	5.08	2106	6.1	<50	<0.004	<0.004	0.07	<0.005			0.032	<0.001			570	31	<0.1	220	130	150	11	14	12	0.2	0.2	<0.2	<0.1	<0.1	<0.1	<0.1		
K8/5W	12	02-Jul-20	10.7	2022	4.7	<50	<0.004	<0.004	0.012	<0.005			0.043	<0.001			530	50	0.2	190	120	130	9.8	16	11	0.6	0.3	0.4	<0.1	<0.1	<0.1	<0.1		
K8/5W	12	23-Jun-21	5.2	2435	2.9	<50	<0.004	<0.004	0.012	<0.005			0.025	<0.001			640	39	0.2	270	140	150	13	14	901	0.2	0.2	<0.2	<0.1	<0.1	<01	<0.1		
K8/5W	12	24-Jun-22	8.21	1592	5.2	<50	<0.004	<0.004	0.064	<0.005			0.025	<0.001			2.8	<0.2	<0.1	0.9	0.6	0.7	<0.1	0.3	0.2	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K8/5W	12	12-Oct-23	10.1	2,490	7.5	<50	<0.005	<0.005	0.019	<0.005			0.014	<0.001			790	62	<1	300	170	180	27	27	19	<1	<1	<2	<1	<1	<1	<1		

Table B-2: Monitoring Data: Shallow Estuarine Wells (1999-2023)

ANALYTES			pH	Conductivity	Ammonia	Phenols	Free Cyanide	Weak Acid Disociable Cyanide	Total Cyanide	Cr VI - Dissolved	Fe - Dissolved	Mn - Dissolved	Mo - Dissolved	Pb - Dissolved	Zn - Dissolved	Hg - Dissolved	Total PAHs	Naphthalene	Acenaphtylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)&(k)fluoranthene	Benzo(a)pyrene	Indeno(1.2.3-cd)pyrene	Dibenzo(ah)anthracene	Benzo(ghi)perylene	1-Methylnaphthalene	2-Methylnaphthalene
			pH units	µs/cm	mg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L
ANZECC CRITERIA			8 to 8.4		0.91	400	0.004		0.004	0.0044		0.08 (L)	0.023 (L)	0.0044	0.015	0.1		70 (M)				0.2 (L)	0.4 (L)	1.4 (L)					0.2 (L)					
K9/2W	18	7-Jun-00	7.6	7700	0.4	<1^	<0.005		<0.005	<0.01	<0.10	0.53	0.06	<0.05	0.01	<0.05	6.7	0.7	0.3	0.2	<0.2	0.7	0.3	1	1	0.4	0.4	0.4	0.4	0.6	0.3	<0.2		
K9/2W	18	6-Sep-00	7.4	8800	0.8	<1^	<0.005		<0.005	<0.01	<0.10	0.41	0.03	<0.002	<0.01	<0.05	1.9	0.4	<0.2	0.4	0.3	0.4	<0.2	0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K9/2W	18	6-Dec-00	7.6	9900	1.1	3^	<0.005		<0.005	<0.01	<0.1	0.49	0.02	<0.002	0.02	<0.05	1.2	0.2	<0.2	<0.2	<0.2	0.4	<0.2	0.3	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K9/2W	18	7-Mar-01	7.5	11100	1.3	1^	<0.005		<0.005	<0.005	0.48	1.03	0.047	<0.005	<0.01	<0.05	1.3	<0.1	<0.1	0.4	0.4	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K9/2W	18	5-Sep-01	7.4	7000	0.3	1^	<0.005		<0.005	<0.01	0.26	0.12	<0.01	<0.002	<0.005	0.05	0.4	0.1	<0.1	<0.1	<0.1	0.1	<0.1	0.1	0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/2W	18	4-Mar-02	7.5	6300	0.8	<1^	0.01		0.007	<0.01	0.58	0.34	<0.01	<0.05	<0.01	<0.05	<0.85	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/2W	18	15-Oct-02	7.8	9600	1.26	20	<0.005		<0.005	0.008	0.08	0.633	0.04	<0.001	0.032	<0.05	21.9	1.2	0.9	0.2	0.2	1	0.6	3.2	3.4	1.6	1	3	2.2	1.8	<0.1	1.6		
K9/2W	18	15-Apr-03	7.7	5300	1.06	<10	<0.005		0.007	<0.005	0.16	0.49	0.12	<0.005	0.11	<0.05	1.6	0.2	0.1	0.1	<0.1	0.1	0.1	0.2	0.2	0.1	<0.1	0.2	0.1	0.1	<0.1	0.1		
K9/2W	18	17-Nov-03	8.29	11030	1.37	<50			0.007	<0.01	0.04	0.865	0.094	<0.001	<0.005	<0.1	0.9	0.2	<0.1	<0.1	<0.1	0.1	<0.1	0.3	0.3	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/2W	18	30-Mar-04	7.5	4210	0.77	<10			<0.005	<0.01	<0.05	<0.001	<0.001	<0.001	<0.002	<0.05	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/2W	18	28-Sep-04	7.64	4940	0.53	<7			0.009	<0.01	<0.1	0.353	0.05	<0.001	0.011	<0.1	1.97	0.2	<0.1	<0.1	<0.1	0.1	<0.1	0.4	0.7	0.1	<0.1	0.3	0.17	<0.1	<0.1	<0.1		
K9/2W	18	30-Mar-05	7.8	5200	0.332	<50			0.0942	<0.100#	<0.05	0.464	0.07	<0.001	<0.005	<0.1	4.25	0.3	0.1	<0.1	<0.1	0.2	0.1	0.6	0.7	0.3	0.2	0.8	0.35	0.1	<0.1	0.1		
K9/2W	18	13-Sep-05	6.9	6970	0.063	<50			0.03	<0.010	0.13	0.445	0.067	<0.001	0.014	<0.1	0.79	0.2	<0.1	0.1	<0.1	<0.1	<0.1	0.2	0.2	<0.1	<0.1	<0.2	0.09	<0.1	<0.1	<0.1		
K9/2W	18	8-Mar-06	7.08	6750	1.12	<50			0.0346	<0.010	0.58	0.578	0.058	<0.001	0.008	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/2W	18	5-Sep-06	7.47	6230	0.774	122			0.0152	<0.010	0.6	0.671	0.07	<0.001	0.023	<0.1	3.69	0.3	0.1	<0.1	<0.1	0.2	<0.1	0.7	0.7	0.3	0.2	0.8	0.39	0.2	<0.1	0.2		
K9/2W[2]	18	8-Mar-07	7.08	6750	1.12	<50			0.0346	<0.010	0.58	0.578	0.058	<0.001	0.008	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/2W	18	28-Sep-07	7.4	3600#	0.206	<50			0.0041	<0.010	0.63	0.442	0.05	<0.001	0.006	<0.1	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K9/2W	18	10-Mar-08	7.5	3300	0.642	<50			0.0267	<0.01	0.29	0.499	0.076	<0.001	<0.005	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K9/2W	18	10-Sep-08	7.12	3800	1.03	<50			0.029	<0.01	0.55	0.464	0.007	<0.001	0.005	<0.1	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/2W	18	5-Mar-09	6.87	7190	0.52	<50			<0.004	<0.01	<0.05	0.341	0.002	<0.001	<0.005	<0.1	1	1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K9/2W	18	9-Sep-09	7.21	25500	0.97	<50			<0.004	<0.01	2.94	1.19	0.016	<0.001	0.009	<0.1	0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K9/2W	18	23-Dec-10	7.5	9000	1.9		<0.004	<0.004	0.005	<0.005			0.068				<1.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1
K9/2W	18	27-Jun-12	7.91	7100	2.5		<0.01	<0.01	<0.005				0.009	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K9/2W	18	21-Feb-13	7.5	790	0.08		<0.005	<0.01	0.01				0.012				<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K9/2W	18	6-Dec-13	7.8	2650	0.67		<0.005	<0.01	<0.005				0.078				<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K9/2W	18	6-Apr-16	7.27	3990	0.63		<0.004	<0.004	<0.004	<0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-18	
K9/2W	18	10-Apr-17	6.65	6920	2	-	<0.004	<0.004	<0.004	<0.005			0.002	-	-	-	0.14	<0.2	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/2W	18	16-May-18	7.3	2000	2.2	-	<0.004	<0.004	<0.004	<0.005			0.001				0.28	<0.2	<0.1	<0.1	<0.1	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/2W	18	4-Jul-19	7.19	608	2.4	-	<0.004	<0.004	<0.004	<0.005			0.004	-			2.7	<0.2	<0.1	0.6	0.6	1.2	<0.1	0.2	0.2	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/2W	18	16-Jun-20	5.99	4686	2.8	-	<0.004	<0.004	<0.004	<0.005			0.005	-			0.37	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/2W	18	15-Aug-21	5.73	12.4	0.69	-	<0.004	<0.004	<0.004	<0.005			0.019	-			0.85	0.2	<0.1	0.4	0.2	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/2W	18	24-Jun-22	5.8	27.9	0.67	-	<0.004	<0.004	<0.004	<0.005			0.018	-			<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/2W	18	10-Oct-23	7.3	2,358	0.89		<0.005	<0.005	<0.005	<0.005			0.034	0.001			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K9/3S	37	5-Jun-00	7.6	7800	0.5	<1^	<0.005		<0.005	<0.01	<0.10	0.52	0.02	<0.05	0.02	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K9/3S	37	4-Sep-00	7.6	8900	0.7	<1^	<0.005		<0.005	<0.01	<0.10	0.54	0.01	<0.002	0.04	<0.05	0.2	<0.2	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K9/3S	37	7-Dec-00	7.6	8700	0.8	<1^	<0.005		<0.005	<0.01	<0.1	0.47	0.01	<0.002	<0.01	<0.05	0.7	<0.2	<0.2	0.2	0.2	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K9/3S	37	5-Mar-01	7.9	8900	1.1	<1^	<0.005		0.012	<0.005	1.55	0.95	0.021	<0.005	<0.01	<0.05	0.7	<0.1	<0.1	0.2	0.2	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K9/3S	37	3-Sep-01	7.9	7300	0.3	1^	<0.005		<0.005	<0.01	<0.1	0.67	<0.01	<0.002	<0.005	0.06	0.8	0.1	<0.1	0.2	0.2	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/3S	37	4-Mar-02	7.7	6300	0.7	1^	<0.005		0.005	<0.01	0.24	0.65	<0.01	<0.05	<0.01	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/3S	37	15-Oct-02	7.9	5900	0.6	10	<0.005		<0.005	0.017	0.22	0.545	0.032	<0.001	0.094	<0.05	0.3	0.2	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/3S	37	15-Apr-03	7.7	4700	0.74	<10	<0.005		0.01	<0.005	<0.05	0.057	0.008	<0.005	0.13	<0.05	<0.755	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.01	<0.1	<0.1	<0.1		
K9/3S	37	11-Nov-03																																
K9/3S	37	31-Mar-04																																
K9/3S	37	27-Sep-04	7.76	5300	0.49	<7			0.012	<0.01	<0.1	0.219	0.014	<0.001	<0.005	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/3S	37	29-Mar-05	6.89	4850																														
K9/3S	37	7-Sep-05	7.53	6100	0.426	<50			0.04	<0.010	0.54	0.83	0.006	<0.001	0.106	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/3S	37	3-Mar-06	6.54	2960	0.174	<50			0.023	-	0.33	0.136	0.015	<0.001	0.054	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/3S	37	1-Sep-06	7.66	5790	0.549	219			0.0306	<0.010	0.61	0.301	0.01	<0.001	0.019	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/3S	37	3-Mar-07	6.54	2960	0.174	<50			0.023	-	0.33	0.136	0.015	<0.001	0.054	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/3S	37	21-Sep-07	6	4510	0.237	78			<0.0040	<0.010	0.67	0.592	0.007	<0.001	0.046	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K9/3S	37	6-Mar-08	7.3	3820	0.607	<50			0.014	<0.01	0.1	0.241	0.013	<0.001	0.006	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K9/3S	37	10-Sep-08	7.37	16450	0.25	<50			0.006	<0.01	0.54	0.455	0.008	<0.001	0.012	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/3S	37	6-Mar-09	6.99	20660	0.45	<50			<0.004	<0.01	<0.05	0.367	0.021	<0.001	<0.005	<0.1	0.6	0.6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K9/3S	37	14-Sep-09	7.77	19500	1.28	<50			0.005	<0.01	5.12	1.28	0.024	<0.001	<0.005	<0.1	1.8	1.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K9/3S	37	24-Dec-10	7.7	7100	2.1	<10	<0.004	<0.004	0.007	<0.005			0.023	<0.001			<1.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1
K9/3S	37	12-Feb-13	9.55	13.3	1.6	20	<0.005	<0.01	<0.005				0.024	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K9/3S	37	10-Dec-13	7.74	8940	1	10	<0.005	<0.01	0.008				0.029	<0.001																				
K9/3s	37	4-Apr-16	9.28	1500	0.75	<0.05	<0.004	<0.004	<0.004	<0.005	-	-	0.031	0.008	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<0.5	<1.0	<1.0	<1.0		
K9/3S	37	13-Apr-17	8.14	5390	0.68	<0.05	<0.004	<0.004	<0.004	0.01			0.026	<0.001	-	-	NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/3S	37	18-May-18	5.8	5020	1.1	<0.05	<0.004	<0.004	<0.004	<0.005			0.024	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/3S	37	16-Jul-19	6.12	7470	0.62	<50	<0.004	<0.004	<0.004	<0.005			-	-			0.36	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/3S	37	30-Jun-20	7.93	5346	0.78	<50	<0.004	<0.004	<0.004	<0.005			0.022	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/3S	37	30-Jun-21	6.09	163.3	1.8	<50	<0.004	<0.004	<0.004	<0.01			0.023	<0.001			0.28	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/3S	37	21-Jun-22	7.75	137.2	0.5	<50	<0.004	<0.004	<0.004	<0.005			0.018	<0.001			<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/3S	37	13-Oct-23	7.7	4,128	1.8	<50	<0.005	<0.005	0.006	<0.005			0.013	<0.001			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K9/4E	19	7-Jun-00	7.4	10100	2.6	<1^	<0.005		0.019	<0.01	<0.10	1.2	0.02	<0.05	<0.01	<0.05	1.5	1	<0.2	<0.2	0.2	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K9/4E	19	6-Sep-00	7.1	25100	6.1	<1^	<0.20		<0.20	<0.01	<0.10	2	<0.01	<0.002	<0.01	<0.05	0.8	0.4	<0.2	0.2	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K9/4E	19	6-Dec-00	7.1	32700	9.7	<1^	<0.005		<0.005	<0.01	<0.1	2.8	<0.01	<0.002	0.03	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K9/4E	19	7-Mar-01	7	36400	11	<1^	<0.005		0.021	<0.005	9.18	4.77	<0.005	<0.005	<0.01	<0.05	0.4	<0.1	<0.1	0.1	0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K9/4E	19	5-Sep-01	7.3	11000	3.5	2^	<0.005		<0.005	<0.01	1.5	0.45	<0.01	<0.002	<0.005	0.05	0.5	0.1	<0.1	0.1	0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/4E	19	4-Mar-02	7.2	24100	8.4	<1^	<0.005		0.03	<0.01	4	1.2	<0.01	0.003	<0.01	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/4E	19	10-Oct-02	7.7	29000	8.84	<10	<0.005		0.013	0.005	0.66	2.17	0.01	<0.001	0.092	0.1	1.2	0.3	<0.1	0.3	0.1	0.2	<0.1	0.2	0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/4E	19	15-Apr-03	7.4	17000	12.2	<10	<0.005		<0.005	0.01	0.55	3.6	<0.005	<0.005	0.048	<0.05	0.24	0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	0.04	<0.1	<0.1	<0.1		
K9/4E	19	17-Nov-03	7.28	31400	8.43	<50			0.367	<0.01	0.05	0.76	0.059	<0.001	<0.005	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/4E	19	30-Mar-04	7.35	29300	9.96	30			0.011	<0.01	<0.05	<0.001	<0.001	<0.001	<0.002	<0.05	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/4E	19	28-Sep-04	7.4	18700	5.27	<7			<0.005	<0.01	<0.1	0.83	0.024	<0.001	<0.050	<0.1	0.5	0.3	<0.1	<0.1	<0.1	0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/4E	19	30-Mar-05	7.04	20900	6.59	<50			0.0225	<0.100#	<0.05	1.78	0.006	<0.001	<0.050#	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/4E	19	8-Sep-05	5.12	13020	3.37	<50			0.05	<0.010	0.31	0.788	0.008	<0.001	0.009	<0.1	0.66	0.3	<0.1	<0.1	<0.1	0.1	<0.1	0.1	0.1	<0.1	<0.1	<0.2	0.06	<0.1	<0.1	<0.1		
K9/4E	19	9-Mar-06	6.72	21210	7.29	<50			0.0272	<0.010	1.67	1.86	0.007	0.002	0.018	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/4E	19	5-Sep-06	7.4	12350	3.03	<50			0.005	<0.010	0.28	1.27	0.02	<0.001	0.014	<0.1	0.6	0.6	<0.1	<0.1	<0.1	0.2	<0.1	0.2	0.2	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/4E	19	9-Mar-07	6.72	21210	7.29	<50			0.0272	<0.010	1.67	1.86	0.007	0.002	0.018	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/4E	19	28-Sep-07	6.9	9020#	2.76	<50			0.0055	<0.010	0.57	0.868	0.002	<0.001	0.02	<0.1	0.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K9/4E	19	10-Mar-08	7.2	9520	6.4	<50			0.012	<0.01	3.46	1.9	0.004	0.009	0.286	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K9/4E	19	10-Sep-08	6.89	7640	3.15	<50			0.023	<0.01	<0.5	1.22	0.001	<0.001	0.011	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/4E	19	6-Mar-09	6.58	14280	2.96	<50			0.004	<0.01	<0.5	1.84	0.005	<0.001	<0.005	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K9/4E	19	9-Sep-09	7.22	6980	1.54	<50			<0.004	<0.01	0.64	1.4	0.01	<0.001	<0.005	<0.1	0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K9/4E	19	23-Dec-10	7.3	6400	0.4		<0.004	<0.004	0.005	<0.005																								
K9/4E	19	19-Feb-13	7.4	11600	3.7		<0.005	<0.001	<0.005																									
K9/4E	19	4-Dec-13	7.3	6390	2.8		<0.005	<0.01	0.009																									
K9/4E	19	27-Oct-15	7.2	6350	1.94	-	<0.004	<0.004	<0.004	<0.01	-	-	-	-	-	-	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0		
K9/4E	19	11-Apr-16	7.41	6243	0.46	-	<0.004	<0.004	<0.004	<0.005	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<0.5	<1.0	<1.0	<1.0		
K9/4E	19	10-Apr-17	6.88	10725	5.3	-	<0.004	<0.004	<0.004	<0.005			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
K9/4E	19	16-May-18	6.88	10150	6.6	-	<0.004	<0.004	<0.004	<0.005							0.43	<0.2	<0.1	<0.1	<0.1	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/4E	19	04-Jul-19	6.86	11310	5.3	-	<0.004	<0.004	<0.004	<0.005			-	-			0.18	<0.2	<0.1	<0.1	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/4E	19	16-Jun-20	6.2	14561	5.8	-	<0.004	<0.004	<0.004	<0.005			-	-			<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/4E	19	23-Jun-21	5.84	321.9	2.8	-	<0.004	<0.004	<0.004	<0.005			-	-			1.3	<0.2	<0.1	0.5	0.4	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/4E	19	24-Jun-22	6.89	296.7	2.2	-	<0.004	<0.004	<0.004	<0.005			-	-			<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/4E	19	10-Oct-23	7.3	10,040	2.1		<0.005	<0.005	<0.005	<0.005							<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		

Table B-2: Monitoring Data: Shallow Estuarine Wells (1999-2023)

ANALYTES		pH	Conductivity	Ammonia	Phenols	Free Cyanide	Weak Acid Dissociable Cyanide	Total Cyanide	Cr VI - Dissolved	Fe - Dissolved	Mn - Dissolved	Mo - Dissolved	Pb - Dissolved	Zn - Dissolved	Hg - Dissolved	Total PAHs	Naphthalene	Acenaphtylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b&k)fluoranthene	Benzo(a)pyrene	Indeno(1.2.3-cd)pyrene	Dibenzo(ah)anthracene	Benzo(ghi)perylene	1-Methylnaphthalene	2-Methylnaphthalene
		pH units	µs/cm	mg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L
ANZECC CRITERIA		8 to 8.4		0.91	400	0.004		0.004	0.0044		0.08 (L)	0.023 (L)	0.0044	0.015	0.1		70 (M)				0.2 (L)	0.4 (L)	1.4 (L)					0.2 (L)					
BHe29s	25-Mar-09	7.7	14860	0.33	80			<0.004	<0.01	0.4	0.415	0.02	<0.001	0.03	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
BHe29s	15-Sep-09	8.3	10680	<0.1	<50			<0.004	<0.01	<0.05	0.226	0.022	<0.001	<0.005	<0.1	0.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
BHe29s	24-Dec-10	8.2	6000	0.46	<0.01	<0.004	<0.004	<0.004	<0.005			0.006	<0.002			<1.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1
BHe29s	2-Apr-12	8.62	3600	0.4	<10	<0.005	<0.01	<0.005	<0.005			0.032	0.013			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
BHe29s	12-Feb-13	8.85	6810	1.3	30	<0.005	<0.01	<0.005				0.008	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
BHe29s	6-Dec-13	8.2	2470	1	<10	<0.005	<0.01	0.01				0.004	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
BHe29s	28-Oct-15	7.04	2380	0.91	<1.0	<0.004	<0.004	<0.004	<0.01	-	-	-	<0.001	-	-	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0		
BHe29s	04-Apr-16	8.76	900	0.76	<0.05	<0.004	<0.004	<0.004	<0.005	-	-	0.015	0.008	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<0.5	<1.0	<1.0	<1.0		
BHe29s	07-Apr-17	7.98	2418	0.64	<0.05	<0.004	<0.004	0.16	<0.005			0.009	0.002	-	-	NIL (+)VE	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
Bhe29s	16-May-18	7.78	2340	0.62	<0.05	<0.004	<0.004	<0.004	<0.005			0.01	<0.001			0.18	<0.2	<0.1	<0.1	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
Bhe29s	15-Jul-19	7.87	1968	1.2	<50	<0.004	<0.004	<0.004	<0.005			0.005	<0.001			0.32	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
BHe29s	29-Jun-20	8.26	1633	0.85	<50	<0.004	<0.004	<0.004	<0.005			0.009	0.011			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
BHe29s	30-Jun-21	7.91	1137	1.7	<50	<0.004	<0.004	<0.004	<0.005			0.005	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
BHe29s	21-Jun-22	7.91	938	1.3	<50	<0.004	<0.004	<0.004	<0.005			0.003	<0.001			<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
BHe29s	12-Oct-23	8.1	1,297	1.2	<50	<0.005	<0.005	<0.005	<0.005			0.005	<0.001			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
GHD01S	26-Mar-09	8.7	6380	4.98	70			0.168	<0.01	0.37	0.12	0.061	0.007	0.043	<0.1	198.92	167	21.1	5.7	1.8	1.2	0.1	0.4	0.5	0.2	0.2	0.3	0.22	<0.1	<0.1	0.2		
GHD01S	18-Sep-09	5.8	5500	5.1	<50			<0.004	<0.01	0.12	0.062	0.083	<0.001	0.053	<0.1	72.6	60.9	7.8	2.5	1.1	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
GHD01S	22-Dec-10	7.0	7700	4.6	0.05	0.19	<0.004	0.006	<0.005			0.07	<0.001			<86.92	67	13	3.6	1.4	0.6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1
GHD01S	11-Apr-12	9.18	8330	4.4	80	0.023	<0.01	0.06	<0.005		0.03	0.055	<0.001			154	130	12	4	2	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
GHD01S	28-Jun-12	8.91	9250	5.1	60	<0.005		0.031				0.03	<0.001			183	160	14	5	3	1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
GHD01S	13-Feb-13	8.7	8600	4.2	<10	<0.005	0.01	0.015			0.037	0.026	<0.001			207	180	16	4	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
GHD01S	28-May-13	9.4	8140	4.1	30	<0.005	0.03	0.027			0.031	0.037	<0.001			174	150	12	4	2	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
GHD01S	9-Dec-13	7.4	33000	4	<10	<0.005	<0.01	<0.005			1.1	0.001	<0.001			22	7	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
GHD01S	22-Apr-14	9	7660	4	<10	0.015	0.02	0.02			0.023	0.023	<0.001			29	13	<1	<1	2	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
GHD01S	28-Oct-15	8.3	1500	0.43	<1.0	<0.004	<0.004	0.02	<0.01	-	-	0.082	<0.001	-	-	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0		
GHD01S	15-Apr-16	7.74	14888	3	<0.05	<0.004	<0.004	0.006	<0.005	-	-	0.004	<0.001	-	-	11	10	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<0.5	<1.0	<1.0	<1.0		
GHD01S	18-Apr-17	7.4	7930	3.8	<0.05	<0.004	<0.004	0.007	<0.005			0.02	<0.001	<100	<100	9.6	6.2	1.4	1.4	0.3	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
GHD01S	11-May-18	7.42	14990	3.6	<0.05	<0.004	<0.004	0.005	<0.005			0.004	<0.001			55	4.4	0.5	0.2	0.2	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
GHD01S	15-Jul-19	20	15801	3.4	<50	<0.004	<0.004	0.005	<0.005			0.007	<0.001			18	13	2	1	0.8	1	0.1	0.3	0.2	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
GHD01S	07-Jul-20	5.87	5616	5.4	<50	<0.004	<0.004	0.007	<0.005			0.037	<0.001			48	41	1.8	2.3	0.7	0.8	<0.1	0.2	0.2	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	48	
GHD01S	07-Jul-21	5.58	6.4	3.5	<50	<0.004	<0.004	<0.004	<0.005			0.001	<0.001				7.7	1	0.3	0.2	<0.1	<0.1	0.2	0.2	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
GHD01S	12-Oct-23	6.9	4,922	6.1	<50	<0.005	0.023	0.068	<0.005			0.021	<0.001			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
E61D	7-Mar-09	6.6	29600	1.27	<50			<0.004	<0.01	7.3	0.804	<0.001	0.004	0.014	<0.1	1.76	1.3	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.1	<0.1	<0.1	<0.1	0.06	<0.1	<0.1	<0.1		
E61D	15-Sep-09	7.3	20200	<0.1	<50			<0.004	<0.01	8.19	0.779	<0.001	<0.001	<0.005	<0.1	0.5	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
E61D	23-Dec-10	7.2	18000	1.6	<0.01	<0.004	<0.004	0.004	<0.005			<0.002	<0.001			<1.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1
E61D	29-Oct-15	6.57	20100	2	<1.0	<0.004	<0.004	<0.004	<0.01	-	-	<0.001	<0.010	-	-	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0		
E61D	08-Apr-16	6.65	44933	0.53	<0.05	<0.004	<0.004	<0.004	<0.005	-	-	<0.001	<0.010	-	-	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0		
E61D	07-Apr-17	6.77	43591	2.7	<50	<0.004	<0.004	<0.004	<0.005			0.002	<0.001	-	-	NIL (+)VE	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
E61D	18-May-18	7.1	36280	2.50	<50	<0.004	<0.004	<0.004	<0.005			0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
E61D	30-Jun-19	6.66	47318	2.40	<50	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
E61D	15-Jun-20	7.31	51926	2.80	<50	<0.004	<0.004	0.006	<0.005			<0.002	<0.002			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
E61D	22-Jun-21	6.95	48081	2.80	<50	<0.004	<0.004	<0.004	<0.005			<0.01	0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
E61D	22-Jun-22	6.92	44047	3.10	<50	<0.004	<0.004	<0.004	<0.005			0.003	<0.001			<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
E61D	09-Oct-23	6.62	52,319	2.1	<50	<0.005	<0.005	<0.004*	<0.005			0.014	<0.01			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
336B	6-Mar-09	6.3	33700	0.97	<50			<0.004	<0.01	<0.5	0.742	<0.001	<0.001	0.006	<0.1	3.9	1	<0.1	1.4	1	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
336B	11-Sep-09	6.8	19900	0.66	370			<0.004	<0.01	8.27	0.507	0.001	<0.001	0.016	<0.1	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
336B	16-Apr-12	6.9	20.4	0.84	<10	<0.005	<0.01	<0.005	<0.005		0.49	<0.001	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
336B	22-Feb-13	7.2	14300	1.2	<10	<0.005	<0.01	<0.005				<0.001	0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
336B	4-Nov-15	6.9	14500	0.19	<10	<0.005	<0.01	<0.005	<0.01	0.002	<0.001	<0.001	<0.001	<1.0	<1.0	<16	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0		
336B	8-Apr-16	6.9	17719	0.053	<0.05	<0.004	<0.004	<0.004	<0.005			0.003	0.03			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<0.5	<1.0	<1.0	<1.0		
336B	6-Apr-17	6.7	25012	1.5	<50	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001		-	NIL (+)VE	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
336B	29-Jun-22	8.94	14.4	0.58	<50	<0.004	<0.004	<0.004	<0.005			0.009	<0.001			<0.1	0.2	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
336B	9-Jun-20	6.98	17989	0.64	<50	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
336B	25-Jun-21	6.11	64.6	0.6	<50	<0.004	<0.004	<0.004	<0.005			0.002	<0.001			0.3	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
336B	28-Jun-22	6.91	6288	0.58	<50	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
336B	9-Oct-23	7	11,101	0.46	<50	<0.005	<0.005	<0.004*	<0.005			<0.005	<0.001			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
344B	23-Dec-10	7.2	11700	0.44	<0.01	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			<2.41	<0.1	<0.1	<0.1	<0.1	0.2	0.3	0.2	0.2	0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	0.1	0.2
344B	10-Apr-12	10.28	16900	2.2		<0.005	<0.01	<0.005	<0.005			0.005	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
344B	19-Feb-13	7.0	15600	3	<10	<0.005	<0.01	<0.005				0.002	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
344B	3-Dec-13	6.7	14800	3		<0.005	<0.01	0.011				<0.001	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
344B	10-May-18	6.22	12460	2.8	<50	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			NIL (+)VE																	
344B	12-Jul-19	5.98	2483	2.4	<50	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
344B	24-Jun-21	6.07	190	2.6	<50	<0.004	<0.004	<0.004	<0.005			0.003	0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
344B	27-Jun-22	6.49	36.8	3	<50	<0.004	<0.004	0.004	<0.005			0.001	<0.001			<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
344B	9-Oct-23	8.77	12,539	2.5	<50	<0.005	<0.005	<0.004*	<0.005			<0.005	<0.001			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
BH21S	03-Nov-15	11.23	1163	6.81	3.3	<0.004	<0.004	0.205	<0.01			0.433	<0.001			201	110	4.3	3	5.7	23.6	4.6	14.2	11	4.7	3.7	6.8	4.2	2.3	<1.0	2.7		
BH21S	08-Apr-16	10.99	1220	6.6	3	-	-	0.44	<0.005			0.59	0.12			250	230	2	3	3	9	1	4	3	<1.0	<1.0	<2.0	<0.5	<1.0	<1.0	<1.0		
BH21S	07-Apr-17	11.05	1126	6.9	<0.05	<0.004	<0.004	0.36	<0.005			0.39	<0.001			NIL (+)VE	<0.2	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
BH21S	10-May-18	10.19	1180	7.4	<0.05	<0.004	<0.004	0.38	<0.005			0.55	<0.001			56	44	0.4	1.3	1.8	5.1	0.9	1.9	1.4	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
BH21S	24-Jun-21	5.03	84	7.6	<50	<0.004	<0.004	0.065	<0.005			0.49	<0.001			270	220	1.8	1.8	3	10	2.4	7.5	6	2.3	2	3.8	2.2	1.1	0.3	1.4		
BH21S	27-Jun-22	10.93	1663	7.5	<50	<0.004	<0.004	0.21	<0.005			0.54	<0.001			240	210	2.6	3.7	3	10	2.8	4.4	3.6	0.8	0.6	0.9	0.6	0.3	<0.1	0.4		
BH21S	09-Oct-23	10.76	2,329	7.4	<50	<0.005	0.096	0.22	<0.005			0.37	<0.001			500	470	2	4	3	8	2	4	3	<1	4	<2	<1	<1	<1	<1		
NCIG1	30-Oct-15	8.4	4650	1.27	<1.0	<0.004	<0.004	<0.004	<0.01			0.019	0.001			<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0		
NCIG1	12-Apr-16	5.82	10007	0.55	<0.05	<0.004	<0.004	<0.004	<0.005			0.016	<0.001			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<0.5	<1.0	<1.0	<1.0		
NCIG1	05-Apr-17	8.99	2012	0.57	<0.05	<0.004	<0.004	<0.004	<0.005			0.024	<0.001	-	-	NIL (+)VE	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
NCIG1	17-May-18	3.37	3280	0.4	<0.05	<0.004	<0.004	0.005	<0.005			0.037	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
NCIG1	08-Jul-19	5.47	3972	1.6	<50	<0.004	<0.004	<0.004	<0.005			0.025	<0.001			NIL (+)VE	<0.001	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1		
NCIG1	23-Jun-20	6.03	5467	1.7	<50	<0.004	<0.004	<0.004	<0.005			0.027	<0.001			0.34	0.2	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
NCIG1	06-Jul-21	6.77	230	0.95	<50	<0.004	<0.004	<0.004	<0.005			0.01	<0.001			NIL (+)VE	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
NCIG1	29-Jun-22	8.94	14.4	0.58	<50	<0.004	<0.004	<0.004	<0.005			0.009	<0.001			<0.1	0.2	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
NCIG1	11-Oct-23	7.9	9,555	2.2	<50	<0.005	<0.005	<0.004*	<0.005			0.012	<0.001			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		

Shading: Value Exceeds 95% trigger value for marine waters as shown in Table 3.4.1 of the Australian and New Zealand Guidelines for Fresh and Marine water Quality 2000

Note

Ammonia guideline based on a pH of the receiving water body of 8.

Total PAH and Total Phenol PQL calculated as the sum of individual compound PQLs divided by 2.

(L) = Low Reliability Trigger Value

(M) = Moderate Reliability Trigger Value

Ammonia determination was as NO3 until April 2003, after which ammonia determination was as N.

Dissolved Chromium was reported until April 2003, after which hexavalent chromium was reported.

Blank indicates not analysed.

nd = not detected at GHDs March 04 detection levels.

Only sample locations that currently require sampling have an EPA ID number.

K12/11 is the "background" estuarine well.

* Sample decanted and supernatant analysed for PAH.

PQL Raised due to matrix interference.

^ Value is for speciated phenol and not total phenols

*Wells reanalysed to lor LOR of 0.004 mg/L

Table B-**3**: Monitoring Data: Deep Estuarine Wells (1999-20**23**)

ANALYTES			pH	Conductivity	Ammonia	Phenols	Free Cyanide	Weak Acid Dissociable Cyanide	Total Cyanide	Cr VI - Dissolved	Fe - Dissolved	Mn - Dissolved	Mo - Dissolved	Pb - Dissolved	Zn - Dissolved	Hg - Dissolved	Total PAHs	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)&(k)fluoranthene	Benzo(e)pyrene	Indeno(1.2.3-cd)pyrene	Dibenzo(ah)anthracene	Benzo(ghi)perylene	1-Methylnaphthalene	2-Methylnaphthalene
			pH units	µs/cm	mg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L
ANZECC CRITERIA			8 to 8.4		0.91	400	0.004		0.004	0.0044		0.08 (L)	0.023 (L)	0.0044	0.015	0.1		70 (M)				0.2 (L)	0.4 (L)	1.4 (L)						0.2 (L)					
Sample ID	EPA ID	Date																																
K11/1S	30	10-Dec-99	7.0	32700	4.2	<1^			0.03	<0.01	0.94	1.2	<0.01	<0.05	0.02	<0.05	0.20	0.1	<0.05	<0.05	<0.05	0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		
K11/1S	30	14-Mar-00	7.4	32100	4.5	<1^			0.03	<0.01	<0.1	1.1	<0.01	<0.05	0.03	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K11/1S	30	8-Jun-00	7.5	31900	5	<1^	<0.005		<0.005	<0.01	<0.10	0.75	<0.01	<0.05	0.01	0.11	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K11/1S	30	7-Sep-00	7.3	31800	4.6	1^	<0.20		<0.20	<0.01	<0.10	0.67	<0.01	<0.002	<0.01	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K11/1S	30	7-Dec-00	7.3	31400	5.2	<1^	<0.005		<0.005	<0.01	<0.1	0.62	<0.01	<0.002	0.01	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K11/1S	30	8-Mar-01	7.3	30500	6	<1^	<0.005		<0.005	<0.005	0.16	1.13	<0.005	<0.005	<0.01	<0.05	<0.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K11/1S	30	6-Sep-01	7.3	30200	5.9	<1^	<0.005		<0.005	<0.01	<0.1	0.58	<0.01	<0.002	<0.005	<0.05	0.10	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K11/1S	30	4-Mar-02	7.4	29600	5.9	<1^	<0.005		0.006	<0.01	<0.10	0.61	<0.01	0.009	<0.01	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1		
K11/1S	30	15-Oct-02	7.9	15000	0.42	<10	<0.005		0.005	0.004	<0.05	0.086	<0.001	<0.001	0.032	<0.05	0.6	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.3	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1		
K11/1S	30	15-Apr-03	7.5	13000	5.62	<10	<0.005		<0.005	<0.005	<0.05	0.52	<0.005	<0.005	0.13	<0.05	<0.755	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.01	<0.1	<0.1	<0.1	<0.1		
K11/1S	30	11-Nov-03	7.2	32000	4.56	60			<0.005	<0.01	0.2	0.751	<0.001	<0.001	0.013	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K11/1S	30	31-Mar-04	7.4	30900	5.89	<10			<0.005	<0.01	<0.05	1.14	<0.001	<0.001	0.005	<0.05	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K11/1S	30	28-Sep-04	7.5	25100	6.93	<7			<0.005	<0.01	<0.1	0.605	0.003	<0.001	<0.050	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K11/1S	30	29-Mar-05	7.9	34900	6.02	<50			<0.0050	<0.100#	<0.05	0.85	<0.001	<0.001	<0.050#	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K11/1S	30	7-Sep-05	7.31	25600	5.22	<50			0.04	<0.010	0.06	0.661	<0.001	<0.001	<0.005	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K11/1S	30	3-Mar-06	6.97	19260	4.86	215			0.019	<0.010*	0.13	0.686	<0.001	<0.001	0.015	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K11/1S	30	1-Sep-06	7.53	24400	7.18	<50			0.0124	<0.010	<0.05	0.58	<0.001	<0.001	<0.005	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K11/1S	30	3-Mar-07	6.97	19260	4.86	215			0.019	<0.010*	0.13	0.686	<0.001	<0.001	0.015	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K11/1S	30	21-Sep-07	6.50	15620	5.00	116			<0.0040	<0.010	0.19	0.35	<0.001	<0.001	0.051	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1		
K11/1S	30	6-Mar-08	7.60	13810	5.01	<50			0.0143	<0.01	<0.05	0.397	<0.001	<0.001	<0.005	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1		
K11/1S	30	11-Sep-08	7.15	18840	3.25	<50			0.013	<0.01	<0.1	0.503	<0.01	<0.002	0.005	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K11/1S	30	7-Mar-09	7.1	20980	4.52	<50			<0.004	<0.01	<0.5	0.392	0.008	<0.001	<0.005	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1		
K11/1S	30	14-Sep-09	7.7	15170	3.82	<50			0.005	<0.01	0.042	0.34	<0.001	<0.001	<0.005	<0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1		
K11/1S	30	24-Dec-10	7.5	15600	5.4	10	<0.004	<0.004	<0.004	<0.005			<0.002	<0.001			<1.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
K11/1S	30	10-Dec-13	7.4	17400	7.4	<10	<0.005	<0.01	0.005			0.32	<0.001	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
K11/1S	30	22-Apr-14	8.4	17600	7.1	20	<0.005	<0.01	0.008			0.28	<0.001	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
K11/1S	30	30-Oct-15	7.68	17500	6.08	<1.0	<0.004	<0.004	<0.004	<0.01	-	-	<0.001	<0.001	-	-	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0		
K11/1S	30	05-Apr-16	7.01	10619	0.31	<0.05	<0.004	<0.004	0.005	<0.005	-	-	<0.001	<0.001	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<0.5	<1.0	<1.0	<1.0		
K11/1S	30	13-Apr-17	8.73	4179	6.4	<0.05	<0.004	<0.004	0.006	<0.005			<0.001	<0.001	<100	<100	NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K11/1S	30	15-May-18	6.18	10130	4.9	<0.05	<0.004	<0.004	0.004	<0.005			<0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K11/1S	30	16-Jul-19	6.85	3920	4.9	<50	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			0.51	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K11/1S	30	05-Jul-20	7.84	9672	5.1	<50	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K11/1S	30	01-Apr-21	6.01	392.2	4.7	<50		<0.004	<0.004	<0.005			<0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K11/1S	30	06-Jul-22	7.82	392.2	6.6	<50	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K11/1S	30	13-Oct-23	6.1	8,501	3.8	<50	<0.005	<0.005	<0.005	<0.005			<0.005	<0.001			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K11/2W	32	10-Dec-99	6.8	31000	11	3^			0.09	<0.01	0.26	1.9	<0.01	<0.05	<0.01	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K11/2W	32	14-Mar-00	6.9	29700	10	2^			0.04	<0.01	0.13	1.8	<0.01	<0.05	0.11	<0.05	0.70	<0.2	<0.2	<0.2	<0.2	<0.2	0.2	<0.2	0.3	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K11/2W	32	8-Jun-00	7.0	28600	11	6^	<0.005		<0.005	0.05	<0.10	1.3	<0.01	<0.05	0.01	0.19	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K11/2W	32	7-Sep-00	7.0	27700	9.8	3^	<0.005		<0.005	<0.01	0.18	1.3	<0.01	<0.002	<0.01	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K11/2W	32	7-Dec-00	7.0	27200	9.1	2^	<0.005		<0.005	<0.01	0.13	1.2	<0.01	<0.002	<0.01	<0.05	<0.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K11/2W	32	8-Mar-01	7.0	26300	9.5	5^	<0.005		<0.005	<0.005	0.45	2	<0.005	<0.005	<0.01	<0.05	<0.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K11/2W	32	6-Sep-01	7.0	26300	9.1	<1^	<0.005		<0.005	<0.01	0.19	0.76	<0.01	<0.002	<0.005	<0.05	<0.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K11/2W	32	4-Mar-02	7.1	25600	9	3^	<0.005		<0.005	<0.01	0.17	0.79	<0.01	0.005	<0.01	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K11/2W	32	14-Oct-02	7.8	10000	0.1	<10	<0.005		<0.005	0.007	<0.05	0.09	<0.001	<0.001	0.126	0.09	2.3	0.1	<0.1	0.1	<0.1	0.2	0.1	0.6	0.4	0.1	<0.1	0.3	0.1	0.2	<0.1	0.1		
K11/2W	32	15-Apr-03	7.2	14000	3.81	10	<0.005		0.008	<0.005	0.3	0.63	<0.005	<0.005	0.032	<0.05	0.3	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.01	<0.1	<0.1	<0.1	<0.1		
K11/2W	32	10-Nov-03	7.2	20180	5.37	<50			<0.005	<0.01	0.26	1.42	<0.001	<0.001	0.006	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K11/2W	32	31-Mar-04	7.3	19930	7.15	<10			<0.005	<0.01	<0.05	1.61	<0.001	<0.001	<0.002	<0.05	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K11/2W	32	27-Sep-04	7.3	19500	8.66	<7			0.035	<0.01	<0.1	1.22	<0.001	<0.001	<0.050	<0.1	7.46	2.2	0.8	0.2	0.6	1.7	<0.1	0.4	0.6	0.2	0.3	0.3	0.16	<0.1	<0.1	<0.1			
K11/2W	32	29-Mar-05	7.9	22300	7.22	<50			0.0538	<0.100#	<0.05	1.45	<0.001	<0.001	<0.005	<0.1	-																		
K11/2W	32	7-Sep-05	6.64	12960	4.81	<50			<0.0050	<0.010	0.13	0.694	<0.001	<0.001	<0.005	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K11/2W	32	3-Mar-06	6.56	14360	3.55	<50			0.031	<0.010*	0.19	0.882	<0.001	<0.001	0.007	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K11/2W	32	1-Sep-06	7.36	17820	6.52	<50			0.0573	<0.010	0.11	0.71	<0.001	<0.001	0.042	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K11/2W	32	3-Mar-07	6.56	14360	3.55	<50			0.031	<0.010*	0.19	0.882	<0.001	<0.001	0.007	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K11/2W	32	21-Sep-07	7.00	15680	7.26	<50			<0.0040	<0.010	0.32	1.24	<0.001	<0.001	0.006	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1		
K11/2W	32	6-Mar-08	7.10	16870	7.77	864			0.0404	<0.01	0.31	1.35	<0.001	<0.001	0.01	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1		
K11/2W	32	11-Sep-08	6.56	28500	8.29	<50			0.009	<0.01	0.54	2.66	<0.01	<0.002	0.029	<0.1	2.8	0.6	<0.1	1	0.7	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K11/2W	32	7-Mar-09	6.6	26500	9.12	<50			<0.004	<0.01	<0.5	2.07	<0.001	<0.001	<0.005	<0.1	2.4	1.7	<0.1	0.3	0.3	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1		
K11/2W	32	8-Sep-09	7.2	12350	<0.5	<50			<0.004	<0.01	0.12	0.772	<0.001	<0.001	<0.005	<0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1		
K11/2W	32	24-Dec-10	7.8	12500	6.5	<10	<0.004	<0.004	<0.004	<0.005			<0.002	<0.001			<1.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
K11/2W	32	2-Apr-12	7.99	6710	10	<10	<0.005	<0.01	<0.005	<0.005			<0.005	<0.005			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1		
K11/2W	32	12-Feb-13	8.12	15.8	4.9	50	<0.005	<0.01	<0.005				<0.001	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1		
K11/2W	32	6-Dec-13	7.2	19100	9	<10	<0.005	<0.01	0.013				<0.001	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1		
K11/2W	32	29-Oct-15	7.01	14400	7.97	<1.0	<0.004	<0.004	<0.004	<0.01			<0.001	<0.001			<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0	<1.0		
K11/2W	32	05-Apr-16	6.6	8280	8.8	<0.05	<0.004	<0.004	0.007	<0.005	-	-	<0.001	<0.002	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<0.5	<1.0	<1.0	<1.0		
K11/2W	32	Not accessible																																
K11/2W	32	08-Jul-19	7.51	8708	5.3	<50	<0.004	<0.004	0.004	<0.025			<0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K11/2W	32	10-Jun-20	7.47	10195	5.1	<50	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K11/2W	32	21-Jun-21	7.69	7033	4.4	<50	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			0.86	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K11/2W	32	21-Jun-22	7.39	368.5	4.9	<50	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K11/2W	32	12-Oct-23	5.8	3,427		<50	<0.005	<0.005	<0.005	<0.005																								

Table B-3: Monitoring Data: Deep Estuarine Wells (1999-2023)

ANALYTES			pH	Conductivity	Ammonia	Phenols	Free Cyanide	Weak Acid Disociable Cyanide	Total Cyanide	Cr VI - Dissolved	Fe - Dissolved	Mn - Dissolved	Mo - Dissolved	Pb - Dissolved	Zn - Dissolved	Hg - Dissolved	Total PAHs	Naphthalene	Acenaphtylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)&(k)fluoranthene	Benzo(a)pyrene	Indeno(1.2.3-cd)pyrene	Dibenzo(ah)anthracene	Benzo(ghi)perylene	1-Methylnaphthalene	2-Methylnaphthalene
			pH units	µs/cm	mg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L
ANZECC CRITERIA			8 to 8.4		0.91	400	0.004		0.004	0.0044		0.08 (L)	0.023 (L)	0.0044	0.015	0.1		70 (M)				0.2 (L)	0.4 (L)	1.4 (L)					0.2 (L)					
K11/3W	22	10-Dec-99	6.8	30800	8.9	2^			0.02	<0.01	5.4	1.1	<0.01	<0.05	0.16	<0.05	3.73	<0.05	<0.05	<0.05	0.08	0.9	<0.05	1.3	0.79	0.19	0.25	0.22	<0.05	<0.05	<0.05	<0.05		
K11/3W	22	14-Mar-00	7.0	31000	6.5	<1^			0.02	<0.01	0.25	0.68	<0.01	<0.05	<0.01	<0.05	0.20	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K11/3W	22	8-Jun-00	7.2	31000	7	<1^	<0.005		<0.005	<0.01	1.1	0.47	<0.01	<0.05	<0.01	0.12	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K11/3W	22	7-Sep-00	6.9	31300	6.1	1^	<0.005		<0.005	<0.01	1.1	0.44	<0.01	<0.002	<0.01	0.08	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K11/3W	22	7-Dec-00	6.8	31200	6	4^	<0.005		0.006	<0.01	0.34	0.41	<0.01	<0.002	<0.01	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K11/3W	22	8-Mar-01	7.1	29100	6.4	1^	<0.005		<0.005	<0.005	9.35	0.811	<0.005	<0.005	<0.01	<0.05	<0.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K11/3W	22	6-Sep-01	6.9	31200	6.4	2^	<0.01		0.009	<0.01	6.2	0.15	<0.01	0.002	<0.005	<0.05	<0.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K11/3W	22	4-Mar-02	6.9	31200	6.3	1^	<0.005		0.011	<0.01	6.4	0.24	<0.01	0.009	<0.01	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K11/3W	22	14-Oct-02	7.2	30000	5.38	<10	<0.005		<0.005	0.031	9.02	1.04	<0.001	<0.001	0.105	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K11/3W	22	15-Apr-03	7.1	16000	7.34	<10	<0.005		<0.005	<0.005	5.91	1	<0.005	<0.005	0.17	<0.05	<0.755	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.01	<0.1	<0.1	<0.1		
K11/3W	22	11-Nov-03	6.8	34500	1.77	<50			0.007	<0.01	14.5	0.587	<0.001	<0.001	0.026	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K11/3W	22	31-Mar-04	6.9	34600	2.54	<10			<0.005	<0.01	8.5	1.83	<0.001	<0.001	<0.002	<0.05	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K11/3W	22	27-Sep-04	7.2	34400	8.19	<7			0.025	<0.01	0.5	0.705	<0.001	<0.001	0.012	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K11/3W	22	29-Mar-05	7.8	44100	7.5	<50			0.0285	<0.100#	<0.05	0.707	<0.001	<0.001	<0.050#	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K11/3W	22	7-Sep-05	6.41	35100	6.8	<50			0.006	<0.010	8.64	0.658	0.011	<0.001	0.013	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K11/3W	22	3-Mar-06	6.46	28300	4.25	<50			0.034	<0.010*	8.64	0.651	<0.001	<0.001	0.014	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K11/3W	22	1-Sep-06	6.72	34200	9.71	<50			0.0593	<0.010	7.98	0.64	<0.001	<0.001	0.01	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K11/3W	22	3-Mar-07	6.46	28300	4.25	<50			0.034	<0.010*	8.64	0.651	<0.001	<0.001	0.014	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K11/3W	22	21-Sep-07	6.50	26900	6.22	119			<0.0040	<0.010	8.28	0.565	<0.001	<0.001	0.03	<0.1	4.8	3.4	<0.1	<0.1	0.1	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K11/3W	22	6-Mar-08	7.0	25010	7.11	<50			0.0364	<0.01	9.03	0.609	<0.01	<0.01	<0.05	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K11/3W	22	11-Sep-08	6.7	27400	4.72	<50			0.023	<0.01	7.76	0.497	<0.01	<0.002	0.06	<0.1	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K11/3W	22	7-Mar-09	6.4	31000	5.38	<50			<0.004	<0.01	7.23	0.457	<0.001	<0.001	0.026	<0.1	2.1	1.6	<0.1	0.2	0.2	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K11/3W	22	14-Sep-09	6.8	21100	7.67	<50			0.005	<0.01	7.92	0.451	0.002	<0.001	<0.005	<0.1	0.6	0.2	<0.1	0.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K11/3W	22	24-Dec-10	7.1	>20000	7.5	<10	<0.004	<0.004	0.025	<0.005			<0.002	<0.001			<1.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1
K11/3W	22	2-Apr-12	7.76	21900	7.4	<10	<0.005	<0.01	<0.005	<0.005			<0.005	<0.005			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K11/3W	22	13-Feb-13	8	21500	8.7	30	<0.005	<0.01	0.011				<0.001	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K11/3W	22	6-Dec-13	7.2	5550	6.1	20	<0.005	<0.01	0.007				<0.001	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K11/3W	22	28-Oct-15	6.31	5200	6.81	<1.0	<0.004	<0.004	0.08	<0.01			-	<0.001			<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0		
K11/3W	22	11-Apr-16	7.51	14435	7.1	<0.05	<0.004	<0.004	0.011	<0.005	-	-	<0.001	<0.001	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<0.5	<1.0	<1.0	<1.0		
K11/3W	22	13-Apr-17	6.89	10438	7.4	<0.05	<0.004	<0.004	0.007	<0.005			<0.001	<0.001	-	-	NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K11/3W	22	16-May-18	6.87	10532	7	<0.05	<0.004	<0.004	0.009	<0.005			<0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K11/3W	22	08-Jul-19	6.63	3793	5.2	<50	<0.004	<0.004	0.005	<0.005			<0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K11/3W	22	30-Jun-20	7.18	16027	6.1	<50	<0.004	<0.004	0.006	<0.005			<0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K11/3W	22	01-Jul-21	6.67	328.5	5.8	<50	<0.004	<0.004	<0.004	<0.004			<0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K11/3W	22	28-Jun-22	6.74	159.8	5.6	<50	<0.004	<0.004	0.009	<0.005			<0.001	<0.001			<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K11/3W	22	13-Oct-23	7	14,207	5.9	<50	<0.005	<0.005	0.009	<0.005			<0.005	<0.001			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K12/10	45	5-Jun-00	7.0	48600	10	1^	<0.005		<0.005	<0.01	<0.10	0.94	<0.01	<0.05	<0.01	0.16	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/10	45	4-Sep-00	6.8	48500	8.3	<1^	<0.005		<0.005	<0.01	<0.10	0.74	<0.01	<0.002	<0.01	0.07	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/10	45	4-Dec-00	6.8	48500	8.8	<1^	<0.005		<0.005	<0.01	<0.1	0.69	<0.01	0.003	<0.01	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/10	45	5-Mar-01	6.9	48500	11	16^	<0.005		<0.005	<0.005	14.2	1.69	<0.005	<0.005	0.012	<0.05	<0.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K12/10	45	3-Sep-01	7.2	47500	11	<1^	<0.005		<0.005	<0.01	9	0.45	<0.01	<0.002	<0.005	0.14	<0.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K12/10	45	4-Mar-02	7.0	47900	13	<1^	<0.005		<0.005	<0.01	9.1	0.49	<0.01	0.019	<0.01	0.11	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/10	45	3-Oct-02	7.3	39000	16.4	<46	<0.005		<0.005	<0.02	6.42	1.45	0.025	<0.02	0.049	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/10	45	11-Apr-03	7.4	23000	13.4	10	<0.005		<0.005	<0.02	12.3	1.34	<0.02	<0.02	0.058	<0.05	0.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.01	<0.1	<0.1	<0.1		
K12/10	45	12-Nov-03	7.1	50500	15	<50			0.005	<0.01	10.8	1.27	<0.001	<0.001	0.009	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/10	45	29-Mar-04	6.9	40800	16.5	<10			<0.005	<0.01	11.9	1.58	<0.001	<0.001	0.01	<0.05	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/10	45	30-Sep-04	6.9	49400	18	<7			0.016	<0.01	<0.1	1.07	0.005	<0.001	<0.050	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/10	45	30-Mar-05	6.9	61900	19	<50			0.0167	<0.100#	<0.05	1.78	0.001	<0.001	<0.050#	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/10	45	6-Sep-05	6.71	50300	13.2	<50			0.02	<0.010	12.3	1.37	0.009	<0.001	<0.050#	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/10	45	2-Mar-06	6.17	47300	19.4	<50			0.025	<0.010	11.4	1.24	<0.010	<0.010#	<0.050#	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/10	45	4-Sep-06	7.05	48400	13.7	<50			<0.0040	<0.010	12	1.21	<0.010#	<0.010#	<0.050#	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/10	45	2-Mar-07	6.17	47300	19.40	<50			0.025	<0.010	11.4	1.24	<0.010	<0.010#	<0.050#	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/10	45	24-Sep-07	7.30	35400	18.40	249			<0.0040	<0.010	5.58	1.16	<0.010	<0.010	<0.050	<0.1	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K12/10	45	3-Mar-08	5.90	54400	26.00	<50			0.007	<0.05	10.9	1.84	<0.01	<0.01	0.121	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K12/10	45	9-Sep-08	6.83	43100	0.07	<50			0.042	<0.01	6.89	1.31	<0.01	<0.01	<0.05	<0.1	0.7	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	0.3	0.2	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/10	45	4-Mar-09	7.2	46000	14.8	<50			<0.004	<0.01	<1	1.34	<0.1	<0.02	<0.05	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K12/10	45	16-Sep-09	7.0	39900	16.3	<50			<0.004	<0.01	9.82	1.3	<0.01	0.01	0.08	<0.1	0.3	0.2	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K12/10	45	23-Dec-10	7	>20000	16	<10	<0.004	<0.004	<0.004	<0.005			<0.004	<0.002			<1.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1
K12/10	45	3-Apr-12	7.47	47200	13	<10	<0.005	<0.01	<0.005	0.011			<0.005	0.009			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	,2	<1	<1	<1	<1		
K12/10	45	14-Feb-13	8	45200	9.3	<10	<0.005	<0.01	<0.005				<0.001	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	,2	<1	<1	<1	<1		
K12/10	45	5-Dec-13	6.9	46900	16	70	<0.005	<0.01	<0.005				<0.001	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	,2	<1	<1	<1	<1		
K12/10	45	10-Oct-15	6.8	41700	3.92	<1.0	<0.004	<0.004	<0.004	<0.01	-	-	<0.010	<0.010	-	-	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0		
K12/10	45	14-Apr-16	7.05	47941	5	<0.05	<0.004	<0.004	<0.004	<0.005	-	-	<0.001	<0.001	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<0.5	<1.0	<1.0	<1.0		
K12/10	45	04-Apr-17	6.81	39344	16	<0.05	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001	-	-	NIL (+)VE	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/10	45	10-Jul-19	5.82	37013	5.9	<50	<0.02	<0.02	<0.02	<0.50			<0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/10	45	06-Jul-20	6.29	53069	6.5	<50	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/10	45	08-Jul-21	5.91	47822	5.3	<50	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/10	45	29-Jun-22	6.87	43539	5.1	<50	<0.004	<0.004	<0.004	<0.005			0.001	<0.001			<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/10	45	11-Oct-23	6.3	2,761	220	<50	<0.005	<0.005	<0.004	<0.005			<0.005	<0.001			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K12/1E	39	6-Jun-00	7.1	36200	1.3	<1^	<0.005		<0.005	<0.01	<0.10	0.57	<0.01	<0.05	0.03	0.22	0.20	<0.2	<0.2	<0.2	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/1E	39	5-Sep-00	7.0	34600	1.3	<1^	<0.005		<0.005	<0.01	<0.10	0.34	<0.01	<0.002	<0.01	0.06	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/1E	39	5-Dec-00	7.1	34400	1.3	<1^	<0.005		<0.005	<0.01	<0.1	0.34	<0.01	0.002	<0.01	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/1E	39	6-Mar-01	6.8	34400	1.3	<1^	<0.005		<0.005	<0.005	9.79	0.866	<0.005	<0.005	<0.01	<0.05	<0.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K12/1E	39	4-Sep-01	7.1	32900	1.2	2^	<0.005		<0.005	<0.01	6.5	0.23	<0.01	<0.002	<0.005	0.08	<0.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K12/1E	39	4-Mar-02	7.0	32500	1.2	<1^	<0.005		<0.005	<0.01	6.9	0.32	<0.01	0.002	<0.01	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/1E	39	3-Oct-02	7.4	26000	1.15	<46	<0.005		<0.005	<0.02	3.66	1.14	<0.02	<0.02	0.078	0.06	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/1E	39	15-Apr-03	6.9	21000	0.73	<10	<0.005		<0.005	<0.005	6.5	0.34	<0.005	<0.005	0.084	<0.05	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.01	<0.1	<0.1	<0.1		
K12/1E	39	11-Nov-03	7.1	32700	0.72	<50			<0.005	<0.01	<0.01	0.573	0.001	<0.001	<0.005	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/1E	39	26-Mar-04	7.1	32500	1.17	<10			<0.005	<0.01	7.92	0.694	<0.001	<0.001	0.011	<0.05	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/1E	39	29-Sep-04	7.4	32300	1.4	<7			0.11	<0.01	<0.1	0.616	0.005	<0.001	<0.050	<0.1	1.08	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	0.4	0.1	<0.1	0.2	0.08	<0.1	<0.1	<0.1		
K12/1E	39	4-Apr-05	6.8	27000	1.33	<50			0.0059	<0.010	7.56	0.602	<0.001	<0.001	<0.050#	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/1E	39	8-Sep-05	6.94	30900	1.17	<50			0.01	<0.010	5.54	0.636	<0.001	<0.001	0.247	<0.1	1.03	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	0.3	0.3	0.1	<0.1	<0.2	0.13	<0.1	<0.1	<0.1		
K12/1E	39	7-Mar-06	6.88	27100	0.853	<50			<0.0050	<0.010	8.1	0.635	<0.010	<0.010#	<0.050#	<0.1	0.48	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.2	<0.1	<0.1	<0.2	0.08	<0.1	<0.1	<0.1		
K12/1E	39	8-Sep-06	7.24	29900	1.59	<50			0.235	<0.010	7.17	0.535	<0.001	<0.001	0.008	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/1E	39	7-Mar-07	6.88	27100	0.853	<50			<0.0050	<0.010	8.1	0.635	<0.010	<0.010#	<0.050#	<0.1	0.48	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.2	<0.1	<0.1	<0.2	0.08	<0.1	<0.1	<0.1		
K12/1E	39	24-Sep-07	7.10	21900	1.51	<50			<0.0040	<0.010	5.85	0.547	<0.001	<0.001	0.039	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K12/1E	39	5-Mar-08	7.10	19890	1.35	257			0.209	<0.01	7.52	0.595	<0.001	<0.001	0.011	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K12/1E	39	11-Sep-08	6.59	25700	0.82	140			0.121	<0.01	6.43	0.564	<0.001	<0.002	0.03	<0.1	1	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	0.3	0.2	<0.1	<0.1	0.2	0.07	<0.1	<0.1	<0.1		
K12/1E	39	4-Mar-09	7.4	28100	1.16	<50			<0.004	<0.01	<0.1	0.51	<0.01	<0.002	0.006	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K12/1E	39	10-Sep-09	6.9	23900	<0.1	<50			<0.004	<0.01	6.14	0.508	<0.001	<0.001	0.012	<0.1	1.7	0.4	<0.1	0.6	0.5	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K12/1E	39	22-Dec-10	8.0	>20000	1.3	20	<0.004	<0.004	<0.004	<0.005			<0.002	<0.001			<1.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1
K12/1E	39	27-Jun-12	7.3	23460	0.78	<10	<0.01	<0.01	<0.005				<0.001	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K12/1E	39	14-Feb-13	8.1	25500	0.88	<10	<0.005	<0.01	<0.005				<0.001	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K12/1E	39	3-Dec-13	7.0	25000	0.93		<0.005	<0.01	0.011				<0.001	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K12/1E	39	03-Nov-15	7.05	22290	0.89	<1.0	<0.004	<0.004	<0.004	0.02	-	-	<0.001	<0.001	-	-	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0		
K12/1E	39	05-Apr-17	7.21	22846	1.2	<0.05	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001	-	-	NIL (+)VE	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/1E	39	17-May-18	6.04	20560	0.84	<0.05	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/1E	39	08-Jul-19	6.62	4900	0.87	<50	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/1E	39	11-Jun-20	6.38	26048	0.95	<50	<0.004	<0.004	<0.004	<0.005			<0.002	<0.002			NIL (+)VE	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K12/1E	39	06-Jul-21	6.79	622	1.3	<50	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/1E	39	11-Oct-23	6.6	25,342	1.1	<50	<0.005	<0.005	<0.004*	<0.005			<0.005	<0.001			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		

Table B-3: Monitoring Data: Deep Estuarine Wells (1999-2023)

ANALYTES			pH	Conductivity	Ammonia	Phenols	Free Cyanide	Weak Acid Dissociable Cyanide	Total Cyanide	Cr VI - Dissolved	Fe - Dissolved	Mn - Dissolved	Mo - Dissolved	Pb - Dissolved	Zn - Dissolved	Hg - Dissolved	Total PAHs	Naphthalene	Acenaphtylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)&(k)fluoranthene	Benzo(e)pyrene	Indeno(1.2.3-cd)pyrene	Dibenzo(ah)anthracene	Benzo(ghi)perylene	1-Methylnaphthalene	2-Methylnaphthalene
			pH units	µs/cm	mg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L
ANZECC CRITERIA			8 to 8.4		0.91	400	0.004		0.004	0.0044		0.08 (L)	0.023 (L)	0.0044	0.015	0.1		70 (M)				0.2 (L)	0.4 (L)	1.4 (L)					0.2 (L)						
K12/3N	40	6-Jun-00	7.1	50300	15	<1^	<0.005		<0.005	<0.01	<0.10	0.61	<0.01	<0.05	<0.01	0.07	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/3N	40	5-Sep-00	7.0	50800	27	<1^	<0.005		<0.005	<0.01	<0.10	0.52	<0.01	<0.002	<0.01	0.1	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/3N	40	5-Dec-00	6.9	50500	17	<1^	<0.005		<0.005	<0.01	<0.1	0.49	<0.01	0.004	<0.01	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/3N	40	6-Mar-01	6.9	49600	18	<1^	<0.05		<0.005	<0.005	14.4	1.14	<0.005	<0.005	0.011	<0.05	<0.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K12/3N	40	4-Sep-01	7.2	49900	18	4^	<0.005		<0.005	<0.01	7.8	0.14	<0.01	0.005	<0.005	<0.05	<0.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K12/3N	40	4-Mar-02	7.0	48900	17	<1^	<0.005		<0.005	<0.01	8.3	0.19	<0.01	0.014	<0.01	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1		
K12/3N	40	3-Oct-02	7.5	36000	8.81	<46	<0.005		<0.005	<0.02	0.2	1.27	<0.02	<0.02	0.145	0.05	5.5	0.6	0.1	0.4	0.1	0.3	0.1	1	0.7	0.2	0.4	0.8	0.2	0.3	<0.1	0.3		
K12/3N	40	11-Apr-03	7.4	23000	18.2	110	<0.005		<0.005	<0.02	2.07	1.06	<0.02	<0.02	0.103	<0.05	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/3N	40	12-Nov-03	6.9	51400	17.2	<50			<0.005	<0.01	<0.01	0.567	0.002	<0.001	0.007	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/3N	40	26-Mar-04	7.0	52200	18.4	<10			<0.005	<0.01	<0.05	0.621	<0.001	<0.001	<0.002	<0.05	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/3N	40	29-Sep-04	7.4	52600	18.9	<7			<0.005	<0.01	0.1	0.677	0.01	<0.001	<0.050	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/3N	40	30-Mar-05	7.2	64000	20.8	<50			<0.0050	<0.100#	<0.05	0.584	0.003	<0.001	<0.050#	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/3N	40	8-Sep-05	6.99	50400	17.3	<50			<0.0050	<0.010	6.18	0.631	0.001	<0.001	0.285	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/3N	40	6-Mar-06	6.77	42800	10.4	<50			0.015	<0.010	10.6	0.621	<0.010	<0.010#	<0.050#	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/3N	40	8-Sep-06	7.22	48500	20.8	<50			0.0129	<0.010	9.79	0.498	<0.010#	<0.010#	<0.050#	<0.1	0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/3N	40	6-Mar-07	6.77	42800	10.40	<50			0.015	<0.010	10.6	0.621	<0.010	<0.010#	<0.050#	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/3N	40	27-Sep-07	6.70	39700	15.50	71			<0.0040	<0.010	9.8	0.613	<0.010	<0.010	0.052	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K12/3N	40	5-Mar-08	6.80	44200	17.20	100			<0.004	<0.01	7.31	0.674	<0.01	<0.01	<0.05	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K12/3N	40	9-Sep-08	7.21	47400	14.40	<50			0.017	<0.01	9.08	0.67	<0.01	<0.01	<0.05	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/3N	40	4-Mar-09	7.3	49400	12.8	<50			<0.004	<0.01	<1	0.684	<0.1	<0.02	<0.05	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K12/3N	40	10-Sep-09	6.8	33900	19.9	<50			<0.004	<0.01	5.89	2.16	<0.01	<0.0002	<0.05	<0.1	2.3	0.7	<0.1	0.9	0.5	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K12/3N	40	22-Dec-10	7.5	>20000	16	<10	<0.004	<0.004	<0.004	<0.005			<0.004	<0.002			<1.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1
K12/3N	40	29-Jun-12	6.9		17	<10	<0.01	<0.01	<0.005				<0.001	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K12/3N	40	14-Feb-13	8.0	49900	150	<10	<0.005	<0.01	<0.005				0.001	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K12/4N	23	16-Mar-99	7.6	49800	59	<1^			0.01	<0.01	<0.10	0.19	<0.01	<0.02	0.03	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/4N	23	22-Jun-99	7.6	50800	59	<1^			<0.005	<0.001	<1	0.296	0.005	<0.001	0.031	<0.1	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/4N	23	8-Sep-99	7.5	50900	47	<1^			<0.005	<0.01	<0.1	0.15	<0.01	<0.02	0.02	0.19	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/4N	23	10-Dec-99	7.5	52800	24	<1^			0.03	<0.01	<0.1	0.2	<0.01	<0.05	0.08	<0.05	<0.375	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		
K12/4N	23	7-Mar-00	7.6	51800	61	<1^			0.02	<0.01	<0.1	0.21	<0.01	<0.05	0.03	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/4N	23	6-Jun-00	7.8	51500	57	<1^	<0.005		<0.005	<0.01	<0.10	0.09	<0.01	<0.05	0.04	0.07	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/4N	23	5-Sep-00	7.6	51400	51	2^	<0.005		<0.005	<0.01	<0.10	0.11	<0.01	<0.002	0.02	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/4N	23	5-Dec-00	7.6	51200	53	2^	<0.005		<0.005	<0.01	<0.1	0.08	<0.01	<0.002	<0.01	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/4N	23	5-Mar-01	7.0	50000	55	<1^	<0.005		<0.005	<0.005	0.14	0.23	<0.005	<0.005	0.017	<0.05	<0.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K12/4N	23	4-Sep-01	7.6	50600	58	<1^	<0.01		0.07	<0.01	<0.1	0.23	<0.01	<0.002	<0.005	0.05	<0.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K12/4N	23	4-Mar-02	7.6	49700	55	<1^	<0.005		<0.005	<0.01	<0.10	0.23	<0.01	<0.05	0.009	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/4N	23	9-Oct-02	7.6	48000	64	30	<0.005		<0.005	0.051	0.84	0.23	<0.001	<0.001	0.061	0.44	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/4N	23	10-Apr-03	7.7	25000	58.8	20	<0.005		<0.005	0.027	0.1	0.23	<0.020	<0.020	0.106	<0.05	0.7	0.4	<0.1	<0.1	<0.1	0.1	<0.1	0.1	0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/4N	23	20-Nov-03	7.4	52300	57.3	<50	<0.005		0.088	<0.01	0.23	0.23	0.003	<0.001	0.02	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/4N	23	29-Mar-04	7.3	51200	60.2	10			<0.005	<0.01	1.35	0.23	<0.001	<0.001	0.015	<0.05	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/4N	23	29-Sep-04	7.5	51300	60.3	<7			<0.005	<0.01	<0.1	0.23	0.001	<0.001	<0.050	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/4N	23	4-Apr-05	7.2	44800	72	<50			0.0289	<0.010	3.66	0.23	<0.001	<0.001	<0.050#	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/4N	23	8-Sep-05	6.40	52000	49.9	<50			0.04	<0.010	0.28	0.23	<0.001	<0.001	0.05	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/4N	23	9-Mar-06	7.07	37400	63.9	<50			0.009	<0.010	4.9	0.23	<0.010	<0.010#	0.562	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/4N	23	4-Sep-06	7.48	50000	32.4	482			0.0524	<0.010	<0.50	0.23	<0.010#	<0.010#	0.196	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/4N	23	9-Mar-07	7.07	37400	63.9	<50			0.009	<0.010	4.9	0.23	<0.010	<0.010#	0.562	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/4N	23	27-Sep-07	7.30	42200	52.3	<50			<0.0040	<0.010	<0.50	0.23	<0.010	<0.010	0.172	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K12/4N	23	3-Mar-08	7.40	30800	84.50	<50			0.0596	<0.05	<0.5	0.23	<0.01	<0.01	0.174	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K12/4N	23	5-Sep-08	7.91	51800	43.90	230			0.005	<0.01	3.24	0.23	<0.01	<0.01	0.339	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/4N	23	4-Mar-09	7.3	53000	44.6	240			<0.004	<0.01	<1	0.23	<0.1	<0.02	0.104	<0.1	1.1	1.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K12/4N	23	15-Sep-09	7.7	34200	59.7	<50			<0.004	<0.01	4.8	0.23	<0.01	<0.0002	0.618	<0.1	0.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K12/4N	23	10-Jan-11	7.4	>20000	73	10	<0.004	<0.004	<0.004	<0.005			<0.002	<0.001			<1.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1
K12/4N	23	9-Dec-13	7.2	53400	60	<10	<0.005	<0.01	<0.005				<0.001	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K12/4N	23	30-Oct-15	7.6	46820	53	<1.0	<0.004	<0.004	<0.004	<0.01	-	-	<0.001	<0.001	-	-	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0		
K12/4N	23	13-Apr-16	6.19	43332	53	<0.05	<0.004	<0.004	<0.004	<0.005	-	-	<0.001	<0.001	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<0.5	<1.0	<1.0	<1.0		
K12/4N	23	19-Apr-17	8.14	13548	58	<0.05	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001	-	-	NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/4N	23	18-May-18	7.06	36440	41	<0.05	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/4N	23	10-Jul-19	6.11	9560	53	50	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			NIL (+) VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/4N	23	24-Jun-20	7.5	52494	53	<50	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			NIL (+) VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/4N	23	06-Jul-21	6.81	740	61	<50	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			NIL (+) VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/4N	23	01-Jul-22	6.28	190.2	48	<50	<0.004	<0.004	<0.004*	<0.005			0.001	<0.001			<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		

Table B-3: Monitoring Data: Deep Estuarine Wells (1999-2023)

ANALYTES			pH	Conductivity	Ammonia	Phenols	Free Cyanide	Weak Acid Dissociable Cyanide	Total Cyanide	Cr VI - Dissolved	Fe - Dissolved	Mn - Dissolved	Mo - Dissolved	Pb - Dissolved	Zn - Dissolved	Hg - Dissolved	Total PAHs	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)&(k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-cd)pyrene	Dibenzo(ah)anthracene	Benzo(ghi)perylene	1-Methylnaphthalene	2-Methylnaphthalene
			pH units	µs/cm	mg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L
ANZECC CRITERIA			**8 to 8.4**		**0.91**	**400**	**0.004**		**0.004**	**0.0044**		**0.08 (L)**	**0.023 (L)**	**0.0044**	**0.015**	**0.1**		**70 (M)**				**0.2 (L)**	**0.4 (L)**	**1.4 (L)**					**0.2 (L)**					
K12/7E	42	5-Jun-00	7.5	24400	5.6	<1^	<0.005		<0.005	<0.01	<0.10	0.75	<0.01	<0.05	<0.01	0.08	1.70	1	<0.2	<0.2	0.3	0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/7E	42	4-Sep-00	7.4	25200	4.1	5^	<0.005		<0.005	<0.01	<0.10	0.63	<0.01	<0.002	0.04	<0.05	0.50	<0.2	<0.2	<0.2	0.3	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/7E	42	4-Dec-00	7.3	34900	6.2	1^	<0.005		<0.005	<0.01	<0.1	0.81	<0.01	<0.002	0.03	<0.05	0.80	0.3	<0.2	<0.2	0.3	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/7E	42	5-Mar-01	7.2	46200	9.2	1^	<0.005		<0.005	0.006	3.25	3.12	0.009	<0.005	0.014	<0.05	1.20	0.5	<0.1	0.2	<0.1	0.2	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K12/7E	42	3-Sep-01	7.3	46500	15	<1^	<0.005		<0.005	<0.01	0.74	1	<0.01	<0.002	0.006	<0.05	<0.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K12/7E	42	4-Mar-02	7.3	42800	12	<1^	<0.005		0.005	<0.01	1.4	0.85	<0.01	0.009	<0.01	0.06	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1		
K12/7E	42	3-Oct-02	7.7	23000	5.32	<46	<0.005		<0.005	<0.02	2.55	1.96	0.029	<0.02	0.07	<0.05	0.5	<0.1	<0.1	0.3	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1		
K12/7E	42	11-Apr-03	7.7	15000	3.55	<10	<0.005		<0.005	<0.02	1.43	1.52	0.02	<0.02	0.098	<0.05	0.9	0.2	<0.1	0.3	0.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.2	<0.01	<0.1	<0.1	<0.1	<0.1		
K12/7E	42	12-Nov-03	7.3	48700	7.44	<50			<0.005	<0.01	<0.01	1.42	0.013	<0.001	<0.005	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K12/7E	42	29-Mar-04	7.3	40900	3.1	<10			0.021	<0.01	<0.05	2.08	0.006	<0.001	<0.002	<0.05	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K12/7E	42	30-Sep-04	7.2	46800	13	<7			<0.005	<0.01	<0.1	0.415	0.003	<0.001	0.016	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K12/7E	42	30-Mar-05	7.3	41300	6.28	<50			<0.0050	<0.100#	<0.05	2	0.016	<0.001	<0.050#	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K12/7E	42	6-Sep-05	7.2	44700	8.67	<50			0.042	<0.010	2.19	2.24	0.05	<0.001	0.093	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K12/7E	42	6-Mar-06	7.03	37700	6.88	<50			0.037	<0.010	2.3	2.19	<0.010	<0.010#	0.061	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K12/7E	42	4-Sep-06	7.43	35600	10.2	1.74			0.0404	<0.010	1.09	1.7	<0.010#	<0.010#	<0.050#	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K12/7E	42	6-Mar-07	7.03	37700	6.88	<50			0.037	<0.010	2.3	2.19	<0.010	<0.010#	0.061	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K12/7E	42	26-Sep-07	7.10	36700	13.30	<50			<0.0040	<0.010	4.78	2.43	<0.010	<0.010	<0.050	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1		
K12/7E	42	4-Mar-08	7.20	39100	24.4	72			0.0316	0.025	6.94	2.04	<0.01	<0.01	<0.05	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1		
K12/7E	42	9-Sep-08	7.39	45700	13.8	60			0.061	<0.01	5.25	2.37	<0.01	<0.01	<0.05	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K12/7E	42	4-Mar-09	7.4	45900	12.4	<50			<0.004	<0.01	<1	1.26	<0.1	<0.02	<0.05	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1		
K12/7E	42	16-Sep-09	7.1	37100	25.4	<50			<0.004	<0.01	7.17	2.01	<0.01	0.001	<0.05	<0.1	0.3	0.2	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1		
K12/7E	42	23-Dec-10	7.2	>20000	9.8	<10	<0.004	<0.004	<0.004	<0.005			0.011	<0.002			<1.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
K12/7E	42	3-Apr-12	7.98	48200	14	<10	<0.005	<0.01	<0.005	<0.005			<0.005	<0.005			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1		
K12/7E	42	19-Feb-13	7.3	48400	11	<10	<0.005	<0.01	<0.005								<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1		
K12/7E	42	5-Dec-13	7.2	51200	21	100	<0.005	<0.01	<0.005								<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1		
K12/7E	42	30-Oct-15	7.16	31890	4.85	<1.0	<0.004	<0.004	<0.004	<0.01	-	-	0.008	<0.001	-	-	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0		
K12/7E	42	14-Apr-16	7.32	23900	4.9	<0.05	<0.004	<0.004	<0.004	<0.005	-	-	0.011	<0.001	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<0.5	<1.0	<1.0	<1.0	<1.0		
K12/7E	42	05-Apr-17	6.9	41500	11	<0.05	<0.004	<0.004	<0.004	<0.005			0.007	<0.001	-	-	NIL (+)VE	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1		
K12/7E	42	21-May-18	5.89	31850	19	<0.05	<0.004	<0.004	<0.004	<0.005			0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1		
K12/7E	42	08-Jul-19	6.39	1217	6.7	200	<0.004	<0.004	<0.004	<0.005			0.005	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1		
K12/7E	42	23-Jun-20	6.74	47154	5.8	<50	<0.004	<0.004	<0.004	<0.005			0.003	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1		
K12/7E	42	08-Jul-21	6.74	47154	9.9	<50		<0.004	<0.004	<0.005			0.003	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1		
K12/7E	42	29-Jun-22	7.08	402.5	20	<50	<0.004	<0.004	<0.004	<0.005			0.002	<0.001			1.5	<0.2	<0.1	0.8	0.7	<1	<1	<0.1	>0.1	>0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1		
K12/7E	42	11-Oct-23	6.75	50,039	26	<50	<0.005	<0.005	<0.004*	<0.005			<0.005	<0.001			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1		
K12/9E	44	5-Jun-00	6.9	50200	1.7	<1^	<0.005		<0.005	<0.01	4	0.89	<0.01	<0.05	<0.01	0.16	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/9E	44	4-Sep-00	6.8	50300	1.3	<1^	<0.005		<0.005	<0.01	2	0.56	<0.01	<0.002	<0.01	0.22	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/9E	44	4-Dec-00	6.8	49400	1.3	<1^	<0.005		<0.005	<0.01	2.7	0.5	<0.01	<0.002	<0.01	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K12/9E	44	5-Mar-01	6.8	48900	1.3	<1^	<0.005		<0.005	0.005	<0.05	1.19	<0.005	<0.005	0.012	<0.05	<0.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K12/9E	44	3-Sep-01	6.8	48300	1.2	<1^	<0.005		<0.005	<0.01	12	0.24	<0.01	<0.002	<0.005	<0.05	<0.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K12/9E	44	4-Mar-02	6.9	47500	1.2	<1^	<0.005		<0.005	<0.01	13	0.28	<0.01	0.005	<0.01	0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1		
K12/9E	44	3-Oct-02	7.3	37000	1.01	<46	<0.005		<0.005	<0.02	15.3	1.17	<0.02	<0.02	0.025	0.1	0.2	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K12/9E	44	11-Apr-03	7.5	23000	0.44	20	<0.005		<0.005	<0.02	2.53	0.63	<0.02	<0.02	0.199	<0.05	0.88	0.2	<0.1	<0.1	<0.1	0.1	<0.1	0.2	0.2	<0.1	0.1	<0.2	0.08	<0.1	<0.1	<0.1		
K12/9E	44	12-Nov-03	7.0	48400	0.86	<50			<0.005	<0.01	6.1	0.532	0.002	<0.001	0.016	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K12/9E	44	29-Mar-04	7.0	49300	1.04	<10			<0.005	<0.01	16.2	0.906	0.001	<0.001	0.011	<0.05	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K12/9E	44	30-Sep-04	6.7	47500	1.48	<7			0.01	<0.01	<0.1	0.747	0.009	<0.001	<0.050	<0.1	1.9	0.3	<0.1	0.2	0.2	0.6	0.2	0.2	0.2	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K12/9E	44	30-Mar-05	7.0	60600	1.28	<50			0.0212	<0.100#	<0.05	0.912	0.003	<0.001	<0.050#	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K12/9E	44	6-Sep-05	6.94	46900	1.29	<50			0.04	<0.010	15.5	0.73	0.002	<0.001	<0.050#	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K12/9E*	44	2-Mar-06	6.18	43200	1.13	<50			0.036	<0.010	13.6	0.631	<0.010	<0.010#	<0.050#	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K12/9E	44	4-Sep-06	7.02	45800	1.29	193			0.0235	<0.010	12.2	0.554	<0.010#	<0.010#	<0.050#	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K12/9E	44	2-Mar-07	6.18	43200	1.13	<50			0.036	<0.010	13.6	0.631	<0.010	<0.010#	<0.050#	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K12/9E	44	26-Sep-07	6.90	28900	0.91	64			<0.0040	<0.010	9.99	0.507	<0.010	<0.010	<0.050	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1		
K12/9E	44	4-Mar-08	7.10	38700	1.88	<50			0.0333	<0.01	11.8	0.597	<0.01	<0.01	<0.05	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1		
K12/9E	44	9-Sep-08	7.21	39300	0.86	221			0.057	<0.01	13	0.548	<0.01	<0.01	<0.05	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1		
K12/9E	44	4-Mar-09	7.0	31500	1.04	<50			<0.004	<0.01	<1	0.584	<0.1	<0.02	<0.05	<0.1	1	1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1		
K12/9E	44	16-Sep-09	7.0	25100	1.21	<50			<0.004	<0.01	10.9	0.462	<0.01	<0.0002	<0.05	<0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1		
K12/9E	44	23-Dec-10	7.1	>20000	1.5	<10	<0.004	<0.004	<0.004	<0.005			<0.004	<0.002			<1.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
K12/9E	44	3-Apr-12	8.19	24000	0.48	<10	<0.005	<0.01	<0.005	<0.005			<0.005	<0.005			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1		
K12/9E	44	20-Feb-13	7.3	38000	1.2	<10	<0.005	<0.01	<0.005				0.007	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1		
K12/9E	44	5-Dec-13	6.9	43100	1.5	60	<0.005	<0.01	<0.005				<0.001	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1		
K12/9E	44	27-Oct-15	7.31	32500	3.38	-	<0.004	<0.004	<0.004	<0.01	<0.001	-	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0	<1	<1	<1	<1		
K12/9E	44	14-Apr-16	7.08	25934	0.72	<0.05	<0.004	<0.004	<0.004	<0.005	-	-	0.002	<0.001	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<0.5	<1.0	<1.0	<1.0		
K12/9E	44	04-Apr-17	6.79	32444	1.8	<0.05	<0.004	<0.004	<0.004	<0.005			0.001	<0.001	-	-	NIL (+)VE	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1		
K12/9E	44	21-May-18	6.79	33800	0.28	<50	<0.004	<0.004	<0.004	<0.005			0.002	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1		
K12/9E	44	09-Jul-19	6.01	33444	0.26	<50	<0.004	<0.004	<0.004	<0.5			0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1		
K12/9E	44	07-Jul-20	7.22	22031	0.49	<50	<0.004	<0.004	<0.004*	<0.005			0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1		

Table B-3: Monitoring Data: Deep Estuarine Wells (1999-2023)

ANALYTES			pH	Conductivity	Ammonia	Phenols	Free Cyanide	Weak Acid Disociable Cyanide	Total Cyanide	Cr VI - Dissolved	Fe - Dissolved	Mn - Dissolved	Mo - Dissolved	Pb - Dissolved	Zn - Dissolved	Hg - Dissolved	Total PAHs	Naphthalene	Acenaphtylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)&(k)fluoranthene	Benzo(a)pyrene	Indeno(1.2.3-cd)pyrene	Dibenzo(ah)anthracene	Benzo(ghi)perylene	1-Methylnaphthalene	2-Methylnaphthalene
			pH units	µs/cm	mg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L
ANZECC CRITERIA			**8 to 8.4**		**0.91**	**400**	**0.004**		**0.004**	**0.0044**		**0.08 (L)**	**0.023 (L)**	**0.0044**	**0.015**	**0.1**		**70 (M)**				**0.2 (L)**	**0.4 (L)**	**1.4 (L)**					**0.2 (L)**					
K5/5S	13	8-Jun-00	7.2	22100	3.5	<1^	<0.005		0.007	<0.01	0.13	0.58	<0.01	<0.05	<0.01	<0.05	0.30	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K5/5S	13	7-Sep-00	7.0	22500	3.3	<1^	<0.005		0.005	<0.01	<0.10	0.43	<0.01	<0.002	0.08	<0.05	0.20	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K5/5S	13	5-Dec-00	7.0	21900	3.3	1^	<0.005		<0.005	<0.01	0.12	0.4	<0.01	<0.002	<0.01	0.05	0.20	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K5/5S	13	8-Mar-01	7.0	21300	3.3	<1^	<0.005		<0.005	<0.005	2.12	0.767	0.005	<0.005	<0.01	<0.05	0.10	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K5/5S	13	6-Sep-01	7.1	22600	3.9	<1^	<0.01		0.005	<0.01	1.3	0.12	<0.01	<0.002	<0.005	<0.05	0.10	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K5/5S	13	4-Mar-02	7.1	22200	3.9	<1^	<0.005		0.006	<0.01	1.3	0.18	<0.01	<0.05	<0.01	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/5S	13	9-Oct-02	7.8	12000	2.6	<10	<0.005		0.008	0.008	0.71	0.349	0.012	<0.001	0.069	0.07	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/5S	13	16-Apr-03	7.7	6700	2.19	<10	<0.005		0.009	<0.005	0.41	0.24	0.018	<0.005	0.018	<0.05	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.01	<0.1	<0.1	<0.1		
K5/5S	13	10-Nov-03	7.0	19400	3.28	<50			<0.005	0.1	0.05	0.413	0.004	<0.001	<0.005	<0.1	<0.755	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/5S	13	31-Mar-04	7.3	19020	4.14	<10			0.006	<0.01	1.16	0.29	0.003	<0.001	0.003	<0.05	0.5	0.3	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/5S	13	27-Sep-04	7.3	16900	5.73	<7			0.028	<0.01	<0.1	0.395	0.004	<0.001	0.01	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/5S	13	31-Mar-05	6.7	13400	4.6	<50			0.06	<0.010	<0.05	0.25	0.005	<0.001	0.008	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/5S	13	8-Sep-05	3.81	14920	3.71	<50			0.09	<0.010	0.5	0.294	0.002	<0.001	0.126	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/5S	13	7-Mar-06	6.98	11920	2.5	<50			0.0377	<0.010	0.74	0.198	0.004	<0.001	<0.005	<0.1	0	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/5S	13	5-Sep-06	7.08	12030	3.01	<50			0.0301	<0.010	0.48	0.113	0.009	<0.001	0.011	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/5S	13	7-Mar-07	6.98	11920	2.50	<50			0.0377	<0.010	0.74	0.198	0.004	<0.001	<0.005	<0.1	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/5S	13	25-Sep-07	7.20	7730	3.19	<50			<0.0040	<0.010	0.56	0.156	0.014	<0.001	0.02	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K5/5S	13	11-Mar-08	7.20	10800	2.74	219			0.0272	<0.01	0.51	0.15	0.016	<0.001	0.011	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K5/5S	13	10-Sep-08	7.06	7710	1.57	200			0.054	<0.01	0.64	0.153	0.014	0.001	0.035	<0.1	11.9	2.5	<0.1	4	2.2	1.5	0.2	0.3	0.2	<0.1	<0.1	0.1	0.09	<0.1	<0.1	<0.1		
K5/5S	13	5-Mar-09	7.5	8160	1.25	<50			<0.004	<0.01	0.09	0.124	0.01	<0.001	0.007	<0.1	0.2	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.05	<0.1	<0.1	<0.1		
K5/5S	13	9-Sep-09	7.3	8140	2.2	<50			<0.004	<0.01	0.43	0.14	0.007	<0.001	0.032	<0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K5/5S	13	23-Dec-10	7.6	5400	2		<0.004	<0.004	0.006	<0.005							<1.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1
K5/5S	13	10-Apr-12	8.2	2460	1.4		<0.005	<0.01	<0.005	<0.005							<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K5/5S	13	19-Feb-13	7.6	5640	2.3		<0.005	<0.01	0.005																									
K5/5S	13	3-Dec-13	7.4	4110	2		<0.005	<0.01	0.01								<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K5/5S	13	3-Nov-15	7.2	4028	1.44	<1.0	<0.004	<0.004	0.01	<0.01	-	-	-	-	-	-	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0		
K5/5S	13	05-Apr-16	5.87	3330	0.24	<0.05	<0.004	<0.004	<0.004	<0.005	-	-	<1	<1	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<0.5	<1.0	<1.0	<1.0		
K5/5S	13	06-Apr-17	7.12	3321	1.8	-	<0.004	<0.004	0.004	<0.005			-	-	-	-	NIL (+)VE	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/5S	13	08-May-18	6.87	3320	1.5	-	<0.004	<0.004	0.005	<0.005							NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/5S	13	30-Jun-19	6.87	3300	1.1	-	<0.004	<0.004	<0.004	<0.05			-	-			NIL (+) VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/5S	13	02-Jul-20	6.28	3958	1.1	-	<0.004	<0.004	<0.004	<0.05			-	-			1.3	0.3	<0.1	0.5	0.3	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/5S	13	22-Jun-21	6.2	3319	0.71	-	<0.004	<0.004	<0.004	<0.005			-	-			NIL (+) VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/5S	13	22-Jun-22	7.2	47	0.93	-	<0.004	<0.004	<0.004	<0.005			-	-			<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/5S	13	09-Oct-23	7.2	3,168	0.86	<50	<0.005	<0.005	0.005	<0.005							<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K5/6S	14	8-Jun-00	6.8	26700	4.5	<1^	<0.005		<0.005	<0.01	2.5	0.66	<0.01	<0.05	<0.01	0.06	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K5/6S	14	7-Sep-00	6.7	25400	3.8	2^	<0.005		<0.005	<0.01	1.5	0.51	<0.01	<0.002	<0.01	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K5/6S	14	5-Dec-00	6.7	24500	3.7	<1^	<0.005		<0.005	<0.01	0.25	0.47	<0.01	<0.002	<0.01	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K5/6S	14	8-Mar-01	6.7	23800	4	1^	<0.005		<0.005	<0.005	15.9	0.917	<0.005	<0.005	<0.01	<0.05	<0.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K5/6S	14	6-Sep-01	6.8	20900	3.8	1^	<0.01		0.009	<0.01	11	0.16	<0.01	<0.002	<0.005	<0.05	<0.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K5/6S	14	4-Mar-02	6.8	19200	3.4	<1^	<0.005		0.011	<0.01	10	0.25	<0.01	<0.05	<0.01	0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/6S	14	9-Oct-02	7.3	14000	2.27	<10	<0.005		0.008	0.013	<0.05	0.181	<0.001	<0.001	0.191	0.05	2.4	0.2	<0.1	0.4	0.3	0.4	<0.1	0.6	0.4	<0.1	0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/6S	14	16-Apr-03	7.3	9000	2.51	<10	<0.005		0.006	<0.005	5.23	0.41	<0.005	<0.005	0.056	<0.05	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.01	<0.1	<0.1	<0.1		
K5/6S	14	10-Nov-03	7.0	13270	1.19	<50			0.012	<0.01	0.76	0.389	0.001	<0.001	0.01	<0.1	<0.755	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/6S	14	31-Mar-04	7.2	12830	2.53	<10			0.009	<0.01	7.53	0.245	0.001	<0.001	0.004	<0.05	0.8	0.4	<0.1	0.3	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/6S	14	28-Sep-04	7.2	11700	3.25	<7			0.126	<0.01	<0.1	0.237	0.008	<0.001	0.015	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/6S	14	31-Mar-05	7.7	9980	2.9	<50			<0.0050	0.036	0.49	0.178	0.002	<0.001	<0.005	<0.1	0.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/6S	14	12-Sep-05	6.53	9280	2.82	<50			0.144	<0.010	4.37	0.18	0.004	<0.001	0.013	<0.1	1.5	0.4	<0.1	0.5	0.2	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/6S	14	8-Mar-06	6.82	8970	3.02	<50			0.0946	<0.010	4.63	0.179	0.002	<0.001	0.007	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/6S	14	5-Sep-06	7.11	8900	2.19	<50			0.104	<0.010	3.92	0.161	0.002	<0.001	<0.005	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/6S	14	8-Mar-07	6.82	8970	3.02	<50			0.0946	<0.010	4.63	0.179	0.002	<0.001	0.007	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/6S	14	25-Sep-07	6.30	5530	2.52	80			0.0047	<0.010	5.96	0.245	<0.001	<0.001	0.074	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K5/6S	14	10-Mar-08	6.90	6630	2.72	138			0.0462	<0.01	6.54	0.258	0.001	<0.001	0.032	<0.1	9.5	2.6	0.1	2.7	2.3	1.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K5/6S	14	8-Sep-08	6.95	7040	1.94	<50			<0.004	<0.01	7.98	0.317	0.002	<0.001	0.016	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K5/6S	14	5-Mar-09	6.8	7000	1.39	<0.05			<0.004	<0.01	<0.05	0.306	0.003	<0.001	0.006	<0.1	5.98	<0.1	<0.1	<0.1	<0.1	0.8	<0.1	1.5	1.2	0.2	0.7	1.0	0.28	0.1	<0.1	0.2		
K5/6S	14	11-Sep-09	6.9	5440	2.12	<50			<0.004	<0.01	11.9	0.414	0.003	<0.001	0.018	<0.1	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K5/6S	14	23-Dec-10	7	5200	1.5	<10	<0.004	<0.004	<0.004	<0.005							<2.04	0.1	<0.1	0.3	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1
K5/6S	14	4-Apr-12	7.65	4680	0.75	<10	<0.005	<0.01	<0.005	<0.005							<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K5/6S	14	20-Feb-13	7.4	4070	0.44	20	<0.005	<0.01	<0.005								<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K5/6S	14	3-Dec-14	7.5	3490	0.16		<0.005	<0.01	0.006								<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K5/6S	14	29-Oct-15	7	4473	0.74	<1.0	<0.004	<0.004	<0.004	<0.01	-	-	-	-	-	-	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0		
K5/6S	14	05-Apr-16	7.1	2080	0.076	<0.05	<0.004	<0.004	0.005	<0.005	-	-	<0.001	<0.001	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<0.5	<1.0	<1.0	<1.0		
K5/6S	14	06-Apr-17	6.79	3057	0.49	<0.05	<0.004	<0.004	<0.004	<0.005			-	-	-	-	NIL (+)VE	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/6S	14	08-May-18	6.52	2930	0.26	<0.05	<0.004	<0.004	0.006	<0.005							NIL (+)VE	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/6S	14	30-Jun-19	5.6	2750	0.55	<50	<0.004	<0.004	<0.004	<0.005			-	-			NIL (+) VE	<0.2	<0.01	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/6S	14	15-Jun-20	6.08	4138	0.56	<50	<0.004	<0.004	0.006	<0.5			-	-			NIL (+) VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/6S	14	22-Jun-21	7.11	3170	0.46	<50	<0.004	<0.004	<0.004	<0.005			-	-			NIL (+) VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/6S	14	22-Jun-22	7.11	3170	0.4	<50	<0.004	<0.004	0.005	<0.005			-	-			<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K5/6S	14	10-Oct-23	6.8	3,285	0.33		<0.005	<0.005	<0.004*	<0.005							<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K9/2E	17	7-Jun-00	7.8	25900	1.5	<1^	<0.005		<0.005	<0.01	1.9	0.29	<0.01	<0.05	0.93	0.15	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K9/2E	17	6-Sep-00	7.7	23800	1.4	<1^	<0.005		<0.005	<0.01	<0.10	0.25	<0.01	<0.002	<0.01	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K9/2E	17	6-Dec-00	7.6	24300	1.4	<1^	<0.005		<0.005	<0.01	<0.1	0.26	<0.01	<0.002	<0.01	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K9/2E	17	7-Mar-01	7.6	25800	1.5	<1^	<0.05		<0.005	<0.005	0.07	<0.005	<0.005	<0.005	<0.01	<0.05	<0.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K9/2E	17	5-Sep-01	7.8	21100	1.2	1^	<0.005		<0.005	<0.01	0.12	0.055	<0.01	<0.002	<0.005	<0.05	0.60	0.1	<0.1	0.1	<0.1	0.2	<0.1	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K9/2E	17	4-Mar-02	7.7	22400	1.6	<1^	<0.03		<0.005	<0.01	<0.10	0.09	<0.01	0.002	<0.01	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/2E	17	15-Oct-02	7.8	11000	0.3	<10	<0.005		<0.005	0.004	0.17	1.1	0.086	<0.001	0.027	<0.05	3.9	0.2	<0.1	0.2	<0.1	0.3	0.1	1	1	0.2	0.2	0.4	0.1	0.1	<0.1	0.1		
K9/2E	17	15-Apr-03	7.8	11000	1.34	<10	<0.005		<0.005	<0.005	0.35	0.56	0.05	<0.005	0.18	<0.05	0.6	0.1	<0.1	0.1	<0.1	<0.1	<0.1	0.2	0.2	<0.1	<0.1	<0.2	<0.01	<0.1	<0.1	<0.1		
K9/2E	17	17-Nov-03	7.7	25900	0.7	<50			0.025	<0.01	0.47	1.54	0.044	<0.001	0.007	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/2E	17	30-Mar-04	7.7	24200	1.97	<10			<0.005	<0.01	0.16	<0.001	<0.001	<0.001	<0.002	<0.05	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/2E	17	28-Sep-04	7.5	23100	2.36	<7			<0.005	<0.01	<0.1	0.529	0.035	<0.001	<0.050	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/2E	17	30-Mar-05	7.4	19300	1.95	<50			0.014	<0.100#	<0.05	0.39	0.002	<0.001	<0.005	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/2E	17	13-Sep-05	7.01	13620	1.31	<50			0.03	<0.010	0.32	0.411	0.007	<0.001	<0.005	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/2E	17	8-Mar-06	7.24	15450	2.21	<50			0.0239	<0.010	0.22	0.389	<0.001	<0.001	<0.005	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/2E	17	5-Sep-06	7.50	19280	1.34	<50			0.0113	<0.010	0.26	0.189	0.012	<0.001	0.005	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/2E	17	8-Mar-07	7.24	15450	2.21	<50			0.0239	<0.010	0.22	0.389	<0.001	<0.001	<0.005	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/2E	17	28-Sep-07	7.40	11200	1.55	<50			0.0041	<0.010	0.37	0.268	0.004	<0.001	0.009	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K9/2E	17	10-Mar-08	7.50	9550	1.68	<50			0.0145	<0.01	0.37	0.225	<0.001	<0.001	0.009	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K9/2E	17	10-Sep-08	6.35	10840	1.47	<50			0.032	<0.01	0.23	0.22	<0.001	<0.001	0.085	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/2E	17	5-Mar-09	7.2	12640	1.42	<0.05			<0.004	<0.01	<0.05	0.19	<0.001	<0.001	<0.005	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K9/2E	17	9-Sep-09	7.3	20130	1.82	<50			<0.004	<0.01	0.75	0.613	0.004	<0.001	0.008	<0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K9/2E	17	23-Dec-10	7.5	17000	3		<0.004	<0.004	<0.004	<0.005			0.048				<1.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1
K9/2E	17	27-Jun-12	7.57	12450	2.7		<0.005	<0.01	<0.005				0.001				<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K9/2E	17	21-Feb-13	7.9	1690	2.5		<0.005	<0.01	0.016				0.002				<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K9/2E	17	6-Dec-13	7.3	30500	3.6		<0.005	<0.01	0.017				0.006				<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K9/2E	17	27-Oct-15	7.31	32500	3.38	-	<0.004	<0.004	<0.004	<0.01			<0.001	-			<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2	<0.5	<1.0	<1.0	<1.0		
K9/2E	17	06-Apr-16	7.05	22328	3	-	<0.004	<0.004	<0.004	<0.05	-	-	<0.001	-	-	-	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2	<0.5	<1.0	<1.0	<1.0		
K9/2E	17	10-Apr-17	6.96	25681	3.5	-	<0.004	<0.004	<0.004	<0.005			<0.001	-	-	-	NIL (+)VE	<0.2	<0.2	<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/2E	17	16-May-18	6.96	25630	3	-	<0.004	<0.004	<0.004	<0.005			<0.001	-			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/2E	17	04-Jul-19	7.02	24904	3.4	-	<0.004	<0.004	<0.004	<0.005			<0.001	-			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/2E	17	16-Jun-20	6.04	33874	4.1	-	<0.004	<0.004	<0.004	<0.005			<0.002	-			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/2E	17	24-Jun-21	5.96	325.9	3.8	-	<0.004	<0.004	<0.004	<0.005			0.001	-			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/2E	17	24-Jun-22	6.98	692.4	3.7	-	<0.004	<0.004	<0.004	<0.005			0.002	-			<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/2E	17	10-Oct-23	5.5	32,741	3.9		<0.005	<0.005	<0.005	<0.005			0.023				<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		

Table B-3: Monitoring Data: Deep Estuarine Wells (1999-2023)

ANALYTES			pH	Conductivity	Ammonia	Phenols	Free Cyanide	Weak Acid Disociable Cyanide	Total Cyanide	Cr VI - Dissolved	Fe - Dissolved	Mn - Dissolved	Mo - Dissolved	Pb - Dissolved	Zn - Dissolved	Hg - Dissolved	Total PAHs	Naphthalene	Acenaphtylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)&(k)fluoranthene	Benzo(a)pyrene	Indeno(1.2.3-cd)pyrene	Dibenzo(ah)anthracene	Benzo(ghi)perylene	1-Methylnaphthalene	2-Methylnaphthalene
			pH units	µs/cm	mg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L
ANZECC CRITERIA			8 to 8.4		0.91	400	0.004		0.004	0.0044		0.08 (L)	0.023 (L)	0.0044	0.015	0.1		70 (M)				0.2 (L)	0.4 (L)	1.4 (L)					0.2 (L)					
K9/3N	36	5-Jun-00	7.2	39400	2.4	<1^	<0.005		<0.005	<0.01	<0.10	0.68	<0.01	<0.05	<0.01	0.2	1.10	<0.2	0.6	0.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K9/3N	36	4-Sep-00	7.1	40100	1.7	<1^	<0.20		<0.20	<0.01	<0.10	0.59	<0.01	<0.002	0.02	0.05	1.40	<0.2	0.6	0.8	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K9/3N	36	7-Dec-00	7.2	39700	1.9	<1^	<0.005		<0.005	<0.01	<0.1	0.57	<0.01	<0.002	<0.01	<0.05	0.50	<0.2	0.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K9/3N	36	5-Mar-01	7.1	39600	2.3	<1^	<0.005		<0.005	<0.005	<0.05	1.17	<0.005	<0.005	0.01	<0.05	0.40	<0.1	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K9/3N	36	3-Sep-01	7.1	39700	2.1	1^	<0.005		<0.005	<0.01	<0.1	0.69	<0.01	<0.002	<0.005	<0.05	0.40	<0.1	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K9/3N	36	4-Mar-02	7.0	39300	2.1	2^	<0.03		<0.005	<0.01	<0.10	0.68	<0.01	0.028	<0.01	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/3N	36	15-Oct-02	7.4	34000	2.03	<10	<0.005		<0.005	0.008	<0.05	1.4	0.002	<0.001	0.036	<0.05	1.7	0.2	0.1	0.1	<0.1	0.1	<0.1	0.4	0.4	<0.1	0.1	0.2	<0.1	0.1	<0.1	<0.1		
K9/3N	36	15-Apr-03	7.3	20000	2.26	<10	<0.005		<0.005	<0.005	0.41	1.5	<0.005	<0.005	0.2	<0.05	0.6	0.1	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.01	<0.1	<0.1	<0.1		
K9/3N	36	11-Nov-03	6.9	41200	2.48	<50			0.005	<0.01	0.1	1.11	0.002	<0.001	0.007	<0.1	0.6	0.2	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/3N	36	31-Mar-04	7.1	40800	2.8	<10			<0.005	<0.01	0.25	1.55	<0.001	<0.001	<0.002	<0.05	0.2	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/3N	36	27-Sep-04	7.2	39100	3.89	<7			0.015	<0.01	<0.1	1.11	0.001	<0.001	<0.050	<0.1	1.2	0.5	0.7	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/3N	36	29-Mar-05	6.7	36800	4.06	<50			<0.0050	<0.100#	<0.05	1.18	<0.001	<0.001	<0.050#	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/3N	36	7-Sep-05	6.44	35200	3.79	95			0.04	<0.010	0.18	1.08	<0.001	<0.001	0.019	<0.1	0.9	0.5	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/3N	36	3-Mar-06	6.92	27100	3.07	<50			0.013	<0.010*	0.22	1.02	<0.001	<0.001	0.012	<0.1	0.2	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/3N	36	1-Sep-06	7.27	30800	5.03	<50			0.022	<0.010	0.07	0.815	<0.001	<0.001	<0.005	<0.1	0	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/3N	36	3-Mar-07	6.92	27100	3.07	<50			0.013	<0.010*	0.22	1.02	<0.001	<0.001	0.012	<0.1	0.2	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/3N	36	21-Sep-07	7.20	21200	2.02	<50			<0.0040	<0.010	<0.05	0.615	<0.001	<0.001	0.005	<0.1	0.2	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K9/3N	36	6-Mar-08	7.20	19140	2.22	<50			0.0117	<0.01	<0.05	0.591	<0.001	<0.001	<0.005	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K9/3N	36	10-Sep-08	6.79	17530	2.65	<50			0.019	<0.01	0.24	0.657	<0.001	<0.001	0.005	<0.1	6.9	1.5	0.1	2.4	1.6	0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/3N	36	6-Mar-09	6.7	24500	1.77	<0.05			<0.004	<0.01	<0.5	1.57	<0.001	<0.001	<0.005	<0.1	3	0.8	<0.1	1	0.8	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K9/3N	36	14-Sep-09	7.1	20700	1.75	<50			<0.004	<0.01	0.107	3.11	<0.001	<0.001	<0.005	<0.1	0.7	0.3	<0.1	0.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K9/3N	36	24-Dec-10	7.2	18000	2.5	<0.01	<0.004	0.004	0.004	<0.005			<0.002	<0.001			<1.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1
K9/3N	36	12-Feb-13	8.25	14300	2.6	40	<0.005	<0.01	<0.005				<0.001	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K9/3N	36	10-Dec-13	7.3	12800	1.6	<10	<0.005	<0.01	<0.005				<0.001	<0.001																				
K9/3N	36	4-Apr-16	7.38	1400	3.3	<0.05	<0.004	<0.004	<0.004	<0.005	-	-	<0.001	<0.001	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<0.5	<1.0	<1.0	<1.0		
K9/3N	36	11-Apr-17	6.92	19948	3.5	<0.05	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001	-	-	NIL (+)VE	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/3N	36	18-May-18	6.88	16540	3.2	<0.05	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/3N	36	15-Jul-19	6.71	2296	2.4	<50	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			0.26	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/3N	36	30-Jun-20	7.09	23713	3.3	<50	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/3N	36	30-Jun-21	5.83	283.3	3.6	<50	<0.004	<0.004	<0.004	<0.005			<0.001	0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/3N	36	21-Jun-22	6.27	75.2	2.8	<50	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/3N	36	12-Oct-23	5.7	18,056	2.8	<50	<0.005	<0.005	<0.005	<0.005			<0.005	<0.001			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K9/4W	20	7-Jun-00	6.9	36100	4.4	<1^	<0.005		<0.005	0.05	0.81	0.66	<0.01	<0.05	0.06	0.22	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K9/4W	20	6-Sep-00	6.9	36200	3.9	<1^	<0.005		<0.005	<0.01	0.63	0.53	<0.01	<0.002	<0.01	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K9/4W	20	6-Dec-00	6.8	36000	3.9	<1^	<0.005		<0.005	<0.01	4.4	0.52	<0.01	<0.002	<0.01	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
K9/4W	20	7-Mar-01	6.7	35800	4.1	<1^	<0.005		<0.005	<0.005	16.5	1.05	<0.005	<0.005	<0.01	<0.05	<0.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K9/4W	20	5-Sep-01	6.8	35900	4.3	1^	<0.005		<0.005	<0.01	11	0.24	<0.01	0.003	<0.005	0.05	<0.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
K9/4W	20	4-Mar-02	6.8	35700	4.1	<1^	<0.005		<0.005	<0.01	12	0.3	<0.01	0.005	<0.01	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/4W	20	10-Oct-02	7.7	19000	0.53	<10	<0.005		<0.005	0.003	0.66	0.203	<0.001	<0.001	0.088	0.06	6.4	0.3	<0.1	0.4	0.2	0.6	<0.1	1.8	1.6	0.2	0.3	0.5	0.1	0.2	<0.1	0.2		
K9/4W	20	15-Apr-03	7.1	19000	4.04	<10	<0.005		<0.005	0.008	10.2	1.3	<0.005	<0.005	0.04	<0.05	0.7	0.2	<0.1	0.2	0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.01	<0.1	<0.1	<0.1		
K9/4W	20	17-Nov-03	6.9	36800	1.97	<50			0.036	<0.01	19.7	1.28	0.002	<0.001	0.018	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/4W	20	30-Mar-04	6.9	37500	3.76	<10			<0.005	<0.01	14.8	<0.001	<0.001	<0.001	<0.002	<0.05	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/4W	20	28-Sep-04	6.9	35600	4.97	<7			<0.005	<0.01	<0.1	0.783	0.007	<0.001	<0.050	<0.1	0.8	0.6	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/4W	20	30-Mar-05	6.8	30500	4.32	<50			0.0196	<0.100#	1.15	1.04	0.001	<0.001	<0.050#	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/4W	20	8-Sep-05	4.90	35900	3.01	<50			0.05	<0.010	9.22	0.821	<0.001	<0.001	0.007	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/4W	20	9-Mar-06	6.56	29400	3.85	<50			0.009	<0.010	12.4	0.81	<0.010	<0.010#	<0.050#	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/4W	20	5-Sep-06	6.78	35200	2.58	<50			0.0177	<0.010	11.4	0.721	<0.001	<0.001	<0.005	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/4W	20	9-Mar-07	6.56	29400	3.85	<50			0.009	<0.010	12.4	0.81	<0.010	<0.010#	<0.050#	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/4W	20#	28-Sep-07	6.70	33800	1.85	<50			<0.0040	<0.010	11.6	0.721	<0.001	<0.001	0.015	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K9/4W	20	10-Mar-08	6.90	29800	1.77	<50			0.0266	<0.01	11.4	0.761	<0.001	<0.001	0.044	<0.1	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K9/4W	20	10-Sep-08	6.61	31100	1.54	<50			0.029	<0.01	11.5	0.755	<0.01	<0.01	0.071	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
K9/4W	20	6-Mar-09	6.4	35400	1.19	<0.05			<0.004	<0.01	<0.5	0.734	<0.001	<0.001	0.019	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K9/4W	20	9-Sep-09	6.7	30200	2.25	80			<0.004	<0.01	11	0.723	<0.001	<0.001	0.013	<0.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K9/4W	20	23-Dec-10	7.0	>20000	2.7		<0.004	<0.004	<0.004	<0.005																								
K9/4W	20	4-Apr-12	8.0	9070	2.4		<0.005	<0.01	<0.005	<0.005																								
K9/4W	20	19-Feb-13	7.4	24700	1.7		<0.005	<0.01	0.026																									
K9/4W	20	4-Dec-13																																
K9/4W	20	27-Oct-15	7.07	24500	1.29	-	<0.004	<0.004	<0.004	<0.01	-	-	-	-	-	-	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0		
K9/4W	20	06-Apr-16	6.3	23951	1.5	-	<0.004	<0.004	<0.004	<0.005	-	-	-	-	-	-	ND	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0		
K9/4W	20	10-Apr-17	7.14	9711	1.9	-	<0.004	<0.004	<0.004	<0.005			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
K9/4W	20	04-Jul-19	7.19	2151	1.6	-	<0.004	<0.004	<0.004	<0.005			-	-			NIL (+) VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/4W	20	16-Jun-20	6.4	15066	1.9	-	<0.004	<0.004	<0.004	<0.05			-	-			NIL (+) VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/4W	20	23-Jun-21	6	45066	1.6	-	<0.004	<0.004	<0.004	<0.005			-	-			3.4	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/4W	20	24-Jun-22	7.13	104.8	1	-	<0.004	<0.004	<0.004	<0.005			-	-			<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K9/4W	20	10-Oct-23	6.95	14,410	1.2		<0.005	<0.005	<0.005	<0.005							<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K7/2N		11-Sep-09	7.4	2060	6.52	31900			0.066	<0.01	0.18	0.43	0.008	<0.001	<0.005	<0.1	945.6	938	0.7	5	1	0.4	0.2	0.2	0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K7/2N		11-Sep-09	7.4	2060	6.52	31900			0.066	<0.01	0.18	0.43	0.008	<0.001	<0.005	<0.1	945.6	938	0.7	5	1	0.4	0.2	0.2	0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
K7/2N		23-Dec-10	7.4	3800	11	16	0.036	0.006	0.15	<0.005							<1074.27	1000	0.9	11	3.1	1.9	0.2	0.3	0.2	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	13	18
K7/2N		21-Feb-13	8	3520	7.9	12	<0.005	0.02	0.067								236	220	<1	9	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K7/2N		5-Dec-13	7.5	2940	8.7	16000	<0.005	0.01	0.088								1230	1200	1	14	3	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
K7/2N		29-Oct-15	7.37	2960	8.32	790	<0.004	<0.004	<0.004	<0.01	-	-	-	-	-	-	326	326	<94.3	<94.3	<94.3	<94.3	<94.3	<94.3	<94.3	<94.3	<94.3	<94.3	<94.3	<94.3	<94.3	<94.3		
K7/2N		08-Apr-16	7.75	2390	0.01	470	<0.004	<0.004	0.12	<0.05	-	-	-	-	-	-	1000	980	<1	20	3	1	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0		
K7/2N		10-Apr-17	7.7	4673	9.7	11	<0.004	<0.004	0.15	<0.005			-	-	-	-	470	460	0.2	9.3	1.7	0.5	0.2	0.2	<0.1	<0.1	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1		
K7/2N		09-May-18	7.49	4720	31	3400	<0.004	<0.004	0.23	<0.005							67	54	0.4	10	1.1	0.2	0.1	0.2	0.2	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K7/2N		05-Jul-19	7.45	5659	8.2	1700	<0.004	<0.004	0.11	<0.05			-	-			170	170	0.2	7.1	0.8	0.1	0.1	0.2	0.2	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
K7/2N		15-Jun-20	7.7	6285	11	6200	<0.004	<0.004	0.28	<0.005			-	-			240	230	0.2	11	1.4	0.2	0.4	0.6	0.6	0.2	<0.1	<0.2	0.2	<0.1	<0.1	<0.1		
K7/2N		14-Jul-21	7.26	3320	10	4800	<0.004	<0.004	0.063	<0.005			-	-			750	<0.1	12	2.1	0.3	0.2	0.2	<1.0	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<0.1		
K7/2N		10-Oct-23	7.12	5,281	6.4	<50	<0.005	0.012	0.085	<0.005							36	30	<1	5	1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
NCIG2		30-Oct-15	7.5	3280	1	<1.0	<0.004	<0.004	<0.004	<0.01	-	-	0.013	0.03	-	-	<0.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0		
NCIG2		12-Apr-16	5.67	10088	7.1	<50	<0.004	<0.004	<0.004	<0.005	-	-	0.002	<0.001	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<0.5	<1.0	<1.0	<1.0		
NCIG2		05-Apr-17	6.52	39874	38	<50	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001	-	-	NIL (+)VE	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
NCIG2		17-May-18	6.55	41410	41	<50	<0.004	<0.004	<0.004	<0.005																								
NCIG2		08-Jul-19	6.13	41730	17	<50	<0.004	<0.004	<0.004	<0.005			0.002	<0.001			NIL (+) VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
NCIG2		23-Jun-20	6.39	51580	44	80	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			NIL (+) VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
NCIG2		09-Jul-21	6.33	3314	43	<50	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			NIL (+) VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
NCIG2		29-Jun-22	7.04	477.3	29	<50	<0.004	<0.004	<0.004	<0.005			0.001	<0.001			<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
NCIG2		11-Oct-23	7	52,941	43	<50	<0.005	<0.005	<0.004*	<0.005			<0.005	<0.001			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		

Shading: Value Exceeds 95% trigger value for marine waters as shown in Table 3.4.1 of the Australian and New Zealand Guidelines for Fresh and Marine water Quality 2000

Note
Ammonia guideline based on a pH of the receiving water body of 8.
Total PAH and Total Phenol PQL calculated as the sum of individual compound PQLs divided by 2.
(L) = Low Reliability Trigger Value
(M) = Moderate Reliability Trigger Value
Ammonia determination was as NO3 until April 2003, after which ammonia determination was as N.
Dissolved Chromium was reported until April 2003, after which hexavalent chromium was reported.
Blank indicates not analysed.
nd = not detected at GHD March 04 detection levels.
Only sample locations that currently require sampling have an EPA ID number.
* Sample decanted and supernatant analysed for PAH.
\# PQL Raised due to matrix interference.
^ Value is for speciated phenol and not total phenols
*Wells reanalysed to lor LOR of 0.004 mg/L

Table B-**4**: Monitoring Data: Surface Water (1999-20**23**)

ANALYTES			pH	Conductivity	Ammonia	Phenols	Free Cyanide	Weak Acid Dissociable Cyanide	Total Cyanide	Cr -Total	Fe - Total	Mn - Total	Mo - Total	Pb - Total	Zn - Total	Hg - Total	Total PAHs	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)&(k)fluoranthene	Benzo(e)pyrene	Indeno(1,2,3-cd)pyrene	Dibenzo(ah)anthracene	Benzo(ghi)perylene	1-Methylnaphthalene	2-Methylnaphthalene
			pH units	µs/cm	mg/L	µg/L	mg/L CN		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
ANZECC CRITERIA			8 to 8.4		0.91	400	0.004		0.004	0.0044		0.08	0.023 (L)	0.0044	0.015	0.1		70 (M)				0.2 (L)	0.4 (L)	1.4 (L)					0.2 (L)						
Sample ID	EPA ID	Date																																
KS10/1	48	15-Mar-99	9.9	11000	<0.1	3			<0.01	<0.01	0.3	0.03	0.02	<0.02	0.22	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
KS10/1	48	17-Jun-99	8.4	8300	<0.1	2			<0.005	0.006	<0.1	0.025	0.017	<0.001	0.002	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
KS10/1	48	07-Sep-99	8.1	7800	0.3	3			0.011	0.03	1.8	0.26	0.02	<0.02	0.24	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
KS10/1	48	07-Dec-99	8.4	12000	<0.1	<1			0.04	0.02	0.17	0.34	0.02	<0.05	0.03	0.06	<0.375	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		
KS10/1	48	06-Mar-00	8.4	17000	3.2	6			<0.01	0.01	1.4	0.19	0.06	<0.05	0.56	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
KS10/1	48	05-Jun-00	8.6	7100	<0.1	1	<0.005		<0.005	0.01	0.63	0.03	0.05	<0.05	0.2	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
KS10/1	48	04-Sep-00	8.8	8400	0.2	<1	<0.005		<0.005	0.03	0.32	0.07	0.1	<0.002	1.6	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
KS10/1	48	04-Dec-00	9.3	8800	<0.1	<1	<0.005		<0.005	<0.01	0.95	0.14	0.04	<0.002	0.03	<0.05	0.02	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.02		
KS10/1	48	05-Mar-01																																
KS10/1	48	03-Sep-01	9.2	6800	<0.1	<1	<0.005		<0.005	0.04	0.11	0.035	<0.01	<0.002	0.2	0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
KS10/1	48	04-Mar-02	8.8	5200	<0.1	<1	<0.005		<0.03	0.026	0.39	0.1	<0.005	0.004	0.075	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
KS10/1	48	10-Oct-02	8.3	8200	<0.01	<10	<0.005		<0.005	0.015	0.54	0.3	0.016	0.003	0.03	<0.05	0.10	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
KS10/1	48	16-Apr-03																																
KS10/1	48	10-Nov-03	9.1	10130	<0.01	<50	<0.005			<0.01 (2)	0.61	0.174	0.049	0.002	0.011	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS10/1	48	25-Mar-04	8.6	5280	<0.01	10			0.006	<0.01	0.33	0.263	0.01	<0.001	<0.002	<0.05	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS10/1	48	27-Sep-04	8.1	3850	0.09	<7			0.048	0.001	1.8	3.95	0.013	0.004	0.029	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS10/1	48	29-Mar-05	9.1	3690	19.1	<50			<0.0050	0.008	0.21	0.087	0.018	0.001	0.01	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS10/1	48	07-Sep-05	8.4	3720	0.043	<50			0.05	<0.001	0.28	0.205	0.026	<0.001	0.007	<0.0001	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS10/1	48	03-Mar-06	8.1	3350	0.017	<50			0.083	0.001	0.7	0.148	0.057	0.002	0.039	<0.0001		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS10/1	48	01-Sep-06	8.4	3330	0.079	124			0.0205	<0.001	0.95	0.101	0.03	0.004	0.038	<0.0001	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS10/1	48	03-Mar-07	8.1	3350	0.017	<50			0.083	0.001	0.7	0.148	0.057	0.002	0.039	<0.0001	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS10/1	48	21-Sep-07	7.8	3000	0.037	241			<0.0040	<0.001	0.25	0.235	0.026	<0.001	<0.005	<0.0001	0.5	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
KS10/1	48	29-Feb-08	7.5	2890	0.017	120.000			0.0318	<0.001	0.71	0.433	0.017	0.001	0.012	<0.0001	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
KS10/1	48	11-Sep-08	8.0	5950	0.01	<50			0.011	<0.001	<0.1	0.06	0.038	<0.002	0.005	<0.0001	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS10/1	48	03-Mar-09	6.6	17930	0.02	<50			<0.004	0.001	0.38	0.327	0.024	<0.001	0.011	<0.0001	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS10/1	48	07-Sep-09	7.9	25200	<0.1	200			<0.004	0.003	0.7	1.06	0.022	0.003	0.042	<0.0001	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS10/1	48	24-Dec-10	8.9	4800	0.07	<0.01	<0.004	<0.004	<0.004	<0.005			0.006	0.001			<1.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1
KS10/1	48	03-Apr-12	9.68	2800	0.06	<10	<0.005	<0.01	<0.005	<0.005			0.01	<0.005			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
KS10/1	48	21-Feb-13	8.9	5070	0.05	<10	<0.005	<0.01	<0.005	<0.005			0.059	<0.005			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
KS10/1	48	06-Dec-13	8.2	2560	0.07	<10	<0.005	<0.01	<0.005				0.07	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
KS10/1	48	26-Oct-15	7.6	3670	0.06	<1	<0.004	<0.004	<0.004	<0.01							<0.05	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.5	<1	<1	<1		
KS10/1	48	05-Apr-16	8.91	1400	0.041	<0.05	<0.004	<0.004	<0.004	<0.005	-	-	0.009	<0.001	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<0.5	<1.0	<1.0	<1.0		
KS10/1	48	13-Apr-17	8.12	1297	0.076	<0.05	<0.004	<0.004	<0.004	<0.005			0.015	<0.001	-	-	NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
KS10/1	48	16-May-18	7.54	960	<0.005	<50	<0.004	<0.004	<0.004	<0.005			0.026	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
KS10/1	48	12-Jul-19	7.54	960	<0.005	<50	<0.004	<0.004	<0.004	<0.005			0.04	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
KS10/1	48	09-Jun-20	7.48	1064	<0.005	<50	<0.004	<0.004	<0.004	<0.005			0.012	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
KS10/1	48	21-Jun-21	7.48	1064	0.008	<50	<0.004	<0.004	<0.004	<0.005			0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
KS10/1	48	20-Jun-22	7.23	801	0.056	<50	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
KS10/1	48	12-Oct-23	8.6	1524	0.37	<50	<0.005	<0.005	<0.005	<0.005			0.007	0.002			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		

Table B-4: Monitoring Data: Surface Water (1999-2023)

ANALYTES			pH	Conductivity	Ammonia	Phenols	Free Cyanide	Weak Acid Dissociable Cyanide	Total Cyanide	Cr -Total	Fe - Total	Mn - Total	Mo - Total	Pb - Total	Zn - Total	Hg - Total	Total PAHs	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)&(k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-cd)pyrene	Dibenzo(ah)anthracene	Benzo(ghi)perylene	1-Methylnaphthalene	2-Methylnaphthalene
			pH units	µs/cm	mg/L	µg/L	mg/L CN		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
ANZECC CRITERIA			**8 to 8.4**		**0.91**	**400**	**0.004**		**0.004**	**0.0044**		**0.08**	**0.023 (L)**	**0.0044**	**0.015**	**0.1**		**70 (M)**				**0.2 (L)**	**0.4 (L)**	**1.4 (L)**					**0.2 (L)**						
KS12/6	53	15-Mar-99	8.0	30100	0.1	4			0.01	<0.01	2.5	0.44	<0.01	<0.02	0.14	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
KS12/6	53	17-Jun-99	7.7	39400	<0.1	<1			<0.005	0.008	<0.1	0.006	0.009	<0.001	0.005	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
KS12/6	53	07-Sep-99	7.6	23100	0.2	<1			0.007	0.01	1.7	0.29	<0.01	<0.02	0.09	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
KS12/6	53	07-Dec-99	7.6	34900	<0.1	<1			0.8	0.01	1.7	0.65	<0.01	<0.05	<0.01	0.1	0.38	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		
KS12/6	53	06-Mar-00	6.7	43500	2.6	1			0.02	0.02	9	1.4	<0.01	<0.05	0.63	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
KS12/6	53	05-Jun-00	7.5	27800	<0.1	<1	<0.005		<0.005	<0.01	0.94	0.08	<0.01	<0.05	0.43	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
KS12/6	53	04-Sep-00	7.4	33100	<0.1	<1	<0.005		<0.005	<0.01	0.83	0.23	<0.01	<0.002	0.42	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
KS12/6	53	04-Dec-00	7.5	21400	0.1	<1	<0.005		<0.005	<0.01	0.67	0.34	<0.01	<0.002	<0.01	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
KS12/6	53	05-Mar-01	7.8	27600	0.2	2	<0.05		<0.005	<0.01	1.4	0.11	<0.01	<0.002	0.13	<0.05	<0.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
KS12/6	53	03-Sep-01	7.8	30900	<0.1	<1	<0.005		<0.005	0.03	0.38	0.027	<0.01	<0.002	0.1	0.07	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
KS12/6	53	04-Mar-02	7.3	33000	0.2	<1	<0.005		<0.03	0.021	1	0.37	<0.005	0.006	0.056	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
KS12/6	53	03-Oct-02	7.8	53000	1.19	<46	<0.005		<0.005	0.026	1.13	1.09	0.008	<0.001	<0.002	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
KS12/6	53	16-Apr-03	8.3	30000	0.2	<10	<0.005		<0.005	0.007	0.88	0.41	0.01	<0.005	0.01	<0.05	<0.755	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.01	<0.1	<0.1	<0.1		
KS12/6	53	12-Nov-03	Dry at time of sampling																															
KS12/6	53	25-Mar-04	2.4	30600	14.6	10			<0.005	<0.01	12.9	4.46	<0.001	0.002	0.27	<0.05	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS12/6	53	30-Sep-04	7.2	43200	2.42	<7			<0.005	<0.010	92.5	2.96	<0.001	0.044	0.572	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS12/6	53	04-Apr-05	10.2	21600	19.3	<50			0.0407	0.164	146	2.34	0.013	0.091	0.382	0.4	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS12/6	53	08-Sep-05	2.9	45200	1.77	<50			0.05	<0.010	1.16	1.08	0.006	<0.001	<0.050#	<0.0001	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS12/6	53	03-Mar-06	3.2	41000	6.56	<50			0.043	<0.010	7.27	1.8	<0.010	<0.010#	0.105	<0.0001	<0.0001	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS12/6	53	04-Sep-06	4.5	38400	1.8	<50			<0.0040	<0.010#	3.41	1.38	<0.010#	<0.010#	<0.050#	<0.0001	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS12/6	53	03-Mar-07	3.2	41000	6.56	<50			0.043	<0.010	7.27	1.8	<0.010	<0.010#	0.105	<0.0001	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS12/6	53	21-Sep-07	8.1	42900	0.598	299			<0.0040	0.019	85.9	0.83	<0.010	0.022	0.11	<0.0001	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
KS12/6	53	03-Mar-08	8.1	21150	0.162	254			0.109	0.002	34.8	0.591	0.004	0.001	0.027	<0.0001	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
KS12/6	53	05-Sep-08	7.8	7700	<0.01	120			0.004	<0.001	0.7	0.192	<0.001	<0.001	0.018	<0.0001	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS12/6	53	03-Mar-09	3.9	22870	3.29	<50			<0.004	<0.001	9.19	2.45	<0.001	<0.001	0.034	<0.0001	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS12/6	53	08-Sep-09	6.5	42900	<0.1	<50			<0.004	<0.01	3.00	0.287	<0.01	0.0003	<0.05	<0.0001	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS12/6	53	10-Jan-11	7.5	15600	4.8	230	<0.004	<0.004	<0.004	<0.005			<0.002	<0.001			<1.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1
KS12/6	53	17-Apr-12	7.6	29300	0.02	<10	<0.005	<0.01	<0.005	<0.005			0.004	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1	
KS12/6	53	21-Feb-13	7.9	23400	0.18	<10	<0.005	<0.01	<0.005	<0.005			<0.005	<0.005			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1	
KS12/6	53	06-Dec-13	7.4	29700	0.01	<10	<0.005	<0.01	0.009				0.002	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1	
KS12/6	53	26-Oct-15	7.9	23883	0.15	<1	<0.004	<0.004	<0.004	<0.01			0.006	<0.001			<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	>0.5	<1	<1	<1		
KS12/6	53	13-Apr-16	7.9	25500	0.03	<0.05	<0.004	<0.004	<0.004	<0.005	-	-	<0.001	<0.001	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<0.5	<1.0	<1.0	<1.0	
KS12/6	53	04-Apr-17	8.3	16114	0.008	<50	<0.004	<0.004	<0.004	<0.005			0.003	0.001	-	-	NIL (+)VE	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
KS12/6	53	18-May-18	7.65	36000	2.6	<50	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
KS12/6	53	10-Jul-19	7.62	36000	5.2	<50	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
KS12/6	53	24-Jun-20	4.24	31480	1	<50	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
KS12/6	53	06-Jul-21	7.51	14335	0.34	<50	<0.004	<0.004	<0.004	<0.050			<0.001	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
KS12/6	53	01-Jul-22	7.31	46.7	0.056	<50	<0.004	<0.004	<0.004	0.01			0.001	<0.001			<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
KS12/6	53	11-Oct-23	8.2	40013	0.92	<50	<0.005	<0.005	<0.004	<0.005			<0.01	0.011			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
KS2/1	50	15-Mar-99	8.8	6500	<0.1	3			<0.01	0.01	0.85	0.14	0.12	<0.02	0.24	0.08	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
KS2/1	50	17-Jun-99	8.4	4900	0.2	3			<0.005	0.006	0.3	0.084	0.129	0.003	0.02	0.06	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
KS2/1	50	07-Sep-99	8.2	3800	0.4	1			0.006	0.01	0.22	0.11	0.12	<0.02	0.35	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
KS2/1	50	07-Dec-99	9.0	4200	<0.1	1			0.01	0.02	0.81	0.12	0.16	<0.05	0.04	0.12	<0.375	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		
KS2/1	50	06-Mar-00	9.0	6700	0.2	<1			<0.01	0.02	5.6	0.3	0.2	<0.05	0.39	<0.05	0.70	<0.2	<0.2	<0.2	<0.2	<0.2	0.3	0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
KS2/1	50	05-Jun-00	8.9	3600	<0.1	1	<0.005		<0.005	<0.01	0.58	0.08	0.12	<0.05	0.08	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
KS2/1	50	04-Sep-00	8.3	4100	0.1	<1	<0.005		<0.005	0.06	0.51	0.11	0.12	0.02	2	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
KS2/1	50	04-Dec-00	8.6	5200	<0.1	<1	<0.005		<0.005	<0.01	6	0.35	0.19	0.017	0.22	<0.05	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
KS2/1	50	05-Mar-01	8.6	10400	0.3	1	<0.005		<0.005	0.07	34	0.61	0.28	0.51	1.3	0.25	1.00	0.1	<0.1	<0.1	<0.1	<0.1	0.3	<0.1	0.2	0.2	0.1	0.1	<0.1	<0.1	<0.1	<0.1		
KS2/1	50	03-Sep-01	8.7	3600	<0.1	<1	<0.005		<0.005	0.05	0.51	0.011	0.05	<0.002	0.21	0.07	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
KS2/1	50	04-Mar-02	8.8	5400	<0.1	<1	<0.005		<0.03	0.032	2.7	0.07	0.1	0.014	0.3	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
KS2/1	50	09-Oct-02	9.5	5300	0.02	<10	<0.005		<0.005	0.017	0.38	0.029	0.146	0.002	0.056	<0.05	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
KS2/1	50	16-Apr-03	10.0	3600	0.08	<10	<0.005		<0.005	<0.005	0.83	0.057	0.059	0.007	0.07	<0.05	<0.755	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.01	<0.1	<0.1	<0.1		
KS2/1	50	17-Nov-03	10.0	4790	<0.01	<50	0.014			<0.001	0.11	0.018	0.032	<0.001	0.006	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS2/1	50	25-Mar-04	11.7	3490	0.51	20			0.01	<0.01	<0.05	0.006	0.018	<0.001	<0.002	<0.05	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS2/1	50	30-Sep-04	7.3	6440	0.48	<7			0.065	<0.001	0.7	0.584	0.151	<0.001	0.013	<0.1	<0.775	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS2/1	50	29-Mar-05	7.6	4460	18.6	<50			<0.0050	0.007	0.24	0.23	0.064	0.002	0.012	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS2/1	50	12-Sep-05	8.5	4420	0.031	<50			0.045	<0.001	0.07	0.04	0.112	0.024	0.01	<0.0001	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS2/1	50	03-Mar-06	10.8	2960	0.8	<50			0.03	<0.001	<0.05	0.006	0.019	<0.001	0.006	<0.0001	<0.825	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS2/1	50	08-Sep-06	8.7	5250	2.76	<50			0.0953	0.001	0.8	0.121	0.094	0.003	0.028	<0.0001	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS2/1	50	03-Mar-07	10.8	2960	0.8	<50			0.03	<0.001	<0.05	0.006	0.019	<0.001	0.006	<0.0001	<0.825	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS2/1	50	21-Sep-07	8.4	2582	0.025	<50			<0.0040	<0.001	0.86	0.131	0.102	0.004	0.027	<0.0001	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1		
KS2/1	50	29-Feb-08																																
KS2/1	50	08-Sep-08	10.0	1765	0.11	<50			<0.004	<0.001	0.41	0.035	0.037	0.002	0.017	<0.0001	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS2/1	50	03-Mar-09	9.0	2540	0.2	<50			<0.004	<0.001	0.49	0.06	0.062	0.002	0.018	<0.0001	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS2/1	50	07-Sep-09	7.7	2319	0.06	100			<0.004	0.004	4.24	0.352	0.064	0.025	0.164	<0.0001	0	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS2/1	50	23-Dec-10	8.8	4700	0.03	<0.01	<0.004	<0.004	<0.004	<0.005			0.12	<0.001			<1.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1
KS2/1	50	10-Apr-12	9.7	1080	0.03	40	<0.005	<0.01	<0.005	<0.005			0.02	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1	
KS2/1	50	22-Feb-13	9.1	2490	0.03	50	<0.005	<0.01	<0.005	<0.005			0.1	<0.005			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1	
KS2/1	50	03-Dec-13	9.2	1650	0.02	50	<0.005	<0.01	<0.005				0.016	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1	
KS2/1	50	26-Oct-15	7.7	2260	0.04	<1	<0.004	<0.004	<0.004	<0.01			0.051				<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.05	<1	<1	<1		
KS2/1	50	04-Apr-16	9.1	1600	0.032	<0.05	<0.004	<0.004	<0.004	<0.005	-	-	0.038	0.003	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<0.5	<1.0	<1.0	<1.0	
KS2/1	50	07-Apr-17	9.4	3002	0.058	<50	<0.004	<0.004	<0.004	<0.005			0.069	0.005	-	-	0.23	<0.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
KS2/1	50	15-May-18	8.04	5000	0.066	<50	<0.004	<0.004	<0.004	<0.005			0.13	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
KS2/1	50	12-Jul-19	8.04	5000	0.006	<50	<0.004	<0.004	<0.004	<0.005			0.052	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
KS2/1	50	06-Jul-20	6.97	6890	0.33	<50	<0.004	<0.004	<0.004	<0.005			0.05	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
KS2/1	50	28-Jun-21	13.3	1369	0.014	<50	<0.004	<0.004	<0.004	<0.005			0.016	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
KS2/1	50	20-Jun-22	8.57	994	0.16	<50	<0.004	<0.004	<0.004	<0.005			0.027	<0.001			<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
KS2/1	50	09-Oct-23	8.44	3468	0.06	<50	<0.005	<0.005	<0.005	<0.005			0.091	0.014			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		

Table B-4: Monitoring Data: Surface Water (1999-2023)

ANALYTES			pH	Conductivity	Ammonia	Phenols	Free Cyanide	Weak Acid Dissociable Cyanide	Total Cyanide	Cr -Total	Fe - Total	Mn - Total	Mo - Total	Pb - Total	Zn - Total	Hg - Total	Total PAHs	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)&(k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-cd)pyrene	Dibenzo(ah)anthracene	Benzo(ghi)perylene	1-Methylnaphthalene	2-Methylnaphthalene
			pH units	µs/cm	mg/L	µg/L	mg/L CN		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
ANZECC CRITERIA			**8 to 8.4**		**0.91**	**400**	**0.004**		**0.004**	**0.0044**		**0.08**	**0.023 (L)**	**0.0044**	**0.015**	**0.1**		**70 (M)**				**0.2 (L)**	**0.4 (L)**	**1.4 (L)**					**0.2 (L)**						
KS1/3	29-Oct-08		8.0	1368	0.42	100			<0.004	0.005	13.5	1.99	0.016	0.023	0.104	<0.0001	0	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	0.2	0.1	<0.1	<0.1	0.2	0.1	<0.1	<0.1	<0.1		
KS1/3	08-Dec-08		8.4	3000	<0.01	280			<0.004	<0.001	1.6	0.6	0.007	<0.001	0.009	<0.0001	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS1/3	06-Jan-09		7.7	10440	0.09	340			<0.004	<0.02	2.78	2.25	0.012	0.003	0.022	<0.0001	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS1/3	03-Mar-09		7.9	3940	<0.01	<50			<0.004	0.003	3.94	0.776	0.006	0.002	0.015	<0.0001	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS1/3	07-Sep-09		7.1	2334	0.6	210			<0.004	0.001	1.86	0.645	0.004	0.004	0.096	<0.0001	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS1/3	16-Apr-12		8.8	2340	0.03	<10	<0.005	<0.01	<0.005	<0.005			0.003	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
KS1/3	22-Feb-13		7.9	950	0.08	<10	<0.005	<0.01	<0.005	0.009			0.013	0.02			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
KS1/3	03-Dec-13		7.9	1280	0.03	100	<0.005	0.01	0.015				0.005	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
KS1/3	26-Oct-15		8.5	2430	0.03	<1	<0.004	<0.004	<0.004	<0.01			0.004	<0.001			<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<0.5	<1	<1	<1		
KS1/3	08-Apr-16		8.2	2235	0.006	<0.05	<0.004	<0.004	<0.004	<0.05	-	-	0.004	0.002	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<0.5	<1.0	<1.0	<1.0		
KS1/3	06-Apr-17		8.5	565	0.13	<0.05	<0.004	<0.004	<0.004	<0.005			0.005	0.001	-	-	NIL (+)VE	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
KS1/3	15-May-18		7.59	1600	0.29	<50	<0.004	<0.004	<0.004	<0.005			0.01	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
KS1/3	10-Jul-19		7.59	1600	0.34	<50	<0.004	<0.004	<0.004	<0.005			0.01	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
KS1/3	09-Jun-20		7.96	1269	0.066	<50	<0.004	<0.004	<0.004	<0.05			0.003	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
KS1/3	28-Jun-21		8.68	1368	0.18	<50	<0.004	<0.004	<0.004	<0.005			0.003	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
KS1/3	20-Jun-22		7.2	621	0.082	<50	<0.004	<0.004	<0.004	<0.005			<0.001	<0.001			<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
KS1/3	10-Oct-23		6.8	1720	0.29	<50	<0.005	<0.005	<0.005	<0.005							<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
KS7/1	28-Oct-08		7.7	1850	0.15	<50			<0.004	<0.001	0.15	0.364	0.133	<0.001	0.006	<0.0001	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS7/1	08-Dec-08		7.8	2380	<0.01	<50			<0.004	<0.001	0.23	0.887	0.152	<0.001	0.006	<0.0001	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS7/1	06-Jan-09		8.4	2660	0.03	150			<0.004	<0.02	0.57	0.7	0.171	0.002	0.013	<0.0001	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS7/1	03-Mar-09		8.5	2930	0.03	<50			<0.004	<0.001	0.14	0.354	0.046	<0.001	0.027	<0.0001	0.1	0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS7/1	26-Mar-09		9.2	2390	<0.01	190			<0.004	<0.001	0.2	0.345	0.18	0.002	0.018	<0.0001	0.3	0.3	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS7/1	07-Sep-09		6.9	2530	0.02	50			<0.004	<0.001	0.1	0.214	0.141	<0.001	0.008	<0.0001	<PQL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1		
KS7/1	23-Dec-10		8.7	3400	0.03	<0.01	<0.004	<0.004	<0.004	<0.005			0.2	<0.001			<1.93	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1
KS7/1	16-Apr-12		8.8	1850	0.4	<10	<0.005	<0.01	<0.005	<0.005			0.067	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
KS7/1	21-Feb-13		8.7	3110	0.06	<10	<0.005	<0.01	<0.005	<0.005			0.27	<0.005			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
KS7/1	05-Dec-13		7.9	2400	0.04	20	<0.005	<0.01	<0.005				0.081	<0.001			<16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		
KS7/1	26-Oct-15		8.0	2890	0.09	<1	<0.004	<0.004	<0.004	<0.01			0.025	<0.001			<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<0.5	<1	<1	<1		
KS7/1	04-Apr-16		9.1	1600	0.048	<0.05	<0.004	<0.004	<0.004	<0.005	-	-	0.04	0.001	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<0.5	<1.0	<1.0	<1.0		
KS7/1	11-Apr-17		8.6	1845	0.43	<0.05	<0.004	<0.004	**0.055**	<0.005			0.24	<0.001	-	-	NIL (+)VE	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
KS7/1	15-May-18		8.35	3601	0.054	<50	<0.004	<0.004	<0.004	<0.005			0.26	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
KS7/1	12-Jul-19		8.35	3601	0.13	<50	<0.004	<0.004	<0.004	<0.005			0.065	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
KS7/1	16-Jun-20		8.3	3228	0.016	<50	<0.004	<0.004	<0.004	<0.005			0.088	<0.001			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
KS7/1	28-Jun-21		8.03	2130	<0.005	<50	<0.004	<0.004	<0.004	<0.005			0.034	<0.01			NIL (+)VE	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
KS7/1	20-Jun-22		6.96	1894	<0.005	<50	<0.004	<0.004	<0.004	<0.005			0.023	<0.001			<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1		
KS7/1	11-Oct-23		7.6	3301	0.95	<50	<0.005	<0.005	0.028	<0.005			0.18	0.007			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1		

Shading Value Exceeds 95% trigger value for marine waters as shown in Table 3.4.1 of the Australian and New Zealand Guidelines for Fresh and Marine water Quality 2000

Note: Ammonia guideline based on a pH of the receiving water body of 8.
Total PAH and Total Phenol PQL calculated as the sum of individual compound PQLs divided by 2.
(L) = Low Reliability Trigger Value
(M) = Moderate Reliability Trigger Value
Ammonia determination was as NO3 until April 2003, after which ammonia determination was as N.
Dissolved Chromium was reported until April 2003, after which hexavalent chromium was reported.
Blank indicates not analysed.
nd = not detected at GHDs March 04 detection levels.
Only sample locations that currently require sampling have an EPA ID number.
PQL Raised due to matrix interference.

Appendix C

2023 Results Table

Appendix C
Table 1
2023 Water Result - Fill Wells

		Field parameters		Nutrients	Phenols - total	Cyanide			Metals			PAHs - standard 16																
		pH	Conductivity	Ammonia as N	Phenolics Total	Cyanide (Free)	Cyanide (Total)	Cyanide (WAD)	Chromium (hexavalent) (filtered)	Lead (filtered)	Molybdenum (filtered)	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo[b+j]fluoranthene	Benzo(k)fluoranthene	Benzo(g,h,i)perylene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	PAHs (Sum of total) - Lab calc
Unit		pH	uS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
LOR				0.01	0.05	0.005	0.005	0.005	0.005	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
ANZECC 2000 - Lowlands Rivers (NSW Coastal rivers)		**6.5-9**	**200**																									
ANZG (2018) - MW - 95% species protection				0.91	0.4	0.004	0.004		0.0044	0.0044	0.023 [1]			0.00001 [2]		0.0001 [2]						0.001 [2]			0.07	0.0006 [2]		
Location Code	**Date**																											
336A	09 Oct 2023	7.21	**5,756**	1.7	<0.05	<0.005	<0.004	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
344A	09 Oct 2023	**11.08**	**1,639**	0.57	<0.05	<0.005	<0.004	<0.005	<0.005	0.0002	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
GHD01N	12 Oct 2023	8.2	**1,571**	0.42	<0.05	<0.005	0.046	<0.005	<0.005	0.001	0.14	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
K5/6N	10 Oct 2023	8.63	**1,221**	0.64	<0.05	<0.005	0.011	<0.005	<0.005	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
K7/1	10 Oct 2023	**5.9**	**3,029**	6.0	<0.05	<0.005	0.074	<0.005	<0.005	<0.001	0.41	0.007	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	0.41	0.003	<0.001	0.42
K7/4N	11 Oct 2023	7.8	**2283.0**	8.7	-	<0.005	0.10	0.007	<0.005	-	0.016	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
K10/2	12 Oct 2023	7.6	**477**	0.02	-	<0.005	-	<0.005	<0.005	<0.001	0.006	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
K10/2N	12 Oct 2023	**9.3**	**1,075**	1.4	-	<0.005	-	0.025	<0.005	<0.001	0.024	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Notes:
1 ANZECC 2000 low reliability trigger values
2 99% Protection marine values to account for bioaccumulation

Appendix C
Table 2
2023 Water Result - Shallow Estuarine Wells

KIWEF

KIWEF Groundwater and Surface Water Moniotring Event

		Field parameters		Nutrients	Phenols - total	Cyanide			Metals			PAHs - standard 16																
		pH	Conductivity	Ammonia as N	Phenolics Total	Cyanide (Free)	Cyanide (Total)	Cyanide (WAD)	Chromium (hexavalent) (filtered)	Lead (filtered)	Molybdenum (filtered)	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo[b+j]fluoranthene	Benzo(k)fluoranthene	Benzo(g,h,i)perylene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	PAHs (Sum of total) - Lab calc
Unit		pH	uS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
LOR				0.01	0.05	0.005	0.005	0.005	0.005	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
ANZECC 2000 - Lowlands Rivers (NSW Coastal rivers)		**6.5-9**	**200**																									
ANZG (2018) - MW - 95% species protection				0.91	0.4	0.004	0.004		0.0044	0.0044	0.023 [1]			0.00001 [2]		0.0001 [2]						0.001 [2]			0.07	0.0006 [2]		
Location Code	**Date**																											
336B	09 Oct 2023	7	**11,101**	0.46	<0.05	<0.005	<0.004	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
344B	09 Oct 2023	8.77	**12,539**	2.5	<0.05	<0.005	<0.004	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
BH21S	09 Oct 2023	**10.76**	**2,329**	7.4	<0.05	<0.005	0.22	0.096	<0.005	<0.001	0.37	0.004	0.002	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.004	0.003	<0.001	0.47	0.008	0.003	0.50
BHe29s	12 Oct 2023	8.1	**1,297**	1.2	<0.05	<0.005	<0.005	<0.005	<0.005	<0.001	0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
E61D	09 Oct 2023	6.62	**52,319**	2.1	<0.05	<0.005	<0.004	<0.005	<0.005	<0.01	0.014	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
GHD01S	12 Oct 2023	6.9	**4,922**	6.1	<0.05	<0.005	0.068	0.023	<0.005	<0.001	0.021	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
K5/6NN	10 Oct 2023	7.2	**3,279**	0.35	<0.05	<0.005	<0.004	<0.005	<0.005	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
K7/2S	10 Oct 2023	7.28	**7,520**	1.7	<0.05	<0.005	0.015	<0.005	<0.005	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
K7/4S	11 Oct 2023	6.5	**18,725**	0.56	-	<0.005	<0.004	<0.005	0.010	<0.001	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
K8/5W	12 Oct 2023	**10.1**	**2,490**	7.5	<0.05	<0.005	0.019	<0.005	<0.005	<0.001	0.014	0.30	<0.001	0.027	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.027	0.17	<0.001	0.062	0.18	0.019	0.79
K9/2W	10 Oct 2023	7.3	**2,358**	0.89	-	<0.005	<0.005	<0.005	<0.005	0.001	0.034	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
K9/3S	13 Oct 2023	7.7	**4,128**	1.8	<0.05	<0.005	0.006	<0.005	<0.005	<0.001	0.013	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
K9/4E	10 Oct 2023	7.3	**10,040**	2.1	-	<0.005	<0.005	<0.005	<0.005	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
K10/2NN	12 Oct 2023	6.5	**19,665**	5.5	-	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.078	<0.001	<0.001	0.078
K11/1	13 Oct 2023	7.3	**1,052**	0.05	<0.05	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
K11/2E	12 Oct 2023	7.4	**915**	0.01	<0.05	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
K11/3E	13 Oct 2023	7	**2,963**	1.7	<0.05	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
K12/1W	11 Oct 2023	7.1	**16,648**	0.05	<0.05	<0.005	<0.004	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
K12/7	11 Oct 2023	8.17	**43,003**	0.10	<0.05	<0.005	<0.004	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
K12/9	11 Oct 2023	6.71	**32,841**	1.4	<0.05	<0.005	<0.004	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
NClG1	11 Oct 2023	7.9	**9,555**	2.2	<0.05	<0.005	<0.005	<0.005	<0.005	<0.001	0.012	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Notes:

1 ANZECC 2000 low reliability trigger values

2 99% Protection marine values to account for bioaccumulation

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Appendix C
Table 3
2023 Water Result - Deep Estuarine Wells

		Field parameters		Nutrients	Phenols - total	Cyanide			Metals			PAHs - standard 16																
		pH	Conductivity	Ammonia as N	Phenolics Total	Cyanide (Free)	Cyanide (Total)	Cyanide (WAD)	Chromium (hexavalent) (filtered)	Lead (filtered)	Molybdenum (filtered)	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo[b+j]fluoranthene	Benzo(k)fluoranthene	Benzo(g,h,i)perylene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	PAHs (Sum of total) - Lab calc
Unit		pH	uS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
LOR				0.01	0.05	0.005	0.005	0.005	0.005	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
ANZECC 2000 - Lowlands Rivers (NSW Coastal rivers)		**6.5-9**	**200**																									
ANZG (2018) - MW - 95% species protection				0.91	0.4	0.004	0.004		0.0044	0.0044	0.023 [1]			0.00001 [2]		0.0001 [2]						0.001 [2]			0.07	0.0006 [2]		
Location Code	**Date**																											
K5/5S	09 Oct 2023	7.2	**3,168**	0.86	<0.05	<0.005	0.005	<0.005	<0.005	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
K5/6S	10 Oct 2023	6.8	**3,285**	0.33	-	<0.005	<0.004	<0.005	<0.005	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
K7/2N	10 Oct 2023	7.12	**5,281**	6.4	<0.05	<0.005	0.085	0.012	<0.005	-	-	0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	0.030	<0.001	<0.001	0.036
K9/2E	10 Oct 2023	**5.5**	**32,741**	3.9	-	<0.005	<0.005	<0.005	<0.005	-	0.023	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
K9/3N	12 Oct 2023	**5.7**	**18,056**	2.8	<0.05	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
K9/4W	10 Oct 2023	6.95	**14,410**	1.2	-	<0.005	<0.005	<0.005	<0.005	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
K11/1S	13 Oct 2023	**6.1**	**8,501**	3.8	<0.05	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
K11/2W	12 Oct 2023	**5.8**	**3,427**	-	<0.05	<0.005	<0.005	<0.005	<0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
K11/3W	13 Oct 2023	7	**14,207**	5.9	<0.05	<0.005	0.009	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
K12/1E	11 Oct 2023	6.6	**25,342**	1.1	<0.05	<0.005	<0.004	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
K12/7E	11 Oct 2023	6.75	**50,039**	26	<0.05	<0.005	<0.004	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
K12/10	11 Oct 2023	**6.3**	**2,761**	220	<0.05	<0.005	<0.004	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
NCIG2	11 Oct 2023	7	**52,941**	43	<0.05	<0.005	<0.004	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Notes:
1 ANZECC 2000 low reliability trigger values
2 99% Protection marine values to account for bioaccumulation

Appendix C
Table 4
2023 Water Result - Surface Water

		Field parameters		Nutrients	Phenols - total	Cyanide			Metals			PAHs - standard 16																
		pH	Conductivity	Ammonia as N	Phenolics Total	Cyanide (Free)	Cyanide (Total)	Cyanide (WAD)	Chromium (hexavalent)	Lead	Molybdenum	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo[b+j]fluoranthene	Benzo(k)fluoranthene	Benzo(g,h,i)perylene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	PAHs (Sum of total) - Lab calc
Unit		pH	uS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
LOR				0.01	0.05	0.005	0.005	0.005	0.005	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
ANZECC 2000 - Lowlands Rivers (NSW Coastal rivers)		**6.5-9**	**200**																									
ANZG (2018) - MW - 95% species protection				0.91	0.4	0.004	0.004		0.0044	0.0044	0.023 [1]			0.00001 [2]		0.0001 [2]						0.001 [2]			0.07	0.0006 [2]		
Location Code	**Date**																											
KS1/3 [3]	10 Oct 2023	6.8	**1720**	0.29	<0.05	<0.005	<0.005	<0.005	<0.005	0.009	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
KS2/1	09 Oct 2023	8.44	**3468**	0.06	<0.05	<0.005	<0.005	<0.005	<0.005	0.014	0.091	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
KS7/1	11 Oct 2023	7.6	**3301**	0.95	<0.05	<0.005	0.028	<0.005	<0.005	0.007	0.18	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
KS10/1	12 Oct 2023	8.6	**1524**	0.37	<0.05	<0.005	<0.005	<0.005	<0.005	0.002	0.007	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
KS12/6	11 Oct 2023	8.2	**40013**	0.92	<0.05	<0.005	<0.004	<0.005	<0.005	0.011	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Notes:
1 ANZECC 2000 low reliability trigger values
2 99% Protection marine values to account for bioaccumulation
3 Molybdenum concentrations of duplicate samples FD08 (0.007 mg/L) and FD09 (0.009 mg/L) were both below criteria

Appendix D

Quality Control/Quality Assurance

Quality control/quality assurance

QA involves all actions, procedures, checks and decisions, undertaken to ensure the representativeness and integrity of samples and accuracy and reliability of analytical results (NEPC 1999). As part of these actions, QC sampling is conducted to allow quantitative assessment of the effectiveness of QA procedures. QA procedures and therefore QC sampling are conducted both in-field and by the analysing laboratories.

Field quality assurance/quality control

All field work was conducted in accordance with the NEPC *National Environment Protection (Assessment of Site Contamination) Measure*, NEPM Amendment 2013 No. 1 (NEPC, 1999). This ensured all samples were collected by a set of uniform and systematic methods including:

– Decontamination procedures: including the use of new disposable gloves for the collection of each sample, decontamination of the sampling equipment (interface probe and water quality meter) between each sampling event and the use of sample containers provided by the laboratory.
– Sample identification and preservation procedures: collected samples were immediately transferred to laboratory supplied sample containers of appropriate composition and preservation for the required laboratory analysis. Sample containers were clearly labelled with a sample location, sample depth, sample date and sampler's initials. All sample containers were then transferred to the lab in an esky for sample preservation prior to and during transport to the testing laboratory.
– Calibration of field equipment: field equipment (interface probe and water quality meter) was calibrated to ensure accuracy of measurements taken in the field. Calibration was undertaken by the rental supplier. Calibration certificates are provided in Appendix H.
– Field monitoring records: field data were recorded using standardised forms and provided in Appendix G.
– CoC information requirements: a CoC form was completed and forwarded to the testing laboratory with the samples. Copies of the CoC's are included in Appendix F.
– QC samples: Blind and split duplicate samples were collected at a frequency of 1:10 and 1:20 respectively. Two rinsate blanks were collected on the last two days of sampling. Two trip blanks and two trip spikes were also collected. The rationale for collecting QC samples includes the following:
    - One blind duplicate to identify the variation in the analyte concentration between samples from the same sampling point and the repeatability of the laboratory's analysis.
    - One split duplicate sample was used to provide an indication of the repeatability of the results between laboratories. Two rinsate blank samples were used to identify any potential cross contamination between locations carried by non-dedicated equipment that was inadequately decontaminated.

Field duplicate samples are summarised in Table C.1.

Table C.1 Summary of duplicate samples

Primary sample	Date	Sample ID	QC Sample Type	Aquifer
336A	9/10/2023	FD01	Intra-lab Duplicate	Fill
		FD02	Inter-lab Duplicate	
K5/5S	9/10/2023	FD03	Intra-lab Duplicate	Deep estuarine
		FD04	Inter-lab Duplicate	
BH21S	9/10/2023	FD05	Intra-lab Duplicate	Shallow estuarine
KS2/1	9/10/2023	FD06	Intra-lab Duplicate	Surface water
E61D	9/10/2023	FD07	Intra-lab Duplicate	Shallow estuarine
KS1/3	10/10/2023	FD08	Intra-lab Duplicate	Surface water
		FD09	Inter-lab Duplicate	
K7/1	10/10/2023	FD10	Intra-lab Duplicate	Fill
K12/10	11/10/2023	FD11	Intra-lab Duplicate	Deep estuarine

Primary sample	Date	Sample ID	QC Sample Type	Aquifer
K12/7	11/10/2023	FD12	Intra-lab Duplicate	Shallow estuarine
		FD13	Inter-lab Duplicate	
K12/1E	11/10/2023	FD14	Intra-lab Duplicate	Deep estuarine

Relative percentage difference

RPD calculations were used to assess the accuracy of the analytical results allowing comparison of primary and split (inter-laboratory) samples. RPDs were calculated in accordance with the procedure described in AS 4482.1 – 2005 (Standards Australia 2005). According to AS 4482.1 - 2005 (Standards Australia 2005), typical RPDs are expected to range between 30% and 50%; however, this may be higher for organics, heterogenous conditions and for low concentrations of analytes. For this investigation, GHD had adopted a nominal acceptance criterion of 50% RPD for field duplicates and splits for organics and 30% for inorganics. However it is noted that this will not always be achieved, particularly in heterogeneous or at low analyte concentrations.

Where a result was reported below the LOR for one of the paired samples, the sample was assigned a concentration equal to the LOR for RPD calculation purposes. Where both results were reported below the LOR, the RPD was not calculated and accepted as zero.

RPD calculations are presented in Table 1, Appendix E. A summary of the exceedances on the RPD criteria are presented in Table C.2.

Table C.2 RPD Exceedances

Parent Sample/QA		Date	Analyte	RPD (%)	Comment
336A	FD02 (Interlab Duplicate)	9/10/2023	Mo	46	Elevated RPD can be attributed to near LOR concentrations (<10x LOR), therefore the RPD exceedance does not affect the decision rule and the primary result is considered valid.
BH21S	FD05 (Field duplicate)	9/10/2023	CN - Free	95	Elevated RPD can be attributed to near LOR concentrations (<10x LOR) therefore the RPD exceedance does not affect the decision rule and the primary result is considered valid.
KS1/3	FD08 (Field duplicate)	10/10/2023	NH_3 - N	32	Both detections are consistent with historical concentrations and were below the adopted assessment criteria, therefore the RPD exceedances do not affect the decision rule and the primary result is considered valid.
	FD09 (Interlab Duplicate)	10/10/2023	NH_3 - N	37	
K7/1	FD10 (Field duplicate)	10/10/2023	CN -Total	49	Both detections are consistent with historical concentrations and are of the same order of magnitude. Both are also above the adopted assessment criteria, therefore the RPD exceedance does not affect the decision rule and the primary result is considered valid.
			CN - WAD	46	Elevated RPD can be attributed to near LOR concentrations (<10x LOR) therefore the RPD exceedance does not affect the decision rule and the primary result is considered valid.

Parent Sample/QA		Date	Analyte	RPD (%)	Comment
			NH_3 - N	38	Both detections are consistent with historical concentrations and are of the same order of magnitude. Both are also above the adopted assessment criteria therefore the RPD exceedance does not affect the decision rule and the primary result is considered valid.
			Fluorene	67	Elevated RPD can be attributed to near LOR concentrations (<10x LOR) and are both below the adopted assessment criteria. Therefore the RPD exceedance does not affect the decision rule and the primary result is considered valid.
			Phenanthrene	100	
K12/10	FD11 (Field duplicate)	11/10/2023	NH_3 - N	32	Both detections are of the same order of magnitude and above the adopted assessment criteria therefore the RPD exceedance which is marginally above 30% does not affect the decision rule and the primary result is considered valid.
K12/7	FD13 (Interlab duplicate)	11/10/2023	NH_3 - N	105	Both detections are consistent with historical concentrations and are of the same order of magnitude. Both values are also below the adopted assessment criteria, therefore the RPD exceedance does not affect the decision rule and the primary result is considered valid.

Rinsate blanks

A total of two rinsate blanks (RB01 - 11 October and RB02 - 12 October) were collected from one of the interface probes used during the monitoring in the last days of sampling and were analysed for the same COPCs as the primary samples. The following were detected above LOR in the rinsates but were not considered to affect the results based on the following reasons:

– Molybdenum (0.006 mg/L) was detected slightly above the 0.005 mg/L LOR in RB01. Of the 12 locations sampled on 11 October, only three locations (NCIG1, K7/4N and KS7/1) recorded Mo concentrations greater than LOR. All of these wells had consistently detected Mo in the previous monitoring and the concentrations were consistent with previous results. Therefore, this detection in RB01 was not considered to affect any of the results during the sampling.
– Ammonia was detected above LOR in RB01 (0.06 mg/L) and RB02 (0.02 mg/L). All wells sampled on both days had ammonia detections above LOR but the concentrations were consistent with previous monitoring results. In addition, the detections in the rinsates were low relative to the ammonia concentrations detected historically on both groundwater wells and surface water and are within the laboratories acceptable precision error limits. Therefore, these detections in RB01 and RB02 were unlikely to impact the ammonia results of this monitoring event.

The two trip blanks and two trip spike were within acceptable QA criteria. A summary of the results are presented in Table 2, Appendix E.

Laboratory QA/QC

Laboratory analysis was completed by NATA accredited laboratories suitable for environmental contaminant analysis. Each laboratory carried out internal QA procedures as part of its NATA accreditation, which included analysis of QC samples (duplicates, method blanks, control samples, laboratory-controlled spikes, matrix spikes, and sample surrogates).

The laboratory QA/QC is included in the laboratory certificates of analysis presented in Appendix F. Table C.3 presents a summary of the non-conformances in the laboratory reports.

Table C.3 Laboratory QA/QC non-conformance

Lab report	Analyte	Comment
1033940	Molybdenum	Duplicate - The RPD reported passes Eurofins Environment Testing's QC - Acceptance Criteria as defined in the Internal Quality Control Review.
ES2334606	PAH/Phenols	Duplicates and matrix spike – no quality control samples during analysis due to insufficient sample volume needed to do a full bottle extraction to include the duplicate and matrix spike.
ES2334776	Ammonia (as N)	Matrix spike recovery was not determined due to background level greater than or equal to 4x spike level.
	Total Hexavalent Chromium	Date analysed – Samples were received on the 10 October 2023, but were only analysed on 12 October exceeding the analysis due date on 11 October.
	PAH/Phenols	Duplicates and matrix spike – no quality control samples during analysis due to insufficient sample volume needed to do a full bottle extraction to include the duplicate and matrix spike.
ES2334995	Total Hexavalent Chromium	Date analysed – Samples were received on 11 October, but were only analysed on 13 October exceeding the analysis due date on 12 October.
	PAH/Phenols	Duplicates and matrix spike – no quality control samples during analysis due to insufficient sample volume needed to do a full bottle extraction to include the duplicate and matrix spike.

QA/QC summary

The review of the QA/QC program indicates that the surface and groundwater analytical data are of an acceptable quality upon which to draw meaningful conclusions regarding impacts to surface and groundwater at the site.

Appendix E

QAQC Table

Appendix D
Table 1
QA/QC - RPD Result

KIWEF
KIWEF Groundwater Monitoring and Monitoring Netweok Rationalisation

					Cyanide			Nutrients	Metals						PAHs - standard 16																
					Cyanide (Free)	Cyanide (Total)	Cyanide (WAD)	Ammonia as N	Chromium (hexavalent)	Chromium (hexavalent) (filtered)	Lead	Lead (filtered)	Molybdenum	Molybdenum (filtered)	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo[b+j]fluoranthene	Benzo(k)fluoranthene	Benzo(g,h,i)perylene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	PAHs (Sum of total) - Lab calc	Total 8 PAHs (as BaP TEQ)(zero LOR) - Lab Calc
Unit					mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
LOR					0.004	0.004	0.004	0.01	0.005	0.005	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.0005	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.0005	0.0005
ANZECC CRITERIA					**0.004**	**0.004**		**0.91**	**0.0044**	**0.0044**	**0.0044**	**0.0044**	**0.023 (L)**	**0.023 (L)**					**200 (L)**						**1400 (L)**			**70000 (M)**	**200 (L)**			
Location Cc	**Date**	**Field ID**	**Sample Type**	**Lab Report**																												
336A	09 Oct 2023	336A	Normal	1033052	<0.005	<0.004	<0.005	1.7	-	<0.005	-	<0.0001	-	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
		FD01	Field_D	1033052	<0.005	<0.004	<0.005	1.7	-	<0.005	-	0.0001	-	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
RPD					0	0	0	0	-	0	-	0	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
336A	09 Oct 2023	336A	Normal	1033052	<0.005	<0.004	<0.005	1.7	-	<0.005	-	<0.001	-	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
		FD02	Interlab_D	ES2334606	<0.004	<0.004	<0.004	1.45	<0.01	-	-	<0.001	-	0.008	<0.0010	<0.0010	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0005	<0.0005
RPD					0	0	0	16	-	-	-	0	-	**46**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
BH21S	09 Oct 2023	BH21S	Normal	1033052	<0.005	0.22	0.096	7.4	-	<0.005	-	0.0002	-	0.37	0.004	0.002	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.004	0.003	<0.001	0.47	0.008	0.003	0.50	-
		FD05	Field_D	1033052	0.014	0.27	0.12	7.3	-	<0.005	-	0.0002	-	0.33	0.004	0.002	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	0.003	<0.001	0.48	0.007	0.002	0.50	-
RPD					**95**	20	22	1	-	0	-	0	-	11	0	0	0	0	0	0	0	0	0	0	0	29	0	0	2	13	40	0	-
E61D	09 Oct 2023	E61D	Normal	1033052	<0.005	<0.004	<0.005	2.1	-	<0.005	-	<0.01	-	0.014	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
		FD07	Field_D	1033052	<0.005	<0.004	<0.005	2.1	-	<0.005	-	<0.01	-	0.014	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
RPD					0	0	0	0	-	0	-	0	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
K5/5S	09 Oct 2023	K5/5S	Normal	1033052	<0.005	0.005	<0.005	0.86	-	<0.005	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
		FD03	Field_D	1033052	<0.005	<0.005	<0.005	0.85	-	<0.005	-	<0.0001	-	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
RPD					0	0.00	0	1	-	0	-	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
K5/5S	09 Oct 2023	K5/5S	Normal	1033052	<0.005	0.005	<0.005	0.86	-	<0.005	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
		FD04	Interlab_D	ES2334606	<0.004	<0.004	<0.004	0.85	<0.01	-	-	<0.001	-	0.002	<0.0010	<0.0010	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0005	<0.0005
RPD					0	22	0	1	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
KS2/1	09 Oct 2023	KS2/1	Normal	1033052	<0.005	<0.004	<0.005	0.06	<0.005	-	0.014	-	0.091	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
		FD06	Field_D	1033052	<0.005	<0.004	<0.005	0.07	<0.005	-	0.013	-	0.090	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
RPD					0	0	0	15	0	-	7	-	1	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
K7/1	10 Oct 2023	K7/1	Normal	1033472	<0.005	0.074	<0.005	6.0	-	<0.005	-	<0.001	-	0.41	0.007	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	0.41	0.003	<0.001	0.42	-
		FD10	Field_D	1033472	<0.005	0.045	0.008	4.1	-	<0.005	-	<0.001	-	0.40	0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	0.30	0.001	<0.001	0.31	-
RPD					0	**49**	**46**	**38**	-	0	-	0	-	2	33	0	0	0	0	0	0	0	0	0	0	0	**67**	0	31	**100**	0	30	-
KS1/3	10 Oct 2023	KS1/3	Normal	1033472	<0.005	<0.005	<0.005	0.29	<0.005	-	0.009	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
		FD08	Field_D	1033472	<0.005	<0.005	<0.005	0.21	<0.005	-	0.009	-	0.007	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
RPD					0	0	0	**32**	0	-	0	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
KS1/3	10 Oct 2023	KS1/3	Normal	1033472	<0.005	<0.005	<0.005	0.29	<0.005	-	0.009	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
		FD09	Interlab_D	ES2334776	<0.004	<0.004	<0.004	0.20	<0.01	-	0.007	-	0.009	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0005	<0.0005
RPD					0	0	0	**37**	0	-	25	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
K12/10	11 Oct 2023	K12/10	Normal	1033940	<0.005	<0.004	<0.005	220	-	<0.005	-	<0.001	-	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
		FD11	Field_D	1033940	<0.005	<0.004	<0.005	160	-	<0.005	-	<0.001	-	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
RPD					0	0	0	**32**	-	0	-	0	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
K12/1E	11 Oct 2023	K12/1E	Normal	1033940	<0.005	<0.004	<0.005	1.1	-	<0.005	-	<0.001	-	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
		FD14	Field_D	1033940	<0.005	<0.004	<0.005	1.1	-	<0.005	-	<0.001	-	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
RPD					0	0	0	0	-	0	-	0	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
K12/7	11 Oct 2023	K12/7	Normal	1033940	<0.005	<0.004	<0.005	0.10	-	<0.005	-	<0.001	-	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
		FD12	Field_D	1033940	<0.005	<0.004	<0.005	0.10	-	<0.005	-	<0.001	-	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
RPD					0	0	0	0	-	0	-	0	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
K12/7	11 Oct 2023	K12/7	Normal	1033940	<0.005	<0.005	<0.005	0.10	-	<0.005	-	<0.001	-	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
		FD13	Interlab_D	ES2334995	<0.004	<0.004	<0.004	0.32	-	<0.01	-	<0.010	-	<0.010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0005	<0.0005
RPD					0	0	0	**105**	-	0	-	0	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-

Note

Shading	Value Exceeds 95% trigger value for marine waters as shown in Table 3.4.1 of the Australian and New Zealand Guidelines for Fresh and Marine water Quality 2000
Shading	Value exceeds acceptable RPD value

Ammonia guideline based on a pH of the receiving water body of 8.

Total PAH and Total Phenol PQL calculated as the sum of individual compound PQLs divided by 2.

(L) = Low Reliability Trigger Value

(M) = Moderate Reliability Trigger Value

Appendix D
Table 1
QA/QC - RPD Result

					Phenols - Halogenated							Phenols - Non-Halogenated					Phenols - total
					2-Chlorophenol	2,4-Dichlorophenol	2,4,5-Trichlorophenol	2,4,6-Trichlorophenol	2,6-Dichlorophenol	4-Chloro-3-methylphenol	Pentachlorophenol	Phenol	2-Nitrophenol	2-Methylphenol (o-Cresol)	3,4-Methylphenol (m,p-cresol)	2,4-Dimethylphenol	Phenolics Total
Unit					mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
LOR					0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.001	0.002	0.001	0.05
ANZECC CRITERIA																	0.4
Location Cc	Date	Field ID	Sample Type	Lab Report													
336A	09 Oct 2023	336A	Normal	1033052	-	-	-	-	-	-	-	-	-	-	-	-	<0.05
		FD01	Field_D	1033052	-	-	-	-	-	-	-	-	-	-	-	-	<0.05
RPD					-	-	-	-	-	-	-	-	-	-	-	-	0
336A	09 Oct 2023	336A	Normal	1033052	-	-	-	-	-	-	-	-	-	-	-	-	<0.05
		FD02	Interlab_D	ES2334606	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0020	<0.0010	<0.0010	<0.0010	<0.0020	<0.0010	-
RPD					-	-	-	-	-	-	-	-	-	-	-	-	-
BH21S	09 Oct 2023	BH21S	Normal	1033052	-	-	-	-	-	-	-	-	-	-	-	-	<0.05
		FD05	Field_D	1033052	-	-	-	-	-	-	-	-	-	-	-	-	<0.05
RPD					-	-	-	-	-	-	-	-	-	-	-	-	0
E61D	09 Oct 2023	E61D	Normal	1033052	-	-	-	-	-	-	-	-	-	-	-	-	<0.05
		FD07	Field_D	1033052	-	-	-	-	-	-	-	-	-	-	-	-	<0.05
RPD					-	-	-	-	-	-	-	-	-	-	-	-	0
K5/5S	09 Oct 2023	K5/5S	Normal	1033052	-	-	-	-	-	-	-	-	-	-	-	-	<0.05
		FD03	Field_D	1033052	-	-	-	-	-	-	-	-	-	-	-	-	<0.05
RPD					-	-	-	-	-	-	-	-	-	-	-	-	0
K5/5S	09 Oct 2023	K5/5S	Normal	1033052	-	-	-	-	-	-	-	-	-	-	-	-	<0.05
		FD04	Interlab_D	ES2334606	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0020	<0.0010	<0.0010	<0.0010	<0.0020	<0.0010	-
RPD					-	-	-	-	-	-	-	-	-	-	-	-	-
KS2/1	09 Oct 2023	KS2/1	Normal	1033052	-	-	-	-	-	-	-	-	-	-	-	-	<0.05
		FD06	Field_D	1033052	-	-	-	-	-	-	-	-	-	-	-	-	<0.05
RPD					-	-	-	-	-	-	-	-	-	-	-	-	0
K7/1	10 Oct 2023	K7/1	Normal	1033472	-	-	-	-	-	-	-	-	-	-	-	-	<0.05
		FD10	Field_D	1033472	-	-	-	-	-	-	-	-	-	-	-	-	<0.05
RPD					-	-	-	-	-	-	-	-	-	-	-	-	0
KS1/3	10 Oct 2023	KS1/3	Normal	1033472	-	-	-	-	-	-	-	-	-	-	-	-	<0.05
		FD08	Field_D	1033472	-	-	-	-	-	-	-	-	-	-	-	-	<0.05
RPD					-	-	-	-	-	-	-	-	-	-	-	-	0
KS1/3	10 Oct 2023	KS1/3	Normal	1033472	-	-	-	-	-	-	-	-	-	-	-	-	<0.05
		FD09	Interlab_D	ES2334776	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0020	0.0023	<0.0010	<0.0010	<0.0020	<0.0010	-
RPD					-	-	-	-	-	-	-	-	-	-	-	-	-
K12/10	11 Oct 2023	K12/10	Normal	1033940	-	-	-	-	-	-	-	-	-	-	-	-	<0.05
		FD11	Field_D	1033940	-	-	-	-	-	-	-	-	-	-	-	-	<0.05
RPD					-	-	-	-	-	-	-	-	-	-	-	-	0
K12/1E	11 Oct 2023	K12/1E	Normal	1033940	-	-	-	-	-	-	-	-	-	-	-	-	<0.05
		FD14	Field_D	1033940	-	-	-	-	-	-	-	-	-	-	-	-	<0.05
RPD					-	-	-	-	-	-	-	-	-	-	-	-	0
K12/7	11 Oct 2023	K12/7	Normal	1033940	-	-	-	-	-	-	-	-	-	-	-	-	<0.05
		FD12	Field_D	1033940	-	-	-	-	-	-	-	-	-	-	-	-	<0.05
RPD					-	-	-	-	-	-	-	-	-	-	-	-	0
K12/7	11 Oct 2023	K12/7	Normal	1033940	-	-	-	-	-	-	-	-	-	-	-	-	<0.05
		FD13	Interlab_D	ES2334995	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0020	<0.0010	<0.0010	<0.0010	<0.0020	<0.0010	-
RPD					-	-	-	-	-	-	-	-	-	-	-	-	-

Note

Shading	Value Exceeds 95% trigger value for marine waters as shown in Table 3.4.1 of the Australian and New Z
Shading	Value exceeds acceptable RPD value

Ammonia guideline based on a pH of the receiving water body of 8.

Total PAH and Total Phenol PQL calculated as the sum of individual compound PQLs divided by 2.

(L) = Low Reliability Trigger Value

(M) = Moderate Reliability Trigger Value

Appendix D
Table 2
QA/QC - Rinsate Result

Matrix Type			Water		Water		Water	
Sample Type			Rinsate		Trip Blank		Trip Spike	
Field ID			RB01	RB02	TB01	TB02	TS01	TS02
Date			11 Oct 2023	12 Oct 2023	11 Oct 2023	13 Oct 2023	11 Oct 2023	13 Oct 2023
Analyte	Unit	LOR						
Cyanide								
Cyanide (Free)	mg/L	0.005	<0.005	<0.005				
Cyanide (Total)	mg/L	0.005	<0.004	<0.005				
Cyanide (WAD)	mg/L	0.005	<0.005	<0.005				
Nutrients								
Ammonia as N	mg/L	0.01	0.06	0.02				
Metals								
Chromium (hexavalent)	mg/L	0.005	<0.005	<0.005				
Lead	mg/L	0.001	<0.001	<0.001				
Molybdenum	mg/L	0.005	0.006	<0.005				
PAHs - standard 16								
Acenaphthene	mg/L	0.001	<0.001	<0.001				
Acenaphthylene	mg/L	0.001	<0.001	<0.001				
Anthracene	mg/L	0.001	<0.001	<0.001				
Benz(a)anthracene	mg/L	0.001	<0.001	<0.001				
Benzo(a)pyrene	mg/L	0.001	<0.001	<0.001				
Benzo[b+j]fluoranthene	mg/L	0.001	<0.001	<0.001				
Benzo(k)fluoranthene	mg/L	0.001	<0.001	<0.001				
Benzo(g,h,i)perylene	mg/L	0.001	<0.001	<0.001				
Chrysene	mg/L	0.001	<0.001	<0.001				
Dibenz(a,h)anthracene	mg/L	0.001	<0.001	<0.001				
Fluoranthene	mg/L	0.001	<0.001	<0.001				
Fluorene	mg/L	0.001	<0.001	<0.001				
Indeno(1,2,3-c,d)pyrene	mg/L	0.001	<0.001	<0.001				
Naphthalene	mg/L	0.001	<0.001	<0.001	<0.01	<0.01	110%	120%
Phenanthrene	mg/L	0.001	<0.001	<0.001				
Pyrene	mg/L	0.001	<0.001	<0.001				
PAHs (Sum of total) - Lab calc	mg/L	0.001	<0.001	<0.001				
Phenols - total								
Phenolics Total	mg/L	0.05	<0.05	<0.05				
BTEX								
Benzene	mg/L	0.001			<0.001	<0.001	110%	110%
Ethylbenzene	mg/L	0.001			<0.001	<0.001	100%	110%
m&p-Xylenes	mg/L	0.002			<0.002	<0.002	110%	110%
o-Xylene	mg/L	0.001			<0.001	<0.001	99%	100%
Toluene	mg/L	0.001			<0.001	<0.001	100%	110%
Xylenes - Total	mg/L	0.003			<0.003	<0.003	100%	110%
TRH								
TRH C6-C10					<0.02	<0.02	71%	78%

Appendix F

Laboratory Report

GHD Pty Ltd
3/24 Honeysuckle Dve
Newcastle
NSW 2300

NATA Accredited
Accreditation Number 1261
Site Number 18217

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates.

Attention: **Alison Monkley**

Report **1033052-W-V3**
Project name Annual Water Monitoring
Received Date Oct 09, 2023

Client Sample ID			**336A**	**336B**	**FD01**	**K5/5S**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins Sample No.			**N23-Oc0018478**	**N23-Oc0018479**	**N23-Oc0018480**	**N23-Oc0018481**
Date Sampled			**Oct 09, 2023**	**Oct 09, 2023**	**Oct 09, 2023**	**Oct 09, 2023**
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Acenaphthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Acenaphthylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benz(a)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(a)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(b&j)fluoranthene[N07]	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(g.h.i)perylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(k)fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Chrysene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Dibenz(a.h)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Fluorene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Indeno(1.2.3-cd)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Naphthalene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Phenanthrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Total PAH*	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
2-Fluorobiphenyl (surr.)	1	%	64	[Q09]INT	62	77
p-Terphenyl-d14 (surr.)	1	%	91	93	89	90
Ammonia (as N)	0.01	mg/L	1.7	0.46	1.7	0.86
Chromium (hexavalent filtered)	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
Cyanide (free)	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
Cyanide (total)	0.004	mg/L	< 0.004	< 0.004	< 0.004	0.005
Cyanide (weak acid dissoc.)	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
Phenolics (total)	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
Heavy Metals						
Lead (filtered)	0.0001	mg/L	< 0.0001	0.0001	0.0001	-
Molybdenum (filtered)	0.005	mg/L	< 0.005	< 0.005	< 0.005	-

Client Sample ID			FD03	344A	344B	BH21S
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			N23-Oc0018482	N23-Oc0018483	N23-Oc0018484	N23-Oc0018485
Date Sampled			Oct 09, 2023	Oct 09, 2023	Oct 09, 2023	Oct 09, 2023
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Acenaphthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	0.004
Acenaphthylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	0.002
Anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	0.002
Benz(a)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(a)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(b&j)fluoranthene[N07]	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(g.h.i)perylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(k)fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Chrysene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Dibenz(a.h)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	0.004
Fluorene	0.001	mg/L	< 0.001	< 0.001	< 0.001	0.003
Indeno(1.2.3-cd)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Naphthalene	0.001	mg/L	< 0.001	< 0.001	< 0.001	0.47
Phenanthrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	0.008
Pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	0.003
Total PAH*	0.001	mg/L	< 0.001	< 0.001	< 0.001	0.50
2-Fluorobiphenyl (surr.)	1	%	61	103	55	63
p-Terphenyl-d14 (surr.)	1	%	101	94	82	95
Ammonia (as N)	0.01	mg/L	0.85	0.57	2.5	7.4
Chromium (hexavalent filtered)	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
Cyanide (free)	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
Cyanide (total)	0.004	mg/L	< 0.005	0.005	< 0.004	0.22
Cyanide (weak acid dissoc.)	0.005	mg/L	< 0.005	< 0.005	< 0.005	0.096
Phenolics (total)	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
Heavy Metals						
Lead (filtered)	0.0001	mg/L	< 0.0001	0.0002	0.0001	0.0002
Molybdenum (filtered)	0.005	mg/L	< 0.005	< 0.005	< 0.005	0.37

Client Sample ID			FD05	FD06	KS2/1	E61D
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			N23-Oc0018486	N23-Oc0018487	N23-Oc0018488	N23-Oc0018489
Date Sampled			Oct 09, 2023	Oct 09, 2023	Oct 09, 2023	Oct 09, 2023
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Acenaphthene	0.001	mg/L	0.004	< 0.001	< 0.001	< 0.001
Acenaphthylene	0.001	mg/L	0.002	< 0.001	< 0.001	< 0.001
Anthracene	0.001	mg/L	0.002	< 0.001	< 0.001	< 0.001
Benz(a)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(a)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(b&j)fluoranthene[N07]	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(g.h.i)perylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(k)fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Chrysene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Dibenz(a.h)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Fluoranthene	0.001	mg/L	0.003	< 0.001	< 0.001	< 0.001

Client Sample ID			FD05	FD06	KS2/1	E61D
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			N23-Oc0018486	N23-Oc0018487	N23-Oc0018488	N23-Oc0018489
Date Sampled			Oct 09, 2023	Oct 09, 2023	Oct 09, 2023	Oct 09, 2023
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Fluorene	0.001	mg/L	0.003	< 0.001	< 0.001	< 0.001
Indeno(1.2.3-cd)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Naphthalene	0.001	mg/L	0.48	< 0.001	< 0.001	< 0.001
Phenanthrene	0.001	mg/L	0.007	< 0.001	< 0.001	< 0.001
Pyrene	0.001	mg/L	0.002	< 0.001	< 0.001	< 0.001
Total PAH*	0.001	mg/L	0.50	< 0.001	< 0.001	< 0.001
2-Fluorobiphenyl (surr.)	1	%	[Q09]INT	68	59	51
p-Terphenyl-d14 (surr.)	1	%	83	79	85	98
Ammonia (as N)	0.01	mg/L	7.3	0.07	0.06	2.1
Chromium (hexavalent filtered)	0.005	mg/L	< 0.005	-	-	< 0.005
Cyanide (free)	0.005	mg/L	0.014	< 0.005	< 0.005	< 0.005
Cyanide (total)	0.004	mg/L	0.27	< 0.004	< 0.004	< 0.004
Cyanide (weak acid dissoc.)	0.005	mg/L	0.12	< 0.005	< 0.005	< 0.005
Phenolics (total)	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
Chromium (hexavalent)	0.005	mg/L	-	< 0.005	< 0.005	-
Heavy Metals						
Lead	0.0001	mg/L	-	0.013	0.014	-
Lead (filtered)	0.0001	mg/L	0.0002	-	-	< 0.01
Molybdenum	0.005	mg/L	-	0.090	0.091	-
Molybdenum (filtered)	0.005	mg/L	0.33	-	-	0.014

Client Sample ID			FD07
Sample Matrix			Water
Eurofins Sample No.			N23-Oc0018490
Date Sampled			Oct 09, 2023
Test/Reference	LOR	Unit	
Polycyclic Aromatic Hydrocarbons			
Acenaphthene	0.001	mg/L	< 0.001
Acenaphthylene	0.001	mg/L	< 0.001
Anthracene	0.001	mg/L	< 0.001
Benz(a)anthracene	0.001	mg/L	< 0.001
Benzo(a)pyrene	0.001	mg/L	< 0.001
Benzo(b&j)fluoranthene[N07]	0.001	mg/L	< 0.001
Benzo(g.h.i)perylene	0.001	mg/L	< 0.001
Benzo(k)fluoranthene	0.001	mg/L	< 0.001
Chrysene	0.001	mg/L	< 0.001
Dibenz(a.h)anthracene	0.001	mg/L	< 0.001
Fluoranthene	0.001	mg/L	< 0.001
Fluorene	0.001	mg/L	< 0.001
Indeno(1.2.3-cd)pyrene	0.001	mg/L	< 0.001
Naphthalene	0.001	mg/L	< 0.001
Phenanthrene	0.001	mg/L	< 0.001
Pyrene	0.001	mg/L	< 0.001
Total PAH*	0.001	mg/L	< 0.001
2-Fluorobiphenyl (surr.)	1	%	[Q09]INT
p-Terphenyl-d14 (surr.)	1	%	83

Client Sample ID			FD07
Sample Matrix			**Water**
Eurofins Sample No.			**N23-Oc0018490**
Date Sampled			**Oct 09, 2023**
Test/Reference	LOR	Unit	
Ammonia (as N)	0.01	mg/L	2.1
Chromium (hexavalent filtered)	0.005	mg/L	< 0.005
Cyanide (free)	0.005	mg/L	< 0.005
Cyanide (total)	0.004	mg/L	< 0.004
Cyanide (weak acid dissoc.)	0.005	mg/L	< 0.005
Phenolics (total)	0.05	mg/L	< 0.05
Heavy Metals			
Lead (filtered)	0.0001	mg/L	< 0.01
Molybdenum (filtered)	0.005	mg/L	0.014

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Polycyclic Aromatic Hydrocarbons	Sydney	Oct 12, 2023	7 Days
- Method: LTM-ORG-2130 PAH and Phenols in Soil and Water			
Ammonia (as N)	Sydney	Oct 12, 2023	28 Days
- Method: LTM-INO-4200 Ammonia by Discrete Analyser			
Chromium (hexavalent filtered)	Sydney	Oct 12, 2023	28 Days
- Method: E057 Speciated Chromium			
Cyanide (free)	Sydney	Oct 12, 2023	14 Days
- Method: E054 Free Cyanide			
Cyanide (total)	Sydney	Nov 01, 2023	14 Days
- Method: E054 Total Cyanide			
Cyanide (weak acid dissoc.)	Melbourne	Oct 13, 2023	14 Days
- Method: LTM-INO-4020 Total Free WAD Cyanide by CFA			
Phenolics (total)	Melbourne	Oct 13, 2023	7 Days
- Method: LTM-INO-4050 Total Phenolics in Waters and solids by CFA			
Chromium (hexavalent)	Sydney	Oct 12, 2023	28 Days
- Method: In-house method E057.1			
Heavy Metals	Sydney	Oct 12, 2023	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Heavy Metals (filtered)	Sydney	Oct 12, 2023	180 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			

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Eurofins Environment Testing Australia Pty Ltd
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Dandenong South	Grovedale	Girraween	Mitchell	Murarrie	Mayfield West NSW 2304
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Tel: +61 3 8564 5000	Tel: +61 3 8564 5000	Tel: +61 2 9900 8400	Tel: +61 2 6113 8091	Tel: +61 7 3902 4600	NATA# 1261
NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	Site# 25079 & 25289
Site# 1254	Site# 25403	Site# 18217	Site# 25466	Site# 20794	

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IANZ# 1327	IANZ# 1290	IANZ# 1402

Company Name: GHD Pty Ltd NEWCASTLE
Address: 3/24 Honeysuckle Dve
Newcastle
NSW 2300

Project Name: Annual Water Monitoring

Order No.:
Report #: 1033052
Phone: 02 4979 9999
Fax: 02 4979 9988

Received: Oct 9, 2023 3:10 PM
Due: Oct 16, 2023
Priority: 5 Day
Contact Name: Alison Monkley

Eurofins Analytical Services Manager : Andrew Black

Sample Detail						Ammonia (as N)	Chromium (hexavalent filtered)	Chromium (hexavalent)	Cyanide (free)	Cyanide (total)	Cyanide (weak acid dissoc.)	Lead	Lead (filtered)	Molybdenum	Molybdenum (filtered)	Phenolics (total)	Polycyclic Aromatic Hydrocarbons
Melbourne Laboratory - NATA # 1261 Site # 1254											X					X	X
Sydney Laboratory - NATA # 1261 Site # 18217						X	X	X	X	X		X	X	X	X		X
External Laboratory																	
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**												
1	336A	Oct 09, 2023		Water	N23-Oc0018478	X	X		X	X	X		X		X	X	X
2	336B	Oct 09, 2023		Water	N23-Oc0018479	X	X		X	X	X		X		X	X	X
3	FD01	Oct 09, 2023		Water	N23-Oc0018480	X	X		X	X	X		X		X	X	X
4	K5/5S	Oct 09, 2023		Water	N23-Oc0018481	X	X		X	X	X					X	X
5	FD03	Oct 09, 2023		Water	N23-Oc0018482	X	X		X	X	X		X		X	X	X
6	344A	Oct 09, 2023		Water	N23-Oc0018483	X	X		X	X	X		X		X	X	X
7	344B	Oct 09, 2023		Water	N23-Oc0018484	X	X		X	X	X		X		X	X	X
8	BH21S	Oct 09, 2023		Water	N23-Oc0018485	X	X		X	X	X		X		X	X	X
9	FD05	Oct 09, 2023		Water	N23-Oc0018486	X	X		X	X	X		X		X	X	X
10	FD06	Oct 09, 2023		Water	N23-Oc0018487	X		X	X	X	X	X		X		X	X
11	KS2/1	Oct 09, 2023		Water	N23-Oc0018488	X		X	X	X	X	X		X		X	X
12	E61D	Oct 09, 2023		Water	N23-Oc0018489	X	X		X	X	X		X		X	X	X
13	FD07	Oct 09, 2023		Water	N23-Oc0018490	X	X		X	X	X		X		X	X	X

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Eurofins Environment Testing Australia Pty Ltd
ABN: 50 005 085 521

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NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	Site# 25079 & 25289
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IANZ# 1327	IANZ# 1290	IANZ# 1402

Company Name: GHD Pty Ltd NEWCASTLE
Address: 3/24 Honeysuckle Dve
Newcastle
NSW 2300

Project Name: Annual Water Monitoring

Order No.:
Report #: 1033052
Phone: 02 4979 9999
Fax: 02 4979 9988

Received: Oct 9, 2023 3:10 PM
Due: Oct 16, 2023
Priority: 5 Day
Contact Name: Alison Monkley

Eurofins Analytical Services Manager : Andrew Black

Sample Detail	Ammonia (as N)	Chromium (hexavalent filtered)	Chromium (hexavalent)	Cyanide (free)	Cyanide (total)	Cyanide (weak acid dissoc.)	Lead	Lead (filtered)	Molybdenum	Molybdenum (filtered)	Phenolics (total)	Polycyclic Aromatic Hydrocarbons
Melbourne Laboratory - NATA # 1261 Site # 1254						X					X	X
Sydney Laboratory - NATA # 1261 Site # 18217	X	X	X	X	X		X	X	X	X		X
Test Counts	13	11	2	13	13	13	2	10	2	10	13	13

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follow guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013. They are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry weight basis unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion unless otherwise stated.
4. For CEC results where the sample's origin is unknown or environmentally contaminated, the results should be used advisedly.
5. Actual LORs are matrix dependent. Quoted LORs may be raised where sample extracts are diluted due to interferences.
6. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
7. SVOC analysis on waters is performed on homogenised, unfiltered samples unless noted otherwise.
8. Samples were analysed on an 'as received' basis.
9. Information identified in this report with blue colour indicates data provided by customers that may have an impact on the results.
10. This report replaces any interim results previously issued.

Holding Times

Please refer to the 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours before sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and despite any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling; therefore, compliance with these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether, the holding time is 7 days; however, for all other VOCs, such as BTEX or C6-10 TRH, the holding time is 14 days.

Units

mg/kg: milligrams per kilogram
mg/L: milligrams per litre
µg/L: micrograms per litre
ppm: parts per million
ppb: parts per billion
%: Percentage
org/100 mL: Organisms per 100 millilitres
NTU: Nephelometric Turbidity Units
MPN/100 mL: Most Probable Number of organisms per 100 millilitres
CFU: Colony forming unit

Terms

APHA	American Public Health Association
CEC	Cation Exchange Capacity
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where moisture has been determined on a solid sample, the result is expressed on a dry weight basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples, these are performed on laboratory-certified clean sands and in the case of water samples, these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC represents the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment; however free tributyltin was measured, and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site-specific Sampling Analysis and Quality Plan (SAQP) have been implemented.

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30%; however the following acceptance guidelines are equally

applicable: Results <10 times the LOR: No Limit

Results between 10-20 times the LOR: RPD must lie between 0-50%

Results >20 times the LOR: RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range, not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%

PFAS field samples that contain surrogate recoveries above the QC limit designated in QSM 5.4, where no positive PFAS results have been reported, have been reviewed, and no data was affected.

QC Data General Comments

1. Where a result is reported as less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown are not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery, the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results, a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data; thus, it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	mg/L	< 0.001			0.001	Pass	
Acenaphthylene	mg/L	< 0.001			0.001	Pass	
Anthracene	mg/L	< 0.001			0.001	Pass	
Benz(a)anthracene	mg/L	< 0.001			0.001	Pass	
Benzo(a)pyrene	mg/L	< 0.001			0.001	Pass	
Benzo(b&j)fluoranthene	mg/L	< 0.001			0.001	Pass	
Benzo(g.h.i)perylene	mg/L	< 0.001			0.001	Pass	
Benzo(k)fluoranthene	mg/L	< 0.001			0.001	Pass	
Chrysene	mg/L	< 0.001			0.001	Pass	
Dibenz(a.h)anthracene	mg/L	< 0.001			0.001	Pass	
Fluoranthene	mg/L	< 0.001			0.001	Pass	
Fluorene	mg/L	< 0.001			0.001	Pass	
Indeno(1.2.3-cd)pyrene	mg/L	< 0.001			0.001	Pass	
Naphthalene	mg/L	< 0.001			0.001	Pass	
Phenanthrene	mg/L	< 0.001			0.001	Pass	
Pyrene	mg/L	< 0.001			0.001	Pass	
Method Blank							
Ammonia (as N)	mg/L	< 0.01			0.01	Pass	
Chromium (hexavalent filtered)	mg/L	< 0.005			0.005	Pass	
Cyanide (free)	mg/L	< 0.005			0.005	Pass	
Cyanide (total)	mg/L	< 0.005			0.004	Fail	
Cyanide (weak acid dissoc.)	mg/L	< 0.005			0.005	Pass	
Phenolics (total)	mg/L	< 0.05			0.05	Pass	
Chromium (hexavalent)	mg/L	< 0.005			0.005	Pass	
Method Blank							
Heavy Metals							
Lead	mg/L	0.0001			0.0001	Pass	
Molybdenum	mg/L	< 0.005			0.005	Pass	
LCS - % Recovery							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	%	116			70-130	Pass	
Acenaphthylene	%	102			70-130	Pass	
Anthracene	%	130			70-130	Pass	
Benz(a)anthracene	%	112			70-130	Pass	
Benzo(a)pyrene	%	123			70-130	Pass	
Benzo(b&j)fluoranthene	%	115			70-130	Pass	
Benzo(g.h.i)perylene	%	119			70-130	Pass	
Benzo(k)fluoranthene	%	127			70-130	Pass	
Chrysene	%	91			70-130	Pass	
Dibenz(a.h)anthracene	%	114			70-130	Pass	
Fluoranthene	%	119			70-130	Pass	
Fluorene	%	106			70-130	Pass	
Indeno(1.2.3-cd)pyrene	%	114			70-130	Pass	
Naphthalene	%	86			70-130	Pass	
Phenanthrene	%	113			70-130	Pass	
Pyrene	%	122			70-130	Pass	
LCS - % Recovery							
Ammonia (as N)	%	97			70-130	Pass	
Chromium (hexavalent filtered)	%	118			70-130	Pass	
Cyanide (free)	%	107			70-130	Pass	

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Cyanide (total)			%	109			70-130	Pass	
Cyanide (weak acid dissoc.)			%	107			70-130	Pass	
Phenolics (total)			%	103			70-130	Pass	
Chromium (hexavalent)			%	118			70-130	Pass	
LCS - % Recovery									
Heavy Metals									
Lead			%	90			80-120	Pass	
Molybdenum			%	103			80-120	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Spike - % Recovery									
				Result 1					
Phenolics (total)	K23-Oc0024382	NCP	%	101			70-130	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Lead (filtered)	N23-Oc0021652	NCP	%	80			75-125	Pass	
Molybdenum (filtered)	N23-Oc0021652	NCP	%	116			75-125	Pass	
Spike - % Recovery									
				Result 1					
Cyanide (free)	N23-Oc0018479	CP	%	116			70-130	Pass	
Cyanide (total)	N23-Oc0018479	CP	%	116			70-130	Pass	
Spike - % Recovery									
				Result 1					
Chromium (hexavalent filtered)	N23-Oc0018480	CP	%	118			70-130	Pass	
Chromium (hexavalent)	N23-Oc0018480	CP	%	118			70-130	Pass	
Spike - % Recovery									
				Result 1					
Cyanide (free)	N23-Oc0018486	CP	%	94			70-130	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Lead	S23-Oc0024121	NCP	%	90			75-125	Pass	
Molybdenum	S23-Oc0024121	NCP	%	99			75-125	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
				Result 1	Result 2	RPD			
Cyanide (free)	N23-Oc0018478	CP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Lead (filtered)	N23-Oc0018478	CP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass	
Molybdenum (filtered)	N23-Oc0018478	CP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Phenolics (total)	N23-Oc0018485	CP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Lead	N23-Oc0021236	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Molybdenum	N23-Oc0021236	NCP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Ammonia (as N)	N23-Oc0018489	CP	mg/L	2.1	2.1	3.0	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Chromium (hexavalent filtered)	N23-Oc0018490	CP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
Chromium (hexavalent)	N23-Oc0018490	CP	mg/L	< 0.005	< 0.005	<1	30%	Pass	

Comments

V3- new version with repeated cyanide on all samples as per client request.

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	No
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs
Q09	The Surrogate recovery is outside of the recommended acceptance criteria due to matrix interference. Acceptance criteria were met for all other QC

Authorised by:

Andrew Black	Analytical Services Manager
Caitlin Breeze	Senior Analyst-Inorganic
Fang Yee Tan	Senior Analyst-Metal
Mary Makarios	Senior Analyst-Inorganic
Roopesh Rangarajan	Senior Analyst-Organic
Ryan Phillips	Senior Analyst-Inorganic

Glenn Jackson
Managing Director

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

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Tel: +61 3 8564 5000	Tel: +61 3 8564 5000	Tel: +61 2 9900 8400	Tel: +61 2 6113 8091	Tel: +61 7 3902 4600	NATA# 1261
NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	Site# 25079 & 25289
Site# 1254	Site# 25403	Site# 18217	Site# 25466	Site# 20794	

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IANZ# 1327	IANZ# 1290	IANZ# 1402

Company Name: GHD Pty Ltd NEWCASTLE
Address: 3/24 Honeysuckle Dve
Newcastle
NSW 2300

Project Name: Annual Water Monitoring

Order No.:
Report #: 1033052
Phone: 02 4979 9999
Fax: 02 4979 9988

Received: Oct 9, 2023 3:10 PM
Due: Oct 16, 2023
Priority: 5 Day
Contact Name: Alison Monkley

Eurofins Analytical Services Manager : Andrew Black

Sample Detail						Ammonia (as N)	Chromium (hexavalent filtered)	Chromium (hexavalent)	Cyanide (free)	Cyanide (total)	Cyanide (weak acid dissoc.)	Lead	Lead (filtered)	Molybdenum	Molybdenum (filtered)	Phenolics (total)	Polycyclic Aromatic Hydrocarbons
Melbourne Laboratory - NATA # 1261 Site # 1254											X					X	X
Sydney Laboratory - NATA # 1261 Site # 18217						X	X	X	X	X		X	X	X	X		X
External Laboratory																	
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**												
1	336A	Oct 09, 2023		Water	N23-Oc0018478	X	X		X	X	X		X		X	X	X
2	336B	Oct 09, 2023		Water	N23-Oc0018479	X	X		X	X	X		X		X	X	X
3	FD01	Oct 09, 2023		Water	N23-Oc0018480	X	X		X	X	X		X		X	X	X
4	K5/5S	Oct 09, 2023		Water	N23-Oc0018481	X	X		X	X	X					X	X
5	FD03	Oct 09, 2023		Water	N23-Oc0018482	X	X		X	X	X		X		X	X	X
6	344A	Oct 09, 2023		Water	N23-Oc0018483	X	X		X	X	X		X		X	X	X
7	344B	Oct 09, 2023		Water	N23-Oc0018484	X	X		X	X	X		X		X	X	X
8	BH21S	Oct 09, 2023		Water	N23-Oc0018485	X	X		X	X	X		X		X	X	X
9	FD05	Oct 09, 2023		Water	N23-Oc0018486	X	X		X	X	X		X		X	X	X
10	FD06	Oct 09, 2023		Water	N23-Oc0018487	X		X	X	X	X	X		X		X	X
11	KS2/1	Oct 09, 2023		Water	N23-Oc0018488	X		X	X	X	X	X		X		X	X
12	E61D	Oct 09, 2023		Water	N23-Oc0018489	X	X		X	X	X		X		X	X	X
13	FD07	Oct 09, 2023		Water	N23-Oc0018490	X	X		X	X	X		X		X	X	X

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Tel: +61 3 8564 5000	Tel: +61 3 8564 5000	Tel: +61 2 9900 8400	Tel: +61 2 6113 8091	Tel: +61 7 3902 4600	NATA# 1261
NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	Site# 25079 & 25289
Site# 1254	Site# 25403	Site# 18217	Site# 25466	Site# 20794	

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IANZ# 1327	IANZ# 1290	IANZ# 1402

Company Name: GHD Pty Ltd NEWCASTLE
Address: 3/24 Honeysuckle Dve
Newcastle
NSW 2300

Project Name: Annual Water Monitoring

Order No.:
Report #: 1033052
Phone: 02 4979 9999
Fax: 02 4979 9988

Received: Oct 9, 2023 3:10 PM
Due: Oct 16, 2023
Priority: 5 Day
Contact Name: Alison Monkley

Eurofins Analytical Services Manager : Andrew Black

Sample Detail	Ammonia (as N)	Chromium (hexavalent filtered)	Chromium (hexavalent)	Cyanide (free)	Cyanide (total)	Cyanide (weak acid dissoc.)	Lead	Lead (filtered)	Molybdenum	Molybdenum (filtered)	Phenolics (total)	Polycyclic Aromatic Hydrocarbons
Melbourne Laboratory - NATA # 1261 Site # 1254						X					X	X
Sydney Laboratory - NATA # 1261 Site # 18217	X	X	X	X	X		X	X	X	X		X
Test Counts	13	11	2	13	13	13	2	10	2	10	13	13

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Eurofins Environment Testing Australia Pty Ltd

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NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	Site# 25079 & 25289
Site# 1254	Site# 25403	Site# 18217	Site# 25466	Site# 20794	

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IANZ# 1327	IANZ# 1290	IANZ# 1402

Sample Receipt Advice

Company name:	GHD Pty Ltd NEWCASTLE
Contact name:	Alison Monkley
Project name:	Annual Water Monitoring
Project ID:	Not provided
Turnaround time:	5 Day
Date/Time received	Oct 9, 2023 3:10 PM
Eurofins reference	1033052

Sample Information

✓	A detailed list of analytes logged into our LIMS, is included in the attached summary table.
✓	Sample Temperature of chilled sample on the batch as recorded by Eurofins Sample Receipt : 26.2 degrees Celsius.
✓	All samples have been received as described on the above COC.
✓	COC has been completed correctly.
✗	Attempt to chill was evident.
✓	Appropriately preserved sample containers have been used.
✓	All samples were received in good condition.
✓	Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
✓	Appropriate sample containers have been used.
✓	Sample containers for volatile analysis received with zero headspace.
✗	Split sample sent to requested external lab.
✗	Some samples have been subcontracted.
N/A	Custody Seals intact (if used).

Notes

Contact

If you have any questions with respect to these samples, please contact your Analytical Services Manager:

Andrew Black on phone : (+61) 2 9900 8490 or by email: AndrewBlack@eurofins.com

Results will be delivered electronically via email to Alison Monkley - alison.monkley@ghd.com.au.

Note: A copy of these results will also be delivered to the general GHD Pty Ltd NEWCASTLE email address.

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CHAIN OF CUSTODY RECORD

Page 1 of 1

CLIENT DETAILS

Company Name: GHD
Office Address: 24 Honeysuckle Drive, Newcastle 2300

Contact Name: Nina Foley
Project Manager: Alison Monkley
Email for results: Alison.monkley@ghd.com; Nina.foley@ghd.com

COC Number:
Eurofins | mgt quote ID: 2309266HDN
Data output format: ESDAT

Special Directions & Comments: Refer to attached sheets for analysis

Eurofins | mgt DI water batch number:

Analytes

	Sample ID	Date	Matrix	Ammonia	Phenols	Cyanide (weak acid and total)	Lead (dissolved)	Molybdenum (dis)	Hex Chromium (dis)	Total PAH	Lead (total)	Molybdenum (tot)	Hex Chromium (tot)
1	336A	9/10/23	W										
2	336B												
3	FD01			X	X	X	X	X	X	X			
4	KS1/5S												
5	FD03			X	X	X	X	X	X	X			
6	344A												
7	344B												
8	BH2/S												
9	FD05			X	X	X	X	X	X	X			
10	KS2/1												
11	FD06			X	X	X	[redacted]			X	X	X	X
12	EQ1D												
13	FD07			X	X	X	X	X	X	X			
15													
16													

Some common holding times (with correct preservation). For further information contact the lab

Waters		Soils	
BTEX, MAH, VOC	14 days	BTEX, MAH, VOC	14 days
TRH, PAH, Phenols, Pesticides	7 days	TRH, PAH, Phenols, Pesticides	14 days
Heavy Metals	6 months	Heavy Metals	6 months
Mercury, CrVI	28 days	Mercury, CrVI	28 days
Microbiological testing	24 hours	Microbiological testing	72 hours
BOD, Nitrate, Nitrite, Total N	2 days	Anions	28 days
Solids - TSS, TDS etc	7 days	SPOCAS, pH Field and FOX, CrS	24 hours
Ferrous Iron	7 days	ASLP, TCLP	7 days

Containers:

1LP	250P	125P	1LA	40mL vial	125mL A	Jar

Sample comments:

Laboratory Staff

Relinquished By: Nina Foley
Date & Time:: 9/10/23 7:10pm
Signature:

Received By: JRandall
Date & Time: 3:10 pm 9/10
Signature:

Turn around time

1 DAY ☐ 2 DAY ☐ 3 DAY ☐
5 DAY ☑ 10 DAY ☐ Other:

Method Of Shipment

☐ Courier
☑ Hand Delivered
☐ Postal
Courier Consignment # :

Temperature on arrival: 26.2

Report number: 103305 2

Table 7.2 Sampling analytical plan - Shallow Estuarine

Sample location	Ammonia	Phenols	Cyanide (weak acid, dissociable and free)	Cyanide (total)	Hexavalent chromium	Molybdenum (dissolved)	Lead (dissolved)	Total PAH
336B	X	X	X	X	X	X	X	X
344B	X	X	X	X	X	X	X	X
BH21S (replacement well for K3/1W)	X	X	X	X	X	X	X	X
BHe29S	X	X	X	X	X	X	X	X
E91D	X	X	X	X	X	X	X	X
GHD01S	X	X	X	X	X	X	X	X
K10/2NN	X		X	X	X	X	X	X
K11/1	X	X	X	X	X	X	X	X
K11/2E	X	X	X	X	X	X	X	X
K11/3C	X	X	X	X	X	X	X	X

Sample location	Ammonia	Phenols	Cyanide (weak acid, dissociable and free)	Cyanide (total)	Hexavalent chromium	Molybdenum (dissolved)	Lead (dissolved)	Total PAH
K12/10E	X	X	X	X	X	X	X	X
K12/1W	X	X	X	X	X	X	X	X
K12/5	X	X	X	X	X	X	X	X
K12/7	X	X	X	X	X	X	X	X
K12/9	X	X	X	X	X	X	X	X
K2/6NN	X	X	X	X	X			X
K7/2S	X	X	X	X	X			X
K7/4S	X		X	X	X	X	X	X
K8/6W	X	X	X	X	X	X	X	X
K9/2W	X		X	X	X	X		X
K9/3S	X	X	X	X	X	X	X	X
K9/4E	X		X	X	X			X
NCIG1 (replacement well for K12/3W)	X	X	X	X	X	X	X	X
QA/QC - duplicate	1	1	1	1	1	1	1	1
QA/QC - triplicate								

Table 7.1 Sampling analytical plan – Fill Aquifer

Sample location	Ammonia	Phenols	Cyanide (weak acid, dissociable and free)	Cyanide (total)	Hexavalent chromium	Molybdenum (dissolved)	Lead (dissolved)	Total PAH
336A ✓	X	X	X	X	X	X	X	X
344A ✓	X	X	X	X	X	X	X	X
~~E61S – Dry~~	X	X	X	X	X	X	X	X
GHD01N	X	X	X	X	X	X	X	X
K10/2	X		X		X	X	X	X
K10/2N	X		X		X	X	X	X
K5/4	X		X	X	X			X
~~K5/5N Dry~~	X		X		X			X
K5/6N	X	X	X	X	X			X
K7/1	X	X	X	X	X	X	X	X
K7/4N	X		X	X	X	X		X
K8/5E	X		X	X	X	X	X	X
~~QA/QC – Duplicate~~	1	1	1	1	1	1	1	1
QA/QC – triplicate ✓	1	1	1	1	1	1	1	1

Table 7.3 Sampling analytical plan – Deep estuarine

Sample location	Ammonia	Phenols	Cyanide (weak acid, dissociable and free)	Cyanide (total)	Hexavalent chromium	Molybdenum (dissolved)	Lead (dissolved)	Total PAH
K11/1S	X	X	X	X	X	X	X	X
K11/2W	X	X	X	X	X	X	X	X
K11/3W	X	X	X	X	X	X	X	X
K12/1D	X	X	X	X	X	X	X	X
K12/1E	X	X	X	X	X	X	X	X
K12/4N	X	X	X	X	X	X	X	X
K12/7E	X	X	X	X	X	X	X	X
K12/9E	X	X	X	X	X	X	X	X
K5/5S ✓	X	X	X	X	X			X
K5/6S	X		X	X	X			X
K7/2N	X	X	X	X	X			X
K9/2E	X		X	X	X	X		X
K9/3N	X	X	X	X	X	X	X	X
K9/4W	X		X	X	X			X

Sample location	Ammonia	Phenols	Cyanide (weak acid, dissociable and free)	Cyanide (total)	Hexavalent chromium	Molybdenum (dissolved)	Lead (dissolved)	Total PAH
NCIG2 (replacement well for K12/2N)	X	X	X	X	X	X	X	X
QA/QC – duplicate	1	1	1	1	1	1	1	1
QA/QC – triplicate	1 ✓	1	1	1	1	1	1	1

Table 7.4 Sampling and analytical plan – Surface Water

Sample location	Ammonia	Phenols	Cyanide (weak acid, dissociable and free)	Cyanide (total)	Hexavalent chromium	Molybdenum (total)	Lead (total)	Total PAH
KS1/3	X	X	X	X	X	X	X	X
KS10/1	X	X	X	X	X	X	X	X
KS12/6	X	X	X	X	X	X	X	X
KS2/1 ✓	X	X	X	X	X	X	X	X
KS7/1	X	X	X	X	X	X	X	X
QA/QC – duplicate	1	1	1	1	1	1	1	1
QA/QC – triplicate	1	1	1	1	1	1	1	1

dissolved

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Tel: +61 3 8564 5000	Tel: +61 3 8564 5000	Tel: +61 2 9900 8400	Tel: +61 2 6113 8091	Tel: +61 7 3902 4600	NATA# 1261
NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	Site# 25079 & 25289
Site# 1254	Site# 25403	Site# 18217	Site# 25466	Site# 20794	

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Site# 2370

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Auckland 1061	Christchurch 7675	Tauranga 3112
Tel: +64 9 526 4551	Tel: +64 3 343 5201	Tel: +64 9 525 0568
IANZ# 1327	IANZ# 1290	IANZ# 1402

Sample Receipt Advice

Company name:	GHD Pty Ltd NEWCASTLE
Contact name:	Alison Monkley
Project name:	Not provided
Project ID:	Not provided
Turnaround time:	5 Day
Date/Time received	Oct 10, 2023 2:00 PM
Eurofins reference	1033472

Sample Information

✓	A detailed list of analytes logged into our LIMS, is included in the attached summary table.
✓	Sample Temperature of chilled sample on the batch as recorded by Eurofins Sample Receipt : 18.7 degrees Celsius.
✓	All samples have been received as described on the above COC.
✓	COC has been completed correctly.
✗	Attempt to chill was evident.
✓	Appropriately preserved sample containers have been used.
✓	All samples were received in good condition.
✓	Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
✓	Appropriate sample containers have been used.
✓	Sample containers for volatile analysis received with zero headspace.
✗	Split sample sent to requested external lab.
✗	Some samples have been subcontracted.
N/A	Custody Seals intact (if used).

Notes

Contact

If you have any questions with respect to these samples, please contact your Analytical Services Manager:

Andrew Black on phone : (+61) 2 9900 8490 or by email: AndrewBlack@eurofins.com

Results will be delivered electronically via email to Alison Monkley - alison.monkley@ghd.com.au.

Note: A copy of these results will also be delivered to the general GHD Pty Ltd NEWCASTLE email address.

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web: www.eurofins.com.au
email: EnviroSales@eurofins.com

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ABN: 50 005 085 521

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Tel: +61 3 8564 5000	Tel: +61 3 8564 5000	Tel: +61 2 9900 8400	Tel: +61 2 6113 8091	Tel: +61 7 3902 4600	NATA# 1261
NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	Site# 25079 & 25289
Site# 1254	Site# 25403	Site# 18217	Site# 25466	Site# 20794	

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Tel: +64 9 526 4551	Tel: +64 3 343 5201	Tel: +64 9 525 0568
IANZ# 1327	IANZ# 1290	IANZ# 1402

Company Name: GHD Pty Ltd NEWCASTLE
Address: 3/24 Honeysuckle Dve
Newcastle
NSW 2300

Project Name:

Order No.:
Report #: 1033472
Phone: 02 4979 9999
Fax: 02 4979 9988

Received: Oct 10, 2023 2:00 PM
Due: Oct 17, 2023
Priority: 5 Day
Contact Name: Alison Monkley

Eurofins Analytical Services Manager : Andrew Black

Sample Detail						Ammonia (as N)	Chromium (hexavalent filtered)	Chromium (hexavalent)	Cyanide (free)	Cyanide (total)	Cyanide (weak acid dissoc.)	Lead	Lead (filtered)	Molybdenum	Molybdenum (filtered)	Phenolics (total)	Polycyclic Aromatic Hydrocarbons
Melbourne Laboratory - NATA # 1261 Site # 1254						X					X					X	X
Sydney Laboratory - NATA # 1261 Site # 18217							X	X	X	X		X	X	X	X		X
External Laboratory																	
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**												
1	KS1/3	Oct 10, 2023		Water	N23-Oc0021640	X		X	X	X	X	X				X	X
2	FD08	Oct 10, 2023		Water	N23-Oc0021641	X		X	X	X	X	X		X		X	X
3	K5/6NN	Oct 10, 2023		Water	N23-Oc0021642	X	X		X	X	X					X	X
4	K5/6N	Oct 10, 2023		Water	N23-Oc0021643	X	X		X	X	X					X	X
5	K5/6S	Oct 10, 2023		Water	N23-Oc0021644	X	X		X	X	X						X
6	K7/1	Oct 10, 2023		Water	N23-Oc0021645	X	X		X	X	X		X		X	X	X
7	K7/2S	Oct 10, 2023		Water	N23-Oc0021646	X	X		X	X	X					X	X
8	K7/2N	Oct 10, 2023		Water	N23-Oc0021647	X	X		X	X	X					X	X
9	K9/2W	Oct 10, 2023		Water	N23-Oc0021648	X	X		X	X	X		X		X		X
10	K9/2E	Oct 10, 2023		Water	N23-Oc0021649	X	X		X	X	X				X		X
11	K9/4W	Oct 10, 2023		Water	N23-Oc0021650	X	X		X	X	X						X
12	K9/4E	Oct 10, 2023		Water	N23-Oc0021651	X	X		X	X	X						X
13	FD10	Oct 10, 2023		Water	N23-Oc0021652	X	X		X	X	X		X		X	X	X

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Tel: +61 3 8564 5000	Tel: +61 3 8564 5000	Tel: +61 2 9900 8400	Tel: +61 2 6113 8091	Tel: +61 7 3902 4600	NATA# 1261
NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	Site# 25079 & 25289
Site# 1254	Site# 25403	Site# 18217	Site# 25466	Site# 20794	

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IANZ# 1327	IANZ# 1290	IANZ# 1402

Company Name: GHD Pty Ltd NEWCASTLE
Address: 3/24 Honeysuckle Dve
Newcastle
NSW 2300

Project Name:

Order No.:
Report #: 1033472
Phone: 02 4979 9999
Fax: 02 4979 9988

Received: Oct 10, 2023 2:00 PM
Due: Oct 17, 2023
Priority: 5 Day
Contact Name: Alison Monkley

Eurofins Analytical Services Manager : Andrew Black

Sample Detail	Ammonia (as N)	Chromium (hexavalent filtered)	Chromium (hexavalent)	Cyanide (free)	Cyanide (total)	Cyanide (weak acid dissoc.)	Lead	Lead (filtered)	Molybdenum	Molybdenum (filtered)	Phenolics (total)	Polycyclic Aromatic Hydrocarbons
Melbourne Laboratory - NATA # 1261 Site # 1254	X					X					X	X
Sydney Laboratory - NATA # 1261 Site # 18217		X	X	X	X		X	X	X	X		X
Test Counts	13	11	2	13	13	13	2	3	1	4	8	13

GHD Pty Ltd
3/24 Honeysuckle Dve
Newcastle
NSW 2300

NATA Accredited
Accreditation Number 1261
Site Number 18217

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates.

Attention: **Alison Monkley**

Report **1033472-W-V2**
Project name
Received Date Oct 10, 2023

Client Sample ID			**KS1/3**	**FD08**	**K5/6NN**	**K5/6N**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins Sample No.			**N23-Oc0021640**	**N23-Oc0021641**	**N23-Oc0021642**	**N23-Oc0021643**
Date Sampled			**Oct 10, 2023**	**Oct 10, 2023**	**Oct 10, 2023**	**Oct 10, 2023**
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Acenaphthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Acenaphthylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benz(a)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(a)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(b&j)fluoranthene[N07]	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(g.h.i)perylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(k)fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Chrysene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Dibenz(a.h)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Fluorene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Indeno(1.2.3-cd)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Naphthalene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Phenanthrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Total PAH*	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
2-Fluorobiphenyl (surr.)	1	%	[Q09]INT	[Q09]INT	57	[Q09]INT
p-Terphenyl-d14 (surr.)	1	%	56	62	119	94
Ammonia (as N)	0.01	mg/L	0.29	0.21	0.35	0.64
Chromium (hexavalent)	0.005	mg/L	< 0.005	< 0.005	-	-
Cyanide (free)	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
Cyanide (total)	0.004	mg/L	< 0.005	< 0.005	< 0.004	0.011
Cyanide (weak acid dissoc.)	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
Phenolics (total)	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
Chromium (hexavalent filtered)	0.005	mg/L	-	-	< 0.005	< 0.005
Heavy Metals						
Lead	0.001	mg/L	0.009	0.009	-	-
Molybdenum	0.005	mg/L	-	0.007	-	-

Client Sample ID			K5/6S	K7/1	K7/2S	K7/2N
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			N23-Oc0021644	N23-Oc0021645	N23-Oc0021646	N23-Oc0021647
Date Sampled			Oct 10, 2023	Oct 10, 2023	Oct 10, 2023	Oct 10, 2023
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Acenaphthene	0.001	mg/L	< 0.001	0.007	< 0.001	0.005
Acenaphthylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benz(a)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(a)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(b&j)fluoranthene[N07]	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(g.h.i)perylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(k)fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Chrysene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Dibenz(a.h)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Fluorene	0.001	mg/L	< 0.001	0.002	< 0.001	0.001
Indeno(1.2.3-cd)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Naphthalene	0.001	mg/L	< 0.001	0.41	< 0.001	0.030
Phenanthrene	0.001	mg/L	< 0.001	0.003	< 0.001	< 0.001
Pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Total PAH*	0.001	mg/L	< 0.001	0.42	< 0.001	0.036
2-Fluorobiphenyl (surr.)	1	%	59	83	108	57
p-Terphenyl-d14 (surr.)	1	%	102	122	[Q09]INT	79
Ammonia (as N)	0.01	mg/L	0.33	6.0	1.7	6.4
Cyanide (free)	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
Cyanide (total)	0.004	mg/L	< 0.004	0.074	0.015	0.085
Cyanide (weak acid dissoc.)	0.005	mg/L	< 0.005	< 0.005	< 0.005	0.012
Phenolics (total)	0.05	mg/L	-	< 0.05	< 0.05	< 0.05
Chromium (hexavalent filtered)	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
Heavy Metals						
Lead (filtered)	0.001	mg/L	-	< 0.001	-	-
Molybdenum (filtered)	0.005	mg/L	-	0.41	-	-

Client Sample ID			K9/2W	K9/2E	K9/4W	K9/4E
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			N23-Oc0021648	N23-Oc0021649	N23-Oc0021650	N23-Oc0021651
Date Sampled			Oct 10, 2023	Oct 10, 2023	Oct 10, 2023	Oct 10, 2023
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Acenaphthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Acenaphthylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benz(a)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(a)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(b&j)fluoranthene[N07]	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(g.h.i)perylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(k)fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Chrysene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Dibenz(a.h)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001

Client Sample ID			K9/2W	K9/2E	K9/4W	K9/4E
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			N23-Oc0021648	N23-Oc0021649	N23-Oc0021650	N23-Oc0021651
Date Sampled			Oct 10, 2023	Oct 10, 2023	Oct 10, 2023	Oct 10, 2023
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Fluorene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Indeno(1.2.3-cd)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Naphthalene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Phenanthrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Total PAH*	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
2-Fluorobiphenyl (surr.)	1	%	54	58	59	57
p-Terphenyl-d14 (surr.)	1	%	82	72	76	74
Ammonia (as N)	0.01	mg/L	0.89	3.9	1.2	2.1
Cyanide (free)	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
Cyanide (total)	0.004	mg/L	< 0.005	< 0.004	< 0.005	< 0.005
Cyanide (weak acid dissoc.)	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
Chromium (hexavalent filtered)	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
Heavy Metals						
Lead (filtered)	0.001	mg/L	0.001	-	-	-
Molybdenum (filtered)	0.005	mg/L	0.034	0.023	-	-

Client Sample ID			FD10
Sample Matrix			Water
Eurofins Sample No.			N23-Oc0021652
Date Sampled			Oct 10, 2023
Test/Reference	LOR	Unit	
Polycyclic Aromatic Hydrocarbons			
Acenaphthene	0.001	mg/L	0.005
Acenaphthylene	0.001	mg/L	< 0.001
Anthracene	0.001	mg/L	< 0.001
Benz(a)anthracene	0.001	mg/L	< 0.001
Benzo(a)pyrene	0.001	mg/L	< 0.001
Benzo(b&j)fluoranthene[N07]	0.001	mg/L	< 0.001
Benzo(g.h.i)perylene	0.001	mg/L	< 0.001
Benzo(k)fluoranthene	0.001	mg/L	< 0.001
Chrysene	0.001	mg/L	< 0.001
Dibenz(a.h)anthracene	0.001	mg/L	< 0.001
Fluoranthene	0.001	mg/L	< 0.001
Fluorene	0.001	mg/L	0.001
Indeno(1.2.3-cd)pyrene	0.001	mg/L	< 0.001
Naphthalene	0.001	mg/L	0.30
Phenanthrene	0.001	mg/L	0.001
Pyrene	0.001	mg/L	< 0.001
Total PAH*	0.001	mg/L	0.31
2-Fluorobiphenyl (surr.)	1	%	53
p-Terphenyl-d14 (surr.)	1	%	76

Client Sample ID			FD10
Sample Matrix			**Water**
Eurofins Sample No.			**N23-Oc0021652**
Date Sampled			**Oct 10, 2023**
Test/Reference	LOR	Unit	
Ammonia (as N)	0.01	mg/L	4.1
Cyanide (free)	0.005	mg/L	< 0.005
Cyanide (total)	0.004	mg/L	0.045
Cyanide (weak acid dissoc.)	0.005	mg/L	0.008
Phenolics (total)	0.05	mg/L	< 0.05
Chromium (hexavalent filtered)	0.005	mg/L	< 0.005
Heavy Metals			
Lead (filtered)	0.001	mg/L	< 0.001
Molybdenum (filtered)	0.005	mg/L	0.40

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Polycyclic Aromatic Hydrocarbons	Sydney	Oct 12, 2023	7 Days
- Method: LTM-ORG-2130 PAH and Phenols in Soil and Water			
Ammonia (as N)	Melbourne	Oct 12, 2023	28 Days
- Method: LTM-INO-4450 Determination of Nitrogen Species by Discrete Analyser			
Chromium (hexavalent)	Sydney	Oct 12, 2023	28 Days
- Method: In-house method E057.1			
Cyanide (free)	Sydney	Oct 12, 2023	14 Days
- Method: E054 Free Cyanide			
Cyanide (total)	Sydney	Oct 12, 2023	14 Days
- Method: E054 Total Cyanide			
Cyanide (weak acid dissoc.)	Melbourne	Oct 12, 2023	14 Days
- Method: LTM-INO-4020 Total Free WAD Cyanide by CFA			
Phenolics (total)	Melbourne	Oct 12, 2023	7 Days
- Method: LTM-INO-4050 Total Phenolics in Waters and solids by CFA			
Chromium (hexavalent filtered)	Sydney	Oct 12, 2023	28 Days
- Method: E057 Speciated Chromium			
Heavy Metals	Sydney	Oct 12, 2023	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Heavy Metals (filtered)	Sydney	Oct 12, 2023	180 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			

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NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	Site# 25079 & 25289
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Company Name: GHD Pty Ltd NEWCASTLE
Address: 3/24 Honeysuckle Dve
Newcastle
NSW 2300

Project Name:

Order No.:
Report #: 1033472
Phone: 02 4979 9999
Fax: 02 4979 9988

Received: Oct 10, 2023 2:00 PM
Due: Oct 17, 2023
Priority: 5 Day
Contact Name: Alison Monkley

Eurofins Analytical Services Manager : Andrew Black

Sample Detail						Ammonia (as N)	Chromium (hexavalent filtered)	Chromium (hexavalent)	Cyanide (free)	Cyanide (total)	Cyanide (weak acid dissoc.)	Lead	Lead (filtered)	Molybdenum	Molybdenum (filtered)	Phenolics (total)	Polycyclic Aromatic Hydrocarbons
Melbourne Laboratory - NATA # 1261 Site # 1254						X					X					X	X
Sydney Laboratory - NATA # 1261 Site # 18217							X	X	X	X		X	X	X	X		X
External Laboratory																	
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**												
1	KS1/3	Oct 10, 2023		Water	N23-Oc0021640	X		X	X	X	X	X				X	X
2	FD08	Oct 10, 2023		Water	N23-Oc0021641	X		X	X	X	X	X		X		X	X
3	K5/6NN	Oct 10, 2023		Water	N23-Oc0021642	X	X		X	X	X					X	X
4	K5/6N	Oct 10, 2023		Water	N23-Oc0021643	X	X		X	X	X					X	X
5	K5/6S	Oct 10, 2023		Water	N23-Oc0021644	X	X		X	X	X						X
6	K7/1	Oct 10, 2023		Water	N23-Oc0021645	X	X		X	X	X		X		X	X	X
7	K7/2S	Oct 10, 2023		Water	N23-Oc0021646	X	X		X	X	X					X	X
8	K7/2N	Oct 10, 2023		Water	N23-Oc0021647	X	X		X	X	X					X	X
9	K9/2W	Oct 10, 2023		Water	N23-Oc0021648	X	X		X	X	X		X		X		X
10	K9/2E	Oct 10, 2023		Water	N23-Oc0021649	X	X		X	X	X				X		X
11	K9/4W	Oct 10, 2023		Water	N23-Oc0021650	X	X		X	X	X						X
12	K9/4E	Oct 10, 2023		Water	N23-Oc0021651	X	X		X	X	X						X
13	FD10	Oct 10, 2023		Water	N23-Oc0021652	X	X		X	X	X		X		X	X	X

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NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	Site# 25079 & 25289
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Contact Name: Alison Monkley

Eurofins Analytical Services Manager : Andrew Black

Sample Detail	Ammonia (as N)	Chromium (hexavalent filtered)	Chromium (hexavalent)	Cyanide (free)	Cyanide (total)	Cyanide (weak acid dissoc.)	Lead	Lead (filtered)	Molybdenum	Molybdenum (filtered)	Phenolics (total)	Polycyclic Aromatic Hydrocarbons
Melbourne Laboratory - NATA # 1261 Site # 1254	X					X					X	X
Sydney Laboratory - NATA # 1261 Site # 18217		X	X	X	X		X	X	X	X		X
Test Counts	13	11	2	13	13	13	2	3	1	4	8	13

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follow guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013. They are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry weight basis unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion unless otherwise stated.
4. For CEC results where the sample's origin is unknown or environmentally contaminated, the results should be used advisedly.
5. Actual LORs are matrix dependent. Quoted LORs may be raised where sample extracts are diluted due to interferences.
6. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
7. SVOC analysis on waters is performed on homogenised, unfiltered samples unless noted otherwise.
8. Samples were analysed on an 'as received' basis.
9. Information identified in this report with blue colour indicates data provided by customers that may have an impact on the results.
10. This report replaces any interim results previously issued.

Holding Times

Please refer to the 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours before sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and despite any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling; therefore, compliance with these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether, the holding time is 7 days; however, for all other VOCs, such as BTEX or C6-10 TRH, the holding time is 14 days.

Units

mg/kg: milligrams per kilogram
mg/L: milligrams per litre
µg/L: micrograms per litre
ppm: parts per million
ppb: parts per billion
%: Percentage
org/100 mL: Organisms per 100 millilitres
NTU: Nephelometric Turbidity Units
MPN/100 mL: Most Probable Number of organisms per 100 millilitres
CFU: Colony forming unit

Terms

APHA	American Public Health Association
CEC	Cation Exchange Capacity
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where moisture has been determined on a solid sample, the result is expressed on a dry weight basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples, these are performed on laboratory-certified clean sands and in the case of water samples, these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC represents the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment; however free tributyltin was measured, and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site-specific Sampling Analysis and Quality Plan (SAQP) have been implemented.

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30%; however the following acceptance guidelines are equally applicable: Results <10 times the LOR: No Limit

Results between 10-20 times the LOR: RPD must lie between 0-50%

Results >20 times the LOR: RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range, not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%

PFAS field samples that contain surrogate recoveries above the QC limit designated in QSM 5.4, where no positive PFAS results have been reported, have been reviewed, and no data was affected.

QC Data General Comments

1. Where a result is reported as less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown are not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery, the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results, a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data; thus, it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	mg/L	< 0.001			0.001	Pass	
Acenaphthylene	mg/L	< 0.001			0.001	Pass	
Anthracene	mg/L	< 0.001			0.001	Pass	
Benz(a)anthracene	mg/L	< 0.001			0.001	Pass	
Benzo(a)pyrene	mg/L	< 0.001			0.001	Pass	
Benzo(b&j)fluoranthene	mg/L	< 0.001			0.001	Pass	
Benzo(g.h.i)perylene	mg/L	< 0.001			0.001	Pass	
Benzo(k)fluoranthene	mg/L	< 0.001			0.001	Pass	
Chrysene	mg/L	< 0.001			0.001	Pass	
Dibenz(a.h)anthracene	mg/L	< 0.001			0.001	Pass	
Fluoranthene	mg/L	< 0.001			0.001	Pass	
Fluorene	mg/L	< 0.001			0.001	Pass	
Indeno(1.2.3-cd)pyrene	mg/L	< 0.001			0.001	Pass	
Naphthalene	mg/L	< 0.001			0.001	Pass	
Phenanthrene	mg/L	< 0.001			0.001	Pass	
Pyrene	mg/L	< 0.001			0.001	Pass	
Method Blank							
Ammonia (as N)	mg/L	< 0.01			0.01	Pass	
Chromium (hexavalent)	mg/L	< 0.005			0.005	Pass	
Cyanide (free)	mg/L	< 0.005			0.005	Pass	
Cyanide (total)	mg/L	< 0.004			0.004	Pass	
Cyanide (weak acid dissoc.)	mg/L	< 0.005			0.005	Pass	
Chromium (hexavalent filtered)	mg/L	< 0.005			0.005	Pass	
Method Blank							
Heavy Metals							
Lead	mg/L	< 0.001			0.001	Pass	
Molybdenum	mg/L	< 0.005			0.005	Pass	
LCS - % Recovery							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	%	104			70-130	Pass	
Acenaphthylene	%	90			70-130	Pass	
Anthracene	%	109			70-130	Pass	
Benz(a)anthracene	%	104			70-130	Pass	
Benzo(a)pyrene	%	107			70-130	Pass	
Benzo(b&j)fluoranthene	%	116			70-130	Pass	
Benzo(g.h.i)perylene	%	112			70-130	Pass	
Benzo(k)fluoranthene	%	105			70-130	Pass	
Chrysene	%	84			70-130	Pass	
Dibenz(a.h)anthracene	%	120			70-130	Pass	
Fluoranthene	%	106			70-130	Pass	
Fluorene	%	105			70-130	Pass	
Indeno(1.2.3-cd)pyrene	%	120			70-130	Pass	
Naphthalene	%	83			70-130	Pass	
Phenanthrene	%	104			70-130	Pass	
Pyrene	%	105			70-130	Pass	
LCS - % Recovery							
Ammonia (as N)	%	104			70-130	Pass	
Chromium (hexavalent)	%	118			70-130	Pass	
Cyanide (free)	%	109			70-130	Pass	
Cyanide (total)	%	109			70-130	Pass	

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Cyanide (weak acid dissoc.)			%	107			70-130	Pass	
Chromium (hexavalent filtered)			%	118			70-130	Pass	
LCS - % Recovery									
Heavy Metals									
Lead			%	90			80-120	Pass	
Molybdenum			%	103			80-120	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Spike - % Recovery									
				Result 1					
Chromium (hexavalent)	N23-Oc0018480	NCP	%	118			70-130	Pass	
Cyanide (free)	N23-Oc0018479	NCP	%	116			70-130	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Lead	S23-Oc0024121	NCP	%	90			75-125	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Molybdenum	S23-Oc0024121	NCP	%	99			75-125	Pass	
Spike - % Recovery									
				Result 1					
Chromium (hexavalent filtered)	N23-Oc0018480	NCP	%	118			70-130	Pass	
Spike - % Recovery									
				Result 1					
Cyanide (total)	N23-Oc0021647	CP	%	75			70-130	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Lead (filtered)	N23-Oc0021652	CP	%	80			75-125	Pass	
Molybdenum (filtered)	N23-Oc0021652	CP	%	116			75-125	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Polycyclic Aromatic Hydrocarbons				Result 1	Result 2	RPD			
Acenaphthene	S23-Oc0010865	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Acenaphthylene	S23-Oc0010865	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Anthracene	S23-Oc0010865	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benz(a)anthracene	S23-Oc0010865	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(a)pyrene	S23-Oc0010865	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(b&j)fluoranthene	S23-Oc0010865	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(g.h.i)perylene	S23-Oc0010865	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(k)fluoranthene	S23-Oc0010865	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Chrysene	S23-Oc0010865	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Dibenz(a.h)anthracene	S23-Oc0010865	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Fluoranthene	S23-Oc0010865	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Fluorene	S23-Oc0010865	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Indeno(1.2.3-cd)pyrene	S23-Oc0010865	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Naphthalene	S23-Oc0010865	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Phenanthrene	S23-Oc0010865	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Pyrene	S23-Oc0010865	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Ammonia (as N)	M23-Oc0022403	NCP	mg/L	0.05	0.04	10	30%	Pass	
Cyanide (free)	N23-Oc0021640	CP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
Cyanide (total)	N23-Oc0021640	CP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Lead	N23-Oc0021236	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	

Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Molybdenum	N23-Oc0021236	NCP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Lead (filtered)	N23-Oc0018478	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Molybdenum (filtered)	N23-Oc0018478	NCP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Chromium (hexavalent filtered)	N23-Oc0018490	NCP	mg/L	< 0.005	< 0.005	<1	30%	Pass	

Comments

V2- new version with repeated cyanide on Oc0021642, 644 and 646 as per client request.

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	No
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs
Q09	The Surrogate recovery is outside of the recommended acceptance criteria due to matrix interference. Acceptance criteria were met for all other QC

Authorised by:

Andrew Black	Analytical Services Manager
Fang Yee Tan	Senior Analyst-Metal
Mary Makarios	Senior Analyst-Inorganic
Roopesh Rangarajan	Senior Analyst-Organic
Ryan Phillips	Senior Analyst-Inorganic

Glenn Jackson
Managing Director

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

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CHAIN OF CUSTODY RECORD

Page 1 of 1

CLIENT DETAILS

Company Name: GHD
Office Address: 24 Honeysuckle Drive
Newcastle 2300

Contact Name: Nina Foley
Project Manager: Alison Monkley
Email for results: Nina.Foley@GHD.com, Alison.Monkley@GHD.com

COC Number:
Eurofins | mgt quote ID: 230926GHDN
Data output format: ESDAT

Special Directions & Comments: Please see attached file.

Eurofins | mgt DI water batch number:

Analytes

	Sample ID	Date	Matrix	Ammonia	Phenols	Cyanide (weak acid, dissociable, free)	Cyanide (total)	Hex. chromium (total)	Molybdenum (dis)	Molybdenum (total)	Lead (dis)	Lead (total)	Total PAH	Hex. Chromium (dis)
1	KS1/3	10/10/23	W											
2	FD08			X	X	X	X	X		X		X	X	
3	KS/6NN													
4	KS/6N													
5	KS/6S													
6	K7/1													
7	K7/2S													
8	K7/2N													
9	K9/2W													
10	K9/2E													
11	K9/4W													
12	K9/4E													
13	FD10			X	X	X	X		X		X		X	X
15														
16														

Some common holding times (with correct preservation).
For further information contact the lab

Waters		Soils	
BTEX, MAH, VOC	14 days	BTEX, MAH, VOC	14 days
TRH, PAH, Phenols, Pesticides	7 days	TRH, PAH, Phenols, Pesticides	14 days
Heavy Metals	6 months	Heavy Metals	6 months
Mercury, CrVI	28 days	Mercury, CrVI	28 days
Microbiological testing	24 hours	Microbiological testing	72 hours
BOD, Nitrate, Nitrite, Total N	2 days	Anions	28 days
Solids - TSS, TDS etc	7 days	SPOCAS, pH Field and FOX, CrS	24 hours
Ferrous iron	7 days	ASLP, TCLP	7 days

Containers:

1LP	250P	125P	1LA	40mL vial	125mL A	Jar

Sample comments:

Relinquished By:
Date & Time::
Signature:

Laboratory Staff
Received By: Randall
Date & Time: 200 10/10
Signature:

Turn around time
1 DAY ☐ 2 DAY ☐ 3 DAY ☐
5 DAY ☑ 10 DAY ☐ Other:

Method Of Shipment
☐ Courier
☑ Hand Delivered
☐ Postal
Courier Consignment #:

Temperature on arrival: 18.7
Report number: 1033472

Table 7.4 Sampling variables for Surface Water

Sample location	Ammonia	Phenol a	Cyanide (weak acid, dissociable and free)	Cyanide (total)	Hexavalent chromium	Molybdenum (total)	Lead (total)	Total PAH
KS1/3 ✓	X	X	X	X	X	X	X	X
KS1D/1	X	X	X	X	X	X	X	X
KS12/5	X	X	X	X	X	X	X	X
KS5/1 ✓	X	X	X	X	X	X	X	X
KS12/1	X	X	X	X	X	X	X	X
QA QC Duplicate ✓	1	1	1	1	1	1	1	1
QA QC triplicate ✓	1	1	1	1	1	1	1	1

— FD06

— FD08
FD09

Table 7.2 Sampling analyte [illegible]

Sample location	Ammonia	Phenols	Cyanide (weak acid, dissociable and free)	Cyanide (total)	Hexavalent chromium	Molybdenum (dissolved)	Lead (dissolved)	Total PAH
336B	X	X	X	X	X	X	X	X
344B	X	X	X	X	X	X	X	X
BH21S replacement well for K3/1W	X	X	X	X	X	X	X	X
BH#29S	X	X	X	X	X	X	X	X
E51C	X	X	X	X	X	X	X	X
GHD01S	X	X	X	X	X	X	X	X
K10/2NN	X		X	X	X	X	X	X
K11/1	X	X	X	X	X	X	X	X
K11/2E	X	X	X	X	X	X	X	X
K11/[illegible]	X	X	X	X	X	X	X	X

Sample location	Ammonia	Phenols	Cyanide (weak acid, dissociable and free)	Cyanide (total)	Hexavalent chromium	Molybdenum (dissolved)	Lead (dissolved)	Total PAH
K12/10E	X	X	X	X	X	X	X	X
K12/1W	X	X	X	X	X	X	X	X
K12/5	X	X	X	X	X	X	X	X
K12/7	X	X	X	X	X	X	X	X
K12/9	X	X	X	X	X	X	X	X
K5/9NN	X	X	X	X	X			X
[illegible]/2S	X	X	X	X	X			X
[illegible]	X		X	X	X	X	X	X
[illegible]/5W	X	X	X	X	X	X	X	X
K[illegible]/2W	X		X	X	X	X		X
K3/3S	X	X	X	X	X	X	X	X
K3/4E	X		X	X	X			X
NCIC1 replacement well for K12/1W	X	X	X	X	X	X	X	X
QA/QC Duplicate	2	2	2	2		2	2	2
QA/QC Triplicate	1	1	1	1	1	1	1	1

FD07, FD05

Table 7.3 Sampling analytical plan – Deep Estuarine

Sample location	Ammonia	Phenols	Cyanide (weak acid, dissociable and free)	Cyanide (total)	Hexavalent chromium	Molybdenum (dissolved)	Lead (dissolved)	Total PAH
K11/1S	X	X	X	X	X	X	X	X
K11/2W	X	X	X	X	X	X	X	X
K11/3W	X	X	X	X	X	X	X	X
K12/1S	X	X	X	X	X	X	X	X
K12/1E	X	X	X	X	X	X	X	X
K12/4N	X	X	X	X	X	X	X	X
K12/7E	X	X	X	X	X	X	X	X
K12/9E	X	X	X	X	X	X	X	X
K5/6N ✓	X	X	X	X	X	X	X	X
K5/6S ✓	X	X	X	X	X	X	X	X
K7/2N ✓	X	X	X	X	X	X	X	X
K9/2E ✓	X	X	X	X	X	X	X	X
K9/3N	X	X	X	X	X	X	X	X
K9/4W ✓	X	X	X	X	X	X	X	X

12605961 | KIWEP Surrender Notice, 2020 Annual Water Monitoring – Sampling, Analysis and Quality Plan

Dups needed ...

2x Deep dup

~~1x deep trip~~

~~1x fill dup~~

~~1x fill trip~~

~~1x SW dup~~

~~1x SW trip~~

~~2x shallow dup~~

1x shallow trip

Sample location	Ammonia	Phenols	Cyanide (weak acid, dissociable and free)	Cyanide (total)	Hexavalent chromium	Molybdenum (dissolved)	Lead (dissolved)	Total PAH
NCIG2 replacement well for K12/GN).	X	X	X	X	X	X	X	X
QA/QC – Duplicate	2	2	2	2	2	2	2	2
QA/QC – Triplicate	1	1	1	1	1	1	1	1

~~FD03~~

FD03, FD04

Table 7.1 *Sampling analytical plan – Fill Aquifer*

Sample location	Ammonia	Phenols	Cyanide (weak acid, dissociable and free)	Cyanide (total)	Hexavalent chromium	Molybdenum (dissolved)	Lead (dissolved)	Total PAH
336A ✓	X	X	X	X	X	X	X	X
344A ✓	X	X	X	X	X	X	X	X
~~E61S~~	X	X	X	X	X	X	X	X
GHD01N	X	X	X	X	X	X	X	X
K10/2	X		X		X	X	X	X
K10/2N	X		X		X	X	X	X
~~K5/7~~	X		X	X	X			X
~~K5/6N~~	X		X		X			X
K5/6N ✓	X	X	X	X	X			X
K7/1 ✓	X	X	X	X	X	X	X	X
K7/4N	X		X	X	X	X		X
K8/5E	X		X	X	X	X	X	X
QA/QC – Duplicate	1	1	1	1	1	1	1	1
QA/QC – triplicate	1	1	1	1	1	1	1	1

~~FD01~~ FD10

FD02, FD01

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Dandenong South	Grovedale	Girraween	Mitchell	Murarrie	Mayfield West NSW 2304
VIC 3175	VIC 3216	NSW 2145	ACT 2911	QLD 4172	Tel: +61 2 4968 8448
Tel: +61 3 8564 5000	Tel: +61 3 8564 5000	Tel: +61 2 9900 8400	Tel: +61 2 6113 8091	Tel: +61 7 3902 4600	NATA# 1261
NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	Site# 25079 & 25289
Site# 1254	Site# 25403	Site# 18217	Site# 25466	Site# 20794	

Eurofins ARL Pty Ltd

ABN: 91 05 0159 898

Perth
46-48 Banksia Road
Welshpool
WA 6106
Tel: +61 8 6253 4444
NATA# 2377
Site# 2370

Eurofins Environment Testing NZ Ltd

NZBN: 9429046024954

Auckland	Christchurch	Tauranga
35 O'Rorke Road	43 Detroit Drive	1277 Cameron Road,
Penrose,	Rolleston,	Gate Pa,
Auckland 1061	Christchurch 7675	Tauranga 3112
Tel: +64 9 526 4551	Tel: +64 3 343 5201	Tel: +64 9 525 0568
IANZ# 1327	IANZ# 1290	IANZ# 1402

Sample Receipt Advice

Company name:	GHD Pty Ltd NEWCASTLE
Contact name:	Alison Monkley
Project name:	Not provided
Project ID:	12609961
Turnaround time:	5 Day
Date/Time received	Oct 11, 2023 3:30 PM
Eurofins reference	1033940

Sample Information

✓	A detailed list of analytes logged into our LIMS, is included in the attached summary table.
✓	Sample Temperature of chilled sample on the batch as recorded by Eurofins Sample Receipt : 18.7 degrees Celsius.
✓	All samples have been received as described on the above COC.
✓	COC has been completed correctly.
✗	Attempt to chill was evident.
✓	Appropriately preserved sample containers have been used.
✓	All samples were received in good condition.
✓	Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
✓	Appropriate sample containers have been used.
✓	Sample containers for volatile analysis received with zero headspace.
✗	Split sample sent to requested external lab.
✗	Some samples have been subcontracted.
N/A	Custody Seals intact (if used).

Notes

Contact

If you have any questions with respect to these samples, please contact your Analytical Services Manager:

Andrew Black on phone : (+61) 2 9900 8490 or by email: AndrewBlack@eurofins.com

Results will be delivered electronically via email to Alison Monkley - alison.monkley@ghd.com.au.

Note: A copy of these results will also be delivered to the general GHD Pty Ltd NEWCASTLE email address.

eurofins

web: www.eurofins.com.au
email: EnviroSales@eurofins.com

Eurofins Environment Testing Australia Pty Ltd
ABN: 50 005 085 521

Melbourne	Geelong	Sydney	Canberra	Brisbane	Newcastle
6 Monterey Road	19/8 Lewalan Street	179 Magowar Road	Unit 1,2 Dacre Street	1/21 Smallwood Place	1/2 Frost Drive
Dandenong South	Grovedale	Girraween	Mitchell	Murarrie	Mayfield West NSW 2304
VIC 3175	VIC 3216	NSW 2145	ACT 2911	QLD 4172	Tel: +61 2 4968 8448
Tel: +61 3 8564 5000	Tel: +61 3 8564 5000	Tel: +61 2 9900 8400	Tel: +61 2 6113 8091	Tel: +61 7 3902 4600	NATA# 1261
NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	Site# 25079 & 25289
Site# 1254	Site# 25403	Site# 18217	Site# 25466	Site# 20794	

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Auckland 1061	Christchurch 7675	Tauranga 3112
Tel: +64 9 526 4551	Tel: +64 3 343 5201	Tel: +64 9 525 0568
IANZ# 1327	IANZ# 1290	IANZ# 1402

Company Name: GHD Pty Ltd NEWCASTLE
Address: 3/24 Honeysuckle Dve
Newcastle
NSW 2300

Project Name:
Project ID: 12609961

Order No.:
Report #: 1033940
Phone: 02 4979 9999
Fax: 02 4979 9988

Received: Oct 11, 2023 3:30 PM
Due: Oct 18, 2023
Priority: 5 Day
Contact Name: Alison Monkley

Eurofins Analytical Services Manager : Andrew Black

Sample Detail						Ammonia (as N)	Chromium (hexavalent filtered)	Chromium (hexavalent)	Cyanide (free)	Cyanide (total)	Cyanide (weak acid dissoc.)	Lead	Lead (filtered)	Molybdenum	Molybdenum (filtered)	Phenolics (total)	Polycyclic Aromatic Hydrocarbons	BTEXN and Volatile TRH	BTEXN and Volatile TRH
Melbourne Laboratory - NATA # 1261 Site # 1254											X					X	X	X	
Sydney Laboratory - NATA # 1261 Site # 18217						X	X	X	X	X		X	X	X	X		X	X	X
External Laboratory																			
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**														
1	KS12/6	Oct 11, 2023		Water	N23-Oc0024988	X		X	X	X	X	X		X		X	X		
2	K12/10	Oct 11, 2023		Water	N23-Oc0024989	X	X		X	X	X		X		X	X	X		
3	FD11	Oct 11, 2023		Water	N23-Oc0024990	X	X		X	X	X		X		X	X	X		
4	RB01	Oct 11, 2023		Water	N23-Oc0024991	X		X	X	X	X	X		X		X	X		
5	K12/9	Oct 11, 2023		Water	N23-Oc0024992	X	X		X	X	X		X		X	X	X		
6	K12/7	Oct 11, 2023		Water	N23-Oc0024993	X	X		X	X	X		X		X	X	X		
7	K12/7E	Oct 11, 2023		Water	N23-Oc0024994	X	X		X	X	X		X		X	X	X		
8	FD12	Oct 11, 2023		Water	N23-Oc0024995	X	X		X	X	X		X		X	X	X		
9	NCIG1	Oct 11, 2023		Water	N23-Oc0024996	X	X		X	X	X		X		X	X	X		
10	NCIG2	Oct 11, 2023		Water	N23-Oc0024997	X	X		X	X	X		X		X	X	X		
11	K12/1W	Oct 11, 2023		Water	N23-Oc0024998	X	X		X	X	X		X		X	X	X		
12	K12/1E	Oct 11, 2023		Water	N23-Oc0024999	X	X		X	X	X		X		X	X	X		

eurofins

web: www.eurofins.com.au
email: EnviroSales@eurofins.com

Eurofins Environment Testing Australia Pty Ltd
ABN: 50 005 085 521

Melbourne	Geelong	Sydney	Canberra	Brisbane	Newcastle
6 Monterey Road	19/8 Lewalan Street	179 Magowar Road	Unit 1,2 Dacre Street	1/21 Smallwood Place	1/2 Frost Drive
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NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	Site# 25079 & 25289
Site# 1254	Site# 25403	Site# 18217	Site# 25466	Site# 20794	

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Eurofins Environment Testing NZ Ltd
NZBN: 9429046024954

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Penrose,	Rolleston,	Gate Pa,
Auckland 1061	Christchurch 7675	Tauranga 3112
Tel: +64 9 526 4551	Tel: +64 3 343 5201	Tel: +64 9 525 0568
IANZ# 1327	IANZ# 1290	IANZ# 1402

Company Name: GHD Pty Ltd NEWCASTLE
Address: 3/24 Honeysuckle Dve
Newcastle
NSW 2300

Project Name:
Project ID: 12609961

Order No.:
Report #: 1033940
Phone: 02 4979 9999
Fax: 02 4979 9988

Received: Oct 11, 2023 3:30 PM
Due: Oct 18, 2023
Priority: 5 Day
Contact Name: Alison Monkley

Eurofins Analytical Services Manager : Andrew Black

Sample Detail						Ammonia (as N)	Chromium (hexavalent filtered)	Chromium (hexavalent)	Cyanide (free)	Cyanide (total)	Cyanide (weak acid dissoc.)	Lead	Lead (filtered)	Molybdenum	Molybdenum (filtered)	Phenolics (total)	Polycyclic Aromatic Hydrocarbons	BTEXN and Volatile TRH	BTEXN and Volatile TRH
Melbourne Laboratory - NATA # 1261 Site # 1254											X					X	X	X	
Sydney Laboratory - NATA # 1261 Site # 18217						X	X	X	X	X		X	X	X	X		X	X	X
13	FD14	Oct 11, 2023		Water	N23-Oc0025000	X	X		X	X	X		X		X	X	X		
14	K7/4S	Oct 11, 2023		Water	N23-Oc0025001	X	X		X	X	X		X		X		X		
15	KS7/1	Oct 11, 2023		Water	N23-Oc0025002	X		X	X	X	X	X		X		X	X		
16	K7/4N	Oct 11, 2023		Water	N23-Oc0025088	X	X		X	X	X				X		X		
17	TB01	Oct 11, 2023		Trip Blank (liquid)	N23-Oc0025107													X	
18	TS01	Oct 11, 2023		Trip Spike (liquid)	N23-Oc0025108														X
Test Counts						16	13	3	32	17	16	3	12	3	13	14	16	1	1

GHD Pty Ltd
3/24 Honeysuckle Dve
Newcastle
NSW 2300

NATA Accredited
Accreditation Number 1261
Site Number 18217

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates.

Attention: **Alison Monkley**

Report **1033940-W-V3**
Project name
Project ID 12609961
Received Date Oct 11, 2023

Client Sample ID			**KS12/6**	**K12/10**	**FD11**	**RB01**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins Sample No.			**N23-Oc0024988**	**N23-Oc0024989**	**N23-Oc0024990**	**N23-Oc0024991**
Date Sampled			**Oct 11, 2023**	**Oct 11, 2023**	**Oct 11, 2023**	**Oct 11, 2023**
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Acenaphthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Acenaphthylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benz(a)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(a)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(b&j)fluoranthene[N07]	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(g.h.i)perylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(k)fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Chrysene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Dibenz(a.h)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Fluorene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Indeno(1.2.3-cd)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Naphthalene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Phenanthrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Total PAH*	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
2-Fluorobiphenyl (surr.)	1	%	131	59	66	63
p-Terphenyl-d14 (surr.)	1	%	[Q09]INT	117	123	146
Ammonia (as N)	0.01	mg/L	0.92	220	160	0.06
Chromium (hexavalent)	0.005	mg/L	< 0.005	-	-	< 0.005
Cyanide (free)	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
Cyanide (total)	0.004	mg/L	< 0.004	< 0.004	< 0.004	< 0.004
Cyanide (weak acid dissoc.)	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
Phenolics (total)	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
Chromium (hexavalent filtered)	0.005	mg/L	-	< 0.005	< 0.005	-
Heavy Metals						
Lead	0.001	mg/L	0.011	-	-	< 0.001
Lead (filtered)	0.001	mg/L	-	< 0.001	< 0.001	-
Molybdenum	0.005	mg/L	< 0.01	-	-	0.006
Molybdenum (filtered)	0.005	mg/L	-	< 0.005	< 0.005	-

Client Sample ID			K12/9	K12/7	K12/7E	FD12
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			N23-Oc0024992	N23-Oc0024993	N23-Oc0024994	N23-Oc0024995
Date Sampled			Oct 11, 2023	Oct 11, 2023	Oct 11, 2023	Oct 11, 2023
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Acenaphthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Acenaphthylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benz(a)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(a)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(b&j)fluoranthene[N07]	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(g.h.i)perylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(k)fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Chrysene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Dibenz(a.h)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Fluorene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Indeno(1.2.3-cd)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Naphthalene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Phenanthrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Total PAH*	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
2-Fluorobiphenyl (surr.)	1	%	56	54	54	79
p-Terphenyl-d14 (surr.)	1	%	[Q09]INT	[Q09]INT	[Q09]INT	[Q09]INT
Ammonia (as N)	0.01	mg/L	1.4	0.10	26	0.10
Cyanide (free)	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
Cyanide (total)	0.004	mg/L	< 0.004	< 0.004	< 0.004	< 0.004
Cyanide (weak acid dissoc.)	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
Phenolics (total)	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
Chromium (hexavalent filtered)	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
Heavy Metals						
Lead (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Molybdenum (filtered)	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005

Client Sample ID			NCIG1	NCIG2	K12/1W	K12/1E
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			N23-Oc0024996	N23-Oc0024997	N23-Oc0024998	N23-Oc0024999
Date Sampled			Oct 11, 2023	Oct 11, 2023	Oct 11, 2023	Oct 11, 2023
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Acenaphthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Acenaphthylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benz(a)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(a)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(b&j)fluoranthene[N07]	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(g.h.i)perylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(k)fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Chrysene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Dibenz(a.h)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001

Client Sample ID			NCIG1	NCIG2	K12/1W	K12/1E
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			N23-Oc0024996	N23-Oc0024997	N23-Oc0024998	N23-Oc0024999
Date Sampled			Oct 11, 2023	Oct 11, 2023	Oct 11, 2023	Oct 11, 2023
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Fluorene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Indeno(1.2.3-cd)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Naphthalene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Phenanthrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Total PAH*	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
2-Fluorobiphenyl (surr.)	1	%	73	66	104	68
p-Terphenyl-d14 (surr.)	1	%	145	137	[Q09]INT	126
Ammonia (as N)	0.01	mg/L	2.2	43	0.05	1.1
Cyanide (free)	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
Cyanide (total)	0.004	mg/L	< 0.004	< 0.004	< 0.004	< 0.004
Cyanide (weak acid dissoc.)	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
Phenolics (total)	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
Chromium (hexavalent filtered)	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
Heavy Metals						
Lead (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Molybdenum (filtered)	0.005	mg/L	0.012	< 0.005	< 0.005	< 0.005

Client Sample ID			FD14	K7/4S	KS7/1	K7/4N
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			N23-Oc0025000	N23-Oc0025001	N23-Oc0025002	N23-Oc0025088
Date Sampled			Oct 11, 2023	Oct 11, 2023	Oct 11, 2023	Oct 11, 2023
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Acenaphthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Acenaphthylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benz(a)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(a)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(b&j)fluoranthene[N07]	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(g.h.i)perylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(k)fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Chrysene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Dibenz(a.h)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Fluorene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Indeno(1.2.3-cd)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Naphthalene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Phenanthrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Total PAH*	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
2-Fluorobiphenyl (surr.)	1	%	87	72	76	104
p-Terphenyl-d14 (surr.)	1	%	[Q09]INT	148	[Q09]INT	[Q09]INT

Client Sample ID			FD14	K7/4S	KS7/1	K7/4N
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			N23-Oc0025000	N23-Oc0025001	N23-Oc0025002	N23-Oc0025088
Date Sampled			Oct 11, 2023	Oct 11, 2023	Oct 11, 2023	Oct 11, 2023
Test/Reference	LOR	Unit				
Ammonia (as N)	0.01	mg/L	1.1	0.56	0.95	8.7
Chromium (hexavalent)	0.005	mg/L	-	-	< 0.005	-
Cyanide (free)	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
Cyanide (total)	0.004	mg/L	< 0.004	< 0.005	0.028	0.10
Cyanide (weak acid dissoc.)	0.005	mg/L	< 0.005	< 0.005	< 0.005	0.007
Phenolics (total)	0.05	mg/L	< 0.05	-	< 0.05	-
Chromium (hexavalent filtered)	0.005	mg/L	< 0.005	0.010	-	< 0.005
Heavy Metals						
Lead	0.001	mg/L	-	-	0.007	-
Lead (filtered)	0.001	mg/L	< 0.001	< 0.001	-	-
Molybdenum	0.005	mg/L	-	-	0.18	-
Molybdenum (filtered)	0.005	mg/L	< 0.005	< 0.005	-	0.016

Client Sample ID			TB01	TS01
Sample Matrix			Trip Blank (liquid)	Trip Spike (liquid)
Eurofins Sample No.			N23-Oc0025107	N23-Oc0025108
Date Sampled			Oct 11, 2023	Oct 11, 2023
Test/Reference	LOR	Unit		
Naphthalene[N02]	0.01	mg/L	< 0.01	-
TRH C6-C10	1	%	-	70
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				
TRH C6-C9	0.02	mg/L	< 0.02	-
BTEX				
Benzene	0.001	mg/L	< 0.001	-
Toluene	0.001	mg/L	< 0.001	-
Ethylbenzene	0.001	mg/L	< 0.001	-
m&p-Xylenes	0.002	mg/L	< 0.002	-
o-Xylene	0.001	mg/L	< 0.001	-
Xylenes - Total*	0.003	mg/L	< 0.003	-
4-Bromofluorobenzene (surr.)	1	%	90	-
Total Recoverable Hydrocarbons				
TRH C6-C10	0.02	mg/L	< 0.02	-
TRH C6-C10 less BTEX (F1)[N04]	0.02	mg/L	< 0.02	-
Naphthalene	1	%	-	110
TRH C6-C9	1	%	-	71
BTEX				
Benzene	1	%	-	110
Ethylbenzene	1	%	-	100
m&p-Xylenes	1	%	-	110
o-Xylene	1	%	-	99
Toluene	1	%	-	100
Xylenes - Total	1	%	-	100
4-Bromofluorobenzene (surr.)	1	%	-	99

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Polycyclic Aromatic Hydrocarbons	Sydney	Oct 17, 2023	7 Days
- Method: LTM-ORG-2130 PAH and Phenols in Soil and Water			
Ammonia (as N)	Sydney	Oct 17, 2023	28 Days
- Method: LTM-INO-4200 Ammonia by Discrete Analyser			
Chromium (hexavalent)	Sydney	Oct 17, 2023	28 Days
- Method: In-house method E057.1			
Cyanide (free)	Sydney	Oct 19, 2023	14 Days
- Method: E054 Free Cyanide			
Cyanide (total)	Sydney	Oct 17, 2023	14 Days
- Method: E054 Total Cyanide			
Cyanide (weak acid dissoc.)	Melbourne	Oct 17, 2023	14 Days
- Method: LTM-INO-4020 Total Free WAD Cyanide by CFA			
Phenolics (total)	Melbourne	Oct 16, 2023	7 Days
- Method: LTM-INO-4050 Total Phenolics in Waters and solids by CFA			
Chromium (hexavalent filtered)	Sydney	Oct 17, 2023	28 Days
- Method: E057 Speciated Chromium			
Heavy Metals	Sydney	Oct 17, 2023	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Heavy Metals (filtered)	Sydney	Oct 17, 2023	180 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Total Recoverable Hydrocarbons - 1999 NEPM Fractions	Sydney	Oct 17, 2023	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
BTEX	Sydney	Oct 12, 2023	14 Days
- Method: LTM-ORG-2010 BTEX and Volatile TRH			
Total Recoverable Hydrocarbons	Sydney	Oct 12, 2023	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			

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Project Name:
Project ID: 12609961

Order No.:
Report #: 1033940
Phone: 02 4979 9999
Fax: 02 4979 9988

Received: Oct 11, 2023 3:30 PM
Due: Oct 18, 2023
Priority: 5 Day
Contact Name: Alison Monkley

Eurofins Analytical Services Manager : Andrew Black

Sample Detail						Ammonia (as N)	Chromium (hexavalent filtered)	Chromium (hexavalent)	Cyanide (free)	Cyanide (total)	Cyanide (weak acid dissoc.)	Lead	Lead (filtered)	Molybdenum	Molybdenum (filtered)	Phenolics (total)	Polycyclic Aromatic Hydrocarbons	BTEXN and Volatile TRH	BTEXN and Volatile TRH
Melbourne Laboratory - NATA # 1261 Site # 1254											X					X	X	X	
Sydney Laboratory - NATA # 1261 Site # 18217						X	X	X	X	X		X	X	X	X		X	X	X
External Laboratory																			
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**														
1	KS12/6	Oct 11, 2023		Water	N23-Oc0024988	X		X	X	X	X	X		X		X	X		
2	K12/10	Oct 11, 2023		Water	N23-Oc0024989	X	X		X	X	X		X		X	X	X		
3	FD11	Oct 11, 2023		Water	N23-Oc0024990	X	X		X	X	X		X		X	X	X		
4	RB01	Oct 11, 2023		Water	N23-Oc0024991	X		X	X	X	X	X		X		X	X		
5	K12/9	Oct 11, 2023		Water	N23-Oc0024992	X	X		X	X	X		X		X	X	X		
6	K12/7	Oct 11, 2023		Water	N23-Oc0024993	X	X		X	X	X		X		X	X	X		
7	K12/7E	Oct 11, 2023		Water	N23-Oc0024994	X	X		X	X	X		X		X	X	X		
8	FD12	Oct 11, 2023		Water	N23-Oc0024995	X	X		X	X	X		X		X	X	X		
9	NCIG1	Oct 11, 2023		Water	N23-Oc0024996	X	X		X	X	X		X		X	X	X		
10	NCIG2	Oct 11, 2023		Water	N23-Oc0024997	X	X		X	X	X		X		X	X	X		
11	K12/1W	Oct 11, 2023		Water	N23-Oc0024998	X	X		X	X	X		X		X	X	X		
12	K12/1E	Oct 11, 2023		Water	N23-Oc0024999	X	X		X	X	X		X		X	X	X		

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Eurofins Environment Testing Australia Pty Ltd
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NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	Site# 25079 & 25289
Site# 1254	Site# 25403	Site# 18217	Site# 25466	Site# 20794	

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Company Name: GHD Pty Ltd NEWCASTLE
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Newcastle
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Order No.:
Report #: 1033940
Phone: 02 4979 9999
Fax: 02 4979 9988

Received: Oct 11, 2023 3:30 PM
Due: Oct 18, 2023
Priority: 5 Day
Contact Name: Alison Monkley

Project Name:
Project ID: 12609961

Eurofins Analytical Services Manager : Andrew Black

Sample Detail						Ammonia (as N)	Chromium (hexavalent filtered)	Chromium (hexavalent)	Cyanide (free)	Cyanide (total)	Cyanide (weak acid dissoc.)	Lead	Lead (filtered)	Molybdenum	Molybdenum (filtered)	Phenolics (total)	Polycyclic Aromatic Hydrocarbons	BTEXN and Volatile TRH	BTEXN and Volatile TRH
Melbourne Laboratory - NATA # 1261 Site # 1254											X					X	X	X	
Sydney Laboratory - NATA # 1261 Site # 18217						X	X	X	X	X		X	X	X	X		X	X	X
13	FD14	Oct 11, 2023		Water	N23-Oc0025000	X	X		X	X	X		X		X	X	X		
14	K7/4S	Oct 11, 2023		Water	N23-Oc0025001	X	X		X	X	X		X		X		X		
15	KS7/1	Oct 11, 2023		Water	N23-Oc0025002	X		X	X	X	X	X		X		X	X		
16	K7/4N	Oct 11, 2023		Water	N23-Oc0025088	X	X		X	X	X				X		X		
17	TB01	Oct 11, 2023		Trip Blank (liquid)	N23-Oc0025107													X	
18	TS01	Oct 11, 2023		Trip Spike (liquid)	N23-Oc0025108														X
Test Counts						16	13	3	32	17	16	3	12	3	13	14	16	1	1

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follow guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013. They are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry weight basis unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion unless otherwise stated.
4. For CEC results where the sample's origin is unknown or environmentally contaminated, the results should be used advisedly.
5. Actual LORs are matrix dependent. Quoted LORs may be raised where sample extracts are diluted due to interferences.
6. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
7. SVOC analysis on waters is performed on homogenised, unfiltered samples unless noted otherwise.
8. Samples were analysed on an 'as received' basis.
9. Information identified in this report with blue colour indicates data provided by customers that may have an impact on the results.
10. This report replaces any interim results previously issued.

Holding Times

Please refer to the 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours before sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and despite any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling; therefore, compliance with these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether, the holding time is 7 days; however, for all other VOCs, such as BTEX or C6-10 TRH, the holding time is 14 days.

Units

mg/kg: milligrams per kilogram
mg/L: milligrams per litre
µg/L: micrograms per litre
ppm: parts per million
ppb: parts per billion
%: Percentage
org/100 mL: Organisms per 100 millilitres
NTU: Nephelometric Turbidity Units
MPN/100 mL: Most Probable Number of organisms per 100 millilitres
CFU: Colony forming unit

Terms

APHA	American Public Health Association
CEC	Cation Exchange Capacity
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where moisture has been determined on a solid sample, the result is expressed on a dry weight basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples, these are performed on laboratory-certified clean sands and in the case of water samples, these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC represents the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment; however free tributyltin was measured, and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site-specific Sampling Analysis and Quality Plan (SAQP) have been implemented.

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30%; however the following acceptance guidelines are equally applicable: Results <10 times the LOR: No Limit

Results between 10-20 times the LOR: RPD must lie between 0-50%

Results >20 times the LOR: RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range, not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%

PFAS field samples that contain surrogate recoveries above the QC limit designated in QSM 5.4, where no positive PFAS results have been reported, have been reviewed, and no data was affected.

QC Data General Comments

1. Where a result is reported as less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown are not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery, the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results, a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data; thus, it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	mg/L	< 0.001			0.001	Pass	
Acenaphthylene	mg/L	< 0.001			0.001	Pass	
Anthracene	mg/L	< 0.001			0.001	Pass	
Benz(a)anthracene	mg/L	< 0.001			0.001	Pass	
Benzo(a)pyrene	mg/L	< 0.001			0.001	Pass	
Benzo(b&j)fluoranthene	mg/L	< 0.001			0.001	Pass	
Benzo(g.h.i)perylene	mg/L	< 0.001			0.001	Pass	
Benzo(k)fluoranthene	mg/L	< 0.001			0.001	Pass	
Chrysene	mg/L	< 0.001			0.001	Pass	
Dibenz(a.h)anthracene	mg/L	< 0.001			0.001	Pass	
Fluoranthene	mg/L	< 0.001			0.001	Pass	
Fluorene	mg/L	< 0.001			0.001	Pass	
Indeno(1.2.3-cd)pyrene	mg/L	< 0.001			0.001	Pass	
Naphthalene	mg/L	< 0.001			0.001	Pass	
Phenanthrene	mg/L	< 0.001			0.001	Pass	
Pyrene	mg/L	< 0.001			0.001	Pass	
Method Blank							
Ammonia (as N)	mg/L	< 0.01			0.01	Pass	
Chromium (hexavalent)	mg/L	< 0.005			0.005	Pass	
Cyanide (free)	mg/L	< 0.005			0.005	Pass	
Cyanide (total)	mg/L	< 0.004			0.004	Pass	
Phenolics (total)	mg/L	< 0.05			0.05	Pass	
Chromium (hexavalent filtered)	mg/L	< 0.005			0.005	Pass	
Naphthalene	mg/L	< 0.01			0.01	Pass	
Method Blank							
Heavy Metals							
Lead	mg/L	< 0.001			0.001	Pass	
Lead (filtered)	mg/L	< 0.001			0.001	Pass	
Molybdenum	mg/L	< 0.005			0.005	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	mg/L	< 0.02			0.02	Pass	
Method Blank							
BTEX							
Benzene	mg/L	< 0.001			0.001	Pass	
Toluene	mg/L	< 0.001			0.001	Pass	
Ethylbenzene	mg/L	< 0.001			0.001	Pass	
m&p-Xylenes	mg/L	< 0.002			0.002	Pass	
o-Xylene	mg/L	< 0.001			0.001	Pass	
Xylenes - Total*	mg/L	< 0.003			0.003	Pass	
Method Blank							
Total Recoverable Hydrocarbons							
TRH C6-C10	mg/L	< 0.02			0.02	Pass	
LCS - % Recovery							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	%	129			70-130	Pass	
Acenaphthylene	%	127			70-130	Pass	
Anthracene	%	115			70-130	Pass	
Benz(a)anthracene	%	129			70-130	Pass	
Benzo(a)pyrene	%	129			70-130	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Benzo(b&j)fluoranthene	%	126			70-130	Pass	
Benzo(g.h.i)perylene	%	127			70-130	Pass	
Benzo(k)fluoranthene	%	120			70-130	Pass	
Chrysene	%	127			70-130	Pass	
Dibenz(a.h)anthracene	%	117			70-130	Pass	
Fluoranthene	%	121			70-130	Pass	
Fluorene	%	130			70-130	Pass	
Indeno(1.2.3-cd)pyrene	%	128			70-130	Pass	
Naphthalene	%	93			70-130	Pass	
Phenanthrene	%	121			70-130	Pass	
Pyrene	%	126			70-130	Pass	
LCS - % Recovery							
Ammonia (as N)	%	115			70-130	Pass	
Chromium (hexavalent)	%	109			70-130	Pass	
Cyanide (free)	%	113			70-130	Pass	
Cyanide (total)	%	113			70-130	Pass	
Phenolics (total)	%	111			70-130	Pass	
Chromium (hexavalent filtered)	%	109			70-130	Pass	
Naphthalene	%	108			70-130	Pass	
LCS - % Recovery							
Heavy Metals							
Lead	%	83			80-120	Pass	
Lead (filtered)	%	99			80-120	Pass	
Molybdenum	%	110			80-120	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	%	88			70-130	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	109			70-130	Pass	
Toluene	%	102			70-130	Pass	
Ethylbenzene	%	100			70-130	Pass	
m&p-Xylenes	%	100			70-130	Pass	
o-Xylene	%	101			70-130	Pass	
Xylenes - Total*	%	100			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons							
TRH C6-C10	%	88			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
				Result 1					
Cyanide (free)	N23-Oc0024988	CP	%	83			70-130	Pass	
Cyanide (total)	N23-Oc0024988	CP	%	83			70-130	Pass	
Spike - % Recovery									
				Result 1					
Chromium (hexavalent)	N23-Oc0024989	CP	%	90			70-130	Pass	
Chromium (hexavalent filtered)	N23-Oc0024989	CP	%	90			70-130	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Lead	N23-Oc0024991	CP	%	84			75-125	Pass	
Spike - % Recovery									
				Result 1					
Ammonia (as N)	N23-Oc0025001	CP	%	71			70-130	Pass	
Chromium (hexavalent)	N23-Oc0025001	CP	%	83			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Chromium (hexavalent filtered)	N23-Oc0025001	CP	%	83			70-130	Pass	
Spike - % Recovery									
				Result 1					
Cyanide (free)	N23-Oc0025002	CP	%	75			70-130	Pass	
Cyanide (total)	N23-Oc0025002	CP	%	75			70-130	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Lead (filtered)	N23-Oc0025088	CP	%	87			75-125	Pass	
Molybdenum (filtered)	N23-Oc0025088	CP	%	104			75-125	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
				Result 1	Result 2	RPD			
Ammonia (as N)	N23-Oc0024988	CP	mg/L	0.92	0.94	1.7	30%	Pass	
Chromium (hexavalent)	N23-Oc0024988	CP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
Chromium (hexavalent filtered)	N23-Oc0024988	CP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Lead (filtered)	S23-Oc0025329	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Ammonia (as N)	N23-Oc0024990	CP	mg/L	160	170	5.5	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Lead	N23-Oc0024991	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Molybdenum	N23-Oc0024991	CP	mg/L	0.006	< 0.005	96	30%	Fail	Q15
Duplicate									
				Result 1	Result 2	RPD			
Phenolics (total)	N23-Oc0024993	CP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Phenolics (total)	N23-Oc0024998	CP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Ammonia (as N)	N23-Oc0025000	CP	mg/L	1.1	1.1	1.8	30%	Pass	
Chromium (hexavalent)	N23-Oc0025000	CP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
Chromium (hexavalent filtered)	N23-Oc0025000	CP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
Duplicate									
Polycyclic Aromatic Hydrocarbons				Result 1	Result 2	RPD			
Acenaphthene	N23-Oc0025001	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Acenaphthylene	N23-Oc0025001	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Anthracene	N23-Oc0025001	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benz(a)anthracene	N23-Oc0025001	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(a)pyrene	N23-Oc0025001	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(b&j)fluoranthene	N23-Oc0025001	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(g.h.i)perylene	N23-Oc0025001	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(k)fluoranthene	N23-Oc0025001	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Chrysene	N23-Oc0025001	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Dibenz(a.h)anthracene	N23-Oc0025001	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Fluoranthene	N23-Oc0025001	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Fluorene	N23-Oc0025001	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Indeno(1.2.3-cd)pyrene	N23-Oc0025001	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Naphthalene	N23-Oc0025001	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Phenanthrene	N23-Oc0025001	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Pyrene	N23-Oc0025001	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	

Duplicate									
				Result 1	Result 2	RPD			
Cyanide (total)	N23-Oc0025001	CP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Cyanide (free)	N23-Oc0028034	NCP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Naphthalene	N23-Oc0024402	NCP	mg/L	< 0.01	< 0.01	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C6-C9	N23-Oc0024402	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
Duplicate									
BTEX				Result 1	Result 2	RPD			
Benzene	N23-Oc0024402	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Toluene	N23-Oc0024402	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Ethylbenzene	N23-Oc0024402	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
m&p-Xylenes	N23-Oc0024402	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
o-Xylene	N23-Oc0024402	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Xylenes - Total*	N23-Oc0024402	NCP	mg/L	< 0.003	< 0.003	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons				Result 1	Result 2	RPD			
TRH C6-C10	N23-Oc0024402	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass	

Comments

V3- new version to amend cyanide free results that were incorrect on Oc0025002 and Oc0025088

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	No
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs
Q09	The Surrogate recovery is outside of the recommended acceptance criteria due to matrix interference. Acceptance criteria were met for all other QC
Q15	The RPD reported passes Eurofins Environment Testing's QC - Acceptance Criteria as defined in the Internal Quality Control Review and Glossary page of this report.

Authorised by:

Andrew Black	Analytical Services Manager
Dilani Samarakoon	Senior Analyst-Inorganic
Fang Yee Tan	Senior Analyst-Metal
Mary Makarios	Senior Analyst-Inorganic
Roopesh Rangarajan	Senior Analyst-Organic
Roopesh Rangarajan	Senior Analyst-Volatile
Ryan Phillips	Senior Analyst-Inorganic

Glenn Jackson
Managing Director

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

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Email: enquiries.melb@mgtlabmark.com.au

CHAIN OF CUSTODY RECORD

Page 1 of 2

CLIENT DETAILS

Company Name: GHD
Office Address: 24 Honeysuckle Drive, Newcastle 2300

Contact Name: Nina Foley
Project Manager: Alison Markley
Email for results: nina.foley@GHD.com, Alison.markley@GHD.com

Project # 12609961

COC Number:
Eurofins | mgt quote ID: 23092GHFDL
Data output format: ESDAT

Special Directions & Comments:

Eurofins | mgt DI water batch number:

Analytes

	Sample ID	Date	Matrix	Ammonia	Phenolics	Cyanide (weak acid dissociable) (free)	Cyanide (total)	Hex. Chromium (to)	Hex. Chromium (diss.)	Molybdenum (total)	Molybdenum (diss.)	Lead (diss.)	Lead (total)	Total PAH
1	KS12/6	11/10	W	X	X	X	X	X		X			X	X
2	KS12/10			X	X	X	X		X		X	X		X
3	FD11			X	X	X	X		X		X	X		X
4	RB02			X	X	X		X		X		X		X
5	K12/9			X	X	X	X	X		X		X		X
6	K12/7			X	X	X	X		X		X		X	X
7	K12/7E			X	X	X	X		X		X		X	X
8	FD12			X	X	X	X		X		X		X	X
9	[redacted]			X	X	X	X		X		X		X	X
10	NC1			X	X	X	X		X		X		X	X
11	NC1 R			X	X	X	X		X		X		X	X
12	K12/7W			X	X	X	X		X		X		X	X
13	K12/7E			X	X	X	X		X		X		X	X
14	FD14			X	X	X	X		X		X		X	X
15	K7/4W			X	X	X	X		X		X		X	X
16				X	X	X	X		X		X		X	X

Some common holding times (with correct preservation). For further information contact the lab

Waters		Soils	
BTEX, MAH, VOC	14 days	BTEX, MAH, VOC	14 days
TRH, PAH, Phenols, Pesticides	7 days	TRH, PAH, Phenols, Pesticides	14 days
Heavy Metals	6 months	Heavy Metals	6 months
Mercury, CrVI	28 days	Mercury, CrVI	28 days
Microbiological testing	24 hours	Microbiological testing	72 hours
BOD, Nitrate, Nitrite, Total N	2 days	Anions	28 days
Solids - TSS, TDS etc	7 days	SPOCAS, pH Field and FOX, CrS	24 hours
Ferrous iron	7 days	ASLP, TCLP	7 days

Containers:

1LP	250P	125P	1LA	40mL vial	125mL A	Jar	

Sample comments:

Relinquished By: Nina Foley
Date & Time: 11/10/23 3:30pm
Signature:

Laboratory Staff
Received By: Randall
Date & Time: 11/10/23 330
Signature:

Turn around time
1 DAY ☐ 2 DAY ☐ 3 DAY ☐
5 DAY ☑ 10 DAY ☐ Other:

Method Of Shipment
☐ Courier
☑ Hand Delivered
☐ Postal
Courier Consignment #:

Temperature on arrival: 18.7

Report number: 1033940

eurofins | mgt

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CHAIN OF CUSTODY RECORD

CLIENT DETAILS

Company Name: GHD
Office Address: 24 Honeysuckle Drive, Newcastle 2300

Contact Name: Nina Foley
Project Manager:
Email for results:

Project #12609961

COC Number:
Eurofins | mgt quote ID: 250926CHDN
Data output format: ESDAT

Special Directions & Comments:

Eurofins | mgt DI water batch number:

Analytes

	Sample ID	Date	Matrix	Ammonia	Phenolics	Cyanide (total)	Cyanide (free)	Hex. chromium (dis)	Hex. chromium (total)	Molybdenum (dis)	Molybdenum (total)	Lead (dis)	Lead (total)	Total PAH
1	K7/45	11/10	W	X		X	X	X		X		X		X
2	K5+/3	〃	〃	X	X	X	X	X	X	X	X	X	X	X
3	TB01	11/10	W	X	X	X	X	X	X	X	X	X	X	X
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
15														
16														

Some common holding times (with correct preservation). For further information contact the lab

Waters		Soils	
BTEX, MAH, VOC	14 days	BTEX, MAH, VOC	14 days
TRH, PAH, Phenols, Pesticides	7 days	TRH, PAH, Phenols, Pesticides	14 days
Heavy Metals	6 months	Heavy Metals	6 months
Mercury, CrVI	28 days	Mercury, CrVI	28 days
Microbiological testing	24 hours	Microbiological testing	72 hours
BOD, Nitrate, Nitrite, Total N	2 days	Anions	28 days
Solids - TSS, TDS etc	7 days	SPOCAS, pH Field and FOX, CrS	24 hours
Ferrous iron	7 days	ASLP, TCLP	7 days

Containers:

1LP	250P	125P	1LA	40mL vial	125mL A	Jar	

Sample comments:

Laboratory Staff

Relinquished By: Nina Foley
Date & Time:: 11/10/23 3:30 PM
Signature:

Received By: Kandall
Date & Time: 11-10-23 330
Signature:

Turn around time

1 DAY ☐ 2 DAY ☐ 3 DAY ☐
5 DAY ☑ 10 DAY ☐ Other:

Method Of Shipment

☐ Courier
☑ Hand Delivered
☐ Postal
Courier Consignment #:

Temperature on arrival: 18.7

Report number: 1033940

GHD Pty Ltd
3/24 Honeysuckle Dve
Newcastle
NSW 2300

NATA Accredited
Accreditation Number 1261
Site Number 18217

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates.

Attention: **Alison Monkley**

Report **1034348-W**
Project name
Project ID 12609961
Received Date Oct 12, 2023

Client Sample ID			**K8/5W**	**RB02**	**KS10/1**	**K11/2W**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins Sample No.			**N23-Oc0028034**	**N23-Oc0028035**	**N23-Oc0028036**	**N23-Oc0028037**
Date Sampled			**Oct 12, 2023**	**Oct 12, 2023**	**Oct 12, 2023**	**Oct 12, 2023**
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Acenaphthene	0.001	mg/L	0.30	< 0.001	< 0.001	-
Acenaphthylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	-
Anthracene	0.001	mg/L	0.027	< 0.001	< 0.001	-
Benz(a)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	-
Benzo(a)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	-
Benzo(b&j)fluoranthene[N07]	0.001	mg/L	< 0.001	< 0.001	< 0.001	-
Benzo(g.h.i)perylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	-
Benzo(k)fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	-
Chrysene	0.001	mg/L	< 0.001	< 0.001	< 0.001	-
Dibenz(a.h)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	-
Fluoranthene	0.001	mg/L	0.027	< 0.001	< 0.001	-
Fluorene	0.001	mg/L	0.17	< 0.001	< 0.001	-
Indeno(1.2.3-cd)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	-
Naphthalene	0.001	mg/L	0.062	< 0.001	< 0.001	-
Phenanthrene	0.001	mg/L	0.18	< 0.001	< 0.001	-
Pyrene	0.001	mg/L	0.019	< 0.001	< 0.001	-
Total PAH*	0.001	mg/L	0.79	< 0.001	< 0.001	-
2-Fluorobiphenyl (surr.)	1	%	INt	69	INT	-
p-Terphenyl-d14 (surr.)	1	%	93	96	INT	-
Ammonia (as N)	0.01	mg/L	7.5	0.02	0.37	-
Chromium (hexavalent filtered)	0.005	mg/L	< 0.005	-	-	< 0.005
Cyanide (free)	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
Cyanide (total)	0.005	mg/L	0.019	< 0.005	< 0.005	< 0.005
Cyanide (weak acid dissoc.)	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
Phenolics (total)	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
Chromium (hexavalent)	0.005	mg/L	-	< 0.005	< 0.005	-
Heavy Metals						
Lead	0.001	mg/L	-	< 0.001	0.002	-
Lead (filtered)	0.001	mg/L	< 0.001	-	-	-
Molybdenum	0.005	mg/L	-	< 0.005	0.007	-
Molybdenum (filtered)	0.005	mg/L	0.014	-	-	-

Client Sample ID			BHe29S	K9/3N	GHD01N	GHD01S
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			N23-Oc0028038	N23-Oc0028039	N23-Oc0028040	N23-Oc0028041
Date Sampled			Oct 12, 2023	Oct 12, 2023	Oct 12, 2023	Oct 12, 2023
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Acenaphthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Acenaphthylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benz(a)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(a)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(b&j)fluoranthene[N07]	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(g.h.i)perylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(k)fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Chrysene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Dibenz(a.h)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Fluorene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Indeno(1.2.3-cd)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Naphthalene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Phenanthrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Total PAH*	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
2-Fluorobiphenyl (surr.)	1	%	INT	INT	55	89
p-Terphenyl-d14 (surr.)	1	%	76	62	84	94
Ammonia (as N)	0.01	mg/L	1.2	2.8	0.42	6.1
Chromium (hexavalent filtered)	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
Cyanide (free)	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
Cyanide (total)	0.005	mg/L	< 0.005	< 0.005	0.046	0.068
Cyanide (weak acid dissoc.)	0.005	mg/L	< 0.005	< 0.005	< 0.005	0.023
Phenolics (total)	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
Heavy Metals						
Lead (filtered)	0.001	mg/L	< 0.001	< 0.001	0.001	< 0.001
Molybdenum (filtered)	0.005	mg/L	0.005	< 0.005	0.14	0.021

Client Sample ID			K10/2N	K10/2NN	K10/2	K11/2E
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			N23-Oc0028042	N23-Oc0028043	N23-Oc0028044	N23-Oc0028185
Date Sampled			Oct 12, 2023	Oct 12, 2023	Oct 12, 2023	Oct 12, 2023
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Acenaphthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Acenaphthylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benz(a)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(a)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(b&j)fluoranthene[N07]	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(g.h.i)perylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(k)fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Chrysene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Dibenz(a.h)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001

Client Sample ID			K10/2N	K10/2NN	K10/2	K11/2E
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			N23-Oc0028042	N23-Oc0028043	N23-Oc0028044	N23-Oc0028185
Date Sampled			Oct 12, 2023	Oct 12, 2023	Oct 12, 2023	Oct 12, 2023
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Fluorene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Indeno(1.2.3-cd)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Naphthalene	0.001	mg/L	< 0.001	0.078	< 0.001	< 0.001
Phenanthrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Total PAH*	0.001	mg/L	< 0.001	0.078	< 0.001	< 0.001
2-Fluorobiphenyl (surr.)	1	%	INT	INT	51	103
p-Terphenyl-d14 (surr.)	1	%	90	78	62	118
Ammonia (as N)	0.01	mg/L	1.4	5.5	0.02	0.01
Chromium (hexavalent filtered)	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
Cyanide (free)	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
Cyanide (total)	0.005	mg/L	-	< 0.005	-	< 0.005
Cyanide (weak acid dissoc.)	0.005	mg/L	0.025	< 0.005	< 0.005	< 0.005
Phenolics (total)	0.05	mg/L	-	-	-	< 0.05
Heavy Metals						
Lead (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Molybdenum (filtered)	0.005	mg/L	0.024	< 0.005	0.006	< 0.005

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Polycyclic Aromatic Hydrocarbons	Sydney	Oct 17, 2023	7 Days
- Method: LTM-ORG-2130 PAH and Phenols in Soil and Water			
Ammonia (as N)	Sydney	Oct 17, 2023	28 Days
- Method: LTM-INO-4200 Ammonia by Discrete Analyser			
Chromium (hexavalent filtered)	Melbourne	Oct 18, 2023	28 Days
- Method: E057 Speciated Chromium			
- Method: LTM-INO-4100 Hexavalent Chromium by Spectrometric detection			
Cyanide (free)	Sydney	Oct 18, 2023	14 Days
- Method: E054 Free Cyanide			
Cyanide (total)	Sydney	Oct 18, 2023	14 Days
- Method: E054 Total Cyanide			
Cyanide (weak acid dissoc.)	Melbourne	Oct 18, 2023	14 Days
- Method: LTM-INO-4020 Total Free WAD Cyanide by CFA			
Phenolics (total)	Melbourne	Oct 16, 2023	7 Days
- Method: LTM-INO-4050 Total Phenolics in Waters and solids by CFA			
Chromium (hexavalent)	Sydney	Oct 17, 2023	28 Days
- Method: In-house method E057.1			
Heavy Metals	Sydney	Oct 18, 2023	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Heavy Metals (filtered)	Sydney	Oct 17, 2023	180 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			

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Eurofins Environment Testing Australia Pty Ltd
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6 Monterey Road	19/8 Lewalan Street	179 Magowar Road	Unit 1,2 Dacre Street	1/21 Smallwood Place	1/2 Frost Drive
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Tel: +61 3 8564 5000	Tel: +61 3 8564 5000	Tel: +61 2 9900 8400	Tel: +61 2 6113 8091	Tel: +61 7 3902 4600	NATA# 1261
NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	Site# 25079 & 25289
Site# 1254	Site# 25403	Site# 18217	Site# 25466	Site# 20794	

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IANZ# 1327	IANZ# 1290	IANZ# 1402

Company Name: GHD Pty Ltd NEWCASTLE
Address: 3/24 Honeysuckle Dve
Newcastle
NSW 2300

Project Name:
Project ID: 12609961

Order No.:
Report #: 1034348
Phone: 02 4979 9999
Fax: 02 4979 9988

Received: Oct 12, 2023 2:30 PM
Due: Oct 19, 2023
Priority: 5 Day
Contact Name: Alison Monkley

Eurofins Analytical Services Manager : Andrew Black

Sample Detail						Ammonia (as N)	Chromium (hexavalent filtered)	Chromium (hexavalent filtered)	Chromium (hexavalent)	Cyanide (free)	Cyanide (total)	Cyanide (weak acid dissoc.)	Lead	Lead (filtered)	Molybdenum	Molybdenum (filtered)	Phenolics (total)	Polycyclic Aromatic Hydrocarbons
Melbourne Laboratory - NATA # 1261 Site # 1254							X					X					X	X
Sydney Laboratory - NATA # 1261 Site # 18217						X		X	X	X	X		X	X	X	X		X
External Laboratory																		
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**													
1	K8/5W	Oct 12, 2023		Water	N23-Oc0028034	X		X		X	X	X		X		X	X	X
2	RB02	Oct 12, 2023		Water	N23-Oc0028035	X			X	X	X	X	X		X		X	X
3	KS10/1	Oct 12, 2023		Water	N23-Oc0028036	X			X	X	X	X	X		X		X	X
4	K11/2W	Oct 12, 2023		Water	N23-Oc0028037		X			X	X	X					X	
5	BHe29S	Oct 12, 2023		Water	N23-Oc0028038	X		X		X	X	X		X		X	X	X
6	K9/3N	Oct 12, 2023		Water	N23-Oc0028039	X		X		X	X	X		X		X	X	X
7	GHD01N	Oct 12, 2023		Water	N23-Oc0028040	X		X		X	X	X		X		X	X	X
8	GHD01S	Oct 12, 2023		Water	N23-Oc0028041	X		X		X	X	X		X		X	X	X
9	K10/2N	Oct 12, 2023		Water	N23-Oc0028042	X		X		X		X		X		X		X
10	K10/2NN	Oct 12, 2023		Water	N23-Oc0028043	X		X		X	X	X		X		X		X
11	K10/2	Oct 12, 2023		Water	N23-Oc0028044	X		X		X		X		X		X		X
12	K11/2E	Oct 12, 2023		Water	N23-Oc0028185	X		X		X	X	X		X		X	X	X

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NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	Site# 25079 & 25289
Site# 1254	Site# 25403	Site# 18217	Site# 25466	Site# 20794	

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Address: 3/24 Honeysuckle Dve
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NSW 2300

Project Name:
Project ID: 12609961

Order No.:
Report #: 1034348
Phone: 02 4979 9999
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Received: Oct 12, 2023 2:30 PM
Due: Oct 19, 2023
Priority: 5 Day
Contact Name: Alison Monkley

Eurofins Analytical Services Manager : Andrew Black

Sample Detail	Ammonia (as N)	Chromium (hexavalent filtered)	Chromium (hexavalent filtered)	Chromium (hexavalent)	Cyanide (free)	Cyanide (total)	Cyanide (weak acid dissoc.)	Lead	Lead (filtered)	Molybdenum	Molybdenum (filtered)	Phenolics (total)	Polycyclic Aromatic Hydrocarbons
Melbourne Laboratory - NATA # 1261 Site # 1254		X					X					X	X
Sydney Laboratory - NATA # 1261 Site # 18217	X		X	X	X	X		X	X	X	X		X
Test Counts	11	10	10	2	12	10	12	2	9	2	9	9	11

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follow guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013. They are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry weight basis unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion unless otherwise stated.
4. For CEC results where the sample's origin is unknown or environmentally contaminated, the results should be used advisedly.
5. Actual LORs are matrix dependent. Quoted LORs may be raised where sample extracts are diluted due to interferences.
6. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
7. SVOC analysis on waters is performed on homogenised, unfiltered samples unless noted otherwise.
8. Samples were analysed on an 'as received' basis.
9. Information identified in this report with blue colour indicates data provided by customers that may have an impact on the results.
10. This report replaces any interim results previously issued.

Holding Times

Please refer to the 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours before sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and despite any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling; therefore, compliance with these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether, the holding time is 7 days; however, for all other VOCs, such as BTEX or C6-10 TRH, the holding time is 14 days.

Units

mg/kg: milligrams per kilogram
mg/L: milligrams per litre
µg/L: micrograms per litre
ppm: parts per million
ppb: parts per billion
%: Percentage
org/100 mL: Organisms per 100 millilitres
NTU: Nephelometric Turbidity Units
MPN/100 mL: Most Probable Number of organisms per 100 millilitres
CFU: Colony forming unit

Terms

APHA	American Public Health Association
CEC	Cation Exchange Capacity
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where moisture has been determined on a solid sample, the result is expressed on a dry weight basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples, these are performed on laboratory-certified clean sands and in the case of water samples, these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC represents the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment; however free tributyltin was measured, and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site-specific Sampling Analysis and Quality Plan (SAQP) have been implemented.

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30%; however the following acceptance guidelines are equally

applicable: Results <10 times the LOR: No Limit

Results between 10-20 times the LOR: RPD must lie between 0-50%

Results >20 times the LOR: RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range, not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%

PFAS field samples that contain surrogate recoveries above the QC limit designated in QSM 5.4, where no positive PFAS results have been reported, have been reviewed, and no data was affected.

QC Data General Comments

1. Where a result is reported as less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown are not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery, the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results, a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data; thus, it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	mg/L	< 0.001			0.001	Pass	
Acenaphthylene	mg/L	< 0.001			0.001	Pass	
Anthracene	mg/L	< 0.001			0.001	Pass	
Benz(a)anthracene	mg/L	< 0.001			0.001	Pass	
Benzo(a)pyrene	mg/L	< 0.001			0.001	Pass	
Benzo(b&j)fluoranthene	mg/L	< 0.001			0.001	Pass	
Benzo(g.h.i)perylene	mg/L	< 0.001			0.001	Pass	
Benzo(k)fluoranthene	mg/L	< 0.001			0.001	Pass	
Chrysene	mg/L	< 0.001			0.001	Pass	
Dibenz(a.h)anthracene	mg/L	< 0.001			0.001	Pass	
Fluoranthene	mg/L	< 0.001			0.001	Pass	
Fluorene	mg/L	< 0.001			0.001	Pass	
Indeno(1.2.3-cd)pyrene	mg/L	< 0.001			0.001	Pass	
Naphthalene	mg/L	< 0.001			0.001	Pass	
Phenanthrene	mg/L	< 0.001			0.001	Pass	
Pyrene	mg/L	< 0.001			0.001	Pass	
Method Blank							
Ammonia (as N)	mg/L	0.01			0.01	Pass	
Chromium (hexavalent filtered)	mg/L	< 0.005			0.005	Pass	
Cyanide (free)	mg/L	< 0.005			0.005	Pass	
Cyanide (total)	mg/L	< 0.005			0.005	Pass	
Phenolics (total)	mg/L	< 0.05			0.05	Pass	
Chromium (hexavalent)	mg/L	< 0.005			0.005	Pass	
Method Blank							
Heavy Metals							
Lead	mg/L	< 0.001			0.001	Pass	
Lead (filtered)	mg/L	< 0.001			0.001	Pass	
Molybdenum (filtered)	mg/L	< 0.005			0.005	Pass	
LCS - % Recovery							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	%	129			70-130	Pass	
Acenaphthylene	%	127			70-130	Pass	
Anthracene	%	115			70-130	Pass	
Benz(a)anthracene	%	129			70-130	Pass	
Benzo(a)pyrene	%	129			70-130	Pass	
Benzo(b&j)fluoranthene	%	126			70-130	Pass	
Benzo(g.h.i)perylene	%	127			70-130	Pass	
Benzo(k)fluoranthene	%	120			70-130	Pass	
Chrysene	%	127			70-130	Pass	
Dibenz(a.h)anthracene	%	117			70-130	Pass	
Fluoranthene	%	121			70-130	Pass	
Fluorene	%	130			70-130	Pass	
Indeno(1.2.3-cd)pyrene	%	128			70-130	Pass	
Naphthalene	%	93			70-130	Pass	
Phenanthrene	%	121			70-130	Pass	
Pyrene	%	126			70-130	Pass	
LCS - % Recovery							
Ammonia (as N)	%	108			70-130	Pass	
Chromium (hexavalent filtered)	%	111			70-130	Pass	
Cyanide (free)	%	112			70-130	Pass	

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Cyanide (total)			%	112			70-130	Pass	
Phenolics (total)			%	108			70-130	Pass	
Chromium (hexavalent)			%	111			70-130	Pass	
LCS - % Recovery									
Heavy Metals									
Lead			%	101			80-120	Pass	
Lead (filtered)			%	92			80-120	Pass	
Molybdenum (filtered)			%	104			80-120	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Spike - % Recovery									
				Result 1					
Chromium (hexavalent filtered)	N23-Oc0028035	CP	%	103			70-130	Pass	
Cyanide (free)	N23-Oc0028035	CP	%	100			70-130	Pass	
Cyanide (total)	N23-Oc0028035	CP	%	110			70-130	Pass	
Chromium (hexavalent)	N23-Oc0028035	CP	%	103			70-130	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Lead	N23-Oc0028036	CP	%	91			75-125	Pass	
Spike - % Recovery									
				Result 1					
Cyanide (free)	N23-Oc0028041	CP	%	80			70-130	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Lead (filtered)	N23-Oc0028044	CP	%	88			75-125	Pass	
Molybdenum (filtered)	N23-Oc0028044	CP	%	106			75-125	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Lead (filtered)	N23-Oc0028185	CP	%	102			75-125	Pass	
Molybdenum (filtered)	N23-Oc0028185	CP	%	98			75-125	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Polycyclic Aromatic Hydrocarbons				Result 1	Result 2	RPD			
Acenaphthene	N23-Oc0031681	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Acenaphthylene	N23-Oc0031681	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Anthracene	N23-Oc0031681	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benz(a)anthracene	N23-Oc0031681	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(a)pyrene	N23-Oc0031681	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(b&j)fluoranthene	N23-Oc0031681	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(g.h.i)perylene	N23-Oc0031681	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(k)fluoranthene	N23-Oc0031681	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Chrysene	N23-Oc0031681	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Dibenz(a.h)anthracene	N23-Oc0031681	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Fluoranthene	N23-Oc0031681	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Fluorene	N23-Oc0031681	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Indeno(1.2.3-cd)pyrene	N23-Oc0031681	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Naphthalene	N23-Oc0031681	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Phenanthrene	N23-Oc0031681	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Pyrene	N23-Oc0031681	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Ammonia (as N)	N23-Oc0028034	CP	mg/L	7.5	7.5	<1	30%	Pass	
Chromium (hexavalent filtered)	N23-Oc0028034	CP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
Cyanide (free)	N23-Oc0028034	CP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
Chromium (hexavalent)	N23-Oc0028034	CP	mg/L	< 0.005	< 0.005	<1	30%	Pass	

Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Lead (filtered)	N23-Oc0028034	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Molybdenum (filtered)	N23-Oc0028034	CP	mg/L	0.014	0.015	8.4	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Lead	S23-Oc0029538	NCP	mg/L	**	< 0.001	11	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Cyanide (total)	N23-Oc0025001	NCP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Phenolics (total)	N23-Oc0028038	CP	mg/L	< 0.05	< 0.05	<1	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs
Q15	The RPD reported passes Eurofins Environment Testing's QC - Acceptance Criteria as defined in the Internal Quality Control Review and Glossary page of this report.

Authorised by:

Andrew Black	Analytical Services Manager
Dilani Samarakoon	Senior Analyst-Inorganic
Mary Makarios	Senior Analyst-Inorganic
Mickael Ros	Senior Analyst-Metal
Roopesh Rangarajan	Senior Analyst-Organic
Ryan Phillips	Senior Analyst-Inorganic

Glenn Jackson
Managing Director

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

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Sample Receipt Advice

Company name:	GHD Pty Ltd NEWCASTLE
Contact name:	Alison Monkley
Project name:	Not provided
Project ID:	12609961
Turnaround time:	5 Day
Date/Time received	Oct 12, 2023 2:30 PM
Eurofins reference	1034348

Sample Information

✓	A detailed list of analytes logged into our LIMS, is included in the attached summary table.
✓	Sample Temperature of chilled sample on the batch as recorded by Eurofins Sample Receipt : 21.5 degrees Celsius.
✓	All samples have been received as described on the above COC.
✓	COC has been completed correctly.
✓	Attempt to chill was evident.
✓	Appropriately preserved sample containers have been used.
✓	All samples were received in good condition.
✓	Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
✓	Appropriate sample containers have been used.
✓	Sample containers for volatile analysis received with zero headspace.
✗	Split sample sent to requested external lab.
✗	Some samples have been subcontracted.
N/A	Custody Seals intact (if used).

Notes

K11/2W missing amber bottle and metal bottle, unable to perform PAH, molybedenum and lead

Contact

If you have any questions with respect to these samples, please contact your Analytical Services Manager:

Andrew Black on phone : (+61) 2 9900 8490 or by email: AndrewBlack@eurofins.com

Results will be delivered electronically via email to Alison Monkley - alison.monkley@ghd.com.au.

Note: A copy of these results will also be delivered to the general GHD Pty Ltd NEWCASTLE email address.

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web: www.eurofins.com.au
email: EnviroSales@eurofins.com

Eurofins Environment Testing Australia Pty Ltd
ABN: 50 005 085 521

Melbourne	Geelong	Sydney	Canberra	Brisbane	Newcastle
6 Monterey Road	19/8 Lewalan Street	179 Magowar Road	Unit 1,2 Dacre Street	1/21 Smallwood Place	1/2 Frost Drive
Dandenong South	Grovedale	Girraween	Mitchell	Murarrie	Mayfield West NSW 2304
VIC 3175	VIC 3216	NSW 2145	ACT 2911	QLD 4172	Tel: +61 2 4968 8448
Tel: +61 3 8564 5000	Tel: +61 3 8564 5000	Tel: +61 2 9900 8400	Tel: +61 2 6113 8091	Tel: +61 7 3902 4600	NATA# 1261
NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	Site# 25079 & 25289
Site# 1254	Site# 25403	Site# 18217	Site# 25466	Site# 20794	

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Site# 2370

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IANZ# 1327	IANZ# 1290	IANZ# 1402

Company Name: GHD Pty Ltd NEWCASTLE
Address: 3/24 Honeysuckle Dve
Newcastle
NSW 2300

Project Name:
Project ID: 12609961

Order No.:
Report #: 1034348
Phone: 02 4979 9999
Fax: 02 4979 9988

Received: Oct 12, 2023 2:30 PM
Due: Oct 19, 2023
Priority: 5 Day
Contact Name: Alison Monkley

Eurofins Analytical Services Manager : Andrew Black

Sample Detail						Ammonia (as N)	Chromium (hexavalent filtered)	Chromium (hexavalent filtered)	Chromium (hexavalent)	Cyanide (free)	Cyanide (total)	Cyanide (weak acid dissoc.)	Lead	Lead (filtered)	Molybdenum	Molybdenum (filtered)	Phenolics (total)	Polycyclic Aromatic Hydrocarbons
Melbourne Laboratory - NATA # 1261 Site # 1254							X					X					X	X
Sydney Laboratory - NATA # 1261 Site # 18217						X		X	X	X	X		X	X	X	X		X
External Laboratory																		
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**													
1	K8/5W	Oct 12, 2023		Water	N23-Oc0028034	X		X		X	X	X		X		X	X	X
2	RB02	Oct 12, 2023		Water	N23-Oc0028035	X			X	X	X	X	X		X		X	X
3	KS10/1	Oct 12, 2023		Water	N23-Oc0028036	X			X	X	X	X	X		X		X	X
4	K11/2W	Oct 12, 2023		Water	N23-Oc0028037		X			X	X	X					X	
5	BHe29S	Oct 12, 2023		Water	N23-Oc0028038	X		X		X	X	X		X		X	X	X
6	K9/3N	Oct 12, 2023		Water	N23-Oc0028039	X		X		X	X	X		X		X	X	X
7	GHD01N	Oct 12, 2023		Water	N23-Oc0028040	X		X		X	X	X		X		X	X	X
8	GHD01S	Oct 12, 2023		Water	N23-Oc0028041	X		X		X	X	X		X		X	X	X
9	K10/2N	Oct 12, 2023		Water	N23-Oc0028042	X		X		X		X		X		X		X
10	K10/2NN	Oct 12, 2023		Water	N23-Oc0028043	X		X		X	X	X		X		X		X
11	K10/2	Oct 12, 2023		Water	N23-Oc0028044	X		X		X		X		X		X		X
12	K11/2E	Oct 12, 2023		Water	N23-Oc0028185	X		X		X	X	X		X		X	X	X

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ABN: 50 005 085 521

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Tel: +61 3 8564 5000	Tel: +61 3 8564 5000	Tel: +61 2 9900 8400	Tel: +61 2 6113 8091	Tel: +61 7 3902 4600	NATA# 1261
NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	Site# 25079 & 25289
Site# 1254	Site# 25403	Site# 18217	Site# 25466	Site# 20794	

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Auckland 1061	Christchurch 7675	Tauranga 3112
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IANZ# 1327	IANZ# 1290	IANZ# 1402

Company Name: GHD Pty Ltd NEWCASTLE
Address: 3/24 Honeysuckle Dve
Newcastle
NSW 2300

Project Name:
Project ID: 12609961

Order No.:
Report #: 1034348
Phone: 02 4979 9999
Fax: 02 4979 9988

Received: Oct 12, 2023 2:30 PM
Due: Oct 19, 2023
Priority: 5 Day
Contact Name: Alison Monkley

Eurofins Analytical Services Manager : Andrew Black

Sample Detail	Ammonia (as N)	Chromium (hexavalent filtered)	Chromium (hexavalent filtered)	Chromium (hexavalent)	Cyanide (free)	Cyanide (total)	Cyanide (weak acid dissoc.)	Lead	Lead (filtered)	Molybdenum	Molybdenum (filtered)	Phenolics (total)	Polycyclic Aromatic Hydrocarbons
Melbourne Laboratory - NATA # 1261 Site # 1254		X					X					X	X
Sydney Laboratory - NATA # 1261 Site # 18217	X		X	X	X	X		X	X	X	X		X
Test Counts	11	10	10	2	12	10	12	2	9	2	9	9	11

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Email: enquiries.melb@mgtlabmark.com.au

CHAIN OF CUSTODY RECORD

CLIENT DETAILS

Company Name : GHD
Office Address : 24 Honeysuckle Drive
Newcastle 2300

Contact Name: Nina Foley
Project Manager : Alison Monkley
Email for results : Alison.Monkley@ghd.com

Project # 12609961

Page 1 of 1

COC Number :
Eurofins | mgt quote ID : 230926GHDN
Data output format: ESDAT

Special Directions & Comments :

Eurofins | mgt DI water batch number:

Analytes

	Sample ID	Date	Matrix	Ammonia	phenolics	Cyanide (weak acid dis. free)	Cyanide (total)	Hex. Chromium (dis)	Hex. Chromium (tot)	Molybedenum (tot)	Molybedenum (dis)	lead (dis)	Lead (tot)	Total PAH
1	K8/5W	12/10/23	W	X	X	X	X	X			X	X		X
2	RB02			X	X	X	X		X	X			X	X
3	K5/0/1			X	X	X	X		X	X			X	X
4	K11/2E			X	X	X	X	X					X	X
5	K11/2W			X	X	X	X	X			X	X		X
6	BHE293			X	X	X	X	X			X	X		X
7	K9/3N			X	X	X	X	X			X	X		X
8	[illegible]			X	X	X	X	X			X	X		X
9	GHD01N			X	X	X	X	X			X	X		X
10	GHD01S			X	X	X	X	X			X	X		X
11	K10/2N			X		X		X			X	X		X
12	K10/2NN			X		X	X	X			X	X		X
13	K10/2			X		X		X			X	X		X
15														
16														

Some common holding times (with correct preservation).
For further information contact the lab

Waters		Soils	
BTEX, MAH, VOC	14 days	BTEX, MAH, VOC	14 days
TRH, PAH, Phenols, Pesticides	7 days	TRH, PAH, Phenols, Pesticides	14 days
Heavy Metals	6 months	Heavy Metals	6 months
Mercury, CrVI	28 days	Mercury, CrVI	28 days
Microbiological testing	24 hours	Microbiological testing	72 hours
BOD, Nitrate, Nitrite, Total N	2 days	Anions	28 days
Solids - TSS, TDS etc	7 days	SPCCAS, pH Field and FOX, CrS	24 hours
Ferrous Iron	7 days	ASLP, TCLP	7 days

Containers:

1LP	250P	125P	1LA	40mL vial	125mL A	Jar

Sample comments:

Relinquished By: Jackson Marlow-Conway
Date & Time: 12/10/2023 14:30
Signature:

Laboratory Staff
Received By: JRandall
Date & Time: 12/10 2:30
Signature:

Turn around time
1 DAY ☐ 2 DAY ☐ 3 DAY ☐
5 DAY ☑ 10 DAY ☐ Other:

Method Of Shipment
☐ Courier
☑ Hand Delivered
☐ Postal
Courier Consignment # :

Temperature on arrival: 21.5
Report number: 1034348

GHD Pty Ltd
3/24 Honeysuckle Dve
Newcastle
NSW 2300

NATA Accredited
Accreditation Number 1261
Site Number 18217

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates.

Attention: **Alison Monkley**

Report **1034352-W**
Project name
Project ID 12609961
Received Date Oct 13, 2023

Client Sample ID			**K9/3S**	**K11/1S**	**K11/1**	**K11/3E**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins Sample No.			**N23-Oc0028095**	**N23-Oc0028096**	**N23-Oc0028097**	**N23-Oc0028098**
Date Sampled			**Oct 13, 2023**	**Oct 13, 2023**	**Oct 13, 2023**	**Oct 13, 2023**
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Acenaphthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Acenaphthylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benz(a)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(a)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(b&j)fluoranthene[N07]	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(g.h.i)perylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(k)fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Chrysene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Dibenz(a.h)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Fluorene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Indeno(1.2.3-cd)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Naphthalene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Phenanthrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Total PAH*	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
2-Fluorobiphenyl (surr.)	1	%	INT	70	79	78
p-Terphenyl-d14 (surr.)	1	%	80	112	115	104
Ammonia (as N)	0.01	mg/L	1.8	3.8	0.05	1.7
Chromium (hexavalent filtered)	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
Cyanide (free)	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
Cyanide (total)	0.005	mg/L	0.006	< 0.005	< 0.005	< 0.005
Cyanide (weak acid dissoc.)	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
Phenolics (total)	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
Heavy Metals						
Lead (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Molybdenum (filtered)	0.005	mg/L	0.013	< 0.005	< 0.005	< 0.005

Client Sample ID			K11/3W	TB02	TS02
Sample Matrix			Water	Trip Blank (liquid)	Trip Spike (liquid)
Eurofins Sample No.			N23-Oc0028099	N23-Oc0028100	N23-Oc0028957
Date Sampled			Oct 13, 2023	Oct 13, 2023	Oct 13, 2023
Test/Reference	LOR	Unit			
Polycyclic Aromatic Hydrocarbons					
Acenaphthene	0.001	mg/L	< 0.001	-	-
Acenaphthylene	0.001	mg/L	< 0.001	-	-
Anthracene	0.001	mg/L	< 0.001	-	-
Benz(a)anthracene	0.001	mg/L	< 0.001	-	-
Benzo(a)pyrene	0.001	mg/L	< 0.001	-	-
Benzo(b&j)fluoranthene[N07]	0.001	mg/L	< 0.001	-	-
Benzo(g.h.i)perylene	0.001	mg/L	< 0.001	-	-
Benzo(k)fluoranthene	0.001	mg/L	< 0.001	-	-
Chrysene	0.001	mg/L	< 0.001	-	-
Dibenz(a.h)anthracene	0.001	mg/L	< 0.001	-	-
Fluoranthene	0.001	mg/L	< 0.001	-	-
Fluorene	0.001	mg/L	< 0.001	-	-
Indeno(1.2.3-cd)pyrene	0.001	mg/L	< 0.001	-	-
Naphthalene	0.001	mg/L	< 0.001	-	-
Phenanthrene	0.001	mg/L	< 0.001	-	-
Pyrene	0.001	mg/L	< 0.001	-	-
Total PAH*	0.001	mg/L	< 0.001	-	-
2-Fluorobiphenyl (surr.)	1	%	64	-	-
p-Terphenyl-d14 (surr.)	1	%	110	-	-
Ammonia (as N)	0.01	mg/L	5.9	-	-
Chromium (hexavalent filtered)	0.005	mg/L	< 0.005	-	-
Cyanide (free)	0.005	mg/L	< 0.005	-	-
Cyanide (total)	0.005	mg/L	0.009	-	-
Cyanide (weak acid dissoc.)	0.005	mg/L	< 0.005	-	-
Phenolics (total)	0.05	mg/L	< 0.05	-	-
Naphthalene[N02]	0.01	mg/L	-	< 0.01	-
TRH C6-C10	1	%	-	-	81
Heavy Metals					
Lead (filtered)	0.001	mg/L	< 0.001	-	-
Molybdenum (filtered)	0.005	mg/L	< 0.005	-	-
Total Recoverable Hydrocarbons - 1999 NEPM Fractions					
TRH C6-C9	0.02	mg/L	-	< 0.02	-
BTEX					
Benzene	0.001	mg/L	-	< 0.001	-
Toluene	0.001	mg/L	-	< 0.001	-
Ethylbenzene	0.001	mg/L	-	< 0.001	-
m&p-Xylenes	0.002	mg/L	-	< 0.002	-
o-Xylene	0.001	mg/L	-	< 0.001	-
Xylenes - Total*	0.003	mg/L	-	< 0.003	-
4-Bromofluorobenzene (surr.)	1	%	-	97	-
Total Recoverable Hydrocarbons					
TRH C6-C10	0.02	mg/L	-	< 0.02	-
TRH C6-C10 less BTEX (F1)[N04]	0.02	mg/L	-	< 0.02	-
Naphthalene	1	%	-	-	120
TRH C6-C9	1	%	-	-	78

Client Sample ID			K11/3W	TB02	TS02
Sample Matrix			Water	Trip Blank (liquid)	Trip Spike (liquid)
Eurofins Sample No.			N23-Oc0028099	N23-Oc0028100	N23-Oc0028957
Date Sampled			Oct 13, 2023	Oct 13, 2023	Oct 13, 2023
Test/Reference	LOR	Unit			
BTEX					
Benzene	1	%	-	-	110
Ethylbenzene	1	%	-	-	110
m&p-Xylenes	1	%	-	-	110
o-Xylene	1	%	-	-	100
Toluene	1	%	-	-	110
Xylenes - Total	1	%	-	-	110
4-Bromofluorobenzene (surr.)	1	%	-	-	121

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Polycyclic Aromatic Hydrocarbons	Sydney	Oct 19, 2023	7 Days
- Method: LTM-ORG-2130 PAH and Phenols in Soil and Water			
Ammonia (as N)	Sydney	Oct 19, 2023	28 Days
- Method: LTM-INO-4200 Ammonia by Discrete Analyser			
Chromium (hexavalent filtered)	Sydney	Oct 19, 2023	28 Days
- Method: E057 Speciated Chromium			
Cyanide (free)	Sydney	Oct 19, 2023	14 Days
- Method: E054 Free Cyanide			
Cyanide (total)	Sydney	Oct 19, 2023	14 Days
- Method: E054 Total Cyanide			
Cyanide (weak acid dissoc.)	Melbourne	Oct 19, 2023	14 Days
- Method: LTM-INO-4020 Total Free WAD Cyanide by CFA			
Phenolics (total)	Melbourne	Oct 16, 2023	7 Days
- Method: LTM-INO-4050 Total Phenolics in Waters and solids by CFA			
Heavy Metals (filtered)	Sydney	Oct 19, 2023	180 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Total Recoverable Hydrocarbons - 1999 NEPM Fractions	Sydney	Oct 19, 2023	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
BTEX	Sydney	Oct 13, 2023	14 Days
- Method: LTM-ORG-2010 BTEX and Volatile TRH			
Total Recoverable Hydrocarbons	Sydney	Oct 13, 2023	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			

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ABN: 50 005 085 521

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NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	Site# 25079 & 25289
Site# 1254	Site# 25403	Site# 18217	Site# 25466	Site# 20794	

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IANZ# 1327	IANZ# 1290	IANZ# 1402

Company Name: GHD Pty Ltd NEWCASTLE
Address: 3/24 Honeysuckle Dve
Newcastle
NSW 2300

Project Name:
Project ID: 12609961

Order No.:
Report #: 1034352
Phone: 02 4979 9999
Fax: 02 4979 9988

Received: Oct 13, 2023 10:30 AM
Due: Oct 20, 2023
Priority: 5 Day
Contact Name: Alison Monkley

Eurofins Analytical Services Manager : Andrew Black

Sample Detail						Ammonia (as N)	Chromium (hexavalent filtered)	Cyanide (free)	Cyanide (total)	Cyanide (weak acid dissoc.)	Lead (filtered)	Molybdenum (filtered)	Phenolics (total)	Polycyclic Aromatic Hydrocarbons	BTEXN and Volatile TRH	BTEXN and Volatile TRH
Melbourne Laboratory - NATA # 1261 Site # 1254										X			X	X	X	
Sydney Laboratory - NATA # 1261 Site # 18217						X	X	X	X		X	X		X	X	X
External Laboratory																
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**											
1	K9/3S	Oct 13, 2023		Water	N23-Oc0028095	X	X	X	X	X	X	X	X	X		
2	K11/1S	Oct 13, 2023		Water	N23-Oc0028096	X	X	X	X	X	X	X	X	X		
3	K11/1	Oct 13, 2023		Water	N23-Oc0028097	X	X	X	X	X	X	X	X	X		
4	K11/3E	Oct 13, 2023		Water	N23-Oc0028098	X	X	X	X	X	X	X	X	X		
5	K11/3W	Oct 13, 2023		Water	N23-Oc0028099	X	X	X	X	X	X	X	X	X		
6	TB02	Oct 13, 2023		Trip Blank (liquid)	N23-Oc0028100										X	
7	TS02	Oct 13, 2023		Trip Spike (liquid)	N23-Oc0028957											X
Test Counts						5	5	5	5	5	5	5	5	5	1	1

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Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follow guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013. They are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry weight basis unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion unless otherwise stated.
4. For CEC results where the sample's origin is unknown or environmentally contaminated, the results should be used advisedly.
5. Actual LORs are matrix dependent. Quoted LORs may be raised where sample extracts are diluted due to interferences.
6. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
7. SVOC analysis on waters is performed on homogenised, unfiltered samples unless noted otherwise.
8. Samples were analysed on an 'as received' basis.
9. Information identified in this report with blue colour indicates data provided by customers that may have an impact on the results.
10. This report replaces any interim results previously issued.

Holding Times

Please refer to the 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours before sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and despite any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling; therefore, compliance with these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether, the holding time is 7 days; however, for all other VOCs, such as BTEX or C6-10 TRH, the holding time is 14 days.

Units

mg/kg: milligrams per kilogram
mg/L: milligrams per litre
µg/L: micrograms per litre
ppm: parts per million
ppb: parts per billion
%: Percentage
org/100 mL: Organisms per 100 millilitres
NTU: Nephelometric Turbidity Units
MPN/100 mL: Most Probable Number of organisms per 100 millilitres
CFU: Colony forming unit

Terms

APHA	American Public Health Association
CEC	Cation Exchange Capacity
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where moisture has been determined on a solid sample, the result is expressed on a dry weight basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples, these are performed on laboratory-certified clean sands and in the case of water samples, these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC represents the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment; however free tributyltin was measured, and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site-specific Sampling Analysis and Quality Plan (SAQP) have been implemented.

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30%; however the following acceptance guidelines are equally applicable: Results <10 times the LOR: No Limit

Results between 10-20 times the LOR: RPD must lie between 0-50%

Results >20 times the LOR: RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range, not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%

PFAS field samples that contain surrogate recoveries above the QC limit designated in QSM 5.4, where no positive PFAS results have been reported, have been reviewed, and no data was affected.

QC Data General Comments

1. Where a result is reported as less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown are not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery, the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results, a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data; thus, it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	mg/L	< 0.001			0.001	Pass	
Acenaphthylene	mg/L	< 0.001			0.001	Pass	
Anthracene	mg/L	< 0.001			0.001	Pass	
Benz(a)anthracene	mg/L	< 0.001			0.001	Pass	
Benzo(a)pyrene	mg/L	< 0.001			0.001	Pass	
Benzo(b&j)fluoranthene	mg/L	< 0.001			0.001	Pass	
Benzo(g.h.i)perylene	mg/L	< 0.001			0.001	Pass	
Benzo(k)fluoranthene	mg/L	< 0.001			0.001	Pass	
Chrysene	mg/L	< 0.001			0.001	Pass	
Dibenz(a.h)anthracene	mg/L	< 0.001			0.001	Pass	
Fluoranthene	mg/L	< 0.001			0.001	Pass	
Fluorene	mg/L	< 0.001			0.001	Pass	
Indeno(1.2.3-cd)pyrene	mg/L	< 0.001			0.001	Pass	
Naphthalene	mg/L	< 0.001			0.001	Pass	
Phenanthrene	mg/L	< 0.001			0.001	Pass	
Pyrene	mg/L	< 0.001			0.001	Pass	
Method Blank							
Ammonia (as N)	mg/L	< 0.01			0.01	Pass	
Chromium (hexavalent filtered)	mg/L	< 0.005			0.005	Pass	
Cyanide (free)	mg/L	< 0.005			0.005	Pass	
Cyanide (total)	mg/L	< 0.005			0.005	Pass	
Phenolics (total)	mg/L	< 0.05			0.05	Pass	
Naphthalene	mg/L	< 0.01			0.01	Pass	
Method Blank							
Heavy Metals							
Lead (filtered)	mg/L	< 0.001			0.001	Pass	
Molybdenum (filtered)	mg/L	< 0.005			0.005	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	mg/L	< 0.02			0.02	Pass	
Method Blank							
BTEX							
Benzene	mg/L	< 0.001			0.001	Pass	
Toluene	mg/L	< 0.001			0.001	Pass	
Ethylbenzene	mg/L	< 0.001			0.001	Pass	
m&p-Xylenes	mg/L	< 0.002			0.002	Pass	
o-Xylene	mg/L	< 0.001			0.001	Pass	
Xylenes - Total*	mg/L	< 0.003			0.003	Pass	
Method Blank							
Total Recoverable Hydrocarbons							
TRH C6-C10	mg/L	< 0.02			0.02	Pass	
LCS - % Recovery							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	%	129			70-130	Pass	
Acenaphthylene	%	127			70-130	Pass	
Anthracene	%	115			70-130	Pass	
Benz(a)anthracene	%	129			70-130	Pass	
Benzo(a)pyrene	%	129			70-130	Pass	
Benzo(b&j)fluoranthene	%	126			70-130	Pass	
Benzo(g.h.i)perylene	%	127			70-130	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Benzo(k)fluoranthene	%	120			70-130	Pass	
Chrysene	%	127			70-130	Pass	
Dibenz(a.h)anthracene	%	117			70-130	Pass	
Fluoranthene	%	121			70-130	Pass	
Fluorene	%	130			70-130	Pass	
Indeno(1.2.3-cd)pyrene	%	128			70-130	Pass	
Naphthalene	%	93			70-130	Pass	
Phenanthrene	%	121			70-130	Pass	
Pyrene	%	126			70-130	Pass	
LCS - % Recovery							
Ammonia (as N)	%	113			70-130	Pass	
Chromium (hexavalent filtered)	%	105			70-130	Pass	
Cyanide (free)	%	92			70-130	Pass	
Cyanide (total)	%	80			70-130	Pass	
Phenolics (total)	%	113			70-130	Pass	
Naphthalene	%	102			70-130	Pass	
LCS - % Recovery							
Heavy Metals							
Lead (filtered)	%	93			80-120	Pass	
Molybdenum (filtered)	%	90			80-120	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	%	89			70-130	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	103			70-130	Pass	
Toluene	%	98			70-130	Pass	
Ethylbenzene	%	100			70-130	Pass	
m&p-Xylenes	%	99			70-130	Pass	
o-Xylene	%	99			70-130	Pass	
Xylenes - Total*	%	99			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons							
TRH C6-C10	%	89			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
				Result 1					
Chromium (hexavalent filtered)	S23-Oc0029539	NCP	%	102			70-130	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Lead (filtered)	N23-Oc0025088	NCP	%	87			75-125	Pass	
Molybdenum (filtered)	N23-Oc0025088	NCP	%	104			75-125	Pass	
Spike - % Recovery									
				Result 1					
Ammonia (as N)	N23-Oc0028097	CP	%	100			70-130	Pass	
Spike - % Recovery									
				Result 1					
Cyanide (free)	N23-Oc0028099	CP	%	78			70-130	Pass	
Cyanide (total)	N23-Oc0028099	CP	%	75			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Polycyclic Aromatic Hydrocarbons				Result 1	Result 2	RPD			
Acenaphthene	N23-Oc0031681	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Acenaphthylene	N23-Oc0031681	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Anthracene	N23-Oc0031681	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benz(a)anthracene	N23-Oc0031681	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(a)pyrene	N23-Oc0031681	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(b&j)fluoranthene	N23-Oc0031681	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(g.h.i)perylene	N23-Oc0031681	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(k)fluoranthene	N23-Oc0031681	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Chrysene	N23-Oc0031681	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Dibenz(a.h)anthracene	N23-Oc0031681	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Fluoranthene	N23-Oc0031681	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Fluorene	N23-Oc0031681	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Indeno(1.2.3-cd)pyrene	N23-Oc0031681	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Naphthalene	N23-Oc0031681	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Phenanthrene	N23-Oc0031681	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Pyrene	N23-Oc0031681	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Chromium (hexavalent filtered)	S23-Oc0045356	NCP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
Cyanide (free)	N23-Oc0028095	CP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
Cyanide (total)	N23-Oc0028095	CP	mg/L	0.006	0.006	<1	30%	Pass	
Phenolics (total)	N23-Oc0028038	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Ammonia (as N)	N23-Oc0028096	CP	mg/L	3.8	3.8	<1	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Lead (filtered)	N23-Oc0028096	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Molybdenum (filtered)	N23-Oc0028096	CP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Lead (filtered)	N23-Oc0028097	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Molybdenum (filtered)	N23-Oc0028097	CP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Naphthalene	S23-Oc0030334	NCP	mg/L	< 0.01	< 0.01	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C6-C9	S23-Oc0030334	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
Duplicate									
BTEX				Result 1	Result 2	RPD			
Benzene	S23-Oc0030334	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Toluene	S23-Oc0030334	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Ethylbenzene	S23-Oc0030334	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
m&p-Xylenes	S23-Oc0030334	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
o-Xylene	S23-Oc0030334	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Xylenes - Total*	S23-Oc0030334	NCP	mg/L	< 0.003	< 0.003	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons				Result 1	Result 2	RPD			
TRH C6-C10	S23-Oc0030334	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	No
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs

Authorised by:

Andrew Black	Analytical Services Manager
Dilani Samarakoon	Senior Analyst-Inorganic
Fang Yee Tan	Senior Analyst-Metal
Mary Makarios	Senior Analyst-Inorganic
Mickael Ros	Senior Analyst-Metal
Roopesh Rangarajan	Senior Analyst-Organic
Roopesh Rangarajan	Senior Analyst-Volatile
Ryan Phillips	Senior Analyst-Inorganic

Glenn Jackson
Managing Director

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

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Eurofins Environment Testing Australia Pty Ltd

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Dandenong South	Grovedale	Girraween	Mitchell	Murarrie	Mayfield West NSW 2304
VIC 3175	VIC 3216	NSW 2145	ACT 2911	QLD 4172	Tel: +61 2 4968 8448
Tel: +61 3 8564 5000	Tel: +61 3 8564 5000	Tel: +61 2 9900 8400	Tel: +61 2 6113 8091	Tel: +61 7 3902 4600	NATA# 1261
NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	Site# 25079 & 25289
Site# 1254	Site# 25403	Site# 18217	Site# 25466	Site# 20794	

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Tel: +64 9 526 4551	Tel: +64 3 343 5201	Tel: +64 9 525 0568
IANZ# 1327	IANZ# 1290	IANZ# 1402

Sample Receipt Advice

Company name:	GHD Pty Ltd NEWCASTLE
Contact name:	Alison Monkley
Project name:	Not provided
Project ID:	12609961
Turnaround time:	5 Day
Date/Time received	Oct 13, 2023 10:30 AM
Eurofins reference	1034352

Sample Information

✓	A detailed list of analytes logged into our LIMS, is included in the attached summary table.
✓	Sample Temperature of chilled sample on the batch as recorded by Eurofins Sample Receipt : 21.1 degrees Celsius.
✓	All samples have been received as described on the above COC.
✓	COC has been completed correctly.
✗	Attempt to chill was evident.
✓	Appropriately preserved sample containers have been used.
✓	All samples were received in good condition.
✓	Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
✓	Appropriate sample containers have been used.
✓	Sample containers for volatile analysis received with zero headspace.
✗	Split sample sent to requested external lab.
✗	Some samples have been subcontracted.
N/A	Custody Seals intact (if used).

Notes

Contact

If you have any questions with respect to these samples, please contact your Analytical Services Manager:

Andrew Black on phone : (+61) 2 9900 8490 or by email: AndrewBlack@eurofins.com

Results will be delivered electronically via email to Alison Monkley - alison.monkley@ghd.com.au.

Note: A copy of these results will also be delivered to the general GHD Pty Ltd NEWCASTLE email address.

eurofins

web: www.eurofins.com.au
email: EnviroSales@eurofins.com

Eurofins Environment Testing Australia Pty Ltd
ABN: 50 005 085 521

Melbourne	Geelong	Sydney	Canberra	Brisbane	Newcastle
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Dandenong South	Grovedale	Girraween	Mitchell	Murarrie	Mayfield West NSW 2304
VIC 3175	VIC 3216	NSW 2145	ACT 2911	QLD 4172	Tel: +61 2 4968 8448
Tel: +61 3 8564 5000	Tel: +61 3 8564 5000	Tel: +61 2 9900 8400	Tel: +61 2 6113 8091	Tel: +61 7 3902 4600	NATA# 1261
NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	Site# 25079 & 25289
Site# 1254	Site# 25403	Site# 18217	Site# 25466	Site# 20794	

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IANZ# 1327	IANZ# 1290	IANZ# 1402

Company Name: GHD Pty Ltd NEWCASTLE
Address: 3/24 Honeysuckle Dve
Newcastle
NSW 2300

Project Name:
Project ID: 12609961

Order No.:
Report #: 1034352
Phone: 02 4979 9999
Fax: 02 4979 9988

Received: Oct 13, 2023 10:30 AM
Due: Oct 20, 2023
Priority: 5 Day
Contact Name: Alison Monkley

Eurofins Analytical Services Manager : Andrew Black

Sample Detail						Ammonia (as N)	Chromium (hexavalent filtered)	Cyanide (free)	Cyanide (total)	Cyanide (weak acid dissoc.)	Lead (filtered)	Molybdenum (filtered)	Phenolics (total)	Polycyclic Aromatic Hydrocarbons	BTEXN and Volatile TRH	BTEXN and Volatile TRH
Melbourne Laboratory - NATA # 1261 Site # 1254										X			X	X	X	
Sydney Laboratory - NATA # 1261 Site # 18217						X	X	X	X		X	X		X	X	X
External Laboratory																
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**											
1	K9/3S	Oct 13, 2023		Water	N23-Oc0028095	X	X	X	X	X	X	X	X	X		
2	K11/1S	Oct 13, 2023		Water	N23-Oc0028096	X	X	X	X	X	X	X	X	X		
3	K11/1	Oct 13, 2023		Water	N23-Oc0028097	X	X	X	X	X	X	X	X	X		
4	K11/3E	Oct 13, 2023		Water	N23-Oc0028098	X	X	X	X	X	X	X	X	X		
5	K11/3W	Oct 13, 2023		Water	N23-Oc0028099	X	X	X	X	X	X	X	X	X		
6	TB02	Oct 13, 2023		Trip Blank (liquid)	N23-Oc0028100										X	
7	TS02	Oct 13, 2023		Trip Spike (liquid)	N23-Oc0028957											X
Test Counts						5	5	5	5	5	5	5	5	5	1	1

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CHAIN OF CUSTODY RECORD

CLIENT DETAILS

Page 1 of

Company Name : GHD
Office Address : 24 Honeysuckle Drive
Newcastle 2300

Contact Name: Nina Foley
Project Manager : Alison Monkley
Email for results : Alison.monkley@GHD.com

Project # 12609961

COC Number : 230926CHDN
Eurofins | mgt quote ID : ~~260925CHDN~~
Data output format: ESDAT

Special Directions & Comments :

Eurofins | mgt DI water batch number:

Analytes

	Sample ID	Date	Matrix	Ammonia	Phenolics	Cyanide (weak acid, dissociable, free)	Cyanide (total)	Hex. chromium (diss)	Molybdenum (diss)	Lead (diss)	Total PAH	Hex. chromium (total)	Molybdenum (total)	Lead (total)
1	K9/35	13/10	✓	X	X	X	X	X	X	X	X			
2	K11/15			X	X	X	X	X	X	X	X			
3	K11/1			X	X	X	X	X	X	X	X			
4	K11/3E			X	X	X	X	X	X	X	X			
5	K11/3W			X	X	X	X	X	X	X	X			
6	TB02			X	X	X	X				X	X	X	X
7														
8														
9														
10														
11														
12														
13														
15														
16														

Some common holding times (with correct preservation).
For further information contact the lab

Waters		Soils	
BTEX, MAH, VOC	14 days	BTEX, MAH, VOC	14 days
TRH, PAH, Phenols, Pesticides	7 days	TRH, PAH, Phenols, Pesticides	14 days
Heavy Metals	6 months	Heavy Metals	6 months
Mercury, CrVI	28 days	Mercury, CrVI	28 days
Microbiological testing	24 hours	Microbiological testing	72 hours
BOD, Nitrate, Nitrite, Total N	2 days	Anions	28 days
Solids - TSS, TDS etc	7 days	SPOCAS, pH Field and FOX, CrS	24 hours
Ferrous iron	7 days	ASLP, TCLP	7 days

Containers:

1LP	250P	125P	1LA	40mL vial	125mL A	Jar		Sample comments:

Relinquished By: Jackson Mclaw Conway
Date & Time:: 13/10/23 10:30
Signature:

Laboratory Staff
Received By: J Randall
Date & Time: 13/10 10:30
Signature:

Turn around time
1 DAY ☐ 2 DAY ☐ 3 DAY ☐
5 DAY ☑ 10 DAY ☐ Other:

Method Of Shipment
☐ Courier
☑ Hand Delivered
☐ Postal
Courier Consignment # :

Temperature on arrival: 21.1
Report number: 1034352

CERTIFICATE OF ANALYSIS

Work Order	: **ES2334606**	Page	: 1 of 5
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS ALISON MONKLEY	Contact	: Sarah Mathew
Address	: Level 3, GHD Tower, 24 Honeysuckle Drive Newcastle 2300	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: 12609961	Date Samples Received	: 09-Oct-2023 15:20
Order number	: ----	Date Analysis Commenced	: 11-Oct-2023
C-O-C number	: ----	Issue Date	: 16-Oct-2023 14:14
Sampler	: NINA FOLEY		
Site	:		
Quote number	: EN/000		
No. of samples received	: 2		
No. of samples analysed	: 2		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EP075 (SIM): Where reported, Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.
- EP075(SIM): Where reported, Total Cresol is the sum of the reported concentrations of 2-Methylphenol and 3- & 4-Methylphenol at or above the LOR.
- Poor spike recovery for Hexavalent Chromium analysis due to matrix interferences. (confirmed by re-analysis).

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	FD02	FD04	----	----	----
				Sampling date / time	09-Oct-2023 15:00	09-Oct-2023 15:00	----	----	----
Compound	CAS Number	LOR	Unit		ES2334606-001	ES2334606-002	--------	--------	--------
					Result	Result	----	----	----
EG020F: Dissolved Metals by ICP-MS									
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	----	----	----
Molybdenum	7439-98-7	0.001	mg/L		**0.008**	**0.002**	----	----	----
EG050T: Total Hexavalent Chromium									
Hexavalent Chromium	18540-29-9	0.01	mg/L		<0.01	<0.01	----	----	----
EK025SF: Free CN by Segmented Flow Analyser									
Free Cyanide	----	0.004	mg/L		<0.004	<0.004	----	----	----
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	0.004	mg/L		<0.004	<0.004	----	----	----
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser									
Weak Acid Dissociable Cyanide	----	0.004	mg/L		<0.004	<0.004	----	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**1.45**	**0.85**	----	----	----
EP075(SIM)A: Phenolic Compounds									
Phenol	108-95-2	1.0	µg/L		<1.0	<1.0	----	----	----
2-Chlorophenol	95-57-8	1.0	µg/L		<1.0	<1.0	----	----	----
2-Methylphenol	95-48-7	1.0	µg/L		<1.0	<1.0	----	----	----
3- & 4-Methylphenol	1319-77-3	2.0	µg/L		<2.0	<2.0	----	----	----
2-Nitrophenol	88-75-5	1.0	µg/L		<1.0	<1.0	----	----	----
2.4-Dimethylphenol	105-67-9	1.0	µg/L		<1.0	<1.0	----	----	----
2.4-Dichlorophenol	120-83-2	1.0	µg/L		<1.0	<1.0	----	----	----
2.6-Dichlorophenol	87-65-0	1.0	µg/L		<1.0	<1.0	----	----	----
4-Chloro-3-methylphenol	59-50-7	1.0	µg/L		<1.0	<1.0	----	----	----
2.4.6-Trichlorophenol	88-06-2	1.0	µg/L		<1.0	<1.0	----	----	----
2.4.5-Trichlorophenol	95-95-4	1.0	µg/L		<1.0	<1.0	----	----	----
Pentachlorophenol	87-86-5	2.0	µg/L		<2.0	<2.0	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1.0	µg/L		<1.0	<1.0	----	----	----
Acenaphthylene	208-96-8	1.0	µg/L		<1.0	<1.0	----	----	----
Acenaphthene	83-32-9	1.0	µg/L		<1.0	<1.0	----	----	----
Fluorene	86-73-7	1.0	µg/L		<1.0	<1.0	----	----	----
Phenanthrene	85-01-8	1.0	µg/L		<1.0	<1.0	----	----	----
Anthracene	120-12-7	1.0	µg/L		<1.0	<1.0	----	----	----
Fluoranthene	206-44-0	1.0	µg/L		<1.0	<1.0	----	----	----
Pyrene	129-00-0	1.0	µg/L		<1.0	<1.0	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	FD02	FD04	----	----	----
				Sampling date / time	09-Oct-2023 15:00	09-Oct-2023 15:00	----	----	----
Compound	CAS Number	LOR	Unit		ES2334606-001	ES2334606-002	--------	--------	--------
					Result	Result	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Benz(a)anthracene	56-55-3	1.0	µg/L		<1.0	<1.0	----	----	----
Chrysene	218-01-9	1.0	µg/L		<1.0	<1.0	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L		<1.0	<1.0	----	----	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L		<1.0	<1.0	----	----	----
Benzo(a)pyrene	50-32-8	0.5	µg/L		<0.5	<0.5	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L		<1.0	<1.0	----	----	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L		<1.0	<1.0	----	----	----
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L		<1.0	<1.0	----	----	----
^ **Sum of polycyclic aromatic hydrocarbons**	----	0.5	µg/L		<0.5	<0.5	----	----	----
^ **Benzo(a)pyrene TEQ (zero)**	----	0.5	µg/L		<0.5	<0.5	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	1.0	%		**29.8**	**28.9**	----	----	----
2-Chlorophenol-D4	93951-73-6	1.0	%		**60.7**	**57.4**	----	----	----
2.4.6-Tribromophenol	118-79-6	1.0	%		**69.5**	**73.4**	----	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	1.0	%		**84.7**	**78.8**	----	----	----
Anthracene-d10	1719-06-8	1.0	%		**83.1**	**86.5**	----	----	----
4-Terphenyl-d14	1718-51-0	1.0	%		**89.3**	**92.2**	----	----	----

Surrogate Control Limits

Sub-Matrix: **WATER**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10	44
2-Chlorophenol-D4	93951-73-6	14	94
2.4.6-Tribromophenol	118-79-6	17	125
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	20	104
Anthracene-d10	1719-06-8	27	113
4-Terphenyl-d14	1718-51-0	32	112

QUALITY CONTROL REPORT

Work Order	: **ES2334606**	Page	: 1 of 4
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS ALISON MONKLEY	Contact	: Sarah Mathew
Address	: Level 3, GHD Tower, 24 Honeysuckle Drive Newcastle 2300	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: 12609961	Date Samples Received	: 09-Oct-2023
Order number	: ----	Date Analysis Commenced	: 11-Oct-2023
C-O-C number	: ----	Issue Date	: 16-Oct-2023
Sampler	: NINA FOLEY		
Site	:		
Quote number	: EN/000		
No. of samples received	: 2		
No. of samples analysed	: 2		

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This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EG020F: Dissolved Metals by ICP-MS (QC Lot: 5355980)									
ES2334505-001	Anonymous	EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Molybdenum	7439-98-7	0.001	mg/L	0.045	0.043	4.3	0% - 20%
ES2334550-001	Anonymous	EG020A-F: Lead	7439-92-1	0.001	mg/L	0.004	0.005	0.0	No Limit
		EG020A-F: Molybdenum	7439-98-7	0.001	mg/L	0.002	<0.001	79.5	No Limit
EG050T: Total Hexavalent Chromium (QC Lot: 5354778)									
ES2334606-001	FD02	EG050G-T: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK025SF: Free CN by Segmented Flow Analyser (QC Lot: 5354401)									
ES2334776-001	Anonymous	EK025SF: Free Cyanide	----	0.004	mg/L	<0.004	<0.004	0.0	No Limit
EK026SF: Total CN by Segmented Flow Analyser (QC Lot: 5351870)									
ES2334691-005	Anonymous	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	0.0	No Limit
ES2334606-001	FD02	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	0.0	No Limit
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser (QC Lot: 5351871)									
ES2334606-001	FD02	EK028SF: Weak Acid Dissociable Cyanide	----	0.004	mg/L	<0.004	<0.004	0.0	No Limit
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 5351751)									
ES2334479-002	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.02	0.04	47.8	No Limit
ES2333700-003	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.10	0.12	20.6	0% - 50%

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 5355980)								
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	95.8	83.0	111
EG020A-F: Molybdenum	7439-98-7	0.001	mg/L	<0.001	0.1 mg/L	100	79.0	113
EG050T: Total Hexavalent Chromium (QCLot: 5354778)								
EG050G-T: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	0.05 mg/L	100	87.0	113
EK025SF: Free CN by Segmented Flow Analyser (QCLot: 5354401)								
EK025SF: Free Cyanide	----	0.004	mg/L	<0.004	0.2 mg/L	109	88.0	128
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 5351870)								
EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	0.2 mg/L	114	73.0	133
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser (QCLot: 5351871)								
EK028SF: Weak Acid Dissociable Cyanide	----	0.004	mg/L	<0.004	0.2 mg/L	104	93.0	127
EK055G: Ammonia as N by Discrete Analyser (QCLot: 5351751)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1 mg/L	103	90.0	114
EP075(SIM)A: Phenolic Compounds (QCLot: 5352363)								
EP075(SIM): Phenol	108-95-2	1	µg/L	<1.0	5 µg/L	35.0	24.5	61.9
EP075(SIM): 2-Chlorophenol	95-57-8	1	µg/L	<1.0	5 µg/L	67.4	52.0	90.0
EP075(SIM): 2-Methylphenol	95-48-7	1	µg/L	<1.0	5 µg/L	69.9	51.0	91.0
EP075(SIM): 3- & 4-Methylphenol	1319-77-3	2	µg/L	<2.0	10 µg/L	58.3	44.0	88.0
EP075(SIM): 2-Nitrophenol	88-75-5	1	µg/L	<1.0	5 µg/L	72.6	48.0	100
EP075(SIM): 2.4-Dimethylphenol	105-67-9	1	µg/L	<1.0	5 µg/L	76.8	49.0	99.0
EP075(SIM): 2.4-Dichlorophenol	120-83-2	1	µg/L	<1.0	5 µg/L	68.0	53.0	105
EP075(SIM): 2.6-Dichlorophenol	87-65-0	1	µg/L	<1.0	5 µg/L	70.4	57.0	105
EP075(SIM): 4-Chloro-3-methylphenol	59-50-7	1	µg/L	<1.0	5 µg/L	70.4	53.0	99.0
EP075(SIM): 2.4.6-Trichlorophenol	88-06-2	1	µg/L	<1.0	5 µg/L	70.6	50.0	106
EP075(SIM): 2.4.5-Trichlorophenol	95-95-4	1	µg/L	<1.0	5 µg/L	76.8	51.0	105
EP075(SIM): Pentachlorophenol	87-86-5	2	µg/L	<2.0	10 µg/L	38.8	10.0	95.0
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 5352363)								
EP075(SIM): Naphthalene	91-20-3	1	µg/L	<1.0	5 µg/L	68.2	50.0	94.0
EP075(SIM): Acenaphthylene	208-96-8	1	µg/L	<1.0	5 µg/L	76.9	63.6	114
EP075(SIM): Acenaphthene	83-32-9	1	µg/L	<1.0	5 µg/L	73.0	62.2	113
EP075(SIM): Fluorene	86-73-7	1	µg/L	<1.0	5 µg/L	80.1	63.9	115

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 5352363) - continued								
EP075(SIM): Phenanthrene	85-01-8	1	µg/L	<1.0	5 µg/L	80.8	62.6	116
EP075(SIM): Anthracene	120-12-7	1	µg/L	<1.0	5 µg/L	82.4	64.3	116
EP075(SIM): Fluoranthene	206-44-0	1	µg/L	<1.0	5 µg/L	72.2	63.6	118
EP075(SIM): Pyrene	129-00-0	1	µg/L	<1.0	5 µg/L	72.7	63.1	118
EP075(SIM): Benz(a)anthracene	56-55-3	1	µg/L	<1.0	5 µg/L	66.5	64.1	117
EP075(SIM): Chrysene	218-01-9	1	µg/L	<1.0	5 µg/L	68.0	62.5	116
EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	1	µg/L	<1.0	5 µg/L	80.4	61.7	119
EP075(SIM): Benzo(k)fluoranthene	207-08-9	1	µg/L	<1.0	5 µg/L	78.5	63.0	115
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	5 µg/L	70.5	63.3	117
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	1	µg/L	<1.0	5 µg/L	67.3	59.9	118
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	1	µg/L	<1.0	5 µg/L	70.1	61.2	117
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	1	µg/L	<1.0	5 µg/L	70.8	59.1	118

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EG020F: Dissolved Metals by ICP-MS (QCLot: 5355980)							
ES2334550-002	Anonymous	EG020A-F: Lead	7439-92-1	1 mg/L	103	70.0	130
EG050T: Total Hexavalent Chromium (QCLot: 5354778)							
ES2334606-001	FD02	EG050G-T: Hexavalent Chromium	18540-29-9	0.5 mg/L	# Not Determined	70.0	130
EK025SF: Free CN by Segmented Flow Analyser (QCLot: 5354401)							
ES2334776-001	Anonymous	EK025SF: Free Cyanide	----	0.2 mg/L	107	70.0	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 5351870)							
ES2334606-001	FD02	EK026SF: Total Cyanide	57-12-5	0.2 mg/L	106	70.0	130
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser (QCLot: 5351871)							
ES2334606-001	FD02	EK028SF: Weak Acid Dissociable Cyanide	----	0.2 mg/L	109	70.0	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 5351751)							
ES2333700-003	Anonymous	EK055G: Ammonia as N	7664-41-7	1 mg/L	117	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2334606**	Page	: 1 of 6
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS ALISON MONKLEY	Telephone	: +61-2-8784 8555
Project	: 12609961	Date Samples Received	: 09-Oct-2023
Site	:	Issue Date	: 16-Oct-2023
Sampler	: NINA FOLEY	No. of samples received	: 2
Order number	: ----	No. of samples analysed	: 2

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type / Method	Count		Rate (%)		Quality Control Specification
	QC 0	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
PAH/Phenols (GC/MS - SIM)	0	6	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)					
PAH/Phenols (GC/MS - SIM)	0	6	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / ***Container*** / Client Sample ID(s)	***Sample Date***	*Extraction / Preparation*			*Analysis*		
		Date extracted	*Due for extraction*	*Evaluation*	***Date analysed***	*Due for analysis*	*Evaluation*
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F)							
FD02, FD04	**09-Oct-2023**	**----**	----	----	**12-Oct-2023**	06-Apr-2024	✓
EG050T: Total Hexavalent Chromium							
Clear Plastic Bottle - NaOH (EG050G-T)							
FD02	**09-Oct-2023**	**----**	----	----	**12-Oct-2023**	06-Nov-2023	✓
Clear Plastic Bottle - NaOH (EG050G-T)							
FD04	**09-Oct-2023**	**----**	----	----	**13-Oct-2023**	06-Nov-2023	✓
EK025SF: Free CN by Segmented Flow Analyser							
Clear Plastic Bottle - NaOH (EK025SF)							
FD02, FD04	**09-Oct-2023**	**----**	----	----	**12-Oct-2023**	23-Oct-2023	✓
EK026SF: Total CN by Segmented Flow Analyser							
Clear Plastic Bottle - NaOH (EK026SF)							
FD02, FD04	**09-Oct-2023**	**----**	----	----	**12-Oct-2023**	23-Oct-2023	✓
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser							
Clear Plastic Bottle - NaOH (EK028SF)							
FD02, FD04	**09-Oct-2023**	**----**	----	----	**12-Oct-2023**	23-Oct-2023	✓
EK055G: Ammonia as N by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK055G)							
FD02, FD04	**09-Oct-2023**	**----**	----	----	**11-Oct-2023**	06-Nov-2023	✓
EP075(SIM)A: Phenolic Compounds							
Amber Glass Bottle - Unpreserved (EP075(SIM))							
FD02, FD04	**09-Oct-2023**	**11-Oct-2023**	16-Oct-2023	✓	**12-Oct-2023**	20-Nov-2023	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP075(SIM))							
FD02, FD04	**09-Oct-2023**	**11-Oct-2023**	16-Oct-2023	✓	**12-Oct-2023**	20-Nov-2023	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Ammonia as N by Discrete analyser	EK055G	2	13	**15.38**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	13	**15.38**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	5	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Total	EG050G-T	1	2	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	0	6	**0.00**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Weak Acid Dissociable Cyanide by Segmented Flow Analyser	EK028SF	1	2	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Ammonia as N by Discrete analyser	EK055G	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Total	EG050G-T	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Weak Acid Dissociable Cyanide by Segmented Flow Analyser	EK028SF	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Ammonia as N by Discrete analyser	EK055G	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Total	EG050G-T	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Weak Acid Dissociable Cyanide by Segmented Flow Analyser	EK028SF	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Ammonia as N by Discrete analyser	EK055G	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Total	EG050G-T	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	0	6	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Weak Acid Dissociable Cyanide by Segmented Flow Analyser	EK028SF	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Hexavalent Chromium by Discrete Analyser - Total	EG050G-T	WATER	In house: Referenced to APHA 3500 Cr-A & B. Hexavalent chromium is determined directly on water sample by Descrete Analyser as received by pH adjustment and colour development using dephenylcarbazide. Each run of samples is measured against a five-point calibration curve. This method is compliant with NEPM Schedule B(3).
Free CN by Segmented Flow Analyser	EK025SF	WATER	In house: Referenced to ASTM D7237, APHA 4500-CN-C&O and ISO 14403: Using an automated segmented flow analyser, a sample at high pH (sodium hydroxide preserved) is buffered to pH 6.0. The hydrogen cyanide present passes across a gas dialysis membrane into an acceptor stream consisting of 0.01 M sodium hydroxide. The acceptor stream mixes with a buffer at pH 5.2 and reacts with chloramine-T to form cyanogen chloride. Cyanogen chloride reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour, measured at 600nm. This method is compliant with NEPM Schedule B(3)
Total Cyanide by Segmented Flow Analyser	EK026SF	WATER	In house: Referenced to APHA 4500-CN C&O / ASTM D7511 / ISO 14403. Sodium hydroxide preserved samples are introduced into an automated segmented flow analyser. Complex bound cyanide is decomposed in a continuously flowing stream, at a pH of 3.8, by the effect of UV light. A UV-B lamp (312 nm) and a decomposition spiral of borosilicate glass are used to filter out UV light with a wavelength of less than 290 nm thus preventing the conversion of thiocyanate into cyanide. The hydrogen cyanide present at a pH of 3.8 is separated by gas dialysis. The hydrogen cyanide is then determined photometrically, based on the reaction of cyanide with chloramine-T to form cyanogen chloride. This then reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour which is measured at 600 nm. This method is compliant with NEPM Schedule B(3)
Weak Acid Dissociable Cyanide by Segmented Flow Analyser	EK028SF	WATER	In house: Referenced to APHA 4500-CN C&O / ISO 14403. Samples preserved with sodium hydroxide are introduced into an automated segmented flow analyser. Hydrogen cyanide is liberated from a slightly acidified (pH 4.5) and is dialysed. Tight cyanide complexes that would not be amenable to oxidation by chlorine are not converted. Iron cyanide complexes are precipitated with zinc acetate. Liberated HCN diffuses through a membrane into a stream of sodium hydroxide where it is carried as CN- The cyanide in caustic solution is buffered to pH 5.2 and further converted to cyanogen chloride by reaction with chloramine-T. Cyanogen chloride subsequently reacts with 4-pyridine carboxylic and 1,3-dimethylbarbituric acids to give a red colour complex. This colour is measured at 600 nm. This method is compliant with NEPM Schedule B(3)
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	WATER	In house: Referenced to USEPA SW 846 - 8270 Sample extracts are analysed by Capillary GC/MS in SIM Mode and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions

Preparation Methods	Method	Matrix	Method Descriptions
Separatory Funnel Extraction of Liquids	ORG14	WATER	In house: Referenced to USEPA SW 846 - 3510 100 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM Schedule B(3) . ALS default excludes sediment which may be resident in the container.

CHAIN OF CUSTODY

ALS Laboratory: please tick →

ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsglobal.com

BRISBANE 32 Shand Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com

GOLDCOAST 46 Callemondah Drive Clinton QLD 4680 Ph: 07 5471 5600 E: gladstone@alsglobal.com

MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com

MELBOURNE 1-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com

MUDGEE 27 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com

NEWCASTLE 5/585 Maitland Rd Mayfield West NSW 2304 Ph: 02 4014 2500 E: samples.newcastle@alsglobal.com

ORANGE 4/13 Geary Place North Orange NSW 2800 Ph: 02 4423 2063 E: orange@alsglobal.com

PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com

SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com

TOWNSVILLE 14-16 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsglobal.com

WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: portkembla@alsglobal.com

CLIENT: GHD	TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)	☑ Standard TAT (List due date):	FOR LABORATORY USE ONLY (Circle)
OFFICE: Newcastle		☐ Non Standard or urgent TAT (List due date):	Custody Seal Intact? Yes / No / (N/A)
PROJECT: 12609961	ALS QUOTE NO.:	COC SEQUENCE NUMBER (Circle) COC: (1) 2 3 4 5 6 7 OF: (1) 2 3 4 5 6 7	Free Ice / frozen ice bricks present upon receipt? Yes / (No) / N/A
ORDER NUMBER:			Random Sample Temperature on Receipt: 27.0 °C
PROJECT MANAGER: Alison Monkley	CONTACT PH:		Other comment:
SAMPLER: Nina Foley	SAMPLER MOBILE: 0480320757	RELINQUISHED BY: Nina Foley	RECEIVED BY: IR
COC emailed to ALS? (YES / (NO)	EDD FORMAT (or default):	DATE/TIME: 9/10/23 Bpm	DATE/TIME: 9-10-23 1517
Email Reports to (will default to PM if no other addresses are listed): Alison.monkley@ghd.com		RELINQUISHED BY:	RECEIVED BY:
Email Invoice to (will default to PM if no other addresses are listed): "		DATE/TIME: 9/10/23 5pm	DATE/TIME: 9/10/23 1940

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE	SAMPLE DETAILS MATRIX: SOLID (S) WATER (W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	Ammonia	phenols	Cyanide (weak acid)	Cyanide (total)	Hexavalent Chromium	Molybdenum (dissolved)	Lead (dissolved)	Total PAH	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	FD02	9/10/23 3pm	W	N, S		X	X	X	X	X	X	X	X	
2	FD07	9/10/23 3pm	W	N, S		X	X	X	X	X	X	X	X	
				TOTAL										

Environmental Division Sydney
Work Order Reference
ES2334606

Telephone : +61-2-8784 8555

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

CERTIFICATE OF ANALYSIS

Work Order	: **ES2334776**	Page	: 1 of 5
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS ALISON MONKLEY	Contact	: Sarah Mathew
Address	: Level 3, GHD Tower, 24 Honeysuckle Drive Newcastle 2300	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: 12609961	Date Samples Received	: 10-Oct-2023 14:27
Order number	: ----	Date Analysis Commenced	: 11-Oct-2023
C-O-C number	: ----	Issue Date	: 17-Oct-2023 14:43
Sampler	: NINA FOLEY		
Site	:		
Quote number	: EN/000		
No. of samples received	: 1		
No. of samples analysed	: 1		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EP075 (SIM): Where reported, Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.
- EP075(SIM): Where reported, Total Cresol is the sum of the reported concentrations of 2-Methylphenol and 3- & 4-Methylphenol at or above the LOR.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	FD09	----	----	----	----
				Sampling date / time	10-Oct-2023 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES2334776-001	--------	--------	--------	--------
					Result	----	----	----	----
EG020T: Total Metals by ICP-MS									
Lead	7439-92-1	0.001	mg/L		**0.007**	----	----	----	----
Molybdenum	7439-98-7	0.001	mg/L		**0.009**	----	----	----	----
EG050T: Total Hexavalent Chromium									
Hexavalent Chromium	18540-29-9	0.01	mg/L		<0.01	----	----	----	----
EK025SF: Free CN by Segmented Flow Analyser									
Free Cyanide	----	0.004	mg/L		<0.004	----	----	----	----
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	0.004	mg/L		<0.004	----	----	----	----
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser									
Weak Acid Dissociable Cyanide	----	0.004	mg/L		<0.004	----	----	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**0.20**	----	----	----	----
EP075(SIM)A: Phenolic Compounds									
Phenol	108-95-2	1.0	µg/L		**2.3**	----	----	----	----
2-Chlorophenol	95-57-8	1.0	µg/L		<1.0	----	----	----	----
2-Methylphenol	95-48-7	1.0	µg/L		<1.0	----	----	----	----
3- & 4-Methylphenol	1319-77-3	2.0	µg/L		<2.0	----	----	----	----
2-Nitrophenol	88-75-5	1.0	µg/L		<1.0	----	----	----	----
2.4-Dimethylphenol	105-67-9	1.0	µg/L		<1.0	----	----	----	----
2.4-Dichlorophenol	120-83-2	1.0	µg/L		<1.0	----	----	----	----
2.6-Dichlorophenol	87-65-0	1.0	µg/L		<1.0	----	----	----	----
4-Chloro-3-methylphenol	59-50-7	1.0	µg/L		<1.0	----	----	----	----
2.4.6-Trichlorophenol	88-06-2	1.0	µg/L		<1.0	----	----	----	----
2.4.5-Trichlorophenol	95-95-4	1.0	µg/L		<1.0	----	----	----	----
Pentachlorophenol	87-86-5	2.0	µg/L		<2.0	----	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1.0	µg/L		<1.0	----	----	----	----
Acenaphthylene	208-96-8	1.0	µg/L		<1.0	----	----	----	----
Acenaphthene	83-32-9	1.0	µg/L		<1.0	----	----	----	----
Fluorene	86-73-7	1.0	µg/L		<1.0	----	----	----	----
Phenanthrene	85-01-8	1.0	µg/L		<1.0	----	----	----	----
Anthracene	120-12-7	1.0	µg/L		<1.0	----	----	----	----
Fluoranthene	206-44-0	1.0	µg/L		<1.0	----	----	----	----
Pyrene	129-00-0	1.0	µg/L		<1.0	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	FD09	----	----	----	----
				Sampling date / time	10-Oct-2023 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES2334776-001	--------	--------	--------	--------
					Result	----	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Benz(a)anthracene	56-55-3	1.0	µg/L		<1.0	----	----	----	----
Chrysene	218-01-9	1.0	µg/L		<1.0	----	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L		<1.0	----	----	----	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L		<1.0	----	----	----	----
Benzo(a)pyrene	50-32-8	0.5	µg/L		<0.5	----	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L		<1.0	----	----	----	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L		<1.0	----	----	----	----
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L		<1.0	----	----	----	----
^ **Sum of polycyclic aromatic hydrocarbons**	----	0.5	µg/L		<0.5	----	----	----	----
^ **Benzo(a)pyrene TEQ (zero)**	----	0.5	µg/L		<0.5	----	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	1.0	%		**21.4**	----	----	----	----
2-Chlorophenol-D4	93951-73-6	1.0	%		**44.4**	----	----	----	----
2.4.6-Tribromophenol	118-79-6	1.0	%		**41.8**	----	----	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	1.0	%		**50.5**	----	----	----	----
Anthracene-d10	1719-06-8	1.0	%		**59.1**	----	----	----	----
4-Terphenyl-d14	1718-51-0	1.0	%		**73.8**	----	----	----	----

Surrogate Control Limits

Sub-Matrix: **WATER**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10	44
2-Chlorophenol-D4	93951-73-6	14	94
2.4.6-Tribromophenol	118-79-6	17	125
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	20	104
Anthracene-d10	1719-06-8	27	113
4-Terphenyl-d14	1718-51-0	32	112

QUALITY CONTROL REPORT

Work Order	: **ES2334776**	Page	: 1 of 4
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS ALISON MONKLEY	Contact	: Sarah Mathew
Address	: Level 3, GHD Tower, 24 Honeysuckle Drive Newcastle 2300	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: 12609961	Date Samples Received	: 10-Oct-2023
Order number	: ----	Date Analysis Commenced	: 11-Oct-2023
C-O-C number	: ----	Issue Date	: 17-Oct-2023
Sampler	: NINA FOLEY		
Site	:		
Quote number	: EN/000		
No. of samples received	: 1		
No. of samples analysed	: 1		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EG020T: Total Metals by ICP-MS (QC Lot: 5357125)									
ES2334756-005	Anonymous	EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Molybdenum	7439-98-7	0.001	mg/L	0.001	<0.001	0.0	No Limit
ES2334764-004	Anonymous	EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	0.0	No Limit
EG050T: Total Hexavalent Chromium (QC Lot: 5354003)									
ES2334776-001	FD09	EG050G-T: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK025SF: Free CN by Segmented Flow Analyser (QC Lot: 5354401)									
ES2334776-001	FD09	EK025SF: Free Cyanide	----	0.004	mg/L	<0.004	<0.004	0.0	No Limit
EK026SF: Total CN by Segmented Flow Analyser (QC Lot: 5354402)									
ES2334776-001	FD09	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	0.0	No Limit
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser (QC Lot: 5354403)									
ES2334776-001	FD09	EK028SF: Weak Acid Dissociable Cyanide	----	0.004	mg/L	<0.004	<0.004	0.0	No Limit
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 5353868)									
ES2334768-002	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	11.1	11.3	1.8	0% - 20%

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG020T: Total Metals by ICP-MS (QCLot: 5357125)								
EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	97.5	85.0	115
EG020A-T: Molybdenum	7439-98-7	0.001	mg/L	<0.001	0.1 mg/L	105	83.0	121
EG050T: Total Hexavalent Chromium (QCLot: 5354003)								
EG050G-T: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	0.05 mg/L	101	87.0	113
EK025SF: Free CN by Segmented Flow Analyser (QCLot: 5354401)								
EK025SF: Free Cyanide	----	0.004	mg/L	<0.004	0.2 mg/L	109	88.0	128
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 5354402)								
EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	0.2 mg/L	111	73.0	133
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser (QCLot: 5354403)								
EK028SF: Weak Acid Dissociable Cyanide	----	0.004	mg/L	<0.004	0.2 mg/L	97.9	93.0	127
EK055G: Ammonia as N by Discrete Analyser (QCLot: 5353868)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1 mg/L	102	90.0	114
EP075(SIM)A: Phenolic Compounds (QCLot: 5354873)								
EP075(SIM): Phenol	108-95-2	1	µg/L	<1.0	5 µg/L	44.0	24.5	61.9
EP075(SIM): 2-Chlorophenol	95-57-8	1	µg/L	<1.0	5 µg/L	72.3	52.0	90.0
EP075(SIM): 2-Methylphenol	95-48-7	1	µg/L	<1.0	5 µg/L	77.2	51.0	91.0
EP075(SIM): 3- & 4-Methylphenol	1319-77-3	2	µg/L	<2.0	10 µg/L	61.9	44.0	88.0
EP075(SIM): 2-Nitrophenol	88-75-5	1	µg/L	<1.0	5 µg/L	67.1	48.0	100
EP075(SIM): 2.4-Dimethylphenol	105-67-9	1	µg/L	<1.0	5 µg/L	77.0	49.0	99.0
EP075(SIM): 2.4-Dichlorophenol	120-83-2	1	µg/L	<1.0	5 µg/L	71.0	53.0	105
EP075(SIM): 2.6-Dichlorophenol	87-65-0	1	µg/L	<1.0	5 µg/L	78.5	57.0	105
EP075(SIM): 4-Chloro-3-methylphenol	59-50-7	1	µg/L	<1.0	5 µg/L	73.4	53.0	99.0
EP075(SIM): 2.4.6-Trichlorophenol	88-06-2	1	µg/L	<1.0	5 µg/L	68.0	50.0	106
EP075(SIM): 2.4.5-Trichlorophenol	95-95-4	1	µg/L	<1.0	5 µg/L	73.7	51.0	105
EP075(SIM): Pentachlorophenol	87-86-5	2	µg/L	<2.0	10 µg/L	34.1	10.0	95.0
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 5354873)								
EP075(SIM): Naphthalene	91-20-3	1	µg/L	<1.0	5 µg/L	73.2	50.0	94.0
EP075(SIM): Acenaphthylene	208-96-8	1	µg/L	<1.0	5 µg/L	69.9	63.6	114
EP075(SIM): Acenaphthene	83-32-9	1	µg/L	<1.0	5 µg/L	76.9	62.2	113
EP075(SIM): Fluorene	86-73-7	1	µg/L	<1.0	5 µg/L	69.2	63.9	115

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 5354873) - continued								
EP075(SIM): Phenanthrene	85-01-8	1	µg/L	<1.0	5 µg/L	89.6	62.6	116
EP075(SIM): Anthracene	120-12-7	1	µg/L	<1.0	5 µg/L	88.5	64.3	116
EP075(SIM): Fluoranthene	206-44-0	1	µg/L	<1.0	5 µg/L	82.4	63.6	118
EP075(SIM): Pyrene	129-00-0	1	µg/L	<1.0	5 µg/L	85.2	63.1	118
EP075(SIM): Benz(a)anthracene	56-55-3	1	µg/L	<1.0	5 µg/L	77.0	64.1	117
EP075(SIM): Chrysene	218-01-9	1	µg/L	<1.0	5 µg/L	93.6	62.5	116
EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	1	µg/L	<1.0	5 µg/L	83.4	61.7	119
EP075(SIM): Benzo(k)fluoranthene	207-08-9	1	µg/L	<1.0	5 µg/L	70.4	63.0	115
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	5 µg/L	86.2	63.3	117
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	1	µg/L	<1.0	5 µg/L	97.8	59.9	118
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	1	µg/L	<1.0	5 µg/L	98.9	61.2	117
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	1	µg/L	<1.0	5 µg/L	96.2	59.1	118

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EG020T: Total Metals by ICP-MS (QCLot: 5357125)							
ES2334756-006	Anonymous	EG020A-T: Lead	7439-92-1	1 mg/L	94.0	70.0	130
EG050T: Total Hexavalent Chromium (QCLot: 5354003)							
ES2334776-001	FD09	EG050G-T: Hexavalent Chromium	18540-29-9	0.05 mg/L	70.1	70.0	130
EK025SF: Free CN by Segmented Flow Analyser (QCLot: 5354401)							
ES2334776-001	FD09	EK025SF: Free Cyanide	----	0.2 mg/L	107	70.0	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 5354402)							
ES2334776-001	FD09	EK026SF: Total Cyanide	57-12-5	0.2 mg/L	108	70.0	130
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser (QCLot: 5354403)							
ES2334776-001	FD09	EK028SF: Weak Acid Dissociable Cyanide	----	0.2 mg/L	104	70.0	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 5353868)							
ES2334768-002	Anonymous	EK055G: Ammonia as N	7664-41-7	1 mg/L	# Not Determined	70.0	130

CHAIN OF CUSTODY

ALS Laboratory: please tick →

☐ BRISBANE 21 Former Road Pooraka Lake Ph: 02 [illegible] E: [illegible]@alsglobal.com
☐ BRISBANE 32 Ariana Street Seafood QLD 4000 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com
☐ GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 7471 5600 E: gladstone@alsglobal.com
☐ MACKAY 79 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com
☐ MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com
☐ MUDGEE 27 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com
☐ NEWCASTLE 5/585 Maitland Rd Mayfield West NSW 2304 Ph: 02 4014 2500 E: samples.newcastle@alsglobal.com
☐ NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 02 [illegible] E: nowra@alsglobal.com
☐ PERTH 10 Red Wood [illegible] Ph: 08 [illegible] E: samples.perth@alsglobal.com
☐ SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com
☐ TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsglobal.com
☐ WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: portkembla@alsglobal.com

LAB OF ORIGIN: NEWCASTLE

CLIENT:	GHD
OFFICE:	Newcastle
PROJECT:	12609961
ORDER NUMBER:	
PROJECT MANAGER:	Alison Monkley
CONTACT PH:	0249799990
SAMPLER:	Nina Foley
SAMPLER MOBILE:	0480320757
COC emailed to ALS? (YES / (NO))	
EDD FORMAT (or default):	ESDAT
Email Reports to (will default to PM if no other addresses are listed):	Alison.monkley@ghd.com
Email Invoice to (will default to PM if no other addresses are listed):	//

TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g.. Ultra Trace Organics)

☐ Standard TAT (List due date):

☐ Non Standard or urgent TAT (List due date):

ALS QUOTE NO.:

COC SEQUENCE NUMBER (Circle)

COC: 1 2 3 4 5 6 7

OF: 1 2 3 4 5 6 7

FOR LABORATORY USE ONLY (Circle)

Custody Seal Intact?	Yes	No	N/A
Free ice / frozen ice bricks present upon receipt?	Yes	No	(N/A)
Random Sample Temperature on Receipt:	22 °C		
Other comment:			

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Nina Foley	[signature]	[signature]	[signature]
DATE/TIME: 10/10/23 2:30pm	DATE/TIME: 10/10/23 1427	DATE/TIME: 10/10/23 [signature]	DATE/TIME: 10/10/23 2000

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE	SAMPLE DETAILS MATRIX: SOLID (S) WATER (W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	Ammonia	Phenols	cyanide (weak acid dis free)	cyanide (tot)	Hex chromium (tot)	molybdenum (tot)	Lead (tot)	total PAH	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
	FD09	10/10/23	W			X	X	X	X	X	X	X	X	
				TOTAL										

Environmental Division
Sydney
Work Order Reference
ES2334776

Telephone : +61-2-8784 8555

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2334776**	Page	: 1 of 6
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS ALISON MONKLEY	Telephone	: +61-2-8784 8555
Project	: 12609961	Date Samples Received	: 10-Oct-2023
Site	:	Issue Date	: 17-Oct-2023
Sampler	: NINA FOLEY	No. of samples received	: 1
Order number	: ----	No. of samples analysed	: 1

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EK055G: Ammonia as N by Discrete Analyser	ES2334768--002	Anonymous	**Ammonia as N**	7664-41-7	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method / Container / Client Sample ID(s)	Extraction / Preparation: Date extracted	Extraction / Preparation: Due for extraction	Extraction / Preparation: Days overdue	Analysis: Date analysed	Analysis: Due for analysis	Analysis: Days overdue
EG050T: Total Hexavalent Chromium						
Opaque plastic bottle - NaOH						
FD09	----	----	----	12-Oct-2023	11-Oct-2023	**1**

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type / Method	Count: QC	Count: Regular	Rate (%): Actual	Rate (%): Expected	Quality Control Specification
	0				
Laboratory Duplicates (DUP)					
PAH/Phenols (GC/MS - SIM)	0	13	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)					
PAH/Phenols (GC/MS - SIM)	0	13	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation: Date extracted	Extraction / Preparation: Due for extraction	Extraction / Preparation: Evaluation	Analysis: Date analysed	Analysis: Due for analysis	Analysis: Evaluation
EG020T: Total Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-T)							
FD09	**10-Oct-2023**	**13-Oct-2023**	07-Apr-2024	✓	**13-Oct-2023**	07-Apr-2024	✓
EG050T: Total Hexavalent Chromium							
Opaque plastic bottle - NaOH (EG050G-T)							
FD09	**10-Oct-2023**	**----**	----	**----**	**12-Oct-2023**	11-Oct-2023	×

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK025SF: Free CN by Segmented Flow Analyser							
Opaque plastic bottle - NaOH (EK025SF)							
FD09	**10-Oct-2023**	**----**	----	**----**	**12-Oct-2023**	24-Oct-2023	✓
EK026SF: Total CN by Segmented Flow Analyser							
Opaque plastic bottle - NaOH (EK026SF)							
FD09	**10-Oct-2023**	**----**	----	**----**	**12-Oct-2023**	24-Oct-2023	✓
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser							
Opaque plastic bottle - NaOH (EK028SF)							
FD09	**10-Oct-2023**	**----**	----	**----**	**12-Oct-2023**	24-Oct-2023	✓
EK055G: Ammonia as N by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK055G)							
FD09	**10-Oct-2023**	**----**	----	**----**	**11-Oct-2023**	07-Nov-2023	✓
EP075(SIM)A: Phenolic Compounds							
Amber Glass Bottle - Unpreserved (EP075(SIM))							
FD09	**10-Oct-2023**	**13-Oct-2023**	17-Oct-2023	✓	**17-Oct-2023**	22-Nov-2023	✓
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP075(SIM))							
FD09	**10-Oct-2023**	**13-Oct-2023**	17-Oct-2023	✓	**17-Oct-2023**	22-Nov-2023	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Ammonia as N by Discrete analyser	EK055G	1	4	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	5	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Total	EG050G-T	1	1	**100.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	0	13	**0.00**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	5	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	7	**28.57**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Weak Acid Dissociable Cyanide by Segmented Flow Analyser	EK028SF	1	2	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Ammonia as N by Discrete analyser	EK055G	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Total	EG050G-T	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	5	**40.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Weak Acid Dissociable Cyanide by Segmented Flow Analyser	EK028SF	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Ammonia as N by Discrete analyser	EK055G	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Total	EG050G-T	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Weak Acid Dissociable Cyanide by Segmented Flow Analyser	EK028SF	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Ammonia as N by Discrete analyser	EK055G	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Total	EG050G-T	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	0	13	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Weak Acid Dissociable Cyanide by Segmented Flow Analyser	EK028SF	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Total Metals by ICP-MS - Suite A	EG020A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Hexavalent Chromium by Discrete Analyser - Total	EG050G-T	WATER	In house: Referenced to APHA 3500 Cr-A & B. Hexavalent chromium is determined directly on water sample by Descrete Analyser as received by pH adjustment and colour development using dephenylcarbazide. Each run of samples is measured against a five-point calibration curve. This method is compliant with NEPM Schedule B(3).
Free CN by Segmented Flow Analyser	EK025SF	WATER	In house: Referenced to ASTM D7237, APHA 4500-CN-C&O and ISO 14403: Using an automated segmented flow analyser, a sample at high pH (sodium hydroxide preserved) is buffered to pH 6.0. The hydrogen cyanide present passes across a gas dialysis membrane into an acceptor stream consisting of 0.01 M sodium hydroxide. The acceptor stream mixes with a buffer at pH 5.2 and reacts with chloramine-T to form cyanogen chloride. Cyanogen chloride reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour, measured at 600nm. This method is compliant with NEPM Schedule B(3)
Total Cyanide by Segmented Flow Analyser	EK026SF	WATER	In house: Referenced to APHA 4500-CN C&O / ASTM D7511 / ISO 14403. Sodium hydroxide preserved samples are introduced into an automated segmented flow analyser. Complex bound cyanide is decomposed in a continuously flowing stream, at a pH of 3.8, by the effect of UV light. A UV-B lamp (312 nm) and a decomposition spiral of borosilicate glass are used to filter out UV light with a wavelength of less than 290 nm thus preventing the conversion of thiocyanate into cyanide. The hydrogen cyanide present at a pH of 3.8 is separated by gas dialysis. The hydrogen cyanide is then determined photometrically, based on the reaction of cyanide with chloramine-T to form cyanogen chloride. This then reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour which is measured at 600 nm. This method is compliant with NEPM Schedule B(3)
Weak Acid Dissociable Cyanide by Segmented Flow Analyser	EK028SF	WATER	In house: Referenced to APHA 4500-CN C&O / ISO 14403. Samples preserved with sodium hydroxide are introduced into an automated segmented flow analyser. Hydrogen cyanide is liberated from a slightly acidified (pH 4.5) and is dialysed. Tight cyanide complexes that would not be amenable to oxidation by chlorine are not converted. Iron cyanide complexes are precipitated with zinc acetate. Liberated HCN diffuses through a membrane into a stream of sodium hydroxide where it is carried as CN- The cyanide in caustic solution is buffered to pH 5.2 and further converted to cyanogen chloride by reaction with chloramine-T. Cyanogen chloride subsequently reacts with 4-pyridine carboxylic and 1,3-dimethylbarbituric acids to give a red colour complex. This colour is measured at 600 nm. This method is compliant with NEPM Schedule B(3)
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	WATER	In house: Referenced to USEPA SW 846 - 8270 Sample extracts are analysed by Capillary GC/MS in SIM Mode and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions

Preparation Methods	Method	Matrix	Method Descriptions
Digestion for Total Recoverable Metals	EN25	WATER	In house: Referenced to USEPA SW846-3005. Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM Schedule B(3)
Separatory Funnel Extraction of Liquids	ORG14	WATER	In house: Referenced to USEPA SW 846 - 3510 100 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM Schedule B(3) . ALS default excludes sediment which may be resident in the container.

CERTIFICATE OF ANALYSIS

Work Order	: **ES2334995**	Page	: 1 of 5
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS ALISON MONKLEY	Contact	: Sarah Mathew
Address	: Level 3, GHD Tower, 24 Honeysuckle Drive Newcastle 2300	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: 12609961	Date Samples Received	: 11-Oct-2023 13:39
Order number	: ----	Date Analysis Commenced	: 12-Oct-2023
C-O-C number	: ----	Issue Date	: 18-Oct-2023 15:22
Sampler	: NINA FOLEY		
Site	:		
Quote number	: EN/000		
No. of samples received	: 1		
No. of samples analysed	: 1		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EP075 (SIM): Where reported, Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.
- EP075(SIM): Where reported, Total Cresol is the sum of the reported concentrations of 2-Methylphenol and 3- & 4-Methylphenol at or above the LOR.
- EG020: LOR's have been raised due to matrix interference.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	FD13	----	----	----	----
				Sampling date / time	11-Oct-2023 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES2334995-001	--------	--------	--------	--------
					Result	----	----	----	----
EG020F: Dissolved Metals by ICP-MS									
Lead	7439-92-1	0.001	mg/L		<0.010	----	----	----	----
Molybdenum	7439-98-7	0.001	mg/L		<0.010	----	----	----	----
EG050F: Dissolved Hexavalent Chromium									
Hexavalent Chromium	18540-29-9	0.01	mg/L		<0.01	----	----	----	----
EK025SF: Free CN by Segmented Flow Analyser									
Free Cyanide	----	0.004	mg/L		<0.004	----	----	----	----
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	0.004	mg/L		<0.004	----	----	----	----
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser									
Weak Acid Dissociable Cyanide	----	0.004	mg/L		<0.004	----	----	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**0.32**	----	----	----	----
EP075(SIM)A: Phenolic Compounds									
Phenol	108-95-2	1.0	µg/L		<1.0	----	----	----	----
2-Chlorophenol	95-57-8	1.0	µg/L		<1.0	----	----	----	----
2-Methylphenol	95-48-7	1.0	µg/L		<1.0	----	----	----	----
3- & 4-Methylphenol	1319-77-3	2.0	µg/L		<2.0	----	----	----	----
2-Nitrophenol	88-75-5	1.0	µg/L		<1.0	----	----	----	----
2.4-Dimethylphenol	105-67-9	1.0	µg/L		<1.0	----	----	----	----
2.4-Dichlorophenol	120-83-2	1.0	µg/L		<1.0	----	----	----	----
2.6-Dichlorophenol	87-65-0	1.0	µg/L		<1.0	----	----	----	----
4-Chloro-3-methylphenol	59-50-7	1.0	µg/L		<1.0	----	----	----	----
2.4.6-Trichlorophenol	88-06-2	1.0	µg/L		<1.0	----	----	----	----
2.4.5-Trichlorophenol	95-95-4	1.0	µg/L		<1.0	----	----	----	----
Pentachlorophenol	87-86-5	2.0	µg/L		<2.0	----	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1.0	µg/L		<1.0	----	----	----	----
Acenaphthylene	208-96-8	1.0	µg/L		<1.0	----	----	----	----
Acenaphthene	83-32-9	1.0	µg/L		<1.0	----	----	----	----
Fluorene	86-73-7	1.0	µg/L		<1.0	----	----	----	----
Phenanthrene	85-01-8	1.0	µg/L		<1.0	----	----	----	----
Anthracene	120-12-7	1.0	µg/L		<1.0	----	----	----	----
Fluoranthene	206-44-0	1.0	µg/L		<1.0	----	----	----	----
Pyrene	129-00-0	1.0	µg/L		<1.0	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	FD13	----	----	----	----
				Sampling date / time	11-Oct-2023 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES2334995-001	--------	--------	--------	--------
					Result	----	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Benz(a)anthracene	56-55-3	1.0	µg/L		<1.0	----	----	----	----
Chrysene	218-01-9	1.0	µg/L		<1.0	----	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L		<1.0	----	----	----	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L		<1.0	----	----	----	----
Benzo(a)pyrene	50-32-8	0.5	µg/L		<0.5	----	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L		<1.0	----	----	----	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L		<1.0	----	----	----	----
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L		<1.0	----	----	----	----
^ **Sum of polycyclic aromatic hydrocarbons**	----	0.5	µg/L		<0.5	----	----	----	----
^ **Benzo(a)pyrene TEQ (zero)**	----	0.5	µg/L		<0.5	----	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	1.0	%		**28.4**	----	----	----	----
2-Chlorophenol-D4	93951-73-6	1.0	%		**61.4**	----	----	----	----
2.4.6-Tribromophenol	118-79-6	1.0	%		**75.4**	----	----	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	1.0	%		**73.5**	----	----	----	----
Anthracene-d10	1719-06-8	1.0	%		**89.0**	----	----	----	----
4-Terphenyl-d14	1718-51-0	1.0	%		**94.0**	----	----	----	----

Surrogate Control Limits

Sub-Matrix: **WATER**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10	44
2-Chlorophenol-D4	93951-73-6	14	94
2.4.6-Tribromophenol	118-79-6	17	125
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	20	104
Anthracene-d10	1719-06-8	27	113
4-Terphenyl-d14	1718-51-0	32	112

QUALITY CONTROL REPORT

Work Order	: **ES2334995**	Page	: 1 of 4
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS ALISON MONKLEY	Contact	: Sarah Mathew
Address	: Level 3, GHD Tower, 24 Honeysuckle Drive Newcastle 2300	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: 12609961	Date Samples Received	: 11-Oct-2023
Order number	: ----	Date Analysis Commenced	: 12-Oct-2023
C-O-C number	: ----	Issue Date	: 18-Oct-2023
Sampler	: NINA FOLEY		
Site	:		
Quote number	: EN/000		
No. of samples received	: 1		
No. of samples analysed	: 1		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EG020F: Dissolved Metals by ICP-MS (QC Lot: 5360941)									
ES2334936-002	Anonymous	EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Molybdenum	7439-98-7	0.001	mg/L	0.021	0.022	0.0	0% - 20%
ES2334971-001	Anonymous	EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	0.0	No Limit
EG050F: Dissolved Hexavalent Chromium (QC Lot: 5354779)									
ES2334751-001	Anonymous	EG050G-F: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.0	No Limit
ES2334764-004	Anonymous	EG050G-F: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK025SF: Free CN by Segmented Flow Analyser (QC Lot: 5354401)									
ES2334776-001	Anonymous	EK025SF: Free Cyanide	----	0.004	mg/L	<0.004	<0.004	0.0	No Limit
EK026SF: Total CN by Segmented Flow Analyser (QC Lot: 5354402)									
ES2334776-001	Anonymous	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	0.0	No Limit
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser (QC Lot: 5354403)									
ES2334776-001	Anonymous	EK028SF: Weak Acid Dissociable Cyanide	----	0.004	mg/L	<0.004	<0.004	0.0	No Limit
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 5354541)									
ES2334995-001	FD13	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.32	0.31	0.0	0% - 20%

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 5360941)								
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	90.0	83.0	111
EG020A-F: Molybdenum	7439-98-7	0.001	mg/L	<0.001	0.1 mg/L	92.7	79.0	113
EG050F: Dissolved Hexavalent Chromium (QCLot: 5354779)								
EG050G-F: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	0.05 mg/L	102	86.0	112
EK025SF: Free CN by Segmented Flow Analyser (QCLot: 5354401)								
EK025SF: Free Cyanide	----	0.004	mg/L	<0.004	0.2 mg/L	109	88.0	128
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 5354402)								
EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	0.2 mg/L	111	73.0	133
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser (QCLot: 5354403)								
EK028SF: Weak Acid Dissociable Cyanide	----	0.004	mg/L	<0.004	0.2 mg/L	97.9	93.0	127
EK055G: Ammonia as N by Discrete Analyser (QCLot: 5354541)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1 mg/L	101	90.0	114
EP075(SIM)A: Phenolic Compounds (QCLot: 5354858)								
EP075(SIM): Phenol	108-95-2	1	µg/L	<1.0	5 µg/L	37.4	24.5	61.9
EP075(SIM): 2-Chlorophenol	95-57-8	1	µg/L	<1.0	5 µg/L	68.2	52.0	90.0
EP075(SIM): 2-Methylphenol	95-48-7	1	µg/L	<1.0	5 µg/L	71.2	51.0	91.0
EP075(SIM): 3- & 4-Methylphenol	1319-77-3	2	µg/L	<2.0	10 µg/L	62.6	44.0	88.0
EP075(SIM): 2-Nitrophenol	88-75-5	1	µg/L	<1.0	5 µg/L	74.7	48.0	100
EP075(SIM): 2.4-Dimethylphenol	105-67-9	1	µg/L	<1.0	5 µg/L	70.3	49.0	99.0
EP075(SIM): 2.4-Dichlorophenol	120-83-2	1	µg/L	<1.0	5 µg/L	77.6	53.0	105
EP075(SIM): 2.6-Dichlorophenol	87-65-0	1	µg/L	<1.0	5 µg/L	69.0	57.0	105
EP075(SIM): 4-Chloro-3-methylphenol	59-50-7	1	µg/L	<1.0	5 µg/L	78.3	53.0	99.0
EP075(SIM): 2.4.6-Trichlorophenol	88-06-2	1	µg/L	<1.0	5 µg/L	67.5	50.0	106
EP075(SIM): 2.4.5-Trichlorophenol	95-95-4	1	µg/L	<1.0	5 µg/L	89.4	51.0	105
EP075(SIM): Pentachlorophenol	87-86-5	2	µg/L	<2.0	10 µg/L	39.2	10.0	95.0
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 5354858)								
EP075(SIM): Naphthalene	91-20-3	1	µg/L	<1.0	5 µg/L	68.7	50.0	94.0
EP075(SIM): Acenaphthylene	208-96-8	1	µg/L	<1.0	5 µg/L	78.3	63.6	114
EP075(SIM): Acenaphthene	83-32-9	1	µg/L	<1.0	5 µg/L	79.2	62.2	113
EP075(SIM): Fluorene	86-73-7	1	µg/L	<1.0	5 µg/L	79.9	63.9	115

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 5354858) - continued								
EP075(SIM): Phenanthrene	85-01-8	1	µg/L	<1.0	5 µg/L	78.1	62.6	116
EP075(SIM): Anthracene	120-12-7	1	µg/L	<1.0	5 µg/L	75.9	64.3	116
EP075(SIM): Fluoranthene	206-44-0	1	µg/L	<1.0	5 µg/L	78.3	63.6	118
EP075(SIM): Pyrene	129-00-0	1	µg/L	<1.0	5 µg/L	76.5	63.1	118
EP075(SIM): Benz(a)anthracene	56-55-3	1	µg/L	<1.0	5 µg/L	76.7	64.1	117
EP075(SIM): Chrysene	218-01-9	1	µg/L	<1.0	5 µg/L	77.2	62.5	116
EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	1	µg/L	<1.0	5 µg/L	70.7	61.7	119
EP075(SIM): Benzo(k)fluoranthene	207-08-9	1	µg/L	<1.0	5 µg/L	86.8	63.0	115
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	5 µg/L	77.2	63.3	117
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	1	µg/L	<1.0	5 µg/L	77.2	59.9	118
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	1	µg/L	<1.0	5 µg/L	71.7	61.2	117
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	1	µg/L	<1.0	5 µg/L	71.0	59.1	118

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EG020F: Dissolved Metals by ICP-MS (QCLot: 5360941)							
ES2334936-003	Anonymous	EG020A-F: Lead	7439-92-1	1 mg/L	86.3	70.0	130
EG050F: Dissolved Hexavalent Chromium (QCLot: 5354779)							
ES2334751-001	Anonymous	EG050G-F: Hexavalent Chromium	18540-29-9	0.05 mg/L	112	70.0	130
EK025SF: Free CN by Segmented Flow Analyser (QCLot: 5354401)							
ES2334776-001	Anonymous	EK025SF: Free Cyanide	----	0.2 mg/L	107	70.0	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 5354402)							
ES2334776-001	Anonymous	EK026SF: Total Cyanide	57-12-5	0.2 mg/L	108	70.0	130
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser (QCLot: 5354403)							
ES2334776-001	Anonymous	EK028SF: Weak Acid Dissociable Cyanide	----	0.2 mg/L	104	70.0	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 5354541)							
ES2334995-001	FD13	EK055G: Ammonia as N	7664-41-7	1 mg/L	110	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2334995**	Page	: 1 of 6
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS ALISON MONKLEY	Telephone	: +61-2-8784 8555
Project	: 12609961	Date Samples Received	: 11-Oct-2023
Site	:	Issue Date	: 18-Oct-2023
Sampler	: NINA FOLEY	No. of samples received	: 1
Order number	: ----	No. of samples analysed	: 1

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method / Container / Client Sample ID(s)	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EG050F: Dissolved Hexavalent Chromium						
Opaque plastic bottle - NaOH						
FD13	----	----	----	13-Oct-2023	12-Oct-2023	**1**

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type / Method	Count		Rate (%)		Quality Control Specification
	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
PAH/Phenols (GC/MS - SIM)	0	18	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)					
PAH/Phenols (GC/MS - SIM)	0	18	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Natural (EG020A-F)							
FD13	**11-Oct-2023**	**----**	----	**----**	**16-Oct-2023**	08-Apr-2024	✓
EG050F: Dissolved Hexavalent Chromium							
Opaque plastic bottle - NaOH (EG050G-F)							
FD13	**11-Oct-2023**	**----**	----	**----**	**13-Oct-2023**	12-Oct-2023	×
EK025SF: Free CN by Segmented Flow Analyser							
Opaque plastic bottle - NaOH (EK025SF)							
FD13	**11-Oct-2023**	**----**	----	**----**	**12-Oct-2023**	25-Oct-2023	✓
EK026SF: Total CN by Segmented Flow Analyser							
Opaque plastic bottle - NaOH (EK026SF)							
FD13	**11-Oct-2023**	**----**	----	**----**	**12-Oct-2023**	25-Oct-2023	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK028SF: Weak Acid Dissociable CN by Segmented Flow Analyser							
Opaque plastic bottle - NaOH (EK028SF)							
FD13	**11-Oct-2023**	**----**	----	----	**12-Oct-2023**	25-Oct-2023	✓
EK055G: Ammonia as N by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK055G)							
FD13	**11-Oct-2023**	**----**	----	----	**12-Oct-2023**	08-Nov-2023	✓
EP075(SIM)A: Phenolic Compounds							
Amber Glass Bottle - Unpreserved (EP075(SIM))							
FD13	**11-Oct-2023**	**13-Oct-2023**	18-Oct-2023	✓	**17-Oct-2023**	22-Nov-2023	✓
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP075(SIM))							
FD13	**11-Oct-2023**	**13-Oct-2023**	18-Oct-2023	✓	**17-Oct-2023**	22-Nov-2023	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Ammonia as N by Discrete analyser	EK055G	1	1	**100.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	13	**15.38**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	5	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	0	18	**0.00**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	5	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Weak Acid Dissociable Cyanide by Segmented Flow Analyser	EK028SF	1	2	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Ammonia as N by Discrete analyser	EK055G	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	5	**40.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Weak Acid Dissociable Cyanide by Segmented Flow Analyser	EK028SF	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Ammonia as N by Discrete analyser	EK055G	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Weak Acid Dissociable Cyanide by Segmented Flow Analyser	EK028SF	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Ammonia as N by Discrete analyser	EK055G	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	0	18	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Weak Acid Dissociable Cyanide by Segmented Flow Analyser	EK028SF	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Hexavalent Chromium by Discrete Analyser - Dissolved	EG050G-F	WATER	In house: Referenced to APHA 3500 Cr-A & B. Samples are 0.45µm filtered prior to analysis. Hexavalent chromium is determined directly on water sample by Descrete Analyser as received by pH adjustment and colour development using dephenylcarbazide. Each run of samples is measured against a five-point calibration curve. This method is compliant with NEPM Schedule B(3).
Free CN by Segmented Flow Analyser	EK025SF	WATER	In house: Referenced to ASTM D7237, APHA 4500-CN-C&O and ISO 14403: Using an automated segmented flow analyser, a sample at high pH (sodium hydroxide preserved) is buffered to pH 6.0. The hydrogen cyanide present passes across a gas dialysis membrane into an acceptor stream consisting of 0.01 M sodium hydroxide. The acceptor stream mixes with a buffer at pH 5.2 and reacts with chloramine-T to form cyanogen chloride. Cyanogen chloride reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour, measured at 600nm. This method is compliant with NEPM Schedule B(3)
Total Cyanide by Segmented Flow Analyser	EK026SF	WATER	In house: Referenced to APHA 4500-CN C&O / ASTM D7511 / ISO 14403. Sodium hydroxide preserved samples are introduced into an automated segmented flow analyser. Complex bound cyanide is decomposed in a continuously flowing stream, at a pH of 3.8, by the effect of UV light. A UV-B lamp (312 nm) and a decomposition spiral of borosilicate glass are used to filter out UV light with a wavelength of less than 290 nm thus preventing the conversion of thiocyanate into cyanide. The hydrogen cyanide present at a pH of 3.8 is separated by gas dialysis. The hydrogen cyanide is then determined photometrically, based on the reaction of cyanide with chloramine-T to form cyanogen chloride. This then reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour which is measured at 600 nm. This method is compliant with NEPM Schedule B(3)
Weak Acid Dissociable Cyanide by Segmented Flow Analyser	EK028SF	WATER	In house: Referenced to APHA 4500-CN C&O / ISO 14403. Samples preserved with sodium hydroxide are introduced into an automated segmented flow analyser. Hydrogen cyanide is liberated from a slightly acidified (pH 4.5) and is dialysed. Tight cyanide complexes that would not be amenable to oxidation by chlorine are not converted. Iron cyanide complexes are precipitated with zinc acetate. Liberated HCN diffuses through a membrane into a stream of sodium hydroxide where it is carried as CN- The cyanide in caustic solution is buffered to pH 5.2 and further converted to cyanogen chloride by reaction with chloramine-T. Cyanogen chloride subsequently reacts with 4-pyridine carboxylic and 1,3-dimethylbarbituric acids to give a red colour complex. This colour is measured at 600 nm. This method is compliant with NEPM Schedule B(3)
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	WATER	In house: Referenced to USEPA SW 846 - 8270 Sample extracts are analysed by Capillary GC/MS in SIM Mode and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions

Preparation Methods	Method	Matrix	Method Descriptions
Separatory Funnel Extraction of Liquids	ORG14	WATER	In house: Referenced to USEPA SW 846 - 3510 100 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM Schedule B(3) . ALS default excludes sediment which may be resident in the container.

CHAIN OF CUSTODY

ALS Laboratory: please tick →

☐ BRISBANE 2-4 Hamilton Road Chinchilla Q 4025 Ph: 07 4660 7000 E: [illegible]
☐ BRISBANE 2-4 Hamilton Road Chinchilla Q 4025 Ph: 07 4660 7000 E: [illegible]
☐ GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 4979 9990 E: gladstone@alsglobal.com
☐ MACKAY 79 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com
☐ MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 08 8549 9600 E: samples.melbourne@alsglobal.com
☐ MUDGEE 27 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com
☐ NEWCASTLE 5/585 Maitland Rd Mayfield West NSW 2304 Ph: 02 4014 2500 E: samples.newcastle@alsglobal.com
☐ NOWRA 4/15 Geary Place North Nowra NSW 2541 Ph: 024433 2068 E: nowra@alsglobal.com
☐ PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com
☐ SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com
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☐ WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: perthmail@alsglobal.com

CLIENT: GHD
OFFICE: Newcastle
PROJECT: 12609961
ORDER NUMBER:
PROJECT MANAGER: Alison Monkley
CONTACT PH: 02 4979 9990
SAMPLER: Nina Foley
SAMPLER MOBILE: 0480320757
COC emailed to ALS? (YES / NO)
EDD FORMAT (or default): Esdat
Email Reports to (will default to PM if no other addresses are listed): nina.foley@GHD.com +
Email Invoice to (will default to PM if no other addresses are listed): Alison.monkley@GHD.com

TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g.. Ultra Trace Organics)
☑ Standard TAT (List due date):
☐ Non Standard or urgent TAT (List due date):

ALS QUOTE NO.:

COC SEQUENCE NUMBER (Circle)
COC: 1 2 3 4 5 6 7
OF: 1 2 3 4 5 6 7

FOR LABORATORY USE ONLY (Circle)
Custody Seal Intact? Yes No N/A
Free ice / frozen ice bricks present upon receipt? Yes No N/A
Random Sample Temperature on Receipt: 21.3 °C
Other comment:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Jackson Marlow-Conway	JAV 11-10-23	LL 11-10-23	[illegible]
DATE/TIME: 13:40	DATE/TIME: 1340	DATE/TIME:	DATE/TIME: 11/10/23 2000

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE	SAMPLE DETAILS MATRIX: SOLID (S) WATER (W)			CONTAINER INFORMATION		ANALYSIS REQUIRED Including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	Ammonia	Phenolics	Cyanide (weak acid dissociable, free)	Cyanide (total)	Hex. Chromium (dissolved)	Molybdenum (dissolved)	Lead (dissolved)	Total PAH	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
2	FD13	11/10/23	W			X	X	X	X	X	X	X	X	
				TOTAL										

Environmental Division Sydney
Work Order Reference
ES2334995

Telephone : + 61-2-8784 8555

Other Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserv
Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

Appendix G

Field Sheets

Purging and Sampling Record
Bore ID: K11/3E

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Peristaltic pump	**SWL(mbTOC) (m):** 1.84	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Peristaltic pump	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:** Ysi	**NAPL check:** No	**Bore diam. (mm)**
Sampler: JMC	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:** Yes
Date: October 13, 2023 9:22 AM	**WLevel Meter Type:** Interface probe	**Bore depth (m):** 5.46	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
09:25	0.5	19.4	7	2,987	1.6	-247.8		2.14	
09:30	1	18.4	7.1	2,985	1.1	-254.1		2.27	
09:34	1.5	18.4	7	2,987	1	-255.2		2.27	
09:40	2	18.4	7	2,981	0.9	-257.8		2.27	
09:44	2.5	18.4	7	2,986	1.1	-254.9		2.27	
09:49	3	18.4	7	2,963	1	-255.9		2.27	pale, light brown, cloudy, odour, no sheen, Other Moderate H2S odour. Trace organic sediment.

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
K11/3E	Water	Yes	Disposable filter	4	NA	

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: K11/1S

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Micropurge	**SWL(mbTOC) (m):** 3.04	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Micropurge	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:** YSI	**NAPL check:**	**Bore diam. (mm)**
Sampler: NF	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:**
Date: October 13, 2023 8:15 AM	**WLevel Meter Type:** Interface probe	**Bore depth (m):** 8.88	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
08:25	0.5	17.6	5.9	8,498	1	-100.9		3.1	
08:26	1	17.6	5.9	8,500	1.1	-110.9		3.1	
08:27	1.5	17.6	6	8,501	1.1	-122		3.1	
08:28	2	17.6	6	8,503	1.1	-125.6		3.1	
08:29	2.5	17.7	6.1	8,504	1.2	-130.9		3.1	
08:30	3	17.7	6.1	8,501	1.2	-136.1		3.1	yellow, slightly turbid, odour, Other Trace black sediments possibly coal

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
K11/1S	Water	Yes	Disposable filter	4		

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: K10/2NN

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Micropurge	**SWL(mbTOC) (m):** 10.65	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Micropurge	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:** Ysi	**NAPL check:** No	**Bore diam. (mm)** 50
Sampler: JMC	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:** Yes
Date: October 12, 2023 1:07 PM	**WLevel Meter Type:** Interface probe	**Bore depth (m):** 14.13	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
13:11	0.5	23.2	6.2	19,133	2.4	-390.5		10.65	
13:12	1	23	6.5	19,372	1.94	-398.5		10.66	
13:15	1.5	23	6.6	19,557	1.6	-421.9		10.66	
13:18	2	23	6.6	19,713	1.5	-416.3		10.66	
13:21	2.5	23	6.5	19,722	1.5	-417.5		10.66	
13:24	3	23	6.5	19,665	1.5	-425		10.66	clear, yellow, odour, Other Trace black / organic sediment. Strong H2S odour.

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
K10/2NN	Water	Yes	Disposable filter	4	NA	

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: K11/2W

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Micropurge	**SWL(mbTOC) (m):** 1.77	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Micropurge	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:**	**NAPL check:**	**Bore diam. (mm)**
Sampler: NF	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:**
Date: October 12, 2023 8:53 AM	**WLevel Meter Type:** Interface probe	**Bore depth (m):** 11.34	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
09:13	0.5	20.1	5.8	3,427	5.9	-299.3		1.77	
09:14	1	22.2	5.8	3,427	5.9	-193.1		1.77	clear, yellow, no sheen, Other Micro took long time to start, lots of sulfur bubbles in well strong sulfur odour. Had to stop bubbles coming out the top of well.

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
K11/2W	Water	Yes	Disposable filter	4		Sample taken at 1L too many sulfur bubbles coming from well. Only inorganics and cyanide take, well over flowed

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: K11/3W

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Micropurge	**SWL(mbTOC) (m):** 1.96	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Micropurge	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:** Ysi	**NAPL check:**	**Bore diam. (mm)**
Sampler: NF	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:** Yes
Date: October 13, 2023 9:09 AM	**WLevel Meter Type:** Interface probe	**Bore depth (m):** 12.47	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
09:32	0.5	18	5.6	164.9	1.8	47.6		1.99	
09:32	1	18	5.6	136.4	1.5	46.9		1.99	
09:33	1.5	18.3	5.6	159	2.4	45.8		1.99	Other Possible hole in tubing effecting DO
09:36	2	18.8	5.9	8,100	2.6	42.4		1.99	
09:40	2.5	19.1	5.6	9,335	2.6	44.6		1.99	
09:44	3	18.9	5.8	12,073	2.3	43.1		1.99	same as previous, Other Trace bacterial sheen, slightly turbid, yellow, trace black sediments, no odour.
09:49	3.5	19.2	6.8	14,119	1.2	9.7		1.99	Other All parameters slowly changing
09:51	4	19.1	6.9	14,189	1.1	3.9		1.99	Other
09:55	4.5	19.2	7	14,207	1.5	-7.5		1.99	

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
K11/3W	Water	Yes	Disposable filter	4		

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: K11/1

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Peristaltic pump	**SWL(mbTOC) (m):** 2.48	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Peristaltic pump	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:** Ysi	**NAPL check:** No	**Bore diam. (mm)**
Sampler: JMC	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:** Yes
Date: October 13, 2023 8:20 AM	**WLevel Meter Type:** Interface probe	**Bore depth (m):** 3.69	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
08:23	0.5	16.6	7.3	1,055	0.9	-10.3		2.5	light brown, slightly turbid, no odour, no sheen
08:26	1	16.7	7.3	1,061	0.7	-20.6		2.5	
08:28	1.5	16.7	7.3	1,064	0.5	-32.5		2.5	
08:31	2	16.7	7.3	1,067	0.4	-44.9		2.5	
08:34	2.5	16.7	7.3	1,061	0.3	-63.9		2.5	
08:37	3	16.7	7.3	1,056	0.2	-74.2		2.5	
08:38	3.5	16.7	7.3	1,052	0.2	-82.5		2.5	

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
K11/1	Water	Yes	Disposable filter	4	NA	

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: K10//2

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Peristaltic pump	**SWL(mbTOC) (m):** 7.52	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Peristaltic pump	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:** Ysi	**NAPL check:** No	**Bore diam. (mm)** 50
Sampler: NF	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:** Yes
Date: October 12, 2023 1:48 PM	**WLevel Meter Type:** Interface probe	**Bore depth (m):** 9.86	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
13:48	0.5	21.9	7.5	470	1.7	29.6		8.3	
13:51	1	22.4	7.4	468	1.6	32.6		8.46	
13:55	1.5	23.8	7.5	470	1.4	28		8.62	
14:00	2	23	7.6	477	1.4	22.2		8.82	light brown, turbid, no odour, slight sheen, bacterial sheen, low flow rate, Other Slow flow rate. Sample taken at 2L so well didnt go dry.

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
K10//2	Water	Yes	Disposable filter	4	NA	Slow flow rate. Sample taken at 2L so well doesnt go dry

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: K10/2N

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Peristaltic pump	**SWL(mbTOC) (m):** 7.3	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Peristaltic pump	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:** Ysi	**NAPL check:**	**Bore diam. (mm)**
Sampler: NF	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:**
Date: October 12, 2023 1:02 PM	**WLevel Meter Type:** Interface probe	**Bore depth (m):** 10.06	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
13:04	0.5	21.5	9.3	1,058	0.6	-90.1		7.7	
13:06	1	21.5	9.3	1,056	0.5	-85.7		7.7	low flow rate
13:10	1.5	21.6	9.4	1,038	0.4	-79.7		7.9	low flow rate
13:15	2	21.9	9.4	1,041	0.4	-80.5		7.97	low flow rate
13:20	2.5	22	9.4	1,052	0.4	-81.8		8.01	low flow rate
13:23	3	22	9.3	1,075	0.4	-81.7		8.09	clear, yellow, odour, no sheen, low flow rate

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
K10/2N	Water	Yes	Disposable filter	4		

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: GHD01S

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Peristaltic pump	**SWL(mbTOC) (m):** 9.41	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Peristaltic pump	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:** Ysi	**NAPL check:** No	**Bore diam. (mm)** 50
Sampler: NF	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:** Yes
Date: October 12, 2023 11:56 AM	**WLevel Meter Type:** Interface probe	**Bore depth (m):** 14.34	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
12:14	0.5	21.8	7.2	4,338	0.37	-51.6		9.44	
12:25	1	21.4	7.2	4,333	0.3	-52.6		9.44	
12:32	1.5	21.4	6.9	4,926	0.3	-56.2		9.44	
12:38	2	21.3	6.9	4,912	0.2	-54.5		9.44	
12:40	2.5	21.2	6.9	4,922	0.2	-54.7		9.44	clear, yellow, no odour, no sheen, Other Sample taken to avoid dry well parameters stable

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
GHD01S	Water	Yes	Disposable filter	4		

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: GHD01N

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Peristaltic pump	**SWL(mbTOC) (m):** 6.63	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Peristaltic pump	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:** Ysi	**NAPL check:** No	**Bore diam. (mm)**
Sampler: NF	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:** Yes
Date: October 12, 2023 11:48 AM	**WLevel Meter Type:** Interface probe	**Bore depth (m):** 9.41	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
11:48	0.5	22.5	8.1	1,559	0.4	14.5		6.87	low flow rate
11:49	1	22.5	8.1	1,560	0.4	15.3		6.87	low flow rate
11:54	1.5	22	8.2	1,564	0.3	18.5		6.87	low flow rate
12:01	2	22	8.2	1,567	0.3	20.7		6.87	low flow rate
12:02	2.5	22.1	8.2	1,566	0.3	21.2		6.87	same as previous, low flow rate
12:05	3	22.2	8.2	1,571	0.3	22.4		6.87	light brown, slightly turbid, no odour, no sheen, low flow rate

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
GHD01N	Water	Yes	Disposable filter	4		

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: K9/3S

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Peristaltic pump	**SWL(mbTOC) (m):** 2.12	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Peristaltic pump	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:** YSI	**NAPL check:** No	**Bore diam. (mm)** 50
Sampler: NF	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:** Yes
Date: October 13, 2023 7:20 AM	**WLevel Meter Type:** Interface probe	**Bore depth (m):** 3.23	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
07:24	0.5	17.9	7.6	5,301	0.8	-250.2		2.16	
07:25	1	18.4	7.7	4,341	0.07	-258.2		2.16	
07:32	1.5	18.4	7.7	4,299	0.11	-248.7		2.16	
07:33	2	18.4	7.7	4,246	0.1	-246.1		2.16	
07:35	2.5	18.4	7.7	4,174	0.1	-243.3		2.16	
07:37	3	18.4	7.7	4,128	0.1	-243		2.16	clear, colourless, odour, no sheen, Other Strong H2S odour.

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
K9/3S	Water	Yes	Disposable filter	4	NA	

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: K9/3N

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Peristaltic pump	**SWL(mbTOC) (m):** 2.89	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Peristaltic pump	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:** YSI	**NAPL check:** No	**Bore diam. (mm)** 50
Sampler: NF	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:** Yes
Date: October 12, 2023 10:33 AM	**WLevel Meter Type:** Interface probe	**Bore depth (m):** 10.09	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
10:38	0.5	21.4	5.7	18,137	3.1	-348.9	10.1	2.92	
10:44	1	21.2	5.7	18,109	4.2	-372.4		2.92	
10:45	1.5	21.2	5.7	18,054	4.2	-374.2		2.92	
10:47	2	21.2	5.7	18,056	4	-382.6		2.92	clear, colourless, odour, slight sheen, bacterial sheen, Other H2S odour. Lots of bubbles in well.

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
K9/3N	Water	Yes	Disposable filter	4	NA	

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: BHe29S

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Peristaltic pump	**SWL(mbTOC) (m):** 2.94	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Peristaltic pump	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:** YSI	**NAPL check:** No	**Bore diam. (mm)** 30
Sampler: JMC	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:** Yes
Date: October 12, 2023 9:50 AM	**WLevel Meter Type:** Interface probe	**Bore depth (m):** 4.5	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
09:56	0.5	19.6	7.8	1,416	0.4	-102.4		3.01	
10:00	1	19.6	7.9	1,365	0.3	-119.4		3.01	
10:05	1.5	19.6	8	1,327	0.2	-134.5		3.01	
10:11	2	19.6	8.1	1,311	0.2	-142		3.01	
10:16	2.5	19.6	8.1	1,297	0.2	-155.8		3.01	
10:18	3	19.6	8.1	1,297	0.2	-158.8		3.01	clear, yellow, no sheen, Other Moderate H2S odour

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
BHe29S	Water	Yes	Disposable filter	4	NA	

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: K11/2E

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Peristaltic pump	**SWL(mbTOC) (m):** 1.51	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Peristaltic pump	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:** YSI	**NAPL check:** No	**Bore diam. (mm)** 50
Sampler: JMC	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:** Yes
Date: October 12, 2023 8:58 AM	**WLevel Meter Type:** Interface probe	**Bore depth (m):** 5.45	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
08:59	0.5	18.6	7.4	909	0.22	-96.2		1.74	
09:05	1	18.4	7.4	908	0.13	-92.3		1.83	
09:09	1.5	18.4	7.4	909	0.11	-88.3		1.88	
09:13	2	18.4	7.4	911	0.16	-90.8		1.88	
09:18	2.5	18.4	7.4	913	0.13	-89.2		1.88	
09:22	3	18.4	7.4	915	0.13	-82.3		1.88	light brown, turbid, no odour, no sheen, Other Moderate organic sediment.

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
K11/2E	Water	Yes	Disposable filter	4	NA	

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: K8/5W

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Peristaltic pump	**SWL(mbTOC) (m):** 5.56	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Peristaltic pump	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:** Ysi	**NAPL check:** No	**Bore diam. (mm)** 50
Sampler: NF	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:**
Date: October 12, 2023 7:26 AM	**WLevel Meter Type:** Interface probe	**Bore depth (m):** 8.04	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
07:27	0.5	18.6	10.1	2,501	0.2	-320		5.8	
07:32	1	18.3	10.1	2,492	0.13	-318.8		5.8	
07:35	1.5	18.3	10.1	2,490	0.04	-323.9		5.8	
07:40	2	18.3	10.1	2,490	0.01	-329.1		5.8	
07:44	2.5	18.3	10.1	2,490	0	-322.8		5.8	
07:47	3	18.3	10.1	2,490	0	-333.6		5.8	clear, yellow, odour, slight sheen, bacterial sheen, Other HC odour.

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
K8/5W	Water	Yes	Disposable filter	4		

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: K7/4S

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Peristaltic pump	**SWL(mbTOC) (m):** 6.47	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Peristaltic pump	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:** YSI	**NAPL check:** No	**Bore diam. (mm)** 50
Sampler: NF	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:** Yes
Date: October 11, 2023 2:02 PM	**WLevel Meter Type:** Interface probe	**Bore depth (m):** 13.6	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
14:21	0.5	22.7	6.3	17,275	0.57	-114.2		6.47	
14:23	1	22.6	6.5	18,013	0.3	-124.9		6.47	
14:24	1.5	22.6	6.5	18,389	0.28	-139.8		6.47	
14:26	2	22.6	6.5	18,510	0.3	-155.8		6.47	
14:28	2.5	22.6	6.5	18,794	0.31	-166.5		6.47	
14:30	3	22.6	6.5	18,725	0.33	-173.5		6.47	clear, yellow, no odour, no sheen, Other Trace organic sediment.

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
K7/4S	Water	Yes	Disposable filter	4	NA	

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: K12/1E

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Micropurge	**SWL(mbTOC) (m):** 1.5	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Micropurge	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:** Ysi	**NAPL check:** No	**Bore diam. (mm)**
Sampler: JMCC	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:**
Date: October 11, 2023 12:28 PM	**WLevel Meter Type:** Interface probe	**Bore depth (m):** 8.69	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
12:31	0.5	18.8	6.4	23,563	1	-94.2		1.57	
12:33	1	18.7	6.3	23,785	0.7	-97.6		1.57	
12:35	1.5	18.7	6.2	24,068	0.7	-100.6		1.59	
12:38	2	18.7	6.3	24,624	0.5	-113		1.59	
12:41	2.5	18.7	6.5	25,163	0.5	-132.2		1.59	
12:43	3	18.7	6.6	25,342	0.4	-142.9		1.59	light brown, turbid, no odour, no sheen

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
K12/1E	Water	Yes	Disposable filter	8	FD14	

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: NCIG/1

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Peristaltic pump	**SWL(mbTOC) (m):** 1.74	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Peristaltic pump	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:** Ysi	**NAPL check:**	**Bore diam. (mm)** 50
Sampler: NF	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:** Yes
Date: October 11, 2023 11:10 AM	**WLevel Meter Type:** Interface probe	**Bore depth (m):** 6.72	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
11:19	0.5	20.2	7.9	15,600	1.3	-130.3		1.74	
11:22	1	20.6	7.7	15,751	1.1	-118.2		1.74	
11:26	1.5	20.1	7.7	15,761	0.6	-102.7		1.74	
11:28	2	20.1	7.7	14,360	0.6	-99.8		1.74	
11:34	2.5	19.6	7.9	10,050	0.6	-88.8		1.74	
11:35	3	19.6	7.9	9,555	0.6	-88.6		1.74	pale, brown, turbid, odour, no sheen

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
NCIG/1	Water	Yes	Disposable filter	4		

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: K12/7

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Peristaltic pump	**SWL(mbTOC) (m):** 0.62	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Peristaltic pump	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:** YSI	**NAPL check:**	**Bore diam. (mm)** 50
Sampler: NF	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:**
Date: October 11, 2023 10:12 AM	**WLevel Meter Type:** Interface probe	**Bore depth (m):** 4.31	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
10:13	0.5	15.5175	8.14	43,194	2.8	-115		1.35	
10:20	1	17.5	8.16	43,196	1.54	-105		1.3	
10:21	1.5	17.9	8.16	43,140	1.31	-96.4		1.3	
10:25	2	17.7	8.16	43,050	0.96	-88		1.3	
10:29	2.5	17.8	8.17	43,012	1.4	-89		1.3	
10:33	3	17.7	8.17	43,003	1.5	-84.6		1.3	light brown, yellow, slightly turbid, no odour, no sheen, Other Black particle

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
K12/7	Water	Yes	Disposable filter	12	FD12 AN FD13	

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: K12/9E

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:**	**SWL(mbTOC) (m):**	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:**	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:**	**NAPL check:** No	**Bore diam. (mm)**
Sampler: JMC	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:** No
Date: October 11, 2023 9:36 AM	**WLevel Meter Type:**	**Bore depth (m):**	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
K12/9E						No samples taken, well could not be located.

Field QA Checks		
Air bubbles in vial:	**Any violent reactions:**	**Decontamination as per GHD procedure:**
COC updated:	**Was sampling equipment pre cleaned:**	**Laboratory:**

Purging and Sampling Record
Bore ID: K12/10

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Micropurge	**SWL(mbTOC) (m):** 1.02	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Micropurge	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:** Ysi	**NAPL check:**	**Bore diam. (mm)** 50
Sampler: NF	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:**
Date: October 11, 2023 8:28 AM	**WLevel Meter Type:** Interface probe	**Bore depth (m):** 14.25	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
09:03	0.5	19.4	6.1	2,711	0.5	-114.4		1.2	Other Recharge too slow for micro purge SWL will not stabalise, lots of bubbles coming up
09:05	1	19.4	6.2	2,721	1	-137.2		1.24	
09:12	1.5	19.4	6.2	2,740	2	-162.4		1.24	
09:12	2	19.5	6.3	2,761	2	-169.4		1.24	turbid, odour, bacterial sheen, low flow rate, Other Stable sample taken with due low flow rate, stabalised enough, turbid black

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
K12/10	Water	Yes	Disposable filter	4	FD11	

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record

Bore ID: K8/5E

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:**	**SWL(mbTOC) (m):**	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:**	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:**	**NAPL check:**	**Bore diam. (mm)**
Sampler: NF	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:**
Date: October 12, 2023 7:44 AM	**WLevel Meter Type:** Interface probe	**Bore depth (m):**	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments

Field QA Checks		
Air bubbles in vial:	**Any violent reactions:**	**Decontamination as per GHD procedure:**
COC updated:	**Was sampling equipment pre cleaned:**	**Laboratory:**

Purging and Sampling Record
Bore ID: K7/4N

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Peristaltic pump	**SWL(mbTOC) (m):** 6.13	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Peristaltic pump	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:** Ysi	**NAPL check:**	**Bore diam. (mm)**
Sampler: NF	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:**
Date: October 11, 2023 2:05 PM	**WLevel Meter Type:** Interface probe	**Bore depth (m):** 8.97	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
14:08	0.5	23.3	7.8	2,480	0.7	-70.2		6.62	
14:21	1	23.4	7.8	2,440	0.4	-53		6.71	
14:25	1.5	23.3	7.8	2,352	0.3	-38.8		7.06	
14:34	2	23.8	7.8	2,283	0.3	-17		7.06	clear, colourless, odour, no sheen, low flow rate, Other Redox is dropping,every thing else are stable, sample taken, surface water unstable.

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
K7/4N	Water		Disposable filter			

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: K12/1W

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Peristaltic pump	**SWL(mbTOC) (m):** 1.3	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Peristaltic pump	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:** Ysi	**NAPL check:**	**Bore diam. (mm)**
Sampler: NF	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:** Yes
Date: October 11, 2023 12:13 PM	**WLevel Meter Type:** Interface probe	**Bore depth (m):** 3.63	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
12:23	0.5	19.4	7.09	16,590	1.14	-53.2		1.34	
12:25	1	19.7	7.1	16,569	1.1	-23.1		1.34	
12:28	1.5	19.1	7.1	16,640	1	-10.4		1.34	
12:33	2	19.1	7.1	16,617	1	-6.1		1.34	
12:36	2.5	19.1	7.1	16,637	1.05	-4.3		1.34	
12:41	3	19	7.1	16,648	1.05	-3.2		1.34	brown, turbid, no odour, bacterial sheen

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
K12/1W	Water	Yes	Disposable filter	4		

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: NCIG2

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Micropurge	**SWL(mbTOC) (m):** 1.22	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Micropurge	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:** YSI	**NAPL check:** No	**Bore diam. (mm)** 50
Sampler: JMC	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:** Yes
Date: October 11, 2023 11:22 AM	**WLevel Meter Type:** Interface probe	**Bore depth (m):** 12.92	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
11:23	0.5	19.2	7.04	52,799	1.25	-127.9		1.61	
11:25	1	19.3	7.02	52,887	1.01	-137.3		1.82	
11:27	1.5	19.1	7.01	52,918	0.89	-143.3		2.03	
11:31	2	19.1	7.01	52,916	0.8	-148.9		2.3	
11:36	2.5	19.1	7.01	52,956	0.7	-152.3		2.52	
11:41	3	19.1	7	52,941	0.72	-153.1		2.76	light brown, turbid, no odour, no sheen, low flow rate

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
NCIG2	Water	Yes	Disposable filter	4	NA	Low flow rate but SWL would not stabilise. All other parameters stable.

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: K12/7E

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Micropurge	**SWL(mbTOC) (m):** 0.92	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Micropurge	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:** Ysi	**NAPL check:**	**Bore diam. (mm)** 50
Sampler: JMC	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:** Yes
Date: October 11, 2023 10:15 AM	**WLevel Meter Type:** Interface probe	**Bore depth (m):** 12.03	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
10:19	0.5	19.3	6.77	49,915	1.27	-110.6		1.24	
10:21	1	19.2	6.7	49,916	1.4	-109		1.43	
10:25	1.5	20	6.73	50,146	1.24	-112.8		1.61	
10:31	2	20.7	6.7	50,186	1.23	-118.4		1.82	
10:38	2.5	19.9	6.74	50,076	1.4	-122.4		2	
10:44	3	19.9	6.75	50,039	1.36	-127.7		2.09	pale, yellow, slightly turbid, no odour, no sheen, low flow rate, Other Trace organic sediment

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
K12/7E	Water	Yes	Disposable filter	4	NA	Low flow rate but SWL would not stabilise. All other parameters stable.

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: K12/9

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Peristaltic pump	**SWL(mbTOC) (m):** 1.43	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Peristaltic pump	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:** Yis	**NAPL check:**	**Bore diam. (mm)**
Sampler: Nf	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:**
Date: October 11, 2023 9:31 AM	**WLevel Meter Type:** Interface probe	**Bore depth (m):** 7.23	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
09:33	0.5	18.6	6.76	32,706	0.31	-47.2		1.44	
09:37	1	18.6	6.76	32,710	0.24	-69.7		1.44	
09:40	1.5	18.5	6.76	32,744	0.22	-90		1.44	
09:43	2	18.5	6.75	32,763	0.21	-109		1.44	
09:46	2.5	18.5	6.74	32,790	0.22	-119.3		1.44	
09:48	3	18.5	6.71	32,841	0.37	-131.6		1.44	pale, brown, orange, no odour, bacterial sheen, Other Algae flocks

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
K12/9	Water	Yes	Disposable filter			

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: K12/10E

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:**	**SWL(mbTOC) (m):**	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:**	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:**	**NAPL check:** No	**Bore diam. (mm)** 50
Sampler: JMC	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:** No
Date: October 11, 2023 8:52 AM	**WLevel Meter Type:**	**Bore depth (m):**	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
K12/10E						No samples collected. Well blocked.

Field QA Checks		
Air bubbles in vial:	**Any violent reactions:**	**Decontamination as per GHD procedure:**
COC updated:	**Was sampling equipment pre cleaned:**	**Laboratory:**

Purging and Sampling Record
Bore ID: K9/4W

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Micropurge	**SWL(mbTOC) (m):** 2.57	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Micropurge	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:** YSI	**NAPL check:** No	**Bore diam. (mm)** 50
Sampler: NF	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:** Yes
Date: October 10, 2023 1:14 PM	**WLevel Meter Type:** Interface probe	**Bore depth (m):** 11.61	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
13:19	0.5	18.2	6.94	12,267	0.56	-129.2		2.31	
13:22	1	18.2	6.98	13,413	0.21	-198.7		2.35	
13:24	1.5	18.2	6.97	13,716	0.17	-224.7		2.31	
13:25	2	18.2	6.94	13,840	0.16	-241.6		2.31	
13:28	2.5	18.2	6.87	14,022	0.15	-249.6		2.31	
13:30	3	18.2	6.95	14,210	0.16	-250		2.31	
13:32	3.5	18.2	6.95	14,410	0.16	-257.4		2.31	clear, yellow, no odour, no sheen

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
K9/4W	Water	Yes	Disposable filter	4	NA	

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: K9/2E

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Micropurge	**SWL(mbTOC) (m):** 2.17	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Micropurge	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:** Ysi	**NAPL check:** No	**Bore diam. (mm)** 50
Sampler: NF	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:** Yes
Date: October 10, 2023 12:05 PM	**WLevel Meter Type:** Interface probe	**Bore depth (m):** 11.59	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
12:17	0.5	20	6.7	31,556	0.3	-248		1.99	
12:19	1	20.3	6.8	34,653	0.1	-253		2.14	
12:25	1.5	20.1	5.5	33,477	0.9	-226		2.19	
12:32	2	20.1	5.5	33,477	0.9	-226		2.19	
12:33	2.5	19.8	5.5	33,269	1.38	-230.4		2.19	
12:35	3	19.8	5.5	33,006	2.27	-239.2		2.19	
12:37	3.5	19.8	5.5	32,802	2.44	-244.1		2.19	
12:39	4	19.8	5.5	32,741	2.5	-247.1		2.19	clear, yellow, odour, Other Moderate black sediment. Trace organic matter. H2S odour

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
K9/2E	Water	Yes	Disposable filter	4		

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: K7/2N

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Peristaltic pump	**SWL(mbTOC) (m):** 6.76	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Peristaltic pump	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:** Ysi	**NAPL check:**	**Bore diam. (mm)** 50
Sampler: JMC	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:**
Date: October 10, 2023 10:32 AM	**WLevel Meter Type:** Interface probe	**Bore depth (m):** 8.93	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
10:44	0.5	234	7.12	5,281	0.24	-1,903		7.74	turbid, odour, no sheen, Other Black, strong HS2, thick gunk coming up in tubing creating bubbles plus slow recharge for full purge sample taken.

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
K7/2N	Water	Yes	Disposable filter	4		Sample taken without full purge due to bubbles and gunk in tube

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: K7/2S

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Peristaltic pump	**SWL(mbTOC) (m):** 6.89	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Peristaltic pump	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:** YSI	**NAPL check:** No	**Bore diam. (mm)** 50
Sampler: JMC	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:** Yes
Date: October 10, 2023 9:56 AM	**WLevel Meter Type:**	**Bore depth (m):** 11.24	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
09:58	0.5	24.2	6.73	1,004	0.2	-77.3		6.95	
10:00	1	24.6	6.71	995	0.2	-85.5		6.96	
10:06	1.5	24.6	6.75	1,346	0.19	-119.8		6.96	
10:10	2	24.6	6.79	1,781	0.17	-139.1		6.96	
10:10	2.5	24.6	7.03	4,864	0.12	-180		6.96	
10:17	3	24.6	7.17	6,142	0.11	-174.3		6.96	
10:20	3.5	24.6	7.23	6,905	0.13	-172.3		6.96	
10:24	4	24.6	7.28	7,520	0.12	-166.8		6.96	brown, turbid, no odour, no sheen, Other Moderate sediment

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
K7/2S	Water	Yes	Disposable filter	4	NA	Parameters would not stabilise.

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: K5/6NN

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Peristaltic pump	**SWL(mbTOC) (m):** 3.65	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Peristaltic pump	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:** YSI	**NAPL check:** No	**Bore diam. (mm)** 50
Sampler: JMC	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:** Yes
Date: October 10, 2023 8:47 AM	**WLevel Meter Type:** Interface probe	**Bore depth (m):** 5.56	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
08:57	0.5	19.1	7.24	3,314	0.18	-215.2		3.68	
08:58	1	19.2	7.24	3,302	0.14	-211.9		3.68	
09:01	1.5	19.2	7.23	3,294	0.12	-204.1		3.68	
09:04	2	19.2	7.22	3,292	0.11	-199		3.68	
09:06	2.5	19.3	7.21	3,288	0.1	-192.6		3.68	
09:08	3	19.3	7.2	3,279	0.1	-185.6		3.68	clear, light brown, no odour, no sheen

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
K5/6NN	Water	Yes	Disposable filter	4	NA	

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: K5/6N

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Peristaltic pump	**SWL(mbTOC) (m):** 2.83	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Peristaltic pump	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:**	**NAPL check:**	**Bore diam. (mm)**
Sampler: NF	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:** Yes
Date: October 10, 2023 7:58 AM	**WLevel Meter Type:**	**Bore depth (m):** 3.56	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
08:23	1	17.8	8.63	1,221	0.4	-194.3		3.1	Other Recharge too slow for peri pump low setting, sample taken anyway. Same well marked as dry previously.

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
K5/6N	Water	Yes	Disposable filter	4		Sample taken due to low recharge did not want well to go dry

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: 336B

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Peristaltic pump	**SWL(mbTOC) (m):** 6.14	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Peristaltic pump	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:** YSI	**NAPL check:** No	**Bore diam. (mm)**
Sampler: Lai	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:** Yes
Date: October 9, 2023 8:03 AM	**WLevel Meter Type:** Interface probe	**Bore depth (m):** 12.21	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
08:18	0.5	6.17	7	8,780	0.7	-46.8		2.01	
08:20	1	19.4	7	9,430	0.7	-52.3		6.17	
08:21	1.5	19.4	7	10,041	0.6	-54.8		6.17	
08:23	2	19.4	7	10,493	0.6	-56.7		6.17	
08:27	2.5	19.4	7	11,001	0.6	-57.3		6.17	
08:28	3	19.5	7	11,101	0.6	-57.5		6.17	clear, yellow, no odour, no sheen

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
336B	Water	Yes	Disposable filter	4		

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: K9/4E

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Peristaltic pump	**SWL(mbTOC) (m):** 2.36	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Peristaltic pump	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:** Ysi	**NAPL check:**	**Bore diam. (mm)** 50
Sampler: NF	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:**
Date: October 10, 2023 1:11 PM	**WLevel Meter Type:** Interface probe	**Bore depth (m):** 5.25	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
13:14	0.5	19.5	7.26	10,020	0.21	-7.93		2.5	
13:28	1	20	7.9	10,044	0.17	-86.1		2.54	
13:30	1.5	20	7.3	10,032	0.14	-91.8		2.64	
13:33	2	21	7.3	10,052	0.13	-97.8		2.64	
13:39	2.5	21	7.3	10,040	0.15	-99		2.92	pale, brown, turbid, odour, low flow rate, Other Too slow for peri reading stable sample taken

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
K9/4E	Water	Yes	Disposable filter	4		Sample taken at 2.5L readings stable

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: K9/2W

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Peristaltic pump	**SWL(mbTOC) (m):** 2.09	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Peristaltic pump	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:** Ysi	**NAPL check:**	**Bore diam. (mm)** 50
Sampler: Nina f	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:**
Date: October 10, 2023 12:05 PM	**WLevel Meter Type:** Fox	**Bore depth (m):** 3.95	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
12:07	0.5	19	7.25	1,731	0.3	-104.5		2.29	
12:18	1	19	7.31	1,632	0.3	-110		2.29	
12:18	1.5	19	7.27	1,629	0.3	-110		2.29	
12:23	2	19	7.4	1,709	0.41	-125		2.29	
12:25	2.5	19.4	7.3	2,711	0.71	-132		2.93	
12:31	3	19.2	7.4	2,322	0.23	-124		3.07	
12:36	3.5	19.1	7.3	2,358	0.25	-126		3.07	pale, light brown, slightly turbid, odour, low flow rate

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
K9/2W	Water	Yes	Disposable filter			

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: K7/1

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Micropurge	**SWL(mbTOC) (m):** 5.21	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Micropurge	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:** YSI	**NAPL check:** No	**Bore diam. (mm)** 50
Sampler: NF	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:** Yes
Date: October 10, 2023 10:11 AM	**WLevel Meter Type:** Interface probe	**Bore depth (m):** 6.57	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
10:13	0.5	20.6	5.9	2,416	0.7	-149.5		5.75	
10:14	1	20.9	5.9	2,512	2.1	-160.5		5.75	Other Slow recharge pump rate reduced
10:28	1.5	20.9	5.9	2,702	2.9	-189.6		5.75	
10:33	2	21	6.1	3,065	2.3	-211.5		5.8	
10:34	2.5	21	5.9	3,023	2.7	-222		5.8	
10:40	3	21	5.9	3,029	2.7	-221.5		5.85	brown, turbid, odour, no sheen

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
K7/1	Water	Yes	Disposable filter	4	FD10	
K7/1	Water	Yes	Disposable filter	8	FD10	

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: K5/6S

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Micropurge	**SWL(mbTOC) (m):** 3.78	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Micropurge	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:** YSI	**NAPL check:**	**Bore diam. (mm)** 50
Sampler: NF	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:** Yes
Date: October 10, 2023 8:56 AM	**WLevel Meter Type:** Interface probe	**Bore depth (m):** 9.84	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
08:57	0.5	19.2	6.9	3,282	1.3	-65.4		3.78	
08:59	1	19.4	6.7	3,263	0.3	-81.7		3.78	
09:02	1.5	19.5	6.8	3,275	0.2	-92.3		3.78	
09:06	2	19.6	6.8	3,283	0.2	-108.9		3.78	
09:09	2.5	19.6	6.7	3,285	0.1	-119.5		3.78	
09:12	3	19.6	6.8	3,285	0.2	-127.5		3.78	clear, pale, brown, yellow, no odour, no sheen

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
K5/6S	Water	Yes	Disposable filter	4		

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: E61D

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Micropurge	**SWL(mbTOC) (m):** 6.12	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Micropurge	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:** Ysi	**NAPL check:**	**Bore diam. (mm)**
Sampler: Nf	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:**
Date: October 9, 2023 2:03 PM	**WLevel Meter Type:** Interface probe	**Bore depth (m):** 29.36	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
14:16	0.5	21.8	6.03	52,300	0.24	-135		6.16	
14:18	1	21.7	6.63	52,300	0.24	-134		6.16	
14:21	1.5	21.5	6.63	52,318	0.21	-155		6.16	
14:22	2	21.5	6.62	52,330	0.19	-168		6.16	
14:23	2.5	21.4	6.62	52,328	0.19	-197		6.16	
14:25	3	21.4	6.62	52,319	0.19	-215		6.16	clear, pale, yellow, no odour, no sheen

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
E61D	Water	Yes	Filter vessel		fdo7	Fdo7

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: E61S

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:**	**SWL(mbTOC) (m):**	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:**	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:**	**NAPL check:**	**Bore diam. (mm)**
Sampler: Nf	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:**
Date: October 9, 2023 2:00 PM	**WLevel Meter Type:** Interface probe	**Bore depth (m):**	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
E61S						Well dry

Field QA Checks		
Air bubbles in vial:	**Any violent reactions:**	**Decontamination as per GHD procedure:**
COC updated:	**Was sampling equipment pre cleaned:**	**Laboratory:**

Purging and Sampling Record
Bore ID: K5/4

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:**	**SWL(mbTOC) (m):** 5.07	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:**	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:**	**NAPL check:**	**Bore diam. (mm)**
Sampler: NF	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:**
Date: October 9, 2023 1:41 PM	**WLevel Meter Type:**	**Bore depth (m):** 5.5	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
13:43	0.5	15.5	5.05	500	10.01	10.1	10.1	2.01	

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
K5/4						Dry well

Field QA Checks		
Air bubbles in vial:	**Any violent reactions:**	**Decontamination as per GHD procedure:**
COC updated:	**Was sampling equipment pre cleaned:**	**Laboratory:**

Purging and Sampling Record
Bore ID: BH21S

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Peristaltic pump	**SWL(mbTOC) (m):** 5.52	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Peristaltic pump	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:**	**NAPL check:** No	**Bore diam. (mm)**
Sampler: NF	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:** Yes
Date: October 9, 2023 12:14 PM	**WLevel Meter Type:** Interface probe	**Bore depth (m):** 6.42	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
12:15	0.5	21.6	10.65	2,302	1.37	-293		5.54	
12:24	1	21.6	10.64	2,305	1.13	-294		5.54	
12:26	1.5	21.6	10.67	2,313	0.68	-303		5.54	
12:30	2	21.6	10.73	2,324	0.28	-329		5.54	
12:31	2.5	21.7	10.75	2,329	0.06	-345		5.54	
12:35	3	21.8	10.76	2,329	0.01	-352		5.54	clear, odour, no sheen, Other Diesel/hydrocarb

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
21S	Water	Yes	Disposable filter	8	FD05	Tubing used

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: 344a

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Peristaltic pump	**SWL(mbTOC) (m):** 5.9	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Peristaltic pump	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:** Ysi	**NAPL check:**	**Bore diam. (mm)** 50
Sampler: NF	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:**
Date: October 9, 2023 11:19 AM	**WLevel Meter Type:** Interface probe	**Bore depth (m):** 8.93	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
11:22	0.5	21.5	11.09	1,640	0.43	-369		5.9	
11:24	1	21.3	11.09	1,638	0.24	-375		5.9	
11:26	1.5	21.3	11.09	1,649	0.19	-377		5.9	
11:28	2	21.3	11.09	1,660	0.17	-378		5.9	
11:30	2.5	21.3	11.08	1,639	0.14	-378		5.9	clear, odour, no sheen

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
344a						

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: 344B

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Peristaltic pump	**SWL(mbTOC) (m):** 8.77	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Peristaltic pump	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:**	**NAPL check:** No	**Bore diam. (mm)** 50
Sampler: NF	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:** Yes
Date: October 9, 2023 10:33 AM	**WLevel Meter Type:** Interface probe	**Bore depth (m):** 12.1	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
10:34	0.5	21.1	6.6	11,400	0.3	-180		8.77	Other Algae build up in well, water coming up but lots of bubbles
10:44	1	21.5	6.6	11,722	0.3	-187		8.77	Other
10:45	1.5	21.3	6.6	12,081	0.3	-208		8.77	Other
10:49	2	21.2	6.6	12,290	0.3	-226		8.77	Other
10:53	2.5	21.2	6.6	12,410	0.3	-212		8.77	Other
10:57	3	21.3	6.6	12,539	0.3	-254.3		8.77	pale, light brown, yellow, slightly turbid, no odour, slight sheen, Other

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
344B						

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: K5/5S

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Peristaltic pump	**SWL(mbTOC) (m):** 4.4	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Peristaltic pump	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:** Ysi	**NAPL check:**	**Bore diam. (mm)**
Sampler: Nf	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:**
Date: October 9, 2023 9:38 AM	**WLevel Meter Type:** Interface probe	**Bore depth (m):** 9.48	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
09:41	0.5	20.1	7.2	3,111	0.2	-114.5		4.4	
09:43	1	20	7.2	3,084	0.2	-175.8		4.4	
09:43	1.5	20	7.2	3,074	0.2	-189.8		4.4	
09:44	2	20	7.2	3,084	0.2	-205		4.4	
09:46	2.5	20	7.2	3,137	0.2	-221		4.4	
09:50	3	20	7.2	3,168	0.2	-228		4.4	pale, light brown, yellow, no odour, no sheen

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
K5/5S			Filter vessel			Triplicate FD3 and FD4 - Tube

Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Purging and Sampling Record
Bore ID: K5/5nN

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Peristaltic pump	**SWL(mbTOC) (m):**	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Peristaltic pump	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:**	**NAPL check:**	**Bore diam. (mm)** 50
Sampler: NF	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:**
Date: October 9, 2023 9:27 AM	**WLevel Meter Type:** Interface probe	**Bore depth (m):**	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
K5/5nN						Dry well

Field QA Checks		
Air bubbles in vial:	**Any violent reactions:**	**Decontamination as per GHD procedure:**
COC updated:	**Was sampling equipment pre cleaned:**	**Laboratory:**

Purging and Sampling Record
Bore ID: 336a

Job Information	Sampling Information	Bore Information	
Client: Hunter & Central Coast Development Corporation	**Purge Method:** Micropurge	**SWL(mbTOC) (m):** 5.52	**Logic check** N/A
Project: KIWEF Groundwater and Surface Water Monitoring	**Sampling Method:** Micropurge	**Screen From:** **To** :	**Stick up (m)**
Project No.: 12609961	**WQ Meter Type:** Ysi	**NAPL check:** No	**Bore diam. (mm)** 50
Sampler: NF	**Flow Cell:** Y	**Ref.datum:** TOC	**Well cap secure:** Yes
Date: October 9, 2023 8:06 AM	**WLevel Meter Type:**	**Bore depth (m):** 6.76	**PID:** N/A
Round:	**Pump Depth (m):**		

Time	Volume (L)	Temp (°C)	pH	Elec Cond (uS/cm)	Dis Oxygen (mg/L)	REDOX (mV)	Turbidity (NTU)	SWL (m TOC)	Comment
Stable when 3 consecutive readings		-	+/-0.05pH	+/- 3%	+/- 10%	+/- 10mV		stable	
08:39	0.4	19	7.2	6,469	0.2	-128.5		5.53	
08:41	1	19.1	7.21	5,901	0.12	-150.3		5.53	
08:44	1.5	19.3	7.21	5,849	0.1	-159.7		5.53	
08:46	2	19.3	7.21	5,811	0.1	-168.3		5.53	
08:47	2.5	19.3	7.21	5,768	0.1	-184		5.53	
08:49	3	19.3	7.21	5,756	0.1	-200		5.53	pale, yellow, slightly turbid, no odour, no sheen

Sample ID	Sample Type	Field Filtered	Filter Type	No of Containers	Duplicates	Comments
336a	Water	Yes	Disposable filter	12	FD01 and FD02	

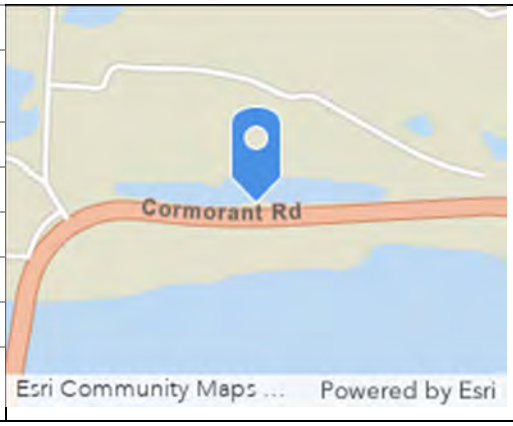
Field QA Checks		
Air bubbles in vial: No	**Any violent reactions:** No	**Decontamination as per GHD procedure:** Yes
COC updated: Yes	**Was sampling equipment pre cleaned:** Yes	**Laboratory:** Yes

Surface Water & Sediment Sampling Record

Location ID: KS10/1

Site Detail

Project No.	12609961
Project Name	KIWEF groundwater & surface water monitoring
Client	Hunter & Central Coast Dev. Corp.
Location ID	KS10/1
Date : Time	October 12, 2023 8:43 AM
Sampling Officer	JMC
Sampling Method	Grab
Coordinates	Lat: -32.875762, Long: 151.739069
Location Description	Pond between cormorant rd and hccdc



Environmental Observations

Weather	Sunny, Warm temperature

Field Measurements

Temperature (°C)	17.1	**Conductivity (uS/cm)**	1,524
pH	8.6	**DO (mg/L)**	0.97
REDOX (mV)	-151.2	**Turbidity (NTU)**	

Samples

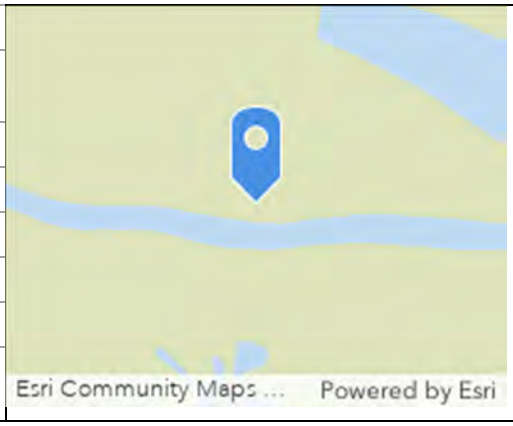
Sample No.	Sample Type	No. of Containers	Preservative	Duplicate	Comments
KS10/1	Water	4		NA	

Surface Water & Sediment Sampling Record

Location ID: KS12/6

Site Detail

Project No.	12609961
Project Name	KIWEF groundwater & surface water monitoring
Client	Hunter & Central Coast Dev. Corp.
Location ID	KS12/6
Date : Time	October 11, 2023 7:33 AM
Sampling Officer	NF
Sampling Method	Grab
Coordinates	Lat: -32.857864, Long: 151.721482
Location Description	



Environmental Observations

Weather	Sunny

Field Measurements

Temperature (°C)	17.9	**Conductivity (uS/cm)**	40,013
pH	8.2	**DO (mg/L)**	0.5
REDOX (mV)	-107.9	**Turbidity (NTU)**	

Samples

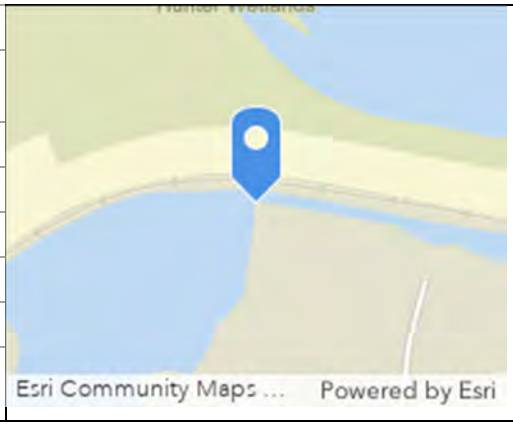
Sample No.	Sample Type	No. of Containers	Preservative	Duplicate	Comments
KS12/6	Water	4			

Surface Water & Sediment Sampling Record

Location ID: KS2/1

Site Detail

Project No.	12609961
Project Name	KIWEF groundwater & surface water monitoring
Client	Hunter & Central Coast Dev. Corp.
Location ID	KS2/1
Date : Time	October 9, 2023 1:05 PM
Sampling Officer	NF
Sampling Method	Grab
Coordinates	Lat: -32.863828, Long: 151.73113
Location Description	



Environmental Observations

Weather	Sunny, Warm temperature

Field Measurements

Temperature (°C)	27.2	**Conductivity (uS/cm)**	3,468
pH	8.44	**DO (mg/L)**	5.82
REDOX (mV)	8.5	**Turbidity (NTU)**	

Samples

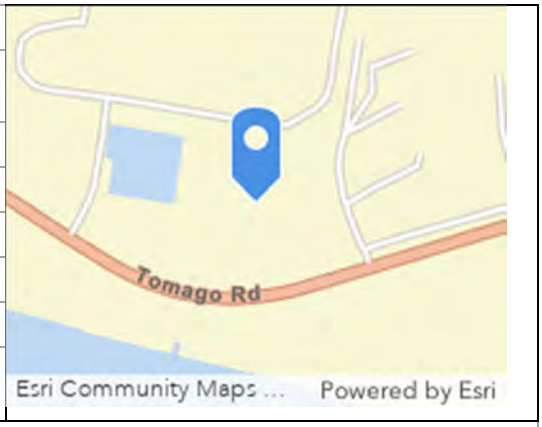
Sample No.	Sample Type	No. of Containers	Preservative	Duplicate	Comments
K2/1	Water	8		Fdo6	FD06

Surface Water & Sediment Sampling Record

Location ID: KS7/1

Site Detail

Project No.	12609961
Project Name	KIWEF groundwater & surface water monitoring
Client	Hunter & Central Coast Dev. Corp.
Location ID	KS7/1
Date : Time	October 11, 2023 2:57 PM
Sampling Officer	JACKSON
Sampling Method	Grab
Coordinates	Lat: -32.830936, Long: 151.723036
Location Description	



Environmental Observations

Weather	Sunny, Warm temperature

Field Measurements

Temperature (°C)	23.5	**Conductivity (uS/cm)**	3,301
pH	7.6	**DO (mg/L)**	3.08
REDOX (mV)	-210.4	**Turbidity (NTU)**	

Samples

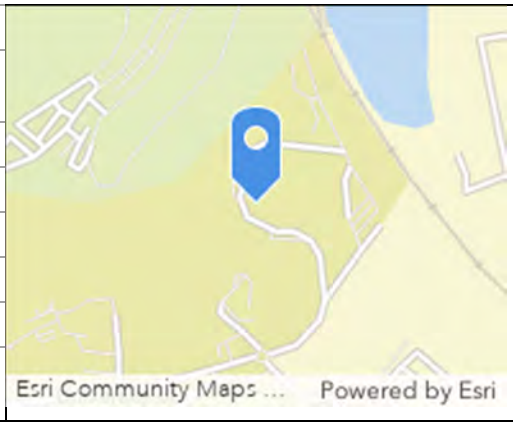
Sample No.	Sample Type	No. of Containers	Preservative	Duplicate	Comments
KS7/1	Water	4			

Surface Water & Sediment Sampling Record

Location ID: KS1/3

Site Detail

Project No.	12609961
Project Name	KIWEF groundwater & surface water monitoring
Client	Hunter & Central Coast Dev. Corp.
Location ID	KS1/3
Date : Time	October 10, 2023 7:39 AM
Sampling Officer	JMC
Sampling Method	Grab
Coordinates	Lat: -32.888129, Long: 151.706594
Location Description	



Environmental Observations

Weather	Cool temperature

Field Measurements

Temperature (°C)	13.7	**Conductivity (uS/cm)**	1,720
pH	6.8	**DO (mg/L)**	0.2
REDOX (mV)	-29.6	**Turbidity (NTU)**	

Samples

Sample No.	Sample Type	No. of Containers	Preservative	Duplicate	Comments
KS1/3	Water	12		FDO8 and FDO9	

Appendix H

Calibration records

Multi Parameter Water Meter

Instrument YSI Quatro Pro Plus
Serial No. 23E103136

Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Charge Condition	✓	
	Fuses	✓	
	Capacity	✓	
Switch/keypad	Operation	✓	
Display	Intensity	✓	
	Operation (segments)	✓	
Grill Filter	Condition	✓	
	Seal	✓	
PCB	Condition	✓	
Connectors	Condition	✓	
Sensor	1. pH	✓	
	2. mV	✓	
	3. EC	✓	
	4. D.O	✓	
	5. Temp	✓	
Alarms	Beeper	✓	
	Settings	✓	
Software	Version	✓	
Data logger	Operation	✓	
Download	Operation	✓	
Other tests:			

Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Sensor	Serial no	Standard Solutions	Certified	Solution Bottle Number	Instrument Reading
2. pH 7.00		pH 7.00		399304	pH 7.01
3. pH 4.00		pH 4.00		399527	pH 4.06
4. mV		233.4 mV		A405006/B398193	233.6 mV
5. EC		2760 mS		401089	2762 mS
6. D.O		0.0%		399958	-0.2%
7. Temp		23.0°C		MultiTherm	23.0°C

Calibrated by: **Guido Camera**

Calibration date: **15/09/2023**

Next calibration due: **16/10/2023**

Oil / Water Interface Meter

Instrument Interface Meter (30M)
Serial No. 484810

Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Compartment	✓	
	Capacity	✓	
Probe	Cleaned/Decon.	✓	
	Operation	✓	
Connectors	Condition	✓	
		✓	
Tape Check	Cleaned	✓	
	Checked for cuts	✓	
Instrument Test	At surface level	✓	

Certificate of Calibration

This is to certify that the above instrument has been cleaned and tested.

Calibrated by: **Sara Angelini**

Calibration date: **28/09/2023**

Next calibration due: **27/11/2023**

Multi Parameter Water Meter

Instrument YSI Quatro Pro Plus
Serial No. 19E100244

Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Charge Condition	✓	
	Fuses	✓	
	Capacity	✓	
Switch/keypad	Operation	✓	
Display	Intensity	✓	
	Operation (segments)	✓	
Grill Filter	Condition	✓	
	Seal	✓	
PCB	Condition	✓	
Connectors	Condition	✓	
Sensor	1. pH	✓	
	2. mV	✓	
	3. EC	✓	
	4. D.O	✓	
	5. Temp	✓	
Alarms	Beeper		
	Settings		
Software	Version		
Data logger	Operation		
Download	Operation		
Other tests:			

Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Sensor	Serial no	Standard Solutions	Certified	Solution Bottle Number	Instrument Reading
1. D.O		0%		391223	-0.1%
2. SPC		2760 uS/cm		396172	2761 uS/cm
3. pH7		pH 7.00		393774	pH 6.97
4. pH4		pH 4.00		399527	pH 4.04
5. ORP mV		236.04 mV		398884/400204	236.0 mV
6. Temp °C		21.8 °C		MultiTherm	21.8 °C

Calibrated by: **Guido Camera**

Calibration date: **27-Sep-23**

Next calibration due: **25-Mar-24**

Oil / Water Interface Meter

Instrument Interface Meter (30M)
Serial No. 312530

Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Compartment	✓	
	Capacity	✓	
Probe	Cleaned/Decon.	✓	
	Operation	✓	
Connectors	Condition	✓	
		✓	
Tape Check	Cleaned	✓	
	Checked for cuts	✓	
Instrument Test	At surface level	✓	

Certificate of Calibration

This is to certify that the above instrument has been cleaned and tested.

Calibrated by: **Sara Angelini**

Calibration date: **26/09/2023**

Next calibration due: **25/11/2023**

Appendix I

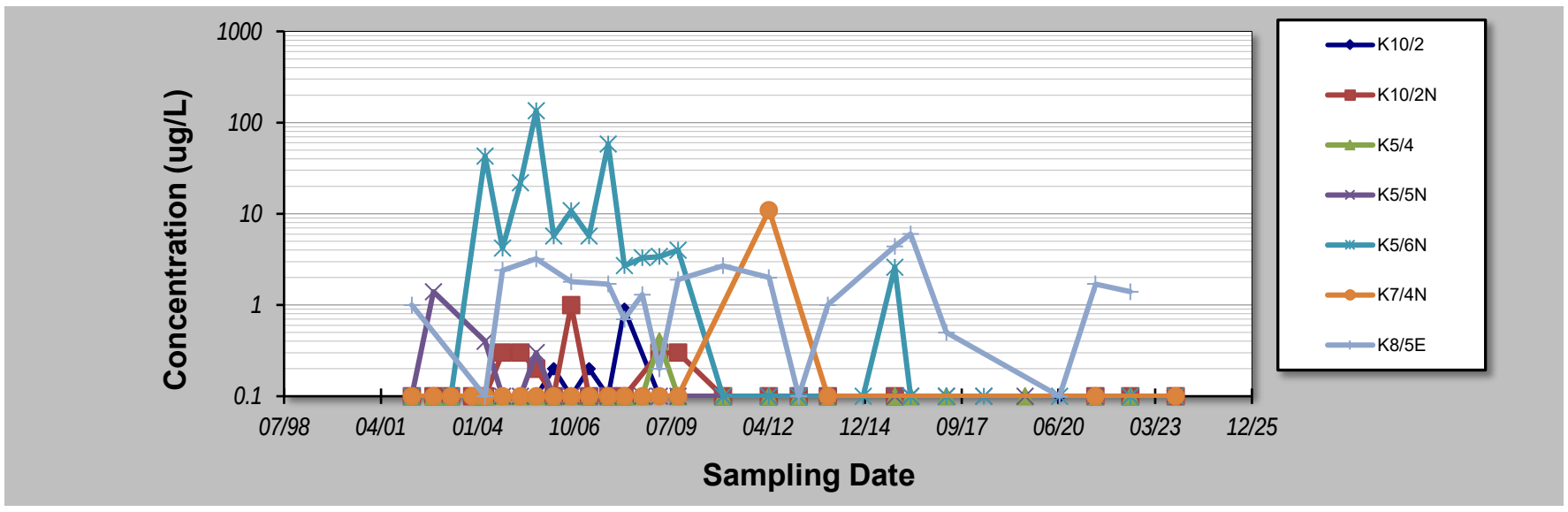
Mann Kendall Analysis

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Acenaphtene**
Concentration Units: **ug/L**

Sampling Point ID:	K10/2	K10/2N	K5/4	K5/5N	K5/6N	K7/4N	K8/5E
Sampling Event	Sampling Date	ACENAPHTENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1	0.1	0.1	0.1	0.1	1
2	14-Oct-02	0.1	0.1	0.1	1.4		0.1	
3	15-Apr-03	0.1	0.1	0.1		0.1	0.1	
4	17-Nov-03	0.1	0.1				0.1	
5	31-Mar-04	0.1	0.1	0.1	0.4	43	0.1	0.1
6	27-Sep-04	0.1	0.3	0.1	0.1	4.2	0.1	2.4
7	31-Mar-05	0.1	0.3	0.1	0.1	21.8	0.1	
8	12-Sep-05	0.1	0.2	0.1	0.3	135	0.1	3.2
9	9-Mar-06	0.2	0.1	0.1	0.1	5.7	0.1	
10	6-Sep-06	0.1	1	0.1	0.1	10.8	0.1	1.8
11	9-Mar-07	0.2	0.1	0.1	0.1	5.7	0.1	
12	22-Sep-07	0.1	0.1	0.1	0.1	58.1	0.1	1.7
13	11-Mar-08	0.9	0.1	0.1	-	2.7	0.1	0.7
14	10-Sep-08			0.1	0.1	3.3	0.1	1.3
15	5-Mar-09	0.1	0.3	0.4	0.1	3.4	0.1	0.2
16	14-Sep-09	0.1	0.3	0.1	0.1	4	0.1	1.9
17	5-Mar-10							
18	24-Dec-10		0.1	0.1	0.1	0.1		2.7
19	5-Mar-11							
20	14-Sep-11							
21	11-Apr-12	0.1	0.1	0.1	0.1	0.1	11	2
22	14-Sep-12							
23	13-Feb-13	0.1	0.1	0.1	0.1	0.1		0.1
24	9-Dec-13	0.1	0.1	0.1	0.1		0.1	1
25	22-Apr-14							
26	9-Dec-14					0.1		
27	2-Nov-15	0.1	0.1	0.1	0.1	2.6		4.4
28	15-Apr-16	0.1		0.1	0.1	0.1		6
29	2-Nov-16							
30	18-Apr-17	0.1		0.1	0.1	0.1		0.5
31	2-Nov-17							
32	11-May-18				0.1	0.1		
33	2-Nov-18							
34	11-Jul-19	0.1		0.1	0.1			
35	1-Nov-19							
36	1-Jul-20	0.1				0.1		0.1
37	1-Nov-20							
38	7-Jul-21	0.1	0.1	0.1	0.1		0.1	1.7
39	01-Jul-22	0.1	0.1	0.1	0.1	0.1		1.4
40	12-Oct-23	0.1	0.1			0.1	0.1	
Coefficient of Variation:		1.14	1.10	0.54	1.55	2.43	3.78	0.88
Mann-Kendall Statistic (S):		-13	-23	2	-56	-133	13	-1
Confidence Factor:		60.3%	71.7%	50.9%	91.3%	99.9%	65.0%	50.0%
Concentration Trend:		No Trend	No Trend	No Trend	Prob. Decreasing	Decreasing	No Trend	Stable



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

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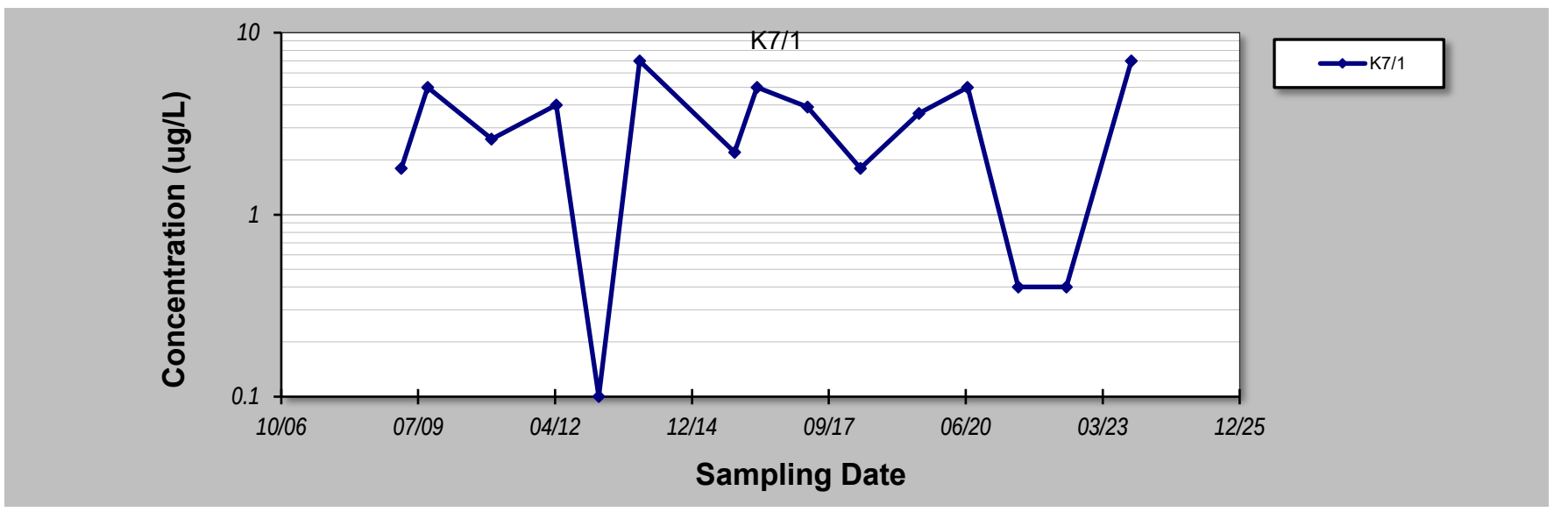
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Acenaphthene**
Concentration Units: **ug/L**

Sampling Point ID: **K7/1**

Sampling Event	Sampling Date	ACENAPHTHENE CONCENTRATION (ug/L)
1	5-Mar-09	1.8
2	14-Sep-09	5
3	5-Mar-10	
4	24-Dec-10	2.6
5	5-Mar-11	
6	14-Sep-11	
7	11-Apr-12	4
8	14-Sep-12	
9	13-Feb-13	0.1
10	9-Dec-13	7
11	22-Apr-14	
12	9-Dec-14	
13	5-Mar-15	
14	2-Nov-15	2.2
15	15-Apr-16	5
16	2-Nov-16	
17	18-Apr-17	3.9
18	2-Nov-17	
19	11-May-18	1.8
20	2-Nov-18	
21	11-Jul-19	3.6
22	1-Nov-19	
23	1-Jul-20	5
24	1-Nov-20	
25	7-Jul-21	0.4
26	23-Jun-22	0.4
27	10-Oct-23	7.00
28		
29		
30		
Coefficient of Variation:		0.67
Mann-Kendall Statistic (S):		-1
Confidence Factor:		50.0%
Concentration Trend:		Stable



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
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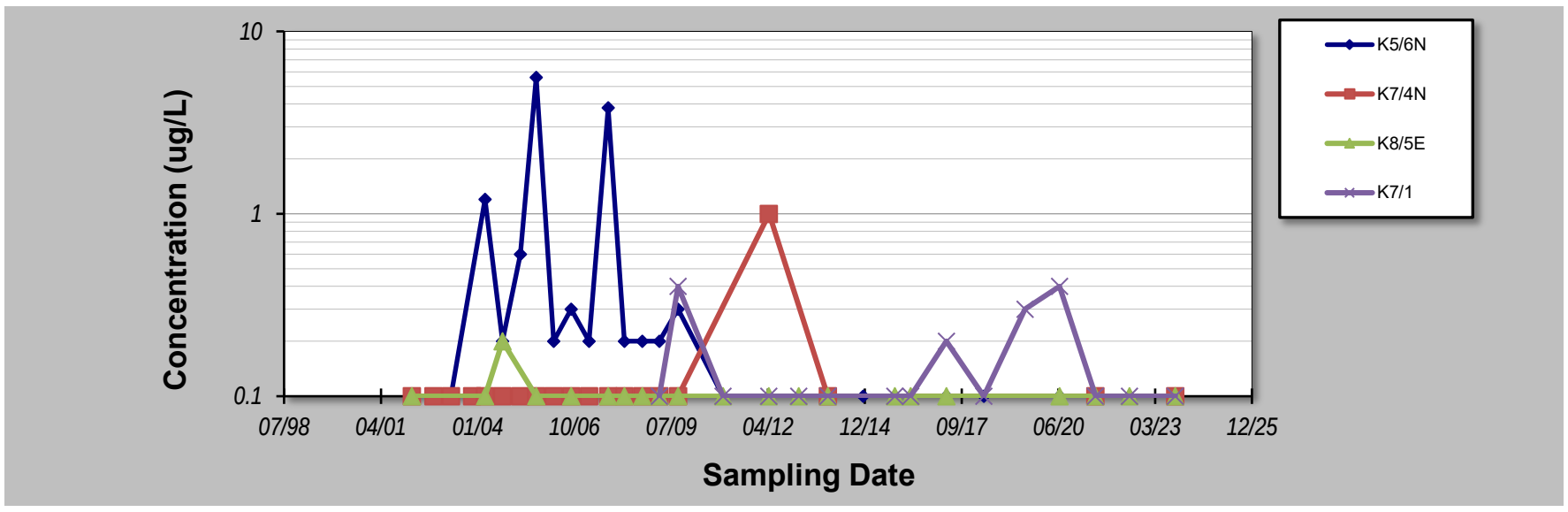
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Acenaphtylene**
Concentration Units: **ug/L**

Sampling Point ID:	K5/6N	K7/4N	K8/5E	K7/1			

Sampling Event	Sampling Date	ACENAPHTYLENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1	0.1				
2	14-Oct-02		0.1					
3	15-Apr-03	0.1	0.1					
4	17-Nov-03		0.1					
5	31-Mar-04	1.2	0.1	0.1				
6	27-Sep-04	0.2	0.1	0.2				
7	31-Mar-05	0.6	0.1					
8	12-Sep-05	5.6	0.1	0.1				
9	9-Mar-06	0.2	0.1					
10	6-Sep-06	0.3	0.1	0.1				
11	9-Mar-07	0.2	0.1					
12	22-Sep-07	3.8	0.1	0.1				
13	11-Mar-08	0.2	0.1	0.1				
14	10-Sep-08	0.2	0.1	0.1				
15	5-Mar-09	0.2	0.1	0.1	0.1			
16	14-Sep-09	0.3	0.1	0.1	0.4			
17	5-Mar-10							
18	24-Dec-10	0.1		0.1	0.1			
19	11-Apr-12	0.1	1	0.1	0.1			
20	14-Sep-12							
21	13-Feb-13	0.1		0.1	0.1			
22	9-Dec-13		0.1	0.1	0.1			
23	22-Apr-14							
24	9-Dec-14	0.1						
25	5-Mar-15							
26	2-Nov-15	0.1		0.1	0.1			
27	15-Apr-16	0.1		0.1	0.1			
28	2-Nov-16							
29	18-Apr-17	0.1		0.1	0.2			
30	2-Nov-17							
31	11-May-18	0.1			0.1			
32	2-Nov-18							
33	11-Jul-19				0.3			
34	1-Nov-19							
35	1-Jul-20	0.1		0.1	0.4			
36	1-Nov-20							
37	7-Jul-21		0.1	0.1	0.1			
38	22-Jun-22	0.1		0.1	0.1			
39	10-Oct-23	0.1	0.1	0.1	0.1			
40								
Coefficient of Variation:		2.26	1.39	0.21	0.70			
Mann-Kendall Statistic (S):		-122	13	-16	5			
Confidence Factor:		99.8%	65.0%	67.3%	57.7%			
Concentration Trend:		Decreasing	No Trend	Stable	No Trend			



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
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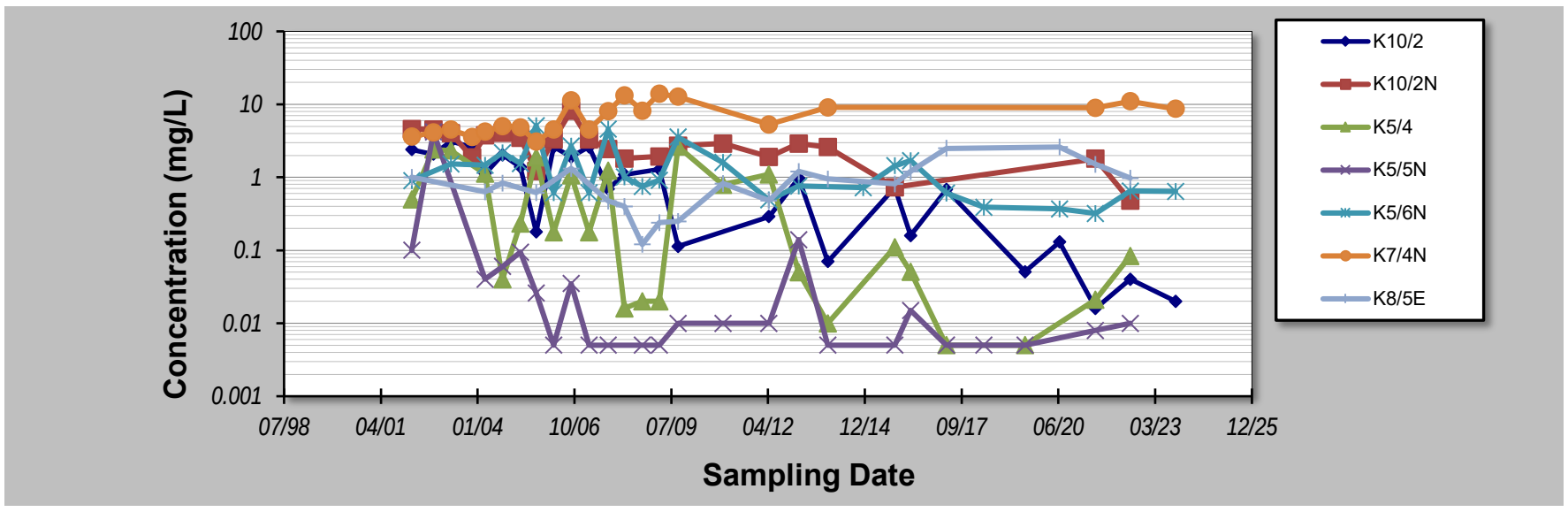
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Ammonia**
Concentration Units: **mg/L**

Sampling Point ID:	K10/2	K10/2N	K5/4	K5/5N	K5/6N	K7/4N	K8/5E
Sampling Event	Sampling Date	AMMONIA CONCENTRATION (mg/L)						
1	4-Mar-02	2.4	4.6	0.5	0.1	0.9	3.6	1
2	14-Oct-02	2.08	4.54	2.4	4.18		4.13	
3	15-Apr-03	3.11	4.01	2.34		1.53	4.5	
4	17-Nov-03	2.6	1.88				3.58	
5	31-Mar-04	1.12	3.75	1.12	0.04	1.46	4.23	0.63
6	27-Sep-04	2.04	4.06	0.04	0.06	2.17	5.01	0.83
7	31-Mar-05	1.38	3.47	0.234	0.094	1.54	4.85	
8	12-Sep-05	0.178	1.21	1.87	0.026	5.11	3.08	0.614
9	9-Mar-06	2.62	3.29	0.177	0.005	0.616	4.54	
10	6-Sep-06	1.90	8.2	1.07	0.035	2.69	11.4	1.32
11	9-Mar-07	2.62	3.29	0.18	0.005	0.62	4.54	
12	22-Sep-07	0.694	2.45	1.24	0.005	4.57	8.04	0.47
13	11-Mar-08	1.09	1.81	0.02	-	1.01	13.30	0.40
14	10-Sep-08			0.02	0.005	0.75	8.21	0.12
15	5-Mar-09	1.28	1.93	0.02	0.005	0.91	14	0.24
16	14-Sep-09	0.113	2.71	2.63	0.01	3.55	12.7	0.25
17	5-Mar-10							
18	24-Dec-10		2.9	0.79	0.01	1.6		0.82
19	11-Apr-12	0.29	1.9	1.1	0.01	0.49	5.3	0.48
20	14-Sep-12							
21	13-Feb-13	0.98	2.9	0.05	0.14	0.76		1.2
22	9-Dec-13	0.07	2.6	0.01	0.005		9.1	0.95
23	22-Apr-14							
24	9-Dec-14					0.72		
25	5-Mar-15							
26	2-Nov-15	0.72	0.73	0.11	0.005	1.44		0.81
27	15-Apr-16	0.16		0.051	0.015	1.7		1.2
28	2-Nov-16							
29	18-Apr-17	0.68		0.005	0.005	0.61		2.5
30	2-Nov-17							
31	11-May-18				0.005	0.39		
32	2-Nov-18							
33	11-Jul-19	0.051		0.005	0.005			
34	1-Nov-19							
35	1-Jul-20	0.13				0.37		2.6
36	1-Nov-20							
37	7-Jul-21	0.016	1.8	0.021	0.008	0.32	9.0	1.5
38	01-Jul-22	0.04	0.48	0.084	0.01	0.65	11.0	0.98
39	12-Oct-23	0.02	1.4			0.64	8.70	
40								
Coefficient of Variation:		**0.93**	**0.56**	**1.33**	**4.25**	**0.88**	**0.49**	**0.70**
Mann-Kendall Statistic (S):		**-216**	**-101**	**-123**	**-93**	**-122**	**113**	**57**
Confidence Factor:		**>99.9%**	**99.8%**	**99.8%**	**99.0%**	**99.7%**	**>99.9%**	**96.6%**
Concentration Trend:		**Decreasing**	**Decreasing**	**Decreasing**	**Decreasing**	**Decreasing**	**Increasing**	**Increasing**



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
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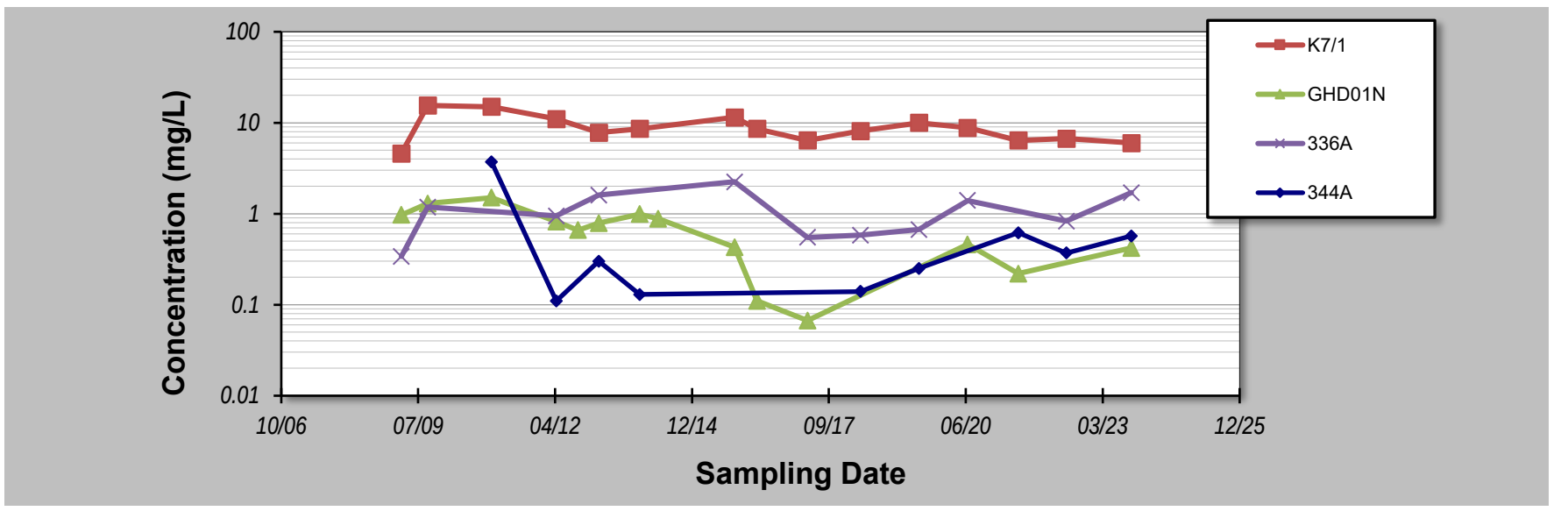
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Ammonia**
Concentration Units: **mg/L**

Sampling Point ID:	K7/1	GHD01N	336A	344A			
Sampling Event	Sampling Date	AMMONIA CONCENTRATION (mg/L)						
1	5-Mar-09	4.6	0.97	0.34				
2	14-Sep-09	15.5	1.3	1.18				
3	5-Mar-10							
4	24-Dec-10	15	1.5		3.7			
5	5-Mar-11							
6	14-Sep-11							
7	11-Apr-12	11	0.82	0.95	0.11			
8	14-Sep-12		0.66					
9	13-Feb-13	7.8	0.79	1.6	0.3			
10	9-Dec-13	8.6	0.99		0.13			
11	22-Apr-14		0.88					
12	9-Dec-14							
13	5-Mar-15							
14	2-Nov-15	11.5	0.43	2.25				
15	15-Apr-16	8.6	0.11					
16	2-Nov-16							
17	18-Apr-17	6.4	0.067	0.55				
18	2-Nov-17							
19	11-May-18	8.1		0.58	0.14			
20	2-Nov-18							
21	11-Jul-19	10		0.67	0.25			
22	1-Nov-19							
23	1-Jul-20	8.8	0.46	1.4				
24	1-Nov-20							
25	7-Jul-21	6.4	0.22		0.62			
26	23-Jun-22	6.7		0.83	0.37			
27	10-Oct-23	6.00	0.42	1.70	0.57			
28								
29								
30								
Coefficient of Variation:		**0.35**	**0.63**	**0.54**	**1.66**			
Mann-Kendall Statistic (S):		**-37**	**-53**	**13**	**10**			
Confidence Factor:		**96.3%**	**99.8%**	**82.1%**	**82.1%**			
Concentration Trend:		Decreasing	Decreasing	No Trend	No Trend			



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

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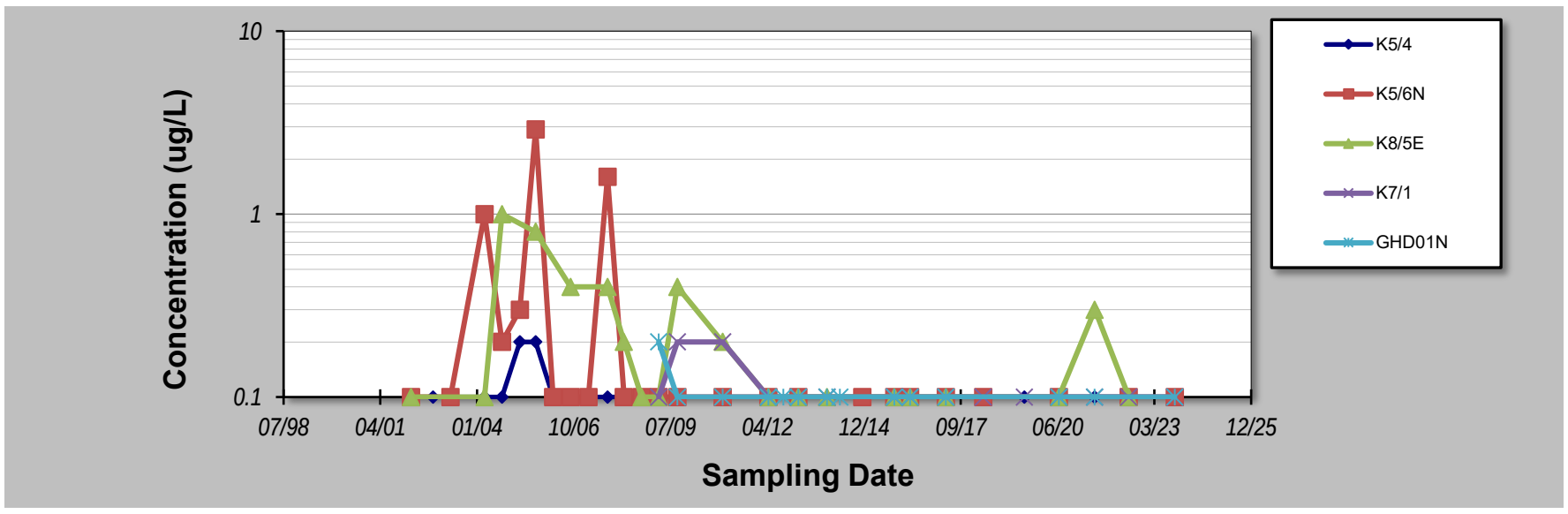
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Anthracene**
Concentration Units: **ug/L**

Sampling Point ID:	K5/4	K5/6N	K8/5E	K7/1	GHD01N		
Sampling Event	Sampling Date	ANTHRACENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1	0.1				
2	14-Oct-02	0.1						
3	15-Apr-03	0.1	0.1					
4	17-Nov-03							
5	31-Mar-04	0.1	1	0.1				
6	27-Sep-04	0.1	0.2	1				
7	31-Mar-05	0.2	0.3					
8	12-Sep-05	0.2	2.9	0.8				
9	9-Mar-06	0.1	0.1					
10	6-Sep-06	0.1	0.1	0.4				
11	9-Mar-07	0.1	0.1					
12	22-Sep-07	0.1	1.6	0.4				
13	11-Mar-08	0.1	0.1	0.2				
14	10-Sep-08	0.1	0.1	0.1				
15	5-Mar-09	0.1	0.1	0.1	0.1	0.2		
16	14-Sep-09	0.1	0.1	0.4	0.2	0.1		
17	5-Mar-10							
18	24-Dec-10	0.1	0.1	0.2	0.2	0.1		
19	5-Mar-11							
20	14-Sep-11							
21	11-Apr-12	0.1	0.1	0.1	0.1	0.1		
22	14-Sep-12					0.1		
23	13-Feb-13	0.1	0.1	0.1	0.1	0.1		
24	9-Dec-13	0.1		0.1	0.1	0.1		
25	22-Apr-14					0.1		
26	9-Dec-14		0.1					
27	5-Mar-15							
28	2-Nov-15	0.1	0.1	0.1	0.1	0.1		
29	15-Apr-16	0.1	0.1	0.1	0.1	0.1		
30	2-Nov-16							
31	18-Apr-17	0.1	0.1	0.1	0.1	0.1		
32	2-Nov-17							
33	11-May-18		0.1		0.1			
34	11-Jul-19	0.1			0.1			
35	1-Nov-19							
36	1-Jul-20		0.1	0.1	0.1	0.1		
37	1-Nov-20							
38	7-Jul-21	0.1		0.3	0.1	0.1		
39	24-Jun-22	0.1	0.1	0.1	0.1			
40	10-Oct-23		0.1		0.1	0.1		
Coefficient of Variation:		0.26	1.99	1.03	0.31	0.25		
Mann-Kendall Statistic (S):		-26	-70	-56	-22	-13		
Confidence Factor:		71.8%	94.6%	96.3%	84.8%	74.1%		
Concentration Trend:		Stable	Prob. Decreasing	Decreasing	Stable	Stable		



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
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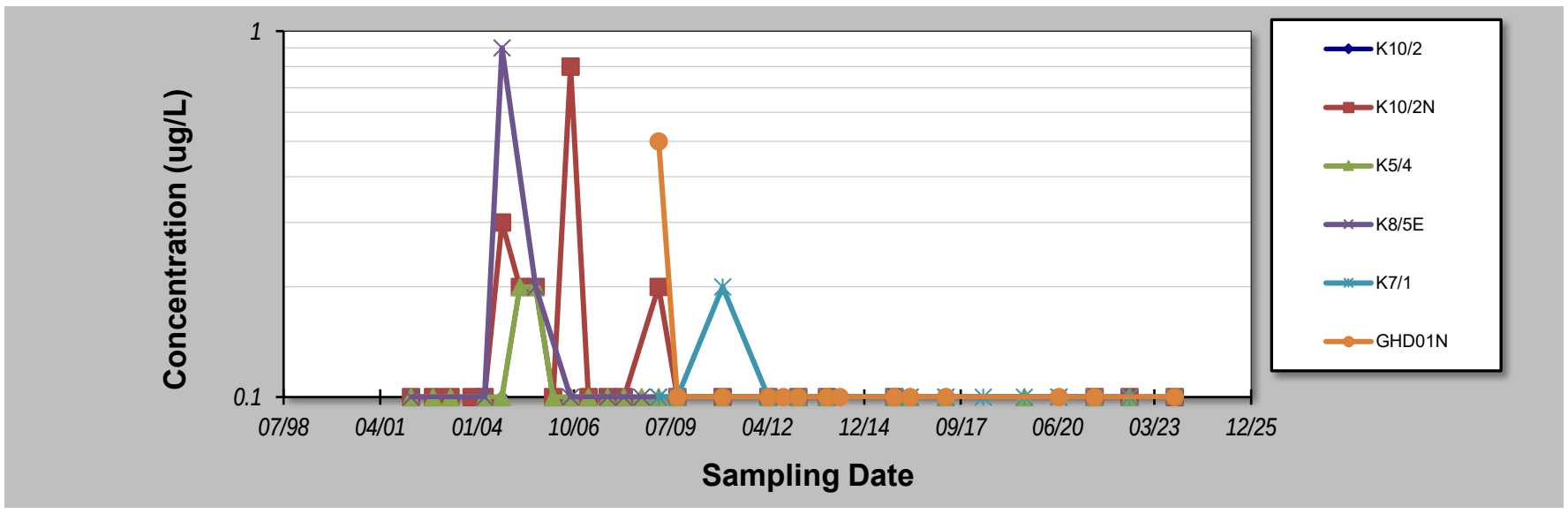
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Benza(a)anthracene**
Concentration Units: **ug/L**

Sampling Point ID:	K10/2	K10/2N	K5/4	K8/5E	K7/1	GHD01N	
Sampling Event	Sampling Date	BENZA(A)ANTHRACENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1	0.1	0.1			
2	14-Oct-02	0.1	0.1	0.1				
3	15-Apr-03	0.1	0.1	0.1				
4	17-Nov-03	0.1	0.1					
5	31-Mar-04	0.1	0.1	0.1	0.1			
6	27-Sep-04	0.1	0.3	0.1	0.9			
7	31-Mar-05	0.2	0.2	0.2				
8	12-Sep-05	0.2	0.2	0.2	0.2			
9	9-Mar-06	0.1	0.1	0.1				
10	6-Sep-06	0.1	0.8	0.1	0.1			
11	9-Mar-07	0.1	0.1	0.1				
12	22-Sep-07	0.1	0.1	0.1	0.1			
13	11-Mar-08	0.1	0.1	0.1	0.1			
14	10-Sep-08			0.1	0.1			
15	5-Mar-09	0.1	0.2	0.1	0.1	0.1	0.5	
16	14-Sep-09	0.1	0.1	0.1	0.1	0.1	0.1	
17	5-Mar-10							
18	24-Dec-10		0.1	0.1	0.1	0.2	0.1	
19	5-Mar-11							
20	14-Sep-11							
21	11-Apr-12	0.1	0.1	0.1	0.1	0.1	0.1	
22	14-Sep-12						0.1	
23	13-Feb-13	0.1	0.1	0.1	0.1	0.1	0.1	
24	9-Dec-13	0.1	0.1	0.1	0.1	0.1	0.1	
25	22-Apr-14						0.1	
26	2-Nov-15	0.1	0.1	0.1	0.1	0.1	0.1	
27	15-Apr-16	0.1		0.1	0.1	0.1	0.1	
28	2-Nov-16							
29	18-Apr-17	0.1		0.1	0.1	0.1	0.1	
30	2-Nov-17							
31	11-May-18					0.1		
32	2-Nov-18							
33	11-Jul-19	0.1		0.1		0.1		
34	1-Nov-19							
35	1-Jul-20	0.1			0.1	0.1	0.1	
36	1-Nov-20							
37	7-Jul-21	0.1	0.1	0.1	0.1	0.1	0.1	
38	01-Jul-22	0.1	0.1	0.1	0.1	0.1		
39	12-Oct-23	0.1	0.1			0.1	0.1	
40								
Coefficient of Variation:		0.25	0.99	0.26	1.24	0.24	0.83	
Mann-Kendall Statistic (S):		-24	-31	-26	-29	-10	-13	
Confidence Factor:		69.2%	78.4%	71.8%	81.6%	66.9%	74.1%	
Concentration Trend:		Stable	Stable	Stable	No Trend	Stable	Stable	



Notes:

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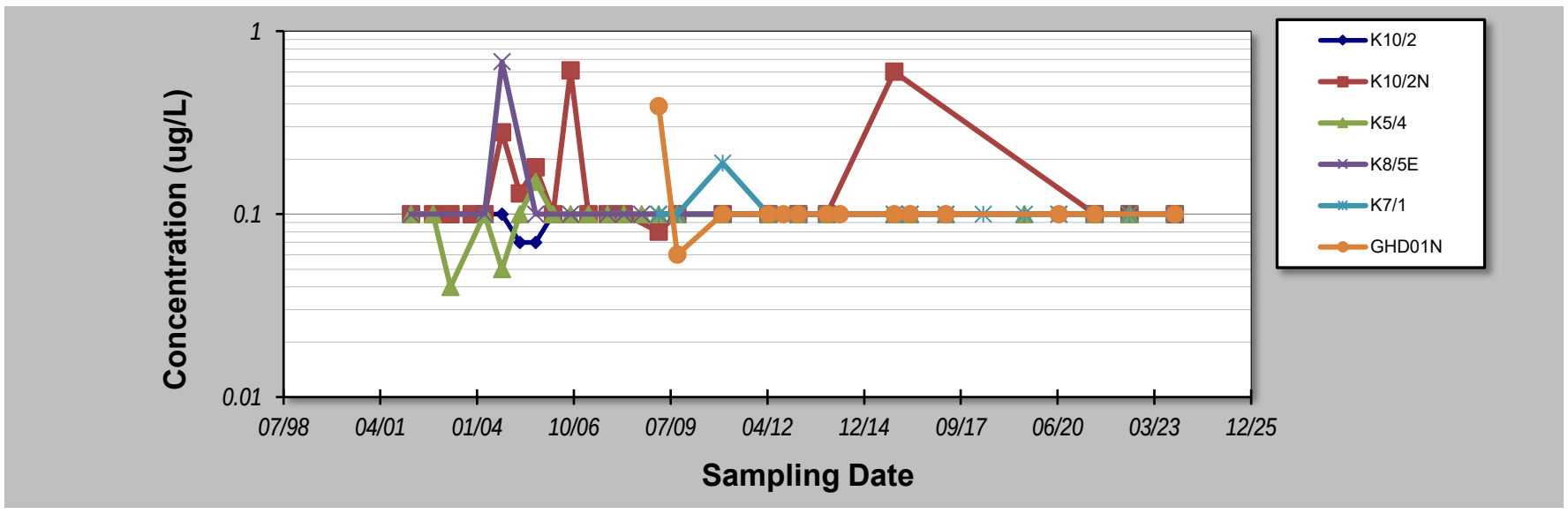
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Benzo(a)pyrene**
Concentration Units: **ug/L**

Sampling Point ID:	K10/2	K10/2N	K5/4	K8/5E	K7/1	GHD01N	
Sampling Event	Sampling Date	BENZO(A)PYRENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1	0.1	0.1			
2	14-Oct-02	0.1	0.1	0.1				
3	15-Apr-03	0.1	0.1	0.04				
4	17-Nov-03	0.1	0.1					
5	31-Mar-04	0.1	0.1	0.1	0.1			
6	27-Sep-04	0.1	0.28	0.05	0.68			
7	31-Mar-05	0.07	0.13	0.1				
8	12-Sep-05	0.07	0.18	0.15	0.1			
9	9-Mar-06	0.1	0.1	0.1				
10	6-Sep-06	0.1	0.61	0.1	0.1			
11	9-Mar-07	0.1	0.1	0.1				
12	22-Sep-07	0.1	0.1	0.1	0.1			
13	11-Mar-08	0.1	0.1	0.1	0.1			
14	10-Sep-08			0.1	0.1			
15	5-Mar-09	0.1	0.08	0.1	0.1	0.1	0.39	
16	14-Sep-09	0.1	0.1	0.1	0.1	0.1	0.06	
17	5-Mar-10							
18	24-Dec-10		0.1	0.1	0.1	0.19	0.1	
19	5-Mar-11							
20	14-Sep-11							
21	11-Apr-12	0.1	0.1	0.1	0.1	0.1	0.1	
22	14-Sep-12						0.1	
23	13-Feb-13	0.1	0.1	0.1	0.1	0.1	0.1	
24	9-Dec-13	0.1	0.1	0.1	0.1	0.1	0.1	
25	22-Apr-14						0.1	
26	2-Nov-15	0.1	0.6	0.1	0.1	0.1	0.1	
27	15-Apr-16	0.1		0.1	0.1	0.1	0.1	
28	2-Nov-16							
29	18-Apr-17	0.1		0.1	0.1	0.1	0.1	
30	2-Nov-17							
31	11-May-18					0.1		
32	11-Jul-19	0.1		0.1		0.1		
33	1-Nov-19							
34	1-Jul-20	0.1			0.1	0.1	0.1	
35	1-Nov-20							
36	7-Jul-21	0.1	0.1	0.1	0.1	0.1	0.1	
37	01-Jul-22	0.1	0.1	0.1		0.1		
38	12-Oct-23	0.1	0.1			0.1	0.1	
39								
40								
Coefficient of Variation:		0.08	0.95	0.19	1.02	0.22	0.67	
Mann-Kendall Statistic (S):		24	-15	23	-14	-10	-1	
Confidence Factor:		69.2%	64.3%	69.5%	67.4%	66.9%	50.0%	
Concentration Trend:		No Trend	Stable	No Trend	No Trend	Stable	Stable	



Notes:

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2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
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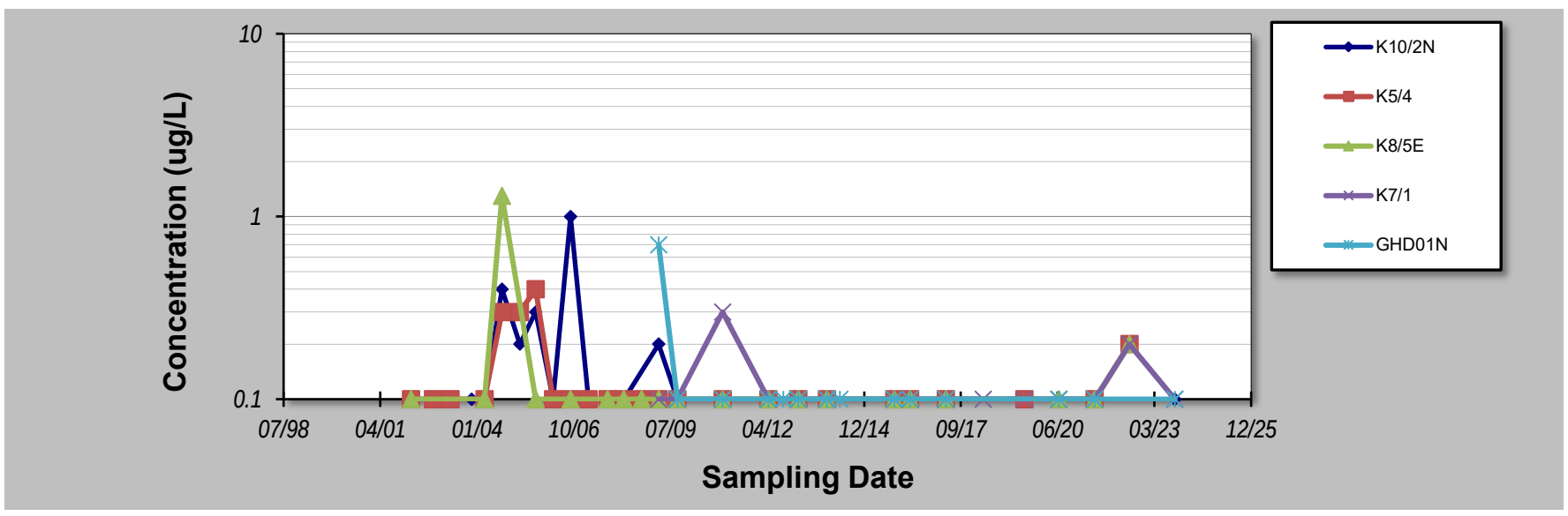
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Benzo(b)&(k)fluoranthene**
Concentration Units: **ug/L**

Sampling Point ID:	K10/2N	K5/4	K8/5E	K7/1	GHD01N		
Sampling Event	Sampling Date	BENZO(B)&(K)FLUORANTHENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1	0.1				
2	14-Oct-02	0.1	0.1					
3	15-Apr-03	0.1	0.1					
4	17-Nov-03	0.1						
5	31-Mar-04	0.1	0.1	0.1				
6	27-Sep-04	0.4	0.3	1.3				
7	31-Mar-05	0.2	0.3	0				
8	12-Sep-05	0.3	0.4	0.1				
9	9-Mar-06	0.1	0.1					
10	6-Sep-06	1	0.1	0.1				
11	9-Mar-07	0.1	0.1					
12	22-Sep-07	0.1	0.1	0.1				
13	11-Mar-08	0.1	0.1	0.1				
14	10-Sep-08		0.1	0.1				
15	5-Mar-09	0.2	0.1	0.1	0.1	0.7		
16	14-Sep-09	0.1	0.1	0.1	0.1	0.1		
17	5-Mar-10							
18	24-Dec-10	0.1	0.1	0.1	0.3	0.1		
19	5-Mar-11							
20	14-Sep-11							
21	11-Apr-12	0.1	0.1	0.1	0.1	0.1		
22	14-Sep-12					0.1		
23	13-Feb-13	0.1	0.1	0.1	0.1	0.1		
24	9-Dec-13	0.1	0.1	0.1	0.1	0.1		
25	22-Apr-14					0.1		
26	2-Nov-15	0.1	0.1	0.1	0.1	0.1		
27	15-Apr-16		0.1	0.1	0.1	0.1		
28	2-Nov-16							
29	18-Apr-17		0.1	0.1	0.1	0.1		
30	2-Nov-17							
31	11-May-18				0.1			
32	2-Nov-18							
33	11-Jul-19		0.1		0.1			
34	1-Nov-19							
35	1-Jul-20			0.1	0.1	0.1		
36	1-Nov-20							
37	7-Jul-21	0.1	0.1	0.1	0.1	0.1		
38	1-Jul-22	0.2	0.2	0.2	0.2			
39	12-Oct-23	0.1			0.1	0.1		
40								
Coefficient of Variation:		1.13	0.61	1.68	0.47	1.12		
Mann-Kendall Statistic (S):		-14	-19	17	1	-13		
Confidence Factor:		63.3%	66.2%	68.4%	50.0%	74.1%		
Concentration Trend:		No Trend	Stable	No Trend	No Trend	No Trend		



Notes:

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2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
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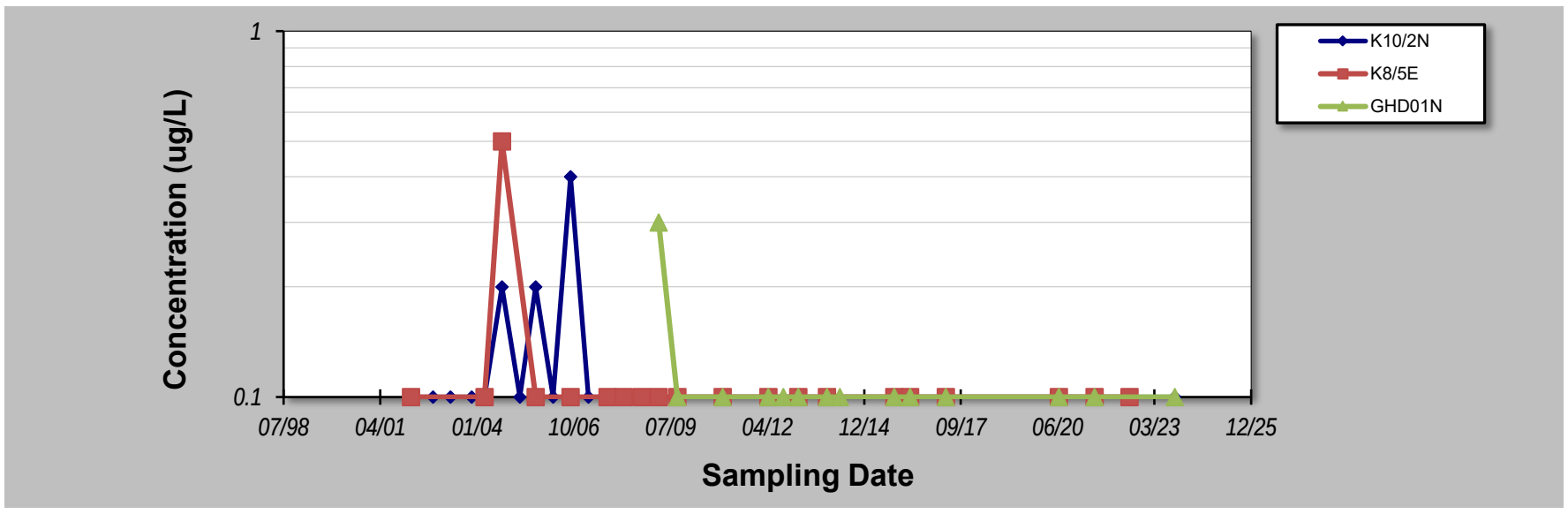
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Benzo(ghi)perylene**
Concentration Units: **ug/L**

Sampling Point ID:	K10/2N	K8/5E	GHD01N				
Sampling Event	Sampling Date	BENZO(GHI)PERYLENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1					
2	14-Oct-02	0.1						
3	15-Apr-03	0.1						
4	17-Nov-03	0.1						
5	31-Mar-04	0.1	0.1					
6	27-Sep-04	0.2	0.5					
7	31-Mar-05	0.1						
8	12-Sep-05	0.2	0.1					
9	9-Mar-06	0.1						
10	6-Sep-06	0.4	0.1					
11	9-Mar-07	0.1						
12	22-Sep-07	0.1	0.1					
13	11-Mar-08	0.1	0.1					
14	10-Sep-08		0.1					
15	5-Mar-09	0.1	0.1	0.3				
16	14-Sep-09	0.1	0.1	0.1				
17	5-Mar-10							
18	24-Dec-10	0.1	0.1	0.1				
19	5-Mar-11							
20	14-Sep-11							
21	11-Apr-12	0.1	0.1	0.1				
22	14-Sep-12			0.1				
23	13-Feb-13	0.1	0.1	0.1				
24	9-Dec-13	0.1	0.1	0.1				
25	22-Apr-14			0.1				
26	2-Nov-15	0.1	0.1	0.1				
27	15-Apr-16		0.1	0.1				
28	2-Nov-16							
29	18-Apr-17		0.1	0.1				
30	2-Nov-17							
31	11-May-18							
32	2-Nov-18							
33	11-Jul-19							
34	1-Nov-19							
35	1-Jul-20		0.1	0.1				
36	1-Nov-20							
37	7-Jul-21	0.1	0.1	0.1				
38	1-Jul-22	0.1	0.1					
39	12-Oct-23	0.1		0.1				
40								
Coefficient of Variation:		**0.55**	**0.75**	**0.47**				
Mann-Kendall Statistic (S):		**-22**	**-15**	**-13**				
Confidence Factor:		**70.8%**	**67.3%**	**74.1%**				
Concentration Trend:		Stable	Stable	Stable				



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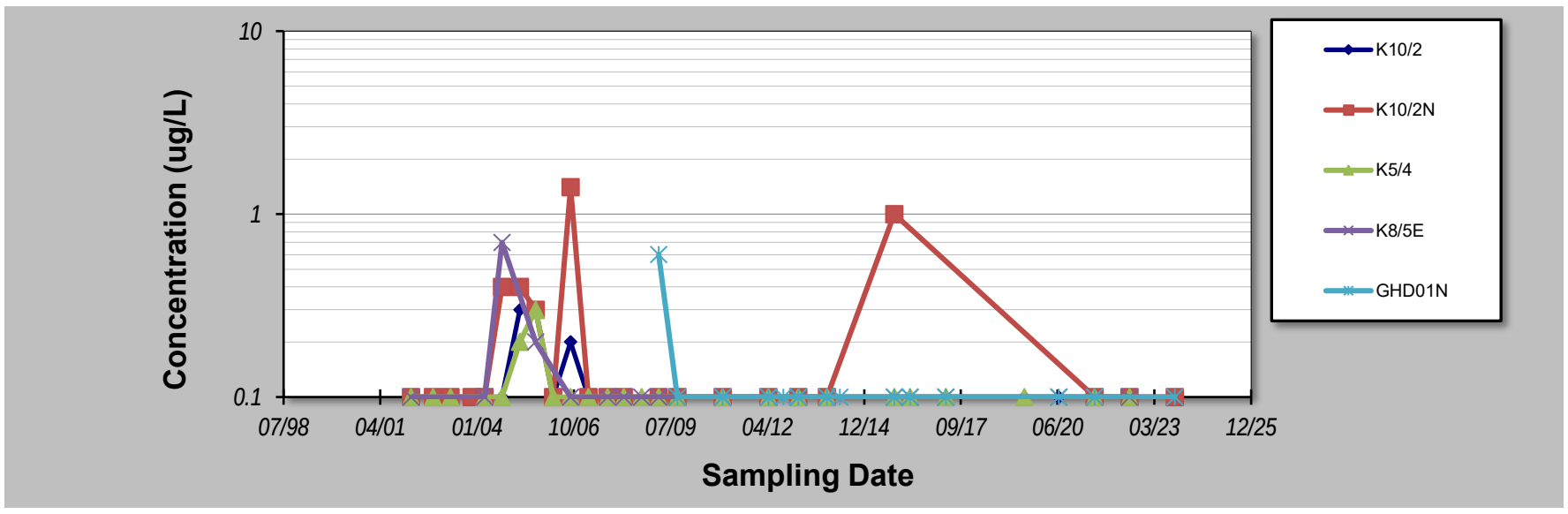
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Chrysene**
Concentration Units: **ug/L**

Sampling Point ID:	K10/2	K10/2N	K5/4	K8/5E	GHD01N		
Sampling Event	Sampling Date	CHRYSENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1	0.1	0.1			
2	14-Oct-02	0.1	0.1	0.1				
3	15-Apr-03	0.1	0.1	0.1				
4	17-Nov-03	0.1	0.1					
5	31-Mar-04	0.1	0.1	0.1	0.1			
6	27-Sep-04	0.1	0.4	0.1	0.7			
7	31-Mar-05	0.3	0.4	0.2				
8	12-Sep-05	0.3	0.3	0.3	0.2			
9	9-Mar-06	0.1	0.1	0.1				
10	6-Sep-06	0.2	1.4	0.1	0.1			
11	9-Mar-07	0.1	0.1	0.1				
12	22-Sep-07	0.1	0.1	0.1	0.1			
13	11-Mar-08	0.1	0.1	0.1	0.1			
14	10-Sep-08			0.1	0.1			
15	5-Mar-09	0.1	0.1	0.1	0.1	0.6		
16	14-Sep-09	0.1	0.1	0.1	0.1	0.1		
17	5-Mar-10							
18	24-Dec-10		0.1	0.1	0.1	0.1		
19	5-Mar-11							
20	14-Sep-11							
21	11-Apr-12	0.1	0.1	0.1	0.1	0.1		
22	14-Sep-12					0.1		
23	13-Feb-13	0.1	0.1	0.1	0.1	0.1		
24	9-Dec-13	0.1	0.1	0.1	0.1	0.1		
25	22-Apr-14					0.1		
26	9-Dec-14							
27	5-Mar-15							
28	2-Nov-15	0.1	1	0.1	0.1	0.1		
29	15-Apr-16	0.1		0.1	0.1	0.1		
30	2-Nov-16							
31	18-Apr-17	0.1		0.1	0.1	0.1		
32	11-Jul-19	0.1		0.1				
33	1-Nov-19							
34	1-Jul-20	0.1			0.1	0.1		
35	1-Nov-20							
36	7-Jul-21	0.1	0.1	0.1	0.1	0.1		
37	01-Jul-22	0.1	0.1	0.1	0.1			
38	12-Oct-23	0.1	0.1			0.1		
39								
40								
Coefficient of Variation:		0.48	1.41	0.39	1.00	0.98		
Mann-Kendall Statistic (S):		-33	-15	-25	-29	-13		
Confidence Factor:		75.8%	64.3%	71.1%	81.6%	74.1%		
Concentration Trend:		Stable	No Trend	Stable	Stable	Stable		



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
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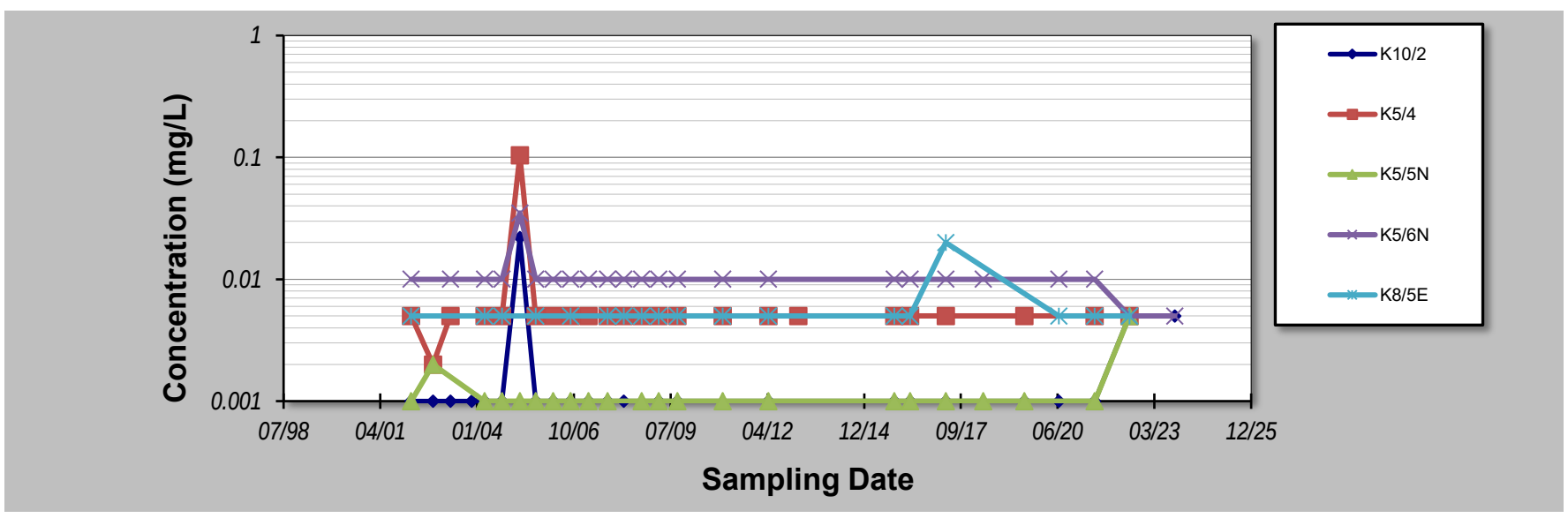
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Chromium**
Concentration Units: **mg/L**

Sampling Point ID:	K10/2	K5/4	K5/5N	K5/6N	K8/5E		
Sampling Event	Sampling Date	CHROMIUM CONCENTRATION (mg/L)						
1	4-Mar-02	0.001	0.005	0.001	0.01	0.005		
2	14-Oct-02	0.001	0.002	0.002				
3	15-Apr-03	0.001	0.005		0.01			
4	17-Nov-03	0.001						
5	31-Mar-04	0.001	0.005	0.001	0.01	0.005		
6	27-Sep-04	0.001	0.005	0.001	0.01	0.005		
7	31-Mar-05	0.022	0.104	0.001	0.035			
8	12-Sep-05	0.001	0.005	0.001	0.01	0.005		
9	9-Mar-06	0.001	0.005	0.001	0.01			
10	6-Sep-06	0.001	0.005	0.001	0.01	0.005		
11	9-Mar-07	0.001	0.005	0.001	0.01			
12	22-Sep-07	0.001	0.005	0.001	0.01	0.005		
13	11-Mar-08	0.001	0.005	-	0.01	0.005		
14	10-Sep-08		0.005	0.001	0.01	0.005		
15	5-Mar-09	0.001	0.005	0.001	0.01	0.005		
16	14-Sep-09	0.001	0.005	0.001	0.01	0.005		
17	5-Mar-10							
18	24-Dec-10		0.005	0.001	0.01	0.005		
19	5-Mar-11							
20	14-Sep-11							
21	11-Apr-12	0.001	0.005	0.001	0.01	0.005		
22	14-Sep-12							
23	13-Feb-13		0.005					
24	9-Dec-13							
25	22-Apr-14							
26	9-Dec-14							
27	5-Mar-15							
28	2-Nov-15	0.001	0.005	0.001	0.01	0.005		
29	15-Apr-16	0.001	0.005	0.001	0.01	0.005		
30	2-Nov-16							
31	18-Apr-17	0.001	0.005	0.001	0.01	0.02		
32	2-Nov-17							
33	11-May-18			0.001	0.01			
34	11-Jul-19	0.001	0.005	0.001				
35	1-Nov-19							
36	1-Jul-20	0.001			0.01	0.005		
37	1-Nov-20							
38	7-Jul-21	0.001	0.005	0.001	0.01	0.005		
39	01-Jul-22	0.005	0.005	0.005	0.005	0.005		
40	12-Oct-23	0.005			0.005			
Coefficient of Variation:		**1.98**	**2.25**	**0.71**	**0.51**	**0.61**		
Mann-Kendall Statistic (S):		**31**	**7**	**3**	**-57**	**11**		
Confidence Factor:		**77.0%**	**55.9%**	**52.2%**	**91.7%**	**64.6%**		
Concentration Trend:		No Trend	No Trend	No Trend	Prob. Decreasing	No Trend		



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

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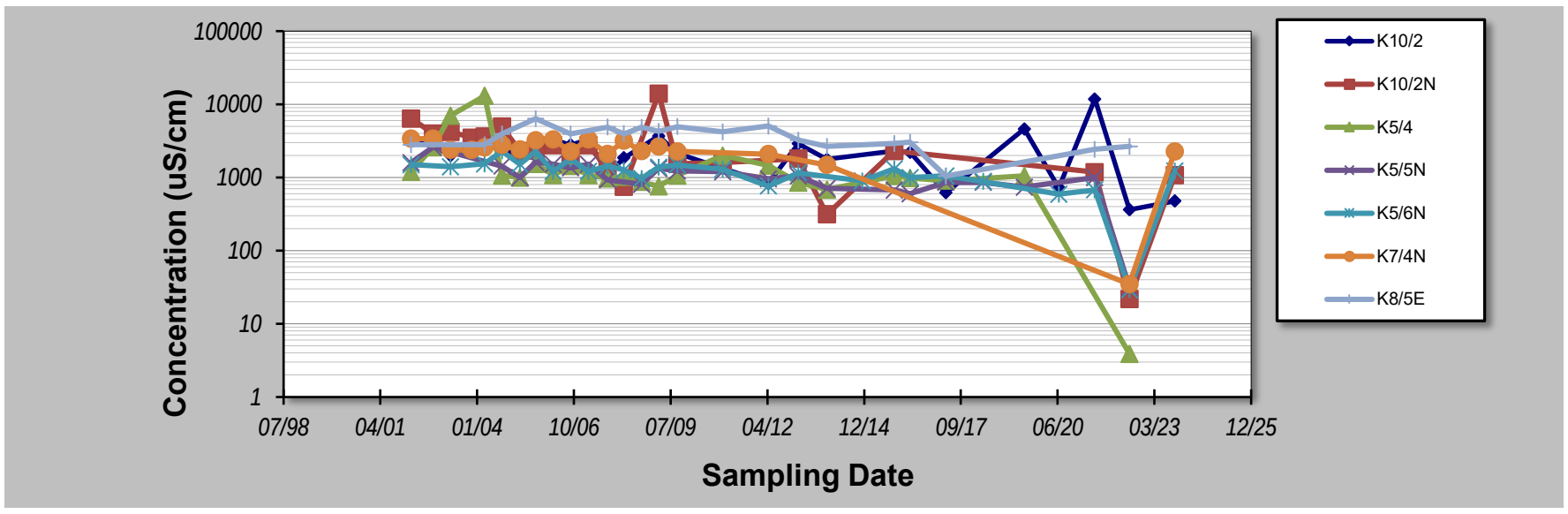
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **EC**
Concentration Units: **uS/cm**

Sampling Point ID:	K10/2	K10/2N	K5/4	K5/5N	K5/6N	K7/4N	K8/5E
Sampling Event	Sampling Date	EC CONCENTRATION (uS/cm)						
1	4-Mar-02	3200	6400	1200	1600	1500	3400	2800
2	14-Oct-02	2700	4000	2600	2600		3400	
3	15-Apr-03	2000	4200	7000		1400	2400	
4	17-Nov-03	2860	3510				2380	
5	31-Mar-04	2850	3620	13010		1540	2590	2810
6	27-Sep-04		4960	1070	1430	2290	2800	3930
7	31-Mar-05	2004	2300	994	995	1517	2430	
8	12-Sep-05	2540	2330	1530	1621	2280	3210	6370
9	9-Mar-06	3310	2760	1084	1523	1204	3300	
10	6-Sep-06	2790	1847	1432	1356	1797	2270	3950
11	9-Mar-07	3310	2760	1084	1523	1204	3300	
12	22-Sep-07	1112	1298	976	927	1436	2100	4880
13	11-Mar-08	1860	747	1020		1264	3170	3970
14	10-Sep-08			870	807	970	2290	4860
15	5-Mar-09	3700	13950	761	1336	1384	2660	4250
16	14-Sep-09	2130	1540	1070	1225	1484	2270	4960
17	5-Mar-10							
18	24-Dec-10		1600	2000	1200	1300		4200
19	5-Mar-11							
20	14-Sep-11							
21	11-Apr-12	830		1460	960	764	2090	5040
22	14-Sep-12							
23	13-Feb-13	2900	1810	855	1050	1160		3230
24	9-Dec-13	1780	314	684	710		1490	2660
25	22-Apr-14							
26	9-Dec-14					899		
27	5-Mar-15							
28	2-Nov-15	2310	2308	1050	673	1310		2921
29	15-Apr-16	2216		986	600	1000		3039
30	2-Nov-16							
31	18-Apr-17	620		903	860	1051		1046
32	2-Nov-17							
33	11-May-18				860	880		
34	11-Jul-19	4601		1050	740			
35	1-Nov-19							
36	1-Jul-20	724				593		
37	1-Nov-20							
38	7-Jul-21	11844	1184		997	678		2424
39	01-Jul-22	362.8	21.8	3.9	31	29.2	34.9	2668
40	12-Oct-23	477	1,075			1,221	2283.0	
Coefficient of Variation:		0.85	0.99	1.45	0.45	0.39	0.31	0.34
Mann-Kendall Statistic (S):		-71	-136	-127	-159	-188	-91	-45
Confidence Factor:		94.9%	>99.9%	99.9%	>99.9%	>99.9%	99.9%	93.8%
Concentration Trend:		Prob. Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Prob. Decreasing



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
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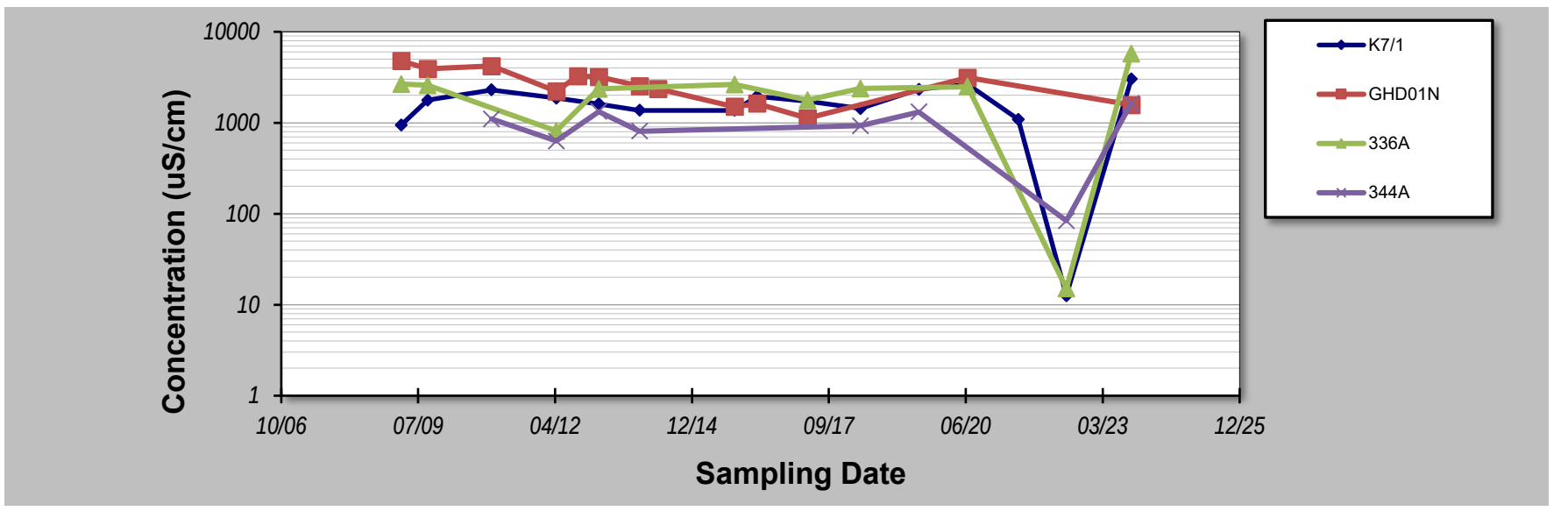
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **EC**
Concentration Units: **uS/cm**

Sampling Point ID:	K7/1	GHD01N	336A	344A			
Sampling Event	Sampling Date	EC CONCENTRATION (uS/cm)						
1	5-Mar-09	948	4790	2670				
2	14-Sep-09	1780	3930	2580				
3	5-Mar-10							
4	24-Dec-10	2300	4200		1100			
5	5-Mar-11							
6	14-Sep-11							
7	11-Apr-12	1860	2210	810	629			
8	14-Sep-12		3250					
9	13-Feb-13	1610	3200	2360	1330			
10	9-Dec-13	1370	2530		809			
11	22-Apr-14		2360					
12	9-Dec-14							
13	5-Mar-15							
14	2-Nov-15	1370	1500	2629				
15	15-Apr-16	1955	1628					
16	2-Nov-16							
17	18-Apr-17	1719	1123	1779				
18	2-Nov-17							
19	11-May-18	1430		2380	930			
20	2-Nov-18							
21	11-Jul-19	2333			1317			
22	1-Nov-19							
23	1-Jul-20	2640	3142	2495				
24	1-Nov-20							
25	7-Jul-21	1093						
26	23-Jun-22	12.6		15.1	83.9			
27	10-Oct-23	3,029	1,571	5,756	1,639			
28								
29								
30								
Coefficient of Variation:		0.43	0.42	0.64	0.49			
Mann-Kendall Statistic (S):		10	-50	-3	4			
Confidence Factor:		66.9%	99.9%	56.9%	64.0%			
Concentration Trend:		No Trend	Decreasing	Stable	No Trend			



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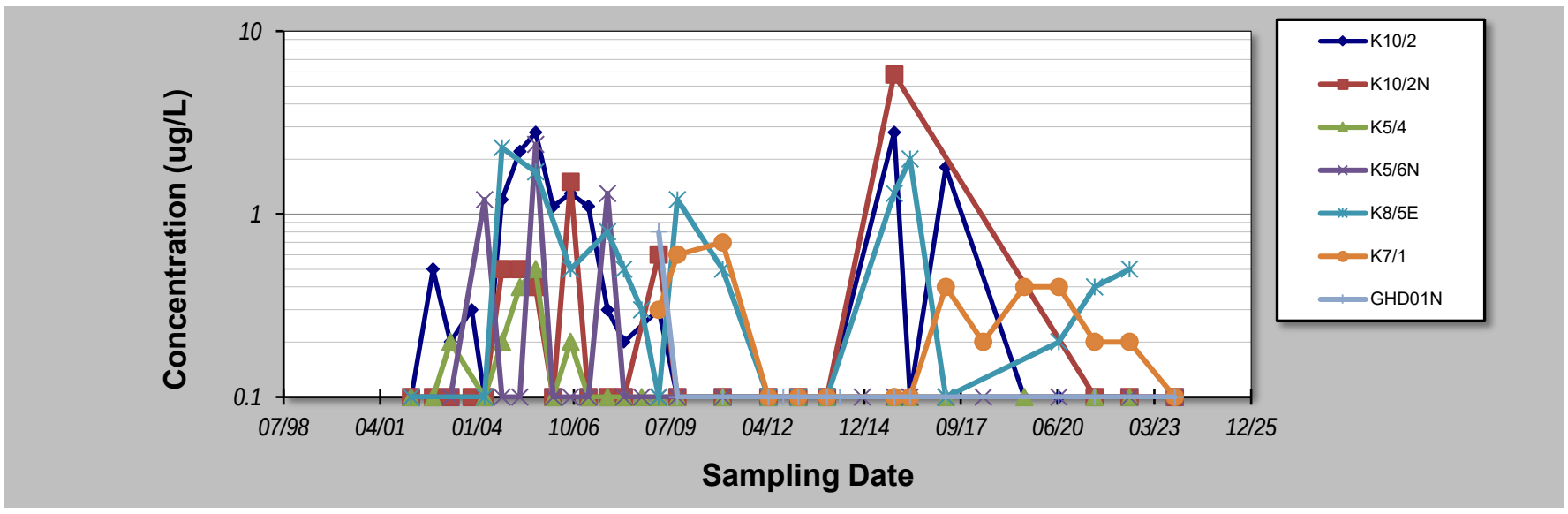
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Fluoranthene**
Concentration Units: **ug/L**

Sampling Point ID:	K10/2	K10/2N	K5/4	K5/6N	K8/5E	K7/1	GHD01N
Sampling Event	Sampling Date	FLUORANTHENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1	0.1	0.1	0.1		
2	14-Oct-02	0.5	0.1	0.1				
3	15-Apr-03	0.2	0.1	0.2	0.1			
4	17-Nov-03	0.3	0.1					
5	31-Mar-04	0.1	0.1	0.1	1.2	0.1		
6	27-Sep-04	1.2	0.5	0.2	0.1	2.3		
7	31-Mar-05	2.2	0.5	0.4	0.1			
8	12-Sep-05	2.8	0.4	0.5	2.4	1.7		
9	9-Mar-06	1.1	0.1	0.1	0.1			
10	6-Sep-06	1.3	1.5	0.2	0.1	0.5		
11	9-Mar-07	1.1	0.1	0.1	0.1			
12	22-Sep-07	0.3	0.1	0.1	1.3	0.8		
13	11-Mar-08	0.2	0.1	0.1	0.1	0.5		
14	10-Sep-08			0.1	0.1	0.3		
15	5-Mar-09	0.3	0.6	0.1	0.1	0.1	0.3	0.8
16	14-Sep-09	0.1	0.1	0.1	0.1	1.2	0.6	0.1
17	5-Mar-10							
18	24-Dec-10		0.1	0.1	0.1	0.5	0.7	0.1
19	5-Mar-11							
20	14-Sep-11							
21	11-Apr-12	0.1	0.1	0.1	0.1	0.1	0.1	0.1
22	14-Sep-12							0.1
23	13-Feb-13	0.1	0.1	0.1	0.1	0.1	0.1	0.1
24	9-Dec-13	0.1	0.1	0.1		0.1	0.1	0.1
25	22-Apr-14							0.1
26	9-Dec-14				0.1			
27	5-Mar-15							
28	2-Nov-15	2.8	5.8	0.1	0.1	1.3	0.1	0.1
29	15-Apr-16	0.1		0.1	0.1	2	0.1	0.1
30	2-Nov-16							
31	18-Apr-17	1.8		0.1	0.1	0.1	0.4	0.1
32	11-May-18				0.1		0.2	
33	2-Nov-18							
34	11-Jul-19	0.1		0.1			0.4	
35	1-Nov-19							
36	1-Jul-20	0.1			0.1	0.2	0.4	0.1
37	1-Nov-20							
38	7-Jul-21	0.1	0.1	0.1		0.4	0.2	0.1
39	01-Jul-22	0.1	0.1	0.1	0.1	0.5	0.2	
40	12-Oct-23	0.1	0.1		0.1		0.1	0.1
Coefficient of Variation:		1.29	2.51	0.71	1.91	1.07	0.73	1.25
Mann-Kendall Statistic (S):		-89	-6	-67	-39	-11	-8	-13
Confidence Factor:		97.4%	55.2%	93.8%	81.1%	62.6%	63.3%	74.1%
Concentration Trend:		Decreasing	No Trend	Prob. Decreasing	No Trend	No Trend	Stable	No Trend



Notes:

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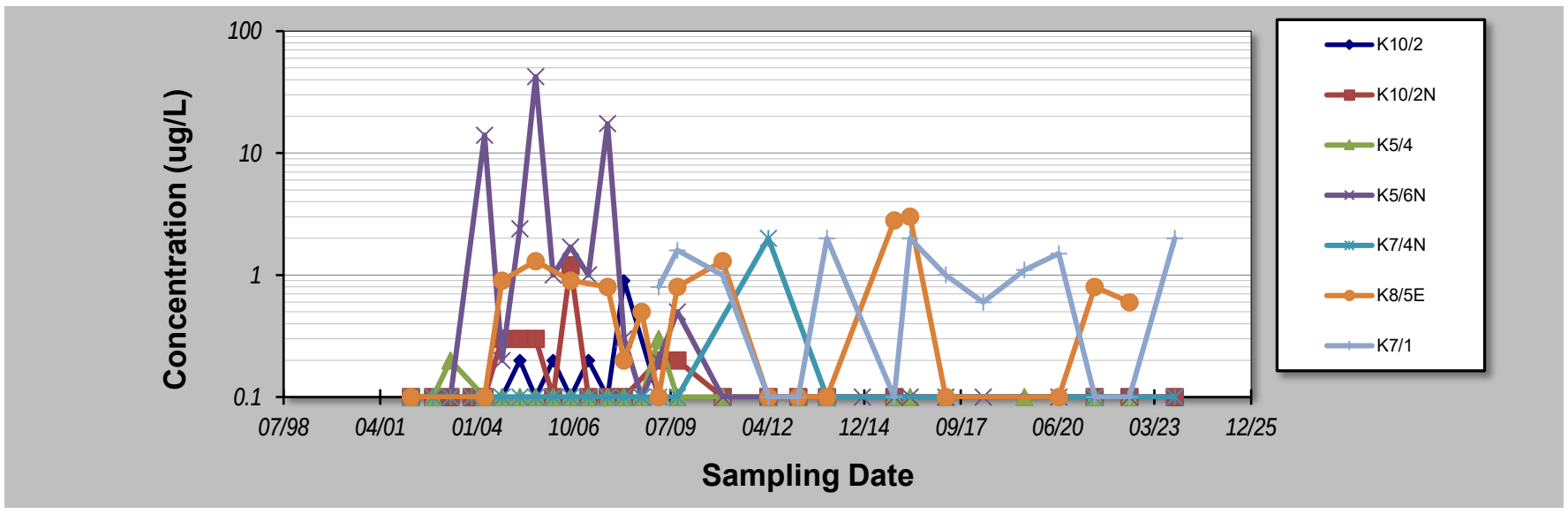
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Fluorene**
Concentration Units: **ug/L**

Sampling Point ID:	K10/2	K10/2N	K5/4	K5/6N	K7/4N	K8/5E	K7/1
Sampling Event	Sampling Date	FLUORENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1	0.1	0.1	0.1	0.1	
2	14-Oct-02	0.1	0.1	0.1		0.1		
3	15-Apr-03	0.1	0.1	0.2	0.1	0.1		
4	17-Nov-03	0.1	0.1			0.1		
5	31-Mar-04	0.1	0.1	0.1	14	0.1	0.1	
6	27-Sep-04	0.1	0.3	0.1	0.2	0.1	0.9	
7	31-Mar-05	0.2	0.3	0.1	2.4	0.1		
8	12-Sep-05	0.1	0.3	0.1	42.4	0.1	1.3	
9	9-Mar-06	0.2	0.1	0.1	1	0.1		
10	6-Sep-06	0.1	1.2	0.1	1.7	0.1	0.9	
11	9-Mar-07	0.2	0.1	0.1	1	0.1		
12	22-Sep-07	0.1	0.1	0.1	17.4	0.1	0.8	
13	11-Mar-08	0.9	0.1	0.1	0.3	0.1	0.2	
14	10-Sep-08			0.1	0.1	0.1	0.5	
15	5-Mar-09	0.1	0.2	0.3	0.2	0.1	0.1	0.8
16	14-Sep-09	0.1	0.2	0.1	0.5	0.1	0.8	1.6
17	5-Mar-10							
18	24-Dec-10		0.1	0.1	0.1		1.3	1
19	5-Mar-11							
20	14-Sep-11							
21	11-Apr-12	0.1	0.1	0.1	0.1	2	0.1	0.1
22	14-Sep-12							
23	13-Feb-13	0.1	0.1	0.1	0.1		0.1	0.1
24	9-Dec-13	0.1	0.1	0.1		0.1	0.1	2
25	22-Apr-14							
26	9-Dec-14				0.1			
27	5-Mar-15							
28	2-Nov-15	0.1	0.1	0.1	0.1		2.8	0.1
29	15-Apr-16	0.1		0.1	0.1		3	2
30	2-Nov-16							
31	18-Apr-17	0.1		0.1	0.1		0.1	1
32	11-May-18				0.1			0.6
33	2-Nov-18							
34	11-Jul-19	0.1		0.1				1.1
35	1-Nov-19							
36	1-Jul-20	0.1			0.1		0.1	1.5
37	1-Nov-20							
38	7-Jul-21	0.1	0.1	0.1		0.1	0.8	0.1
39	01-Jul-22	0.1	0.1	0.1	0.1		0.6	0.1
40	12-Oct-23	0.1	0.1		0.1	0.1		2
Coefficient of Variation:		1.11	1.28	0.39	2.79	2.18	1.15	0.79
Mann-Kendall Statistic (S):		-25	-29	-17	-123	13	-3	3
Confidence Factor:		70.0%	76.8%	64.5%	99.8%	65.0%	52.6%	53.9%
Concentration Trend:		No Trend	No Trend	Stable	Decreasing	No Trend	No Trend	No Trend



Notes:

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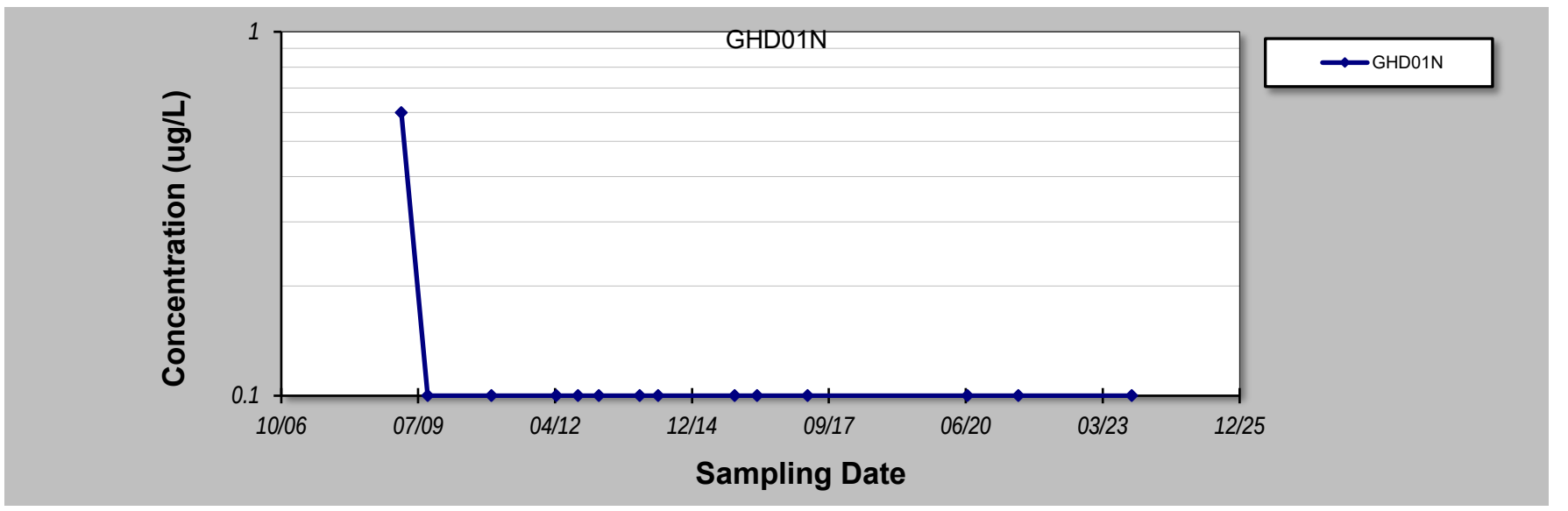
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Fluorene**
Concentration Units: **ug/L**

Sampling Point ID: **GHD01N**

Sampling Event	Sampling Date	FLUORENE CONCENTRATION (ug/L)
1	5-Mar-09	0.6
2	14-Sep-09	0.1
3	5-Mar-10	
4	24-Dec-10	0.1
5	5-Mar-11	
6	14-Sep-11	
7	11-Apr-12	0.1
8	14-Sep-12	0.1
9	13-Feb-13	0.1
10	9-Dec-13	0.1
11	22-Apr-14	0.1
12	9-Dec-14	
13	5-Mar-15	
14	2-Nov-15	0.1
15	15-Apr-16	0.1
16	2-Nov-16	
17	18-Apr-17	0.1
18	2-Nov-17	
19	11-May-18	
20	2-Nov-18	
21	11-Jul-19	
22	1-Nov-19	
23	1-Jul-20	0.1
24	1-Nov-20	
25	7-Jul-21	0.1
26	12-Oct-23	0.1
27		
28		
29		
30		
Coefficient of Variation:		**0.98**
Mann-Kendall Statistic (S):		**-13**
Confidence Factor:		**74.1%**
Concentration Trend:		Stable



Notes:

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3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

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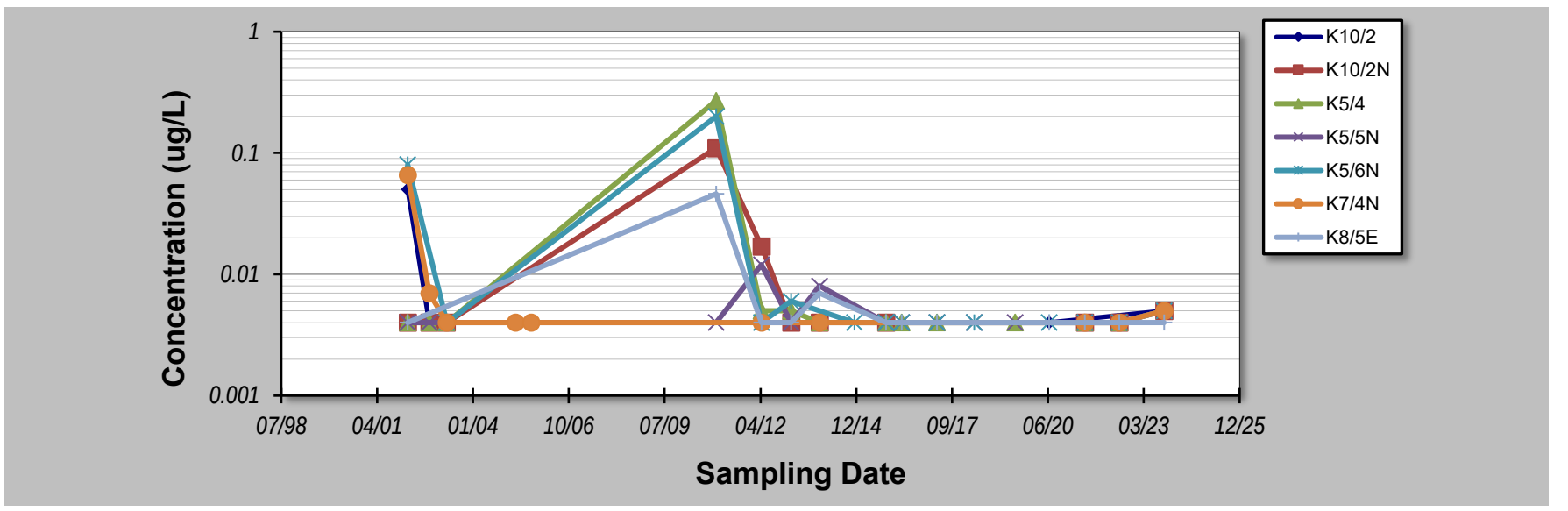
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Free Cyanide**
Concentration Units: **ug/L**

Sampling Point ID:	K10/2	K10/2N	K5/4	K5/5N	K5/6N	K7/4N	K8/5E
Sampling Event	Sampling Date	FREE CYANIDE CONCENTRATION (ug/L)						
1	4-Mar-02	0.05	0.004	0.004	0.004	0.08	0.066	0.004
2	14-Oct-02	0.004	0.004	0.004	0.004		0.007	
3	15-Apr-03	0.004	0.004	0.004		0.004	0.004	
4	17-Nov-03							
5	31-Mar-04							
6	27-Sep-04							
7	31-Mar-05						0.004	
8	12-Sep-05						0.004	
9	24-Dec-10		0.11	0.27	0.004	0.2		0.046
10	5-Mar-11							
11	14-Sep-11							
12	11-Apr-12	0.004	0.017	0.005	0.012	0.004	0.004	0.004
13	14-Sep-12							
14	13-Feb-13	0.004	0.004	0.005	0.004	0.006		0.004
15	9-Dec-13	0.004	0.004	0.004	0.008		0.004	0.007
16	22-Apr-14							
17	9-Dec-14					0.004		
18	5-Mar-15							
19	2-Nov-15	0.004	0.004	0.004	0.004	0.004		0.004
20	15-Apr-16	0.004		0.004	0.004	0.004		0.004
21	2-Nov-16							
22	18-Apr-17	0.004		0.004	0.004	0.004		0.004
23	2-Nov-17							
24	11-May-18				0.004	0.004		
25	2-Nov-18							
26	11-Jul-19	0.004		0.004	0.004			
27	1-Nov-19							
28	1-Jul-20	0.004				0.004		0.004
29	1-Nov-20							
30	7-Jul-21	-	0.004	0.004	0.004	0.004	0.004	0.004
31	01-Jul-22	-	0.004	0.004	0.004	0.004	0.004	0.004
32	12-Oct-23	0.005	0.005			0.005	0.005	0.004
33								
34								
35								
Coefficient of Variation:		1.67	2.13	3.00	0.49	2.31	1.84	1.56
Mann-Kendall Statistic (S):		-1	1	-14	-9	-18	-10	-13
Confidence Factor:		50.0%	50.0%	78.2%	68.4%	82.1%	78.4%	79.0%
Concentration Trend:		No Trend	No Trend	No Trend	Stable	No Trend	No Trend	No Trend



Notes:

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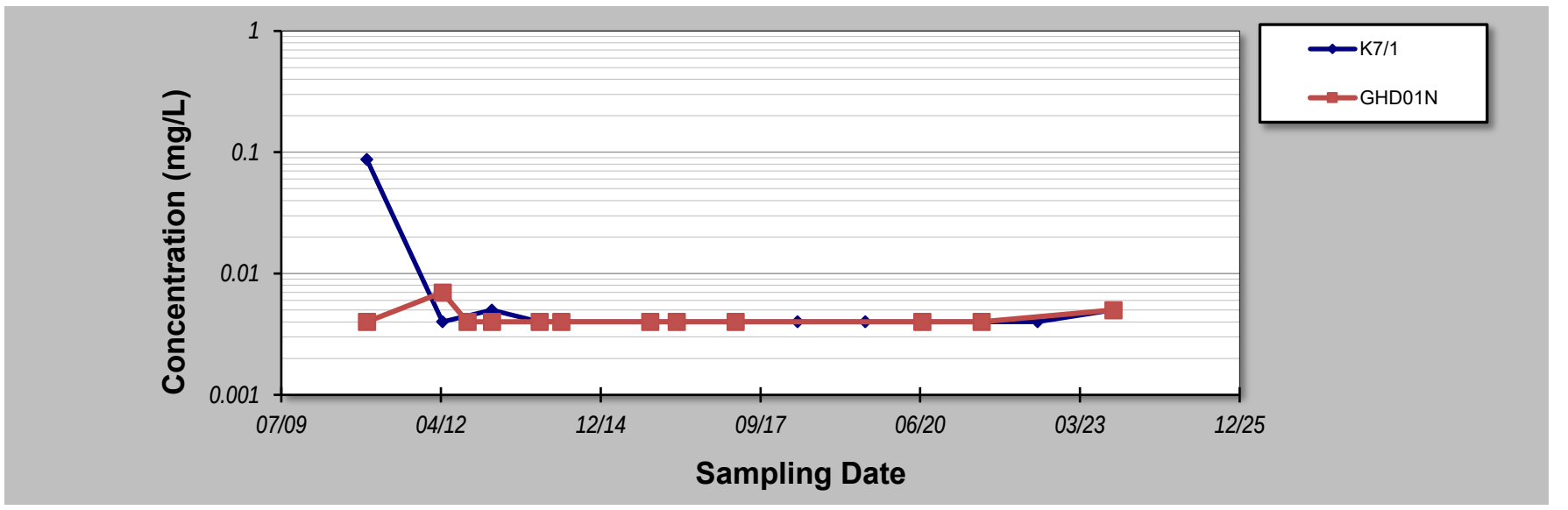
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Free Cyanide**
Concentration Units: **mg/L**

Sampling Point ID: **K7/1** | **GHD01N**

Sampling Event	Sampling Date	FREE CYANIDE CONCENTRATION (mg/L)	
1	24-Dec-10	0.087	0.004
2	5-Mar-11		
3	14-Sep-11		
4	11-Apr-12	0.004	0.007
5	14-Sep-12		0.004
6	13-Feb-13	0.005	0.004
7	9-Dec-13	0.004	0.004
8	22-Apr-14		0.004
9	9-Dec-14		
10	5-Mar-15		
11	2-Nov-15	0.004	0.004
12	15-Apr-16	0.004	0.004
13	2-Nov-16		
14	18-Apr-17	0.004	0.004
15	2-Nov-17		
16	11-May-18	0.004	
17	2-Nov-18		
18	11-Jul-19	0.004	
19	1-Nov-19		
20	1-Jul-20	0.004	0.004
21	1-Nov-20		
22	7-Jul-21	0.004	0.004
23	23-Jun-22	0.004	
24	10-Oct-23	0.005	0.005
25			
Coefficient of Variation:		2.18	0.20
Mann-Kendall Statistic (S):		-10	1
Confidence Factor:		70.5%	50.0%
Concentration Trend:		No Trend	No Trend



Notes:

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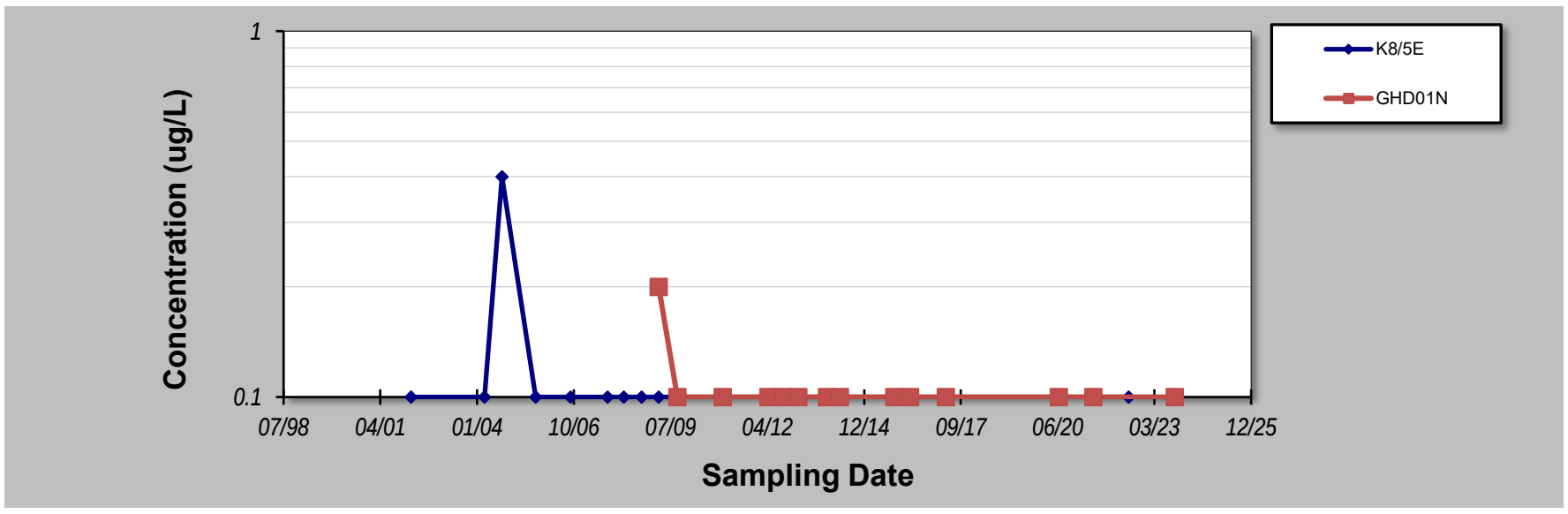
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Indeno(1.2.3-cd)pyrene**
Concentration Units: **ug/L**

Sampling Point ID:	K8/5E	GHD01N					
Sampling Event	Sampling Date	INDENO(1.2.3-CD)PYRENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1						
2	14-Oct-02							
3	15-Apr-03							
4	17-Nov-03							
5	31-Mar-04	0.1						
6	27-Sep-04	0.4						
7	31-Mar-05							
8	12-Sep-05	0.1						
9	9-Mar-06							
10	6-Sep-06	0.1						
11	9-Mar-07							
12	22-Sep-07	0.1						
13	11-Mar-08	0.1						
14	10-Sep-08	0.1						
15	5-Mar-09	0.1	0.2					
16	14-Sep-09	0.1	0.1					
17	5-Mar-10							
18	24-Dec-10	0.1	0.1					
19	5-Mar-11							
20	14-Sep-11							
21	11-Apr-12	0.1	0.1					
22	14-Sep-12		0.1					
23	13-Feb-13	0.1	0.1					
24	9-Dec-13	0.1	0.1					
25	22-Apr-14		0.1					
26	9-Dec-14							
27	5-Mar-15							
28	2-Nov-15	0.1	0.1					
29	15-Apr-16	0.1	0.1					
30	2-Nov-16							
31	18-Apr-17	0.1	0.1					
32	1-Jul-20	0.1	0.1					
33	23-Jun-21	0.1	0.1					
34	24-Jun-22	0.1						
35	12-Oct-23		0.1					
36								
37								
38								
39								
40								
Coefficient of Variation:		0.58	0.25					
Mann-Kendall Statistic (S):		-15	-13					
Confidence Factor:		67.3%	74.1%					
Concentration Trend:		Stable	Stable					



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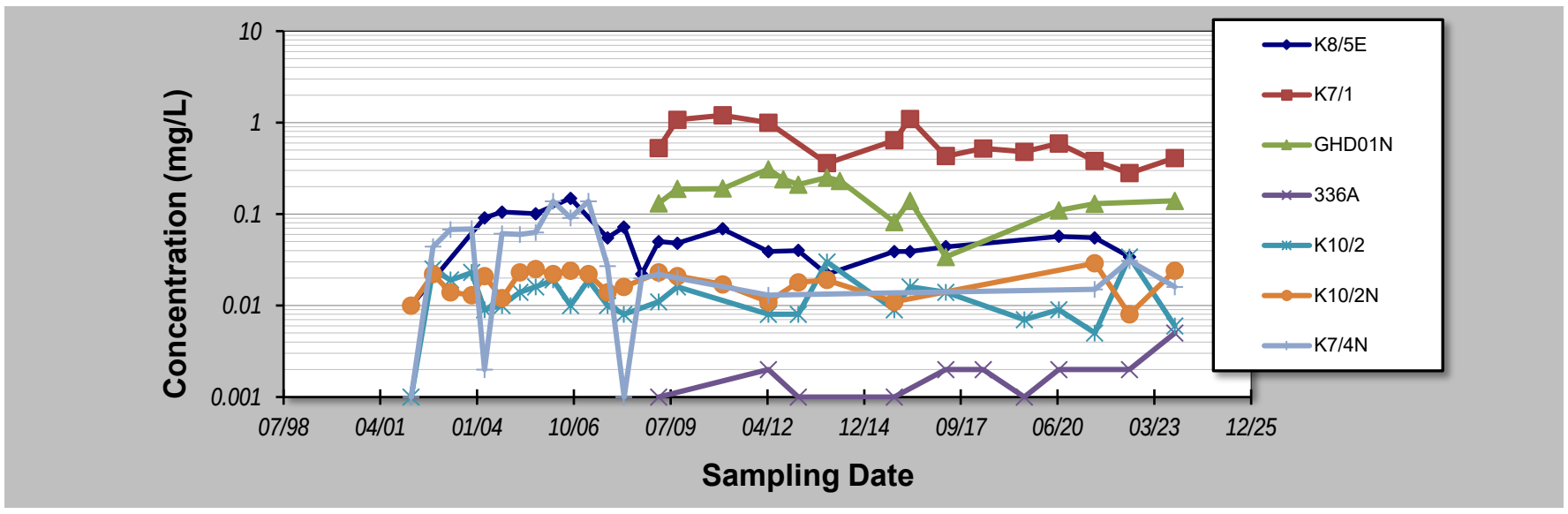
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Molybdenum**
Concentration Units: **mg/L**

Sampling Point ID:	K10/2	K10/2N	K7/4N	K8/5E	K7/1	GHD01N	336A
Sampling Event	Sampling Date	MOLYBDENUM CONCENTRATION (mg/L)						
1	4-Mar-02	0.001	0.01	0.001	0.01			
2	14-Oct-02	0.025	0.022	0.044				
3	15-Apr-03	0.019	0.014	0.068				
4	17-Nov-03	0.023	0.013	0.069				
5	31-Mar-04	0.009	0.021	0.002	0.091			
6	27-Sep-04	0.01	0.012	0.061	0.105			
7	31-Mar-05	0.014	0.023	0.06				
8	12-Sep-05	0.016	0.025	0.063	0.101			
9	9-Mar-06	0.019	0.022	0.138				
10	6-Sep-06	0.01	0.024	0.091	0.149			
11	9-Mar-07	0.019	0.022	0.138				
12	22-Sep-07	0.01	0.014	0.027	0.055			
13	11-Mar-08	0.008	0.016	0.001	0.072			
14	10-Sep-08			0.02	0.022			
15	5-Mar-09	0.011	0.023	0.022	0.05	0.526	0.131	0.001
16	14-Sep-09	0.016	0.021	0.02	0.048	1.07	0.188	0.001
17	5-Mar-10							
18	24-Dec-10		0.017		0.069	1.2	0.19	
19	5-Mar-11							
20	14-Sep-11							
21	11-Apr-12	0.008	0.011	0.013	0.039	1	0.31	0.002
22	14-Sep-12						0.24	
23	13-Feb-13	0.008	0.018		0.04		0.21	0.001
24	9-Dec-13	0.03	0.019		0.022	0.36	0.25	
25	22-Apr-14						0.23	
26	9-Dec-14							
27	5-Mar-15							
28	2-Nov-15	0.009	0.011		0.039	0.64	0.082	0.001
29	15-Apr-16	0.016			0.039	1.1	0.14	
30	2-Nov-16							
31	18-Apr-17	0.014			0.044	0.43	0.034	0.002
32	2-Nov-17							
33	11-May-18					0.52		0.002
34	11-Jul-19	0.007				0.48		0.001
35	1-Nov-19							
36	1-Jul-20	0.009			0.057	0.59	0.11	0.002
37	1-Nov-20							
38	7-Jul-21	0.005	0.029	0.015	0.055	0.38	0.13	
39	01-Jul-22	0.034	0.008	0.031	0.034	0.28		0.002
40	12-Oct-23	0.01	0.02	0.02		0.41	0.14	0.01
Coefficient of Variation:	0.57	0.31	0.91	0.58	0.49	0.44	0.63
Mann-Kendall Statistic (S):	-67	7	-35	-55	-41	-24	11
Confidence Factor:	92.7%	56.2%	86.3%	96.0%	98.7%	89.4%	81.0%
Concentration Trend:	Prob. Decreasing	No Trend	Stable	Decreasing	Decreasing	Stable	No Trend



Notes:

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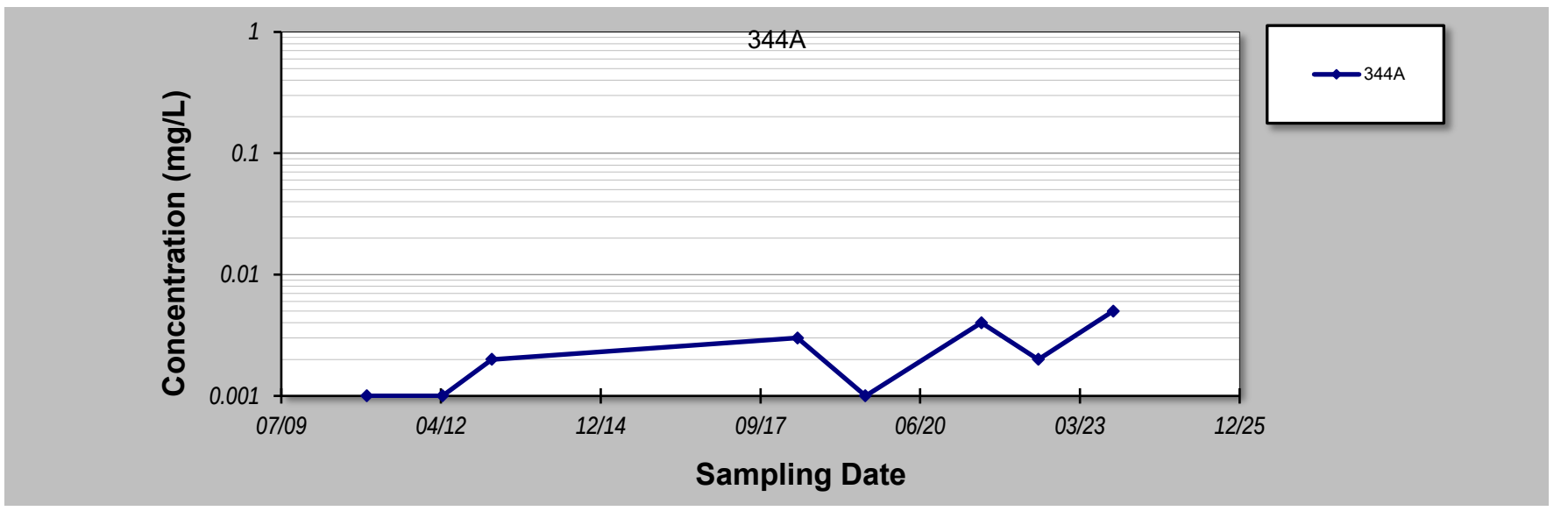
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Molybdenum**
Concentration Units: **mg/L**

Sampling Point ID: **344A**

Sampling Event	Sampling Date	MOLYBDENUM CONCENTRATION (mg/L)
1	24-Dec-10	0.001
2	14-Sep-11	
3	11-Apr-12	0.001
4	13-Feb-13	0.002
5	22-Apr-14	
6	5-Mar-15	
7	15-Apr-16	
8	18-Apr-17	
9	11-May-18	0.003
10	11-Jul-19	0.001
11	1-Jul-20	
12	7-Jul-21	0.004
13	27-Jun-22	0.002
14	9-Oct-23	0.01
15		
16		
17		
18		
19		
20		
Coefficient of Variation:		**0.63**
Mann-Kendall Statistic (S):		**16**
Confidence Factor:		**96.9%**
Concentration Trend:		Increasing



Notes:

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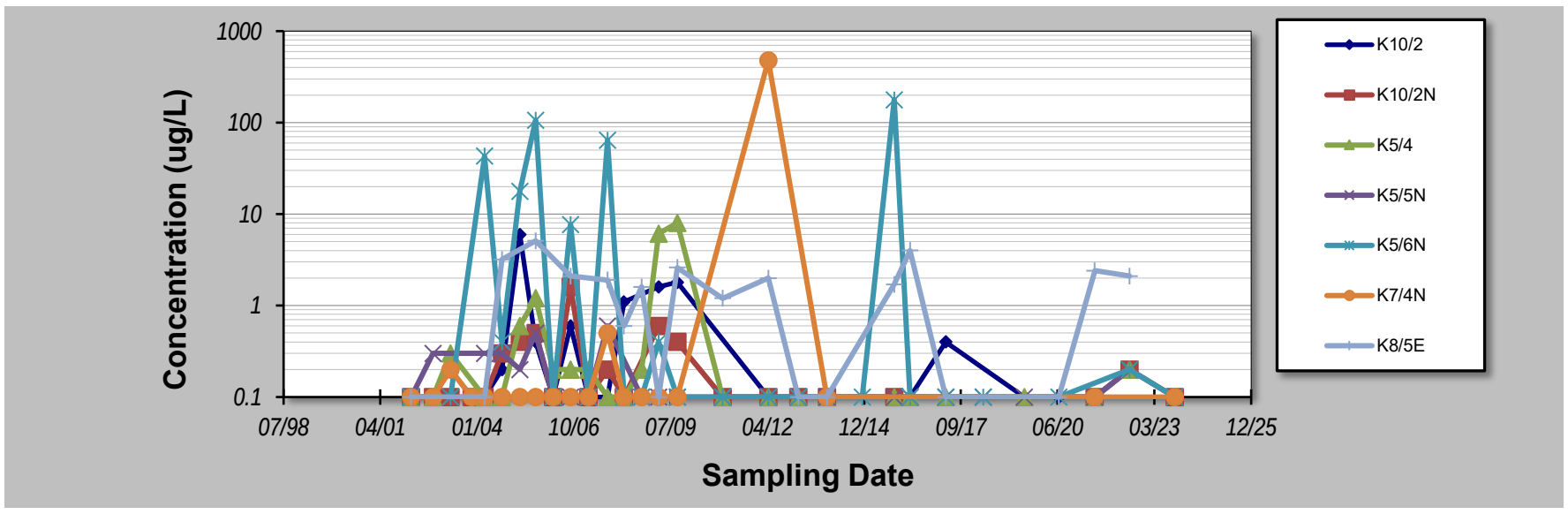
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Naphthalene**
Concentration Units: **ug/L**

Sampling Point ID:	K10/2	K10/2N	K5/4	K5/5N	K5/6N	K7/4N	K8/5E
Sampling Event	Sampling Date	NAPHTHALENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2	14-Oct-02	0.1	0.1	0.1	0.3		0.1	
3	15-Apr-03	0.2	0.1	0.3		0.1	0.2	
4	17-Nov-03	0.1	0.1				0.1	
5	31-Mar-04	0.1	0.1	0.1	0.3	43	0.1	0.1
6	27-Sep-04	0.2	0.3	0.1	0.3	0.4	0.1	3.2
7	31-Mar-05	6	0.4	0.6	0.2	17.8	0.1	
8	12-Sep-05	0.4	0.5	1.2	0.5	106	0.1	5.1
9	9-Mar-06	0.1	0.1	0.2	0.1	0.1	0.1	
10	6-Sep-06	0.6	1.6	0.2	0.1	7.7	0.1	2.1
11	9-Mar-07	0.1	0.1	0.2	0.1	0.1	0.1	
12	22-Sep-07	0.1	0.2	0.1	0.6	64.5	0.5	1.9
13	11-Mar-08	1.1	0.1	0.1	-	0.1	0.1	0.6
14	10-Sep-08			0.2	0.1	0.1	0.1	1.6
15	5-Mar-09	1.6	0.6	6.1	0.1	0.4	0.1	0.1
16	14-Sep-09	1.8	0.4	8	0.1	0.1	0.1	2.6
17	5-Mar-10							
18	24-Dec-10		0.1	0.1	0.1	0.1		1.2
19	5-Mar-11							
20	14-Sep-11							
21	11-Apr-12	0.1	0.1	0.1	0.1	0.1	480	2
22	14-Sep-12							
23	13-Feb-13	0.1	0.1	0.1	0.1	0.1		0.1
24	9-Dec-13	0.1	0.1	0.1	0.1		0.1	0.1
25	22-Apr-14							
26	9-Dec-14					0.1		
27	5-Mar-15							
28	2-Nov-15	0.1	0.1	0.1	0.1	178		1.7
29	15-Apr-16	0.1		0.1	0.1	0.1		4
30	2-Nov-16							
31	18-Apr-17	0.4		0.1	0.1	0.1		0.1
32	11-May-18				0.1	0.1		
33	2-Nov-18							
34	11-Jul-19	0.1		0.1	0.1			
35	1-Nov-19							
36	1-Jul-20	0.1				0.1		0.1
37	1-Nov-20							
38	7-Jul-21	0.1	0.1	0.1	0.1		0.1	2.4
39	01-Jul-22	0.2	0.2	0.2	0.2	0.2		2.1
40	12-Oct-23	0.1	0.1			0.1	0.1	
Coefficient of Variation:		2.22	1.33	2.58	0.80	2.50	4.45	0.93
Mann-Kendall Statistic (S):		-19	-6	-39	-66	-53	4	-6
Confidence Factor:		65.3%	55.2%	81.1%	94.6%	88.7%	53.8%	56.4%
Concentration Trend:		No Trend	No Trend	No Trend	Prob. Decreasing	No Trend	No Trend	Stable



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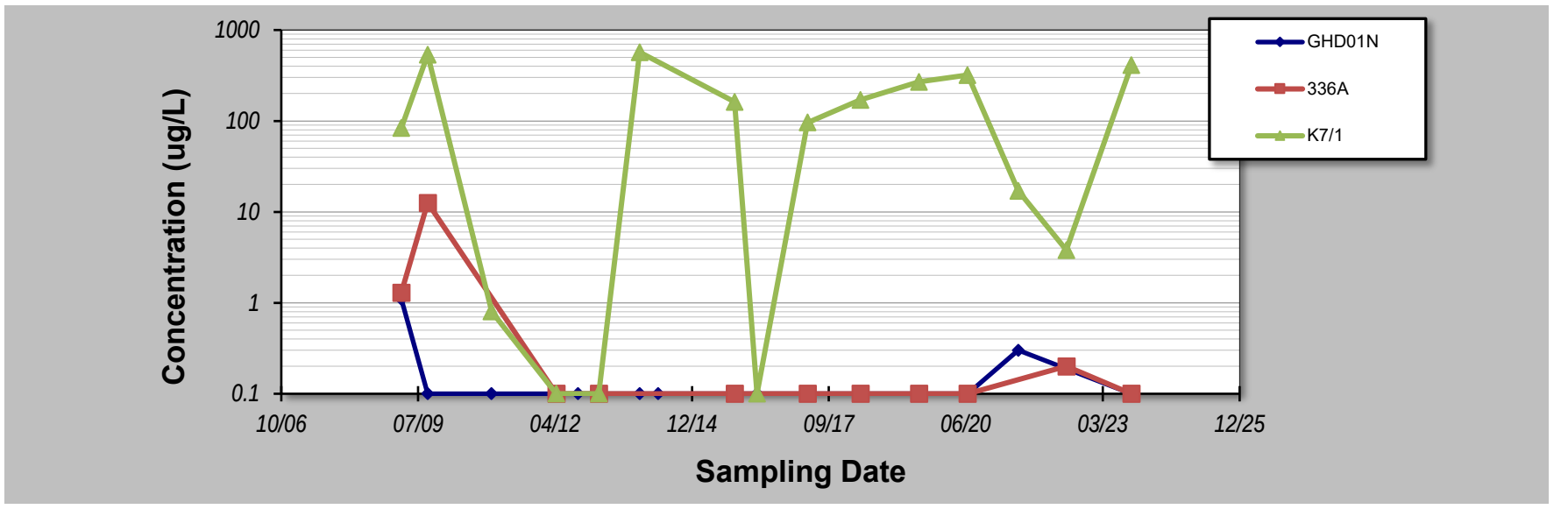
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Naphthalene**
Concentration Units: **ug/L**

Sampling Point ID:	K7/1	GHD01N	336A				

Sampling Event	Sampling Date	NAPHTHALENE CONCENTRATION (ug/L)						
1	5-Mar-09	84.1	1.1	1.3				
2	14-Sep-09	535	0.1	12.6				
3	5-Mar-10							
4	24-Dec-10	0.8	0.1					
5	5-Mar-11							
6	14-Sep-11							
7	11-Apr-12	0.1	0.1	0.1				
8	14-Sep-12		0.1					
9	13-Feb-13	0.1	0.1	0.1				
10	9-Dec-13	570	0.1					
11	22-Apr-14		0.1					
12	9-Dec-14							
13	5-Mar-15							
14	2-Nov-15	162	0.1	0.1				
15	15-Apr-16	0.1	0.1					
16	2-Nov-16							
17	18-Apr-17	96	0.1	0.1				
18	2-Nov-17							
19	11-May-18	170		0.1				
20	2-Nov-18							
21	11-Jul-19	270		0.1				
22	1-Nov-19							
23	1-Jul-20	320	0.1	0.1				
24	1-Nov-20							
25	7-Jul-21	17	0.3					
26	23-Jun-22	3.8		0.2				
27	10-Oct-23	410.00	0.1	0.1				
28								
29								
30								
Coefficient of Variation:		1.14	1.45	2.77				
Mann-Kendall Statistic (S):		16	-3	-11				
Confidence Factor:		76.7%	54.3%	77.7%				
Concentration Trend:		No Trend	No Trend	No Trend				



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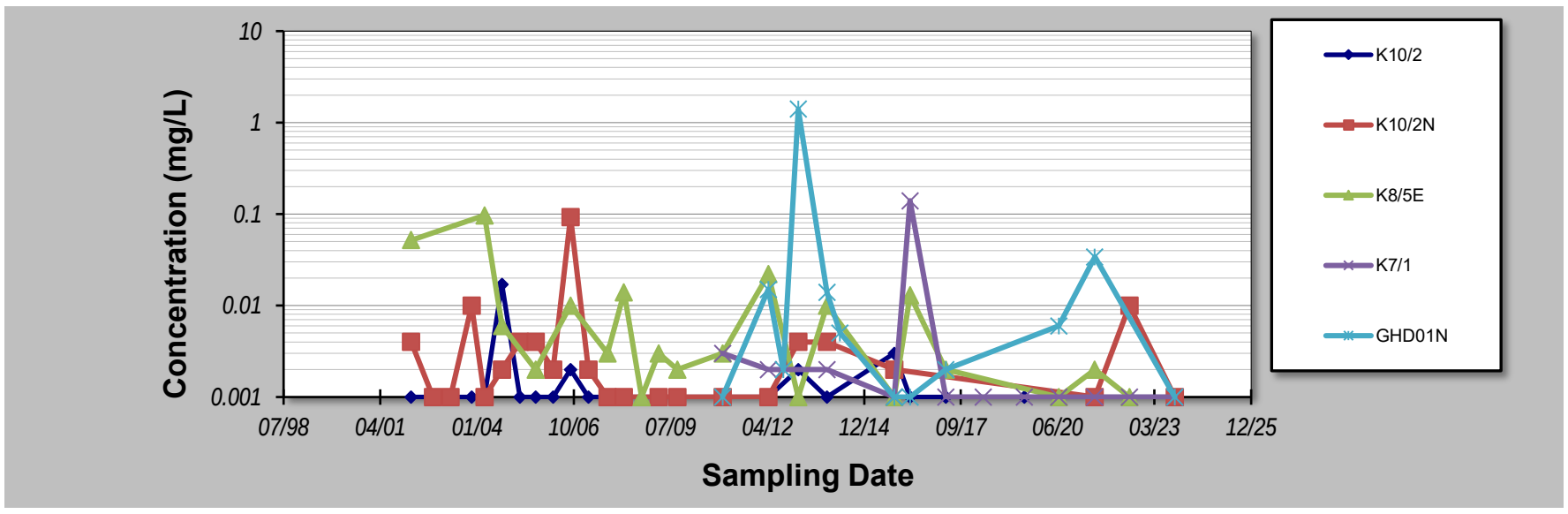
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Lead**
Concentration Units: **mg/L**

Sampling Point ID:	K10/2	K10/2N	K8/5E	K7/1	GHD01N		
Sampling Event	Sampling Date	LEAD CONCENTRATION (mg/L)						
1	4-Mar-02	0.001	0.004	0.052				
2	14-Oct-02	0.001	0.001					
3	15-Apr-03	0.001	0.001					
4	17-Nov-03	0.001	0.01					
5	31-Mar-04	0.001	0.001	0.097				
6	27-Sep-04	0.017	0.002	0.006				
7	31-Mar-05	0.001	0.004					
8	12-Sep-05	0.001	0.004	0.002				
9	9-Mar-06	0.001	0.002					
10	6-Sep-06	0.002	0.093	0.01				
11	9-Mar-07	0.001	0.002					
12	22-Sep-07	0.001	0.001	0.003				
13	11-Mar-08	0.001	0.001	0.014				
14	10-Sep-08			0.001				
15	5-Mar-09	0.001	0.001	0.003	0.002	0.017		
16	14-Sep-09	0.001	0.001	0.002	0.001	0.001		
17	5-Mar-10							
18	24-Dec-10		0.001	0.003	0.003	0.001		
19	5-Mar-11							
20	14-Sep-11							
21	11-Apr-12	0.001	0.001	0.022	0.002	0.015		
22	14-Sep-12					0.002		
23	13-Feb-13	0.002	0.004	0.001		1.4		
24	9-Dec-13	0.001	0.004	0.01	0.002	0.014		
25	22-Apr-14					0.005		
26	9-Dec-14							
27	5-Mar-15							
28	2-Nov-15	0.003	0.002	0.001	0.001	0.001		
29	15-Apr-16	0.001		0.013	0.14	0.001		
30	18-Apr-17	0.001		0.002	0.001	0.002		
31	2-Nov-17							
32	11-May-18				0.001			
33	2-Nov-18							
34	11-Jul-19	0.001			0.001			
35	1-Nov-19							
36	1-Jul-20	0.001		0.001	0.001	0.006		
37	1-Nov-20							
38	7-Jul-21	0.001	0.001	0.002	0.001	0.034		
39	01-Jul-22	0.001	0.01	0.001	0.001			
40	12-Oct-23	0.001	0.001		0.001	0.001		
Coefficient of Variation:		**1.78**	**2.88**	**1.89**	**3.10**	**3.26**		
Mann-Kendall Statistic (S):		**-5**	**-19**	**-72**	**-54**	**-30**		
Confidence Factor:		**53.5%**	**68.1%**	**99.0%**	**>99.9%**	**97.8%**		
Concentration Trend:		No Trend	No Trend	Decreasing	Decreasing	Decreasing		



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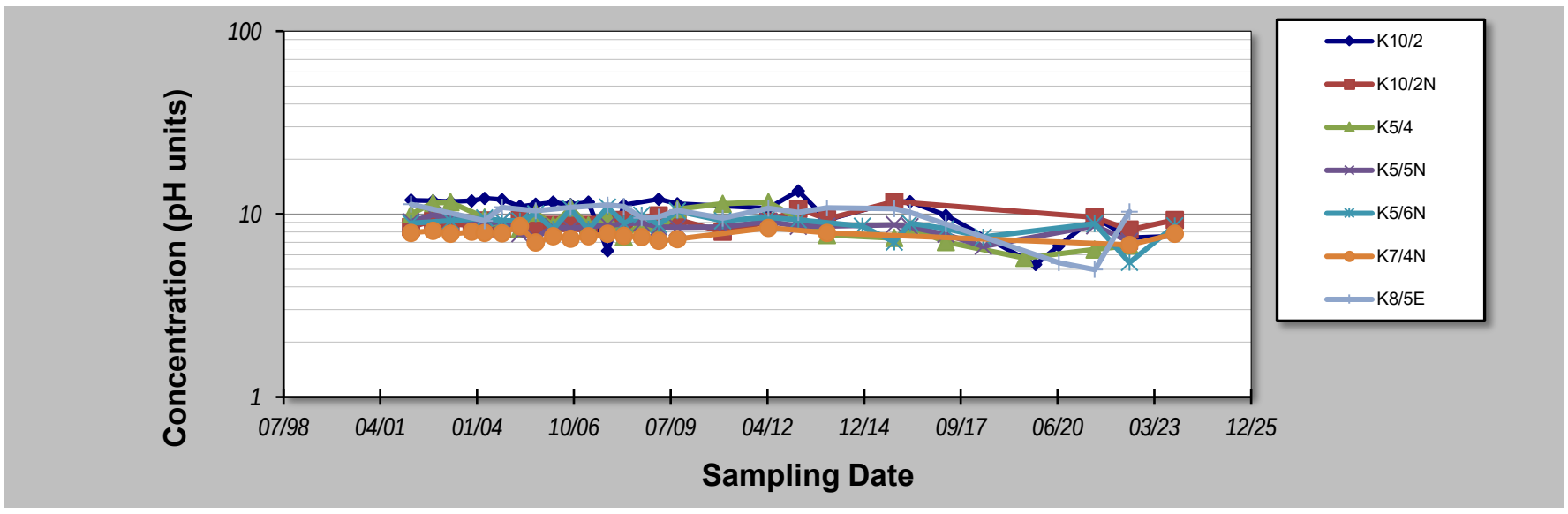
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **pH**
Concentration Units: **pH units**

Sampling Point ID:	K10/2	K10/2N	K5/4	K5/5N	K5/6N	K7/4N	K8/5E
Sampling Event	Sampling Date	PH CONCENTRATION (pH units)						
1	4-Mar-02	11.9	8.5	10.0	9.1	8.9	7.9	11.3
2	14-Oct-02	11.8	9.2	11.5	9.9		8.1	
3	15-Apr-03	11.7	8.8	11.6		9.2	7.8	
4	17-Nov-03	11.8	8.7				8.0	
5	31-Mar-04	12.2	9.3	9.6	8.7	9.5	7.9	9.2
6	27-Sep-04	12.0	8.3	8.5	9.2	9.2	7.9	10.9
7	31-Mar-05	11.0	9.3	8.3	7.8	9.2	8.6	
8	12-Sep-05	11.3	8.7	10.2	7.4	10.0	7.0	10.4
9	9-Mar-06	11.59	8.7	8.7	8.5	8.3	7.6	
10	6-Sep-06	11.29	8.9	10.8	8.4	10.7	7.4	10.9
11	9-Mar-07	11.6	8.72	8.69	8.54	8.26	7.57	
12	22-Sep-07	6.3	8.80	9.60	8.70	10.90	7.80	11.20
13	11-Mar-08	11.2	9.30	7.50		8.90	7.60	11.00
14	10-Sep-08			8.93	8.95	9.88	7.49	9.53
15	5-Mar-09	12.1	9.9	7.7	8.5	8.8	7.1	9.7
16	14-Sep-09	11.4	9.3	10.7	8.4	10.4	7.3	10.5
17	5-Mar-10							
18	24-Dec-10		8.0	11.4	8.5	9.2		9.5
19	5-Mar-11							
20	14-Sep-11							
21	11-Apr-12	10.8	9.1	11.64	9.12	9.6	8.4	10.7
22	14-Sep-12							
23	13-Feb-13	13.4	10.7		8.58	9.3		10.2
24	9-Dec-13	9.3	9.4	7.7	8.6		7.9	10.8
25	22-Apr-14							
26	9-Dec-14					8.6		
27	5-Mar-15							
28	2-Nov-15	11.7	11.7	7.4	8.74	7.05		10.68
29	15-Apr-16	11.68		8.45	8.52	8.91		10.19
30	2-Nov-16							
31	18-Apr-17	9.85		7.03	7.75	8.31		8.83
32	11-May-18				6.66	7.5		
33	2-Nov-18							
34	11-Jul-19			5.75				
35	1-Nov-19	5.29						
36	1-Jul-20	6.71						5.42
37	1-Nov-20							
38	7-Jul-21	9.57	9.6	6.41	8.62	8.87		4.97
39	01-Jul-22	7.43	8.2	6.73	7.09	5.43	6.8	10.32
40	12-Oct-23	7.6	9.3			8.63	7.8	
Coefficient of Variation:		0.20	0.09	0.20	0.08	0.13	0.06	0.18
Mann-Kendall Statistic (S):		-147	84	-121	-64	-93	-55	-74
Confidence Factor:		100.0%	98.6%	99.9%	95.2%	98.5%	96.0%	99.2%
Concentration Trend:		Decreasing	Increasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing



Notes:

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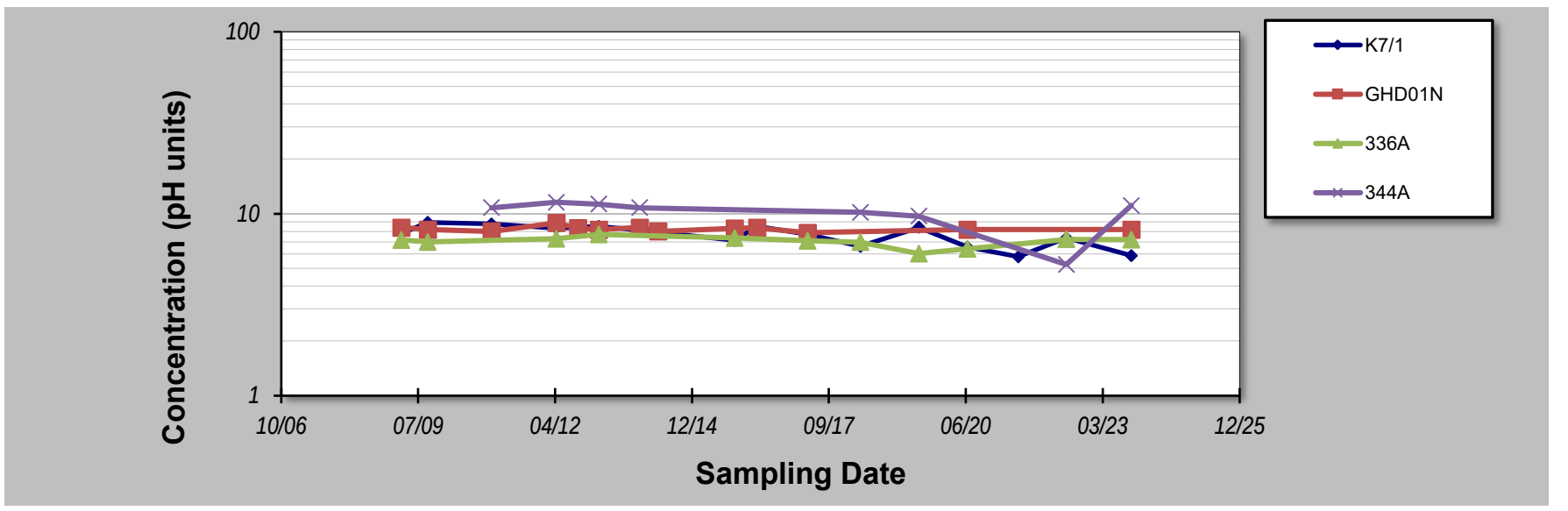
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **pH**
Concentration Units: **pH units**

Sampling Point ID:	K7/1	GHD01N	336A	344A			
Sampling Event	Sampling Date	PH CONCENTRATION (pH units)						
1	5-Mar-09	7.8	8.4	7.2				
2	14-Sep-09	9.0	8.2	7.0				
3	5-Mar-10							
4	24-Dec-10	8.8	8.0		10.8			
5	5-Mar-11							
6	14-Sep-11							
7	11-Apr-12	8.34	8.9	7.3	11.6			
8	14-Sep-12		8.3					
9	13-Feb-13	8.54	8.2	7.7	11.3			
10	9-Dec-13	8.11	8.4		10.8			
11	22-Apr-14		8.0					
12	9-Dec-14							
13	5-Mar-15							
14	2-Nov-15	7.13	8.3	7.36				
15	15-Apr-16	8.53	8.38					
16	2-Nov-16							
17	18-Apr-17	7.72	7.87	7.11				
18	2-Nov-17							
19	11-May-18	6.63		6.98	10.17			
20	2-Nov-18							
21	11-Jul-19	8.42		6.04	9.7			
22	1-Nov-19							
23	1-Jul-20	6.55	8.19	6.41				
24	1-Nov-20							
25	7-Jul-21	5.81						
26	23-Jun-22	7.35		7.23	5.26			
27	10-Oct-23	5.9	8.2	7.21	11.08			
28								
29								
30								
Coefficient of Variation:		**0.14**	**0.03**	**0.06**	**0.20**			
Mann-Kendall Statistic (S):		**-61**	**-20**	**-11**	**-13**			
Confidence Factor:		**99.9%**	**87.4%**	**77.7%**	**92.9%**			
Concentration Trend:		Decreasing	Stable	Stable	Prob. Decreasing			



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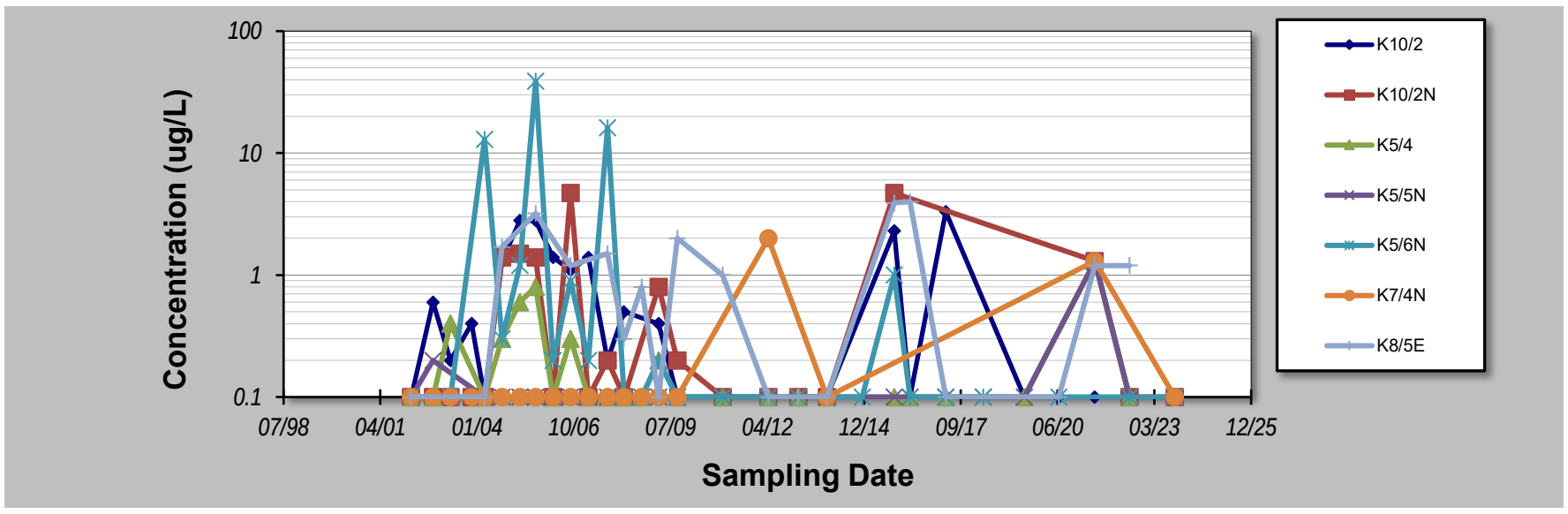
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Phenanthrene**
Concentration Units: **ug/L**

Sampling Point ID:	K10/2	K10/2N	K5/4	K5/5N	K5/6N	K7/4N	K8/5E
Sampling Event	Sampling Date	PHENANTHRENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2	14-Oct-02	0.6	0.1	0.1	0.2		0.1	
3	15-Apr-03	0.2	0.1	0.4		0.1	0.1	
4	17-Nov-03	0.4	0.1				0.1	
5	31-Mar-04	0.1	0.1	0.1	0.1	13	0.1	0.1
6	27-Sep-04	1.3	1.4	0.3	0.1	0.3	0.1	1.7
7	31-Mar-05	2.8	1.5	0.6	0.1	1.2	0.1	
8	12-Sep-05	2.8	1.4	0.8	0.1	38.9	0.1	3.2
9	9-Mar-06	1.4	0.1	0.1	0.1	0.2	0.1	
10	6-Sep-06	1.1	4.7	0.3	0.1	0.9	0.1	1.2
11	9-Mar-07	1.4	0.1	0.1	0.1	0.2	0.1	
12	22-Sep-07	0.2	0.2	0.1	0.1	16.2	0.1	1.5
13	11-Mar-08	0.5	0.1	0.1	-	0.1	0.1	0.3
14	10-Sep-08			0.1	0.1	0.1	0.1	0.8
15	5-Mar-09	0.4	0.8	0.2	0.1	0.2	0.1	0.1
16	14-Sep-09	0.1	0.2	0.1	0.1	0.1	0.1	2
17	5-Mar-10							
18	24-Dec-10		0.1	0.1	0.1	0.1		1
19	5-Mar-11							
20	14-Sep-11							
21	11-Apr-12	0.1	0.1	0.1	0.1	0.1	2	0.1
22	14-Sep-12							
23	13-Feb-13	0.1	0.1	0.1	0.1	0.1		0.1
24	9-Dec-13	0.1	0.1	0.1	0.1		0.1	0.1
25	22-Apr-14							
26	9-Dec-14					0.1		
27	5-Mar-15							
28	2-Nov-15	2.3	4.7	0.1	0.1	1		3.9
29	15-Apr-16	0.1		0.1	0.1	0.1		4
30	2-Nov-16							
31	18-Apr-17	3.3		0.1	0.1	0.1		0.1
32	2-Nov-17							
33	11-May-18				0.1	0.1		
34	11-Jul-19	0.1		0.1	0.1			
35	1-Nov-19							
36	1-Jul-20	0.1				0.1		0.1
37	1-Nov-20							
38	7-Jul-21	0.1	1.3	1.3	1.3		1.3	1.2
39	01-Jul-22	0.1	0.1	0.1	0.1	0.1		1.2
40	12-Oct-23	0.1	0.1			0.1	0.1	
Coefficient of Variation:		1.30	1.75	1.25	1.59	2.89	1.92	1.12
Mann-Kendall Statistic (S):		-83	5	-44	1	-100	29	-1
Confidence Factor:		96.5%	54.2%	84.1%	50.0%	99.0%	81.6%	50.0%
Concentration Trend:		Decreasing	No Trend	No Trend	No Trend	Decreasing	No Trend	No Trend



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

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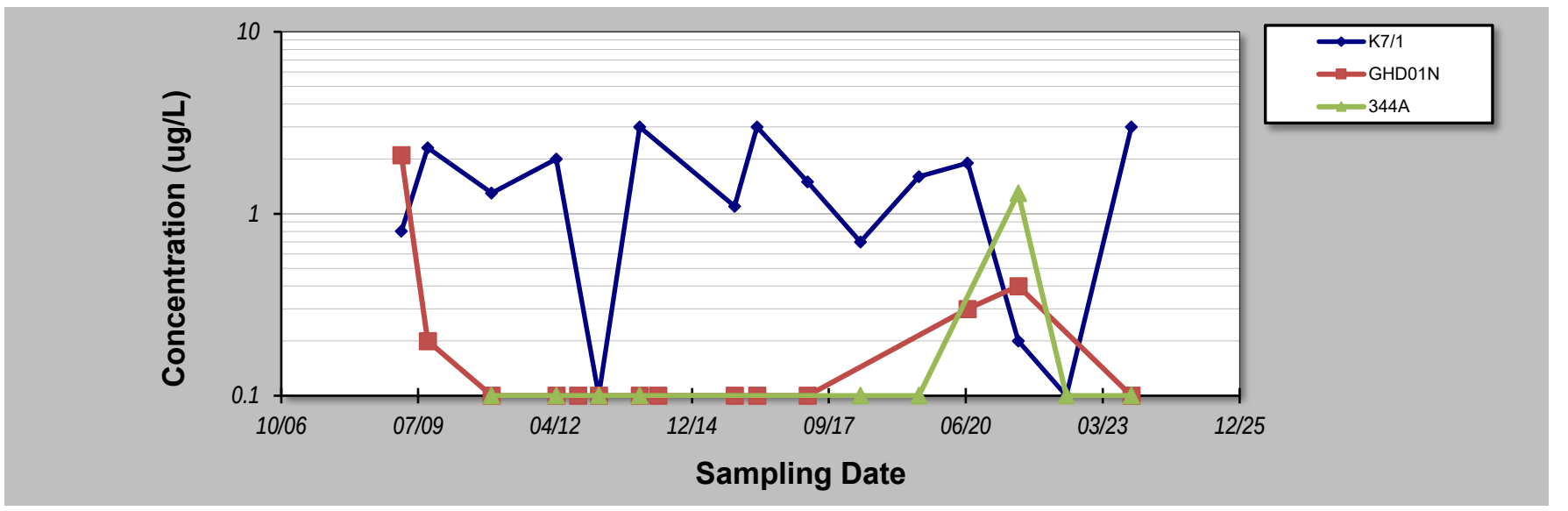
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Phenanthrene**
Concentration Units: **ug/L**

Sampling Point ID:	K7/1	GHD01N	344A				

Sampling Event	Sampling Date	PHENANTHRENE CONCENTRATION (ug/L)						
1	5-Mar-09	0.8	2.1					
2	14-Sep-09	2.3	0.2					
3	5-Mar-10							
4	24-Dec-10	1.3	0.1	0.1				
5	5-Mar-11							
6	14-Sep-11							
7	11-Apr-12	2	0.1	0.1				
8	14-Sep-12		0.1					
9	13-Feb-13	0.1	0.1	0.1				
10	9-Dec-13	3	0.1	0.1				
11	22-Apr-14		0.1					
12	9-Dec-14							
13	5-Mar-15							
14	2-Nov-15	1.1	0.1					
15	15-Apr-16	3	0.1					
16	2-Nov-16							
17	18-Apr-17	1.5	0.1					
18	2-Nov-17							
19	11-May-18	0.7		0.1				
20	2-Nov-18							
21	11-Jul-19	1.6		0.1				
22	1-Nov-19							
23	1-Jul-20	1.9	0.3					
24	1-Nov-20							
25	7-Jul-21	0.2	0.4	1.3				
26	23-Jun-22	0.1		0.1				
27	10-Oct-23	3	0.1	0.1				
28								
29								
30								
Coefficient of Variation:		0.68	1.86	1.71				
Mann-Kendall Statistic (S):		-5	-4	4				
Confidence Factor:		57.7%	56.4%	61.9%				
Concentration Trend:		Stable	No Trend	No Trend				



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
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3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

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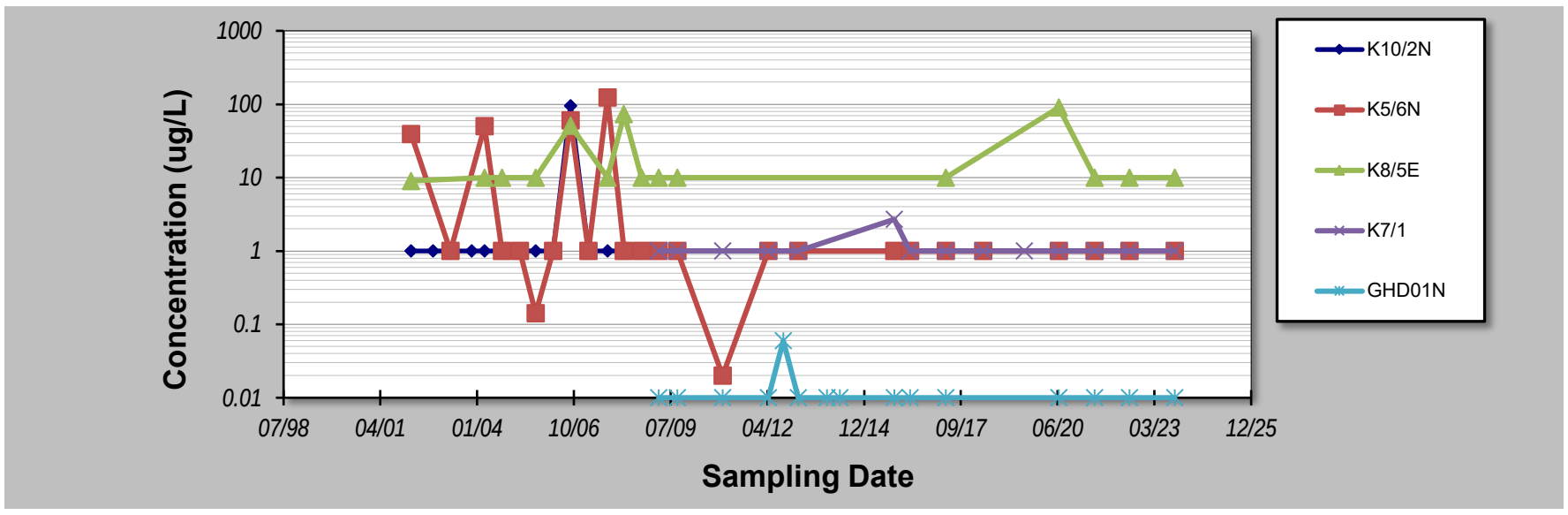
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Phenols**
Concentration Units: **ug/L**

Sampling Point ID:	K10/2N	K5/6N	K8/5E	K7/1	GHD01N		
Sampling Event	Sampling Date	PHENOLS CONCENTRATION (ug/L)						
1	4-Mar-02	1	39	9				
2	14-Oct-02	1						
3	15-Apr-03	1	1					
4	17-Nov-03	1						
5	31-Mar-04	1	50	10				
6	27-Sep-04	1	1	10				
7	31-Mar-05	1	1					
8	12-Sep-05	1	0.141	10				
9	9-Mar-06	1	1					
10	6-Sep-06	95	60	51				
11	9-Mar-07	1	1					
12	22-Sep-07	1	123	10				
13	11-Mar-08	1	1	73				
14	10-Sep-08		1	10				
15	5-Mar-09	1	1	10	1	0.01		
16	14-Sep-09	1	1	10	1	0.01		
17	5-Mar-10							
18	24-Dec-10		0.02		1	0.01		
19	5-Mar-11							
20	14-Sep-11							
21	11-Apr-12		1		1	0.01		
22	14-Sep-12					0.06		
23	13-Feb-13		1		1	0.01		
24	9-Dec-13					0.01		
25	22-Apr-14					0.01		
26	2-Nov-15	-	1	-	2.7	0.01		
27	15-Apr-16		1	-	1	0.01		
28	2-Nov-16							
29	18-Apr-17		1	10	1	0.01		
30	2-Nov-17							
31	11-May-18		1		1			
32	2-Nov-18							
33	11-Jul-19				1			
34	1-Nov-19							
35	1-Jul-20		1	90	1	0.01		
36	1-Nov-20							
37	7-Jul-21	1	1	10	1	0.01		
38	1-Jul-22	1	1	10	1	0.01		
39	12-Oct-23		1	10	1	0.01		
40								
Coefficient of Variation:		3.49	2.44	1.19	0.41	0.97		
Mann-Kendall Statistic (S):		2	-41	14	-3	-6		
Confidence Factor:		51.6%	82.3%	73.7%	54.3%	59.6%		
Concentration Trend:		No Trend	No Trend	No Trend	Stable	Stable		



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
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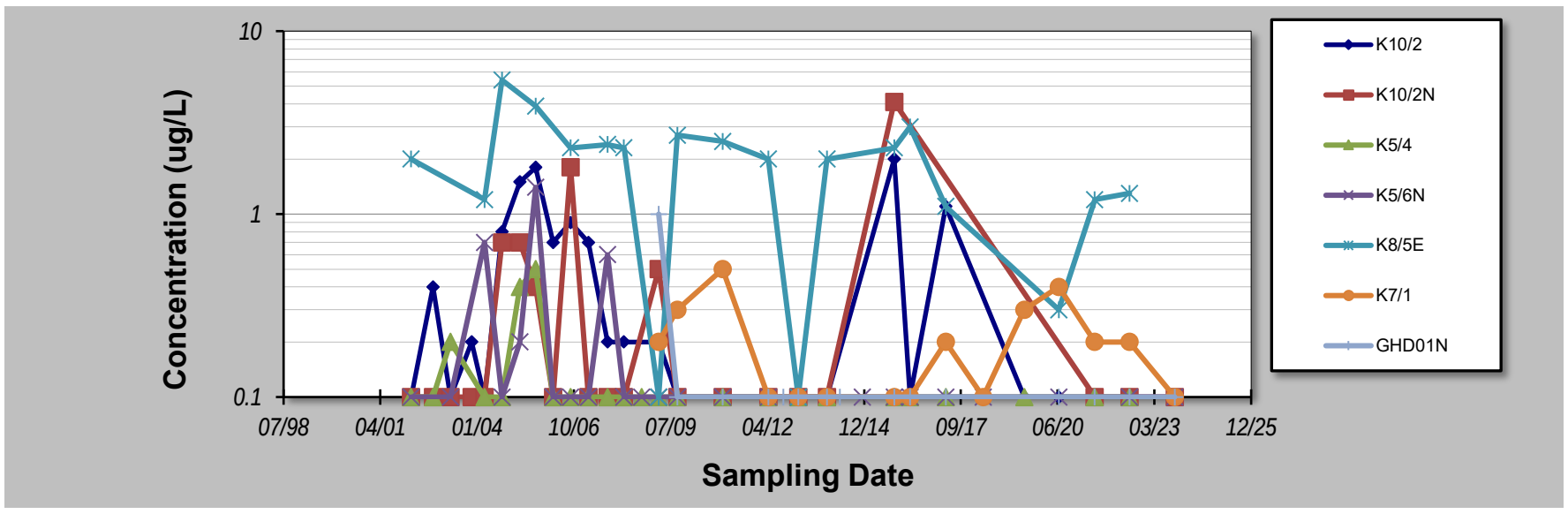
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Pyrene**
Concentration Units: **ug/L**

Sampling Point ID:	K10/2	K10/2N	K5/4	K5/6N	K8/5E	K7/1	GHD01N
Sampling Event	Sampling Date	PYRENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1	0.1	0.1	2		
2	14-Oct-02	0.4	0.1	0.1				
3	15-Apr-03	0.1	0.1	0.2	0.1			
4	17-Nov-03	0.2	0.1					
5	31-Mar-04	0.1	0.1	0.1	0.7	1.2		
6	27-Sep-04	0.8	0.7	0.1	0.1	5.4		
7	31-Mar-05	1.5	0.7	0.4	0.2			
8	12-Sep-05	1.8	0.4	0.5	1.4	3.9		
9	9-Mar-06	0.7	0.1	0.1	0.1			
10	6-Sep-06	0.9	1.8	0.1	0.1	2.3		
11	9-Mar-07	0.7	0.1	0.1	0.1			
12	22-Sep-07	0.2	0.1	0.1	0.6	2.4		
13	11-Mar-08	0.2	0.1	0.1	0.1	2.3		
14	10-Sep-08			0.1	0.1	0.6		
15	5-Mar-09	0.2	0.5	0.1	0.1	0.1	0.2	1
16	14-Sep-09	0.1	0.1	0.1	0.1	2.7	0.3	0.1
17	5-Mar-10							
18	24-Dec-10		0.1	0.1	0.1	2.5	0.5	0.1
19	5-Mar-11							
20	14-Sep-11							
21	11-Apr-12	0.1	0.1	0.1	0.1	2	0.1	0.1
22	14-Sep-12							0.1
23	13-Feb-13	0.1	0.1	0.1	0.1	0.1	0.1	0.1
24	9-Dec-13	0.1	0.1	0.1		2	0.1	0.1
25	22-Apr-14							0.1
26	9-Dec-14				0.1			
27	5-Mar-15							
28	2-Nov-15	2	4.1	0.1	0.1	2.3	0.1	0.1
29	15-Apr-16	0.1		0.1	0.1	3	0.1	0.1
30	2-Nov-16							
31	18-Apr-17	1.1		0.1	0.1	1.1	0.2	0.1
32	11-May-18				0.1		0.1	
33	2-Nov-18							
34	11-Jul-19	0.1		0.1			0.3	
35	1-Nov-19							
36	1-Jul-20	0.1			0.1	0.3	0.4	0.1
37	1-Nov-20							
38	7-Jul-21	0.1	0.1	0.1		1.2	0.2	0.1
39	01-Jul-22	0.1	0.1	0.1	0.1	1.3	0.2	0.1
40	12-Oct-23	0.1	0.1		0.1		0.1	0.1
Coefficient of Variation:		1.23	2.06	0.75	1.46	0.64	0.63	1.45
Mann-Kendall Statistic (S):		-76	-10	-43	-56	-48	-1	-14
Confidence Factor:		95.1%	59.3%	83.5%	89.9%	95.0%	50.0%	73.7%
Concentration Trend:		Decreasing	No Trend	Stable	No Trend	Prob. Decreasing	Stable	No Trend



Notes:

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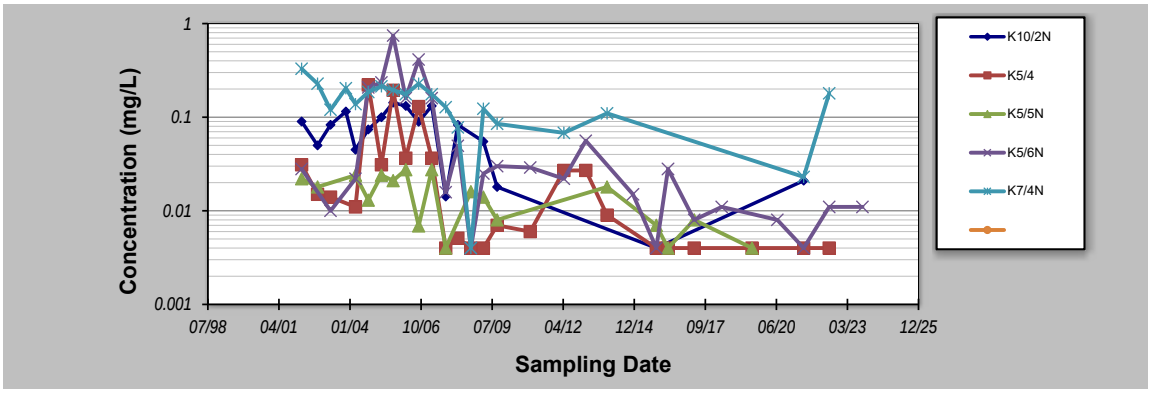
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: 21-Nov-23
Facility Name: KIWEF
Conducted By: Laisly Brito

Job ID: 12568155
Constituent: Total Cyanide
Concentration Units: mg/L

Sampling Point ID:	K10/2N	K5/4	K5/5N	K5/6N	K7/4N		K8/5E
Sampling Event	Sampling Date	TOTAL CYANIDE CONCENTRATION (mg/L)						
1	4-Mar-02	0.09	0.031	0.022	0.028	0.329		0.099
2	14-Oct-02	0.05	0.015	0.018		0.228		
3	15-Apr-03	0.083	0.014		0.01	0.12		
4	17-Nov-03	0.115				0.204		
5	31-Mar-04	0.045	0.011	0.024	0.022	0.138		0.006
6	27-Sep-04	0.074	0.221	0.013	0.208	0.186		0.205
7	31-Mar-05	0.1	0.031	0.024	0.235	0.214		
8	12-Sep-05	0.143	0.194	0.021	0.745	0.195		0.198
9	9-Mar-06	0.132	0.0365	0.0275	0.16	0.176		
10	6-Sep-06	0.0895	0.13	0.0069	0.413	0.228		0.0989
11	9-Mar-07	0.132	0.0365	0.0275	0.16	0.176		
12	22-Sep-07	0.0142	0.004	0.004	0.0158	0.128		0.028
13	11-Mar-08	0.0828	0.0051		0.0495	0.0777		0.0432
14	10-Sep-08		0.004	0.016	0.004	0.004		0.016
15	5-Mar-09	0.055	0.004	0.014	0.025	0.123		0.096
16	14-Sep-09	0.018	0.007	0.008	0.03	0.085		0.066
17	5-Mar-10							
18	24-Dec-10		0.006		0.029			0.054
19	5-Mar-11							
20	14-Sep-11							
21	11-Apr-12		0.027		0.022	0.068		0.065
22	14-Sep-12							
23	13-Feb-13		0.027		0.056			0.081
24	9-Dec-13		0.009	0.018		0.11		0.031
25	22-Apr-14							
26	9-Dec-14				0.015			
27	5-Mar-15							
28	2-Nov-15	0.004	0.004	0.007	0.004			0.072
29	15-Apr-16		0.004	0.004	0.028			0.12
30	2-Nov-16							
31	18-Apr-17		0.004	0.008	0.008			0.021
32	11-May-18				0.011			
33	2-Nov-18							
34	11-Jul-19		0.004	0.004				
35	1-Nov-19							
36	1-Jul-20				0.008			0.004
37	1-Nov-20							
38	7-Jul-21	0.021	0.004		0.004	0.023		0.017
39	01-Jul-22	-	0.004	-	0.011	0.18		0.038
40	12-Oct-23				0.01	0.10		
Coefficient of Variation:		0.60	1.75	0.56	1.86	0.52		0.84
Mann-Kendall Statistic (S):		-39	-139	-66	-137	-76		-52
Confidence Factor:		94.1%	>99.9%	99.4%	99.9%	99.3%		95.1%
Concentration Trend:		Prob. Decreasing	Decreasing	Decreasing	Decreasing	Decreasing		Decreasing



Notes:

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2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
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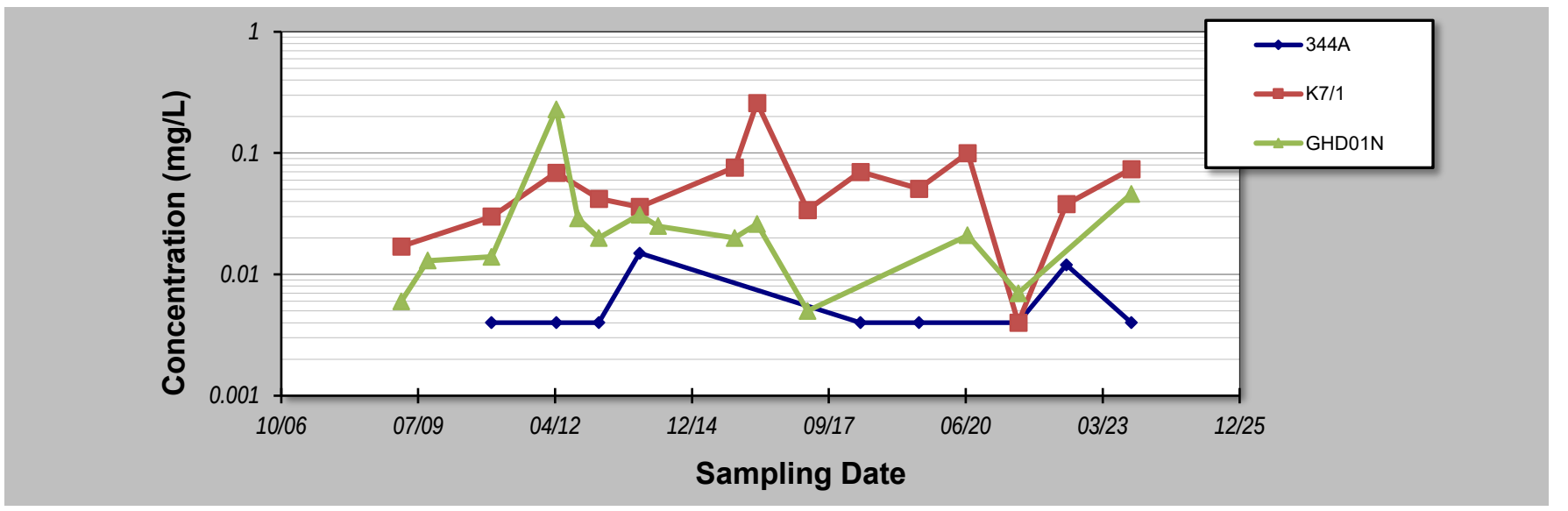
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Total Cyanide**
Concentration Units: **mg/L**

Sampling Point ID:	K7/1	GHD01N	344A				
Sampling Event	Sampling Date	TOTAL CYANIDE CONCENTRATION (mg/L)						
1	5-Mar-09	0.017	0.006					
2	14-Sep-09	0.053	0.013					
3	5-Mar-10							
4	24-Dec-10	0.03	0.014	0.004				
5	5-Mar-11							
6	14-Sep-11							
7	11-Apr-12	0.069	0.23	0.004				
8	14-Sep-12		0.029					
9	13-Feb-13	0.042	0.02	0.004				
10	9-Dec-13	0.036	0.031	0.015				
11	22-Apr-14		0.025					
12	9-Dec-14							
13	5-Mar-15							
14	2-Nov-15	0.076	0.02					
15	15-Apr-16	0.26	0.026					
16	2-Nov-16							
17	18-Apr-17	0.034	0.005					
18	2-Nov-17							
19	11-May-18	0.07		0.004				
20	2-Nov-18							
21	11-Jul-19	0.051		0.004				
22	1-Nov-19							
23	1-Jul-20	0.1	0.021					
24	1-Nov-20							
25	7-Jul-21	0.004	0.007	0.004				
26	23-Jun-22	0.038		0.012				
27	10-Oct-23	0.07	0.05	0.00				
28								
29								
30								
Coefficient of Variation:		0.96	1.62	0.70				
Mann-Kendall Statistic (S):		7	10	3				
Confidence Factor:		62.6%	68.6%	58.0%				
Concentration Trend:		No Trend	No Trend	No Trend				



Notes:

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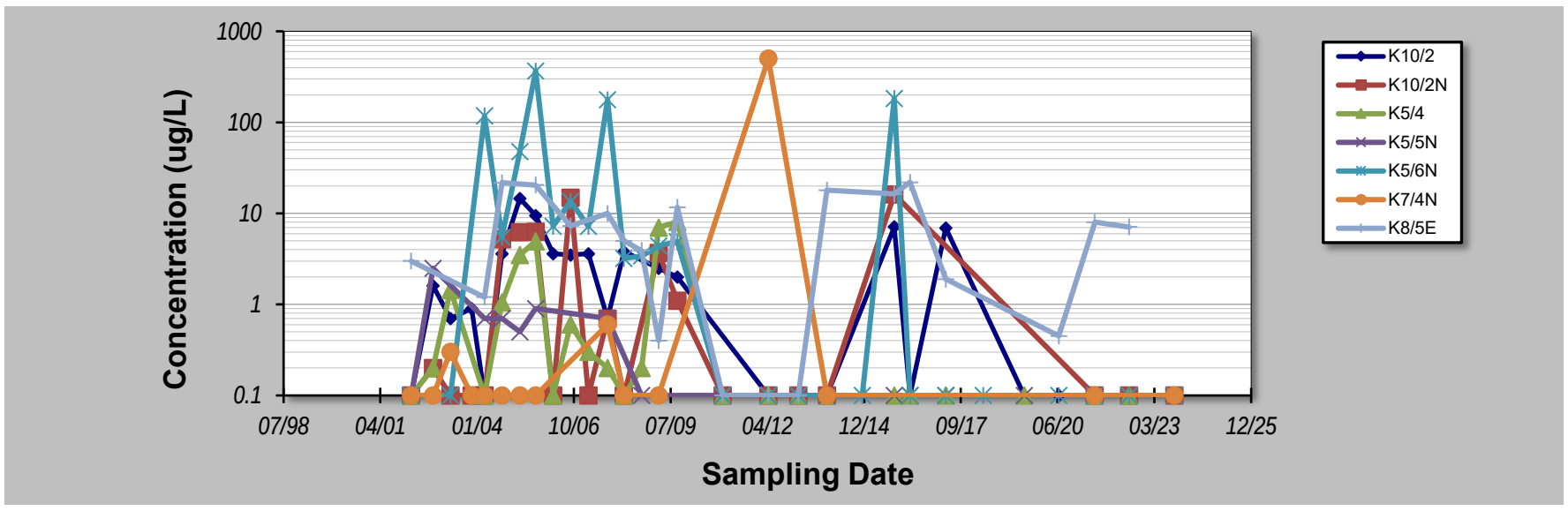
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Total PAHs**
Concentration Units: **ug/L**

Sampling Point ID:	K10/2	K10/2N	K5/4	K5/5N	K5/6N	K7/4N	K8/5E
Sampling Event	Sampling Date	TOTAL PAHS CONCENTRATION (ug/L)						
1	4-Mar-02	0.10	0.10	0.10	0.10	0.10	0.1	3.00
2	14-Oct-02	1.60	0.20	0.20	2.50		0.10	
3	15-Apr-03	0.70	0.10	1.44		0.10	0.30	
4	17-Nov-03	0.90	0.10				0.1	
5	31-Mar-04	0.10	0.10	0.10	0.70	117.10	0.1	1.20
6	27-Sep-04	3.60	5.18	1.05	0.70	5.50	0.1	21.68
7	31-Mar-05	14.57	6.23	3.50	0.50	47.60	0.10	-
8	12-Sep-05	9.47	6.28	4.95	0.90	366.80	0.10	20.50
9	9-Mar-06	3.60	0.10	0.10	-	7.20	-	-
10	6-Sep-06	3.5	14.91	0.60	-	13.50	-	7.30
11	9-Mar-07	3.60	0.1	0.3	-	7.2	-	-
12	22-Sep-07	0.70	0.7	0.2	0.7	178	0.6	10
13	11-Mar-08	3.8	0.1	0.10	-	3.2	0.1	5
14	10-Sep-08			0.2	0.1	3.4	-	3.9
15	5-Mar-09	2.5	3.68	7	-	4.4	0.1	0.4
16	14-Sep-09	2.0	1.1	8.1	0.0	4.9	0.0	11.7
17	5-Mar-10							
18	24-Dec-10		0.10	0.10	0.1	0.1		0.1
19	5-Mar-11							
20	14-Sep-11							
21	11-Apr-12	0.10	0.10	0.10	0.1	0.1	501.2	0.1
22	14-Sep-12							
23	13-Feb-13	0.10	0.10	0.10	0.1	0.1		0.1
24	9-Dec-13	0.10	0.10	0.10	0.1		0.1	18
25	22-Apr-14							
26	9-Dec-14					0.1		
27	5-Mar-15							
28	2-Nov-15	7.1	16.2	0.10	0.1	182		16.4
29	15-Apr-16	0.10		0.10	0.1	0.1		22
30	2-Nov-16							
31	18-Apr-17	6.9		0.10	0.1	0.1		1.9
32	2-Nov-17							
33	11-May-18					0.1		
34	11-Jul-19	0.10		0.10	0.1			
35	1-Nov-19							
36	1-Jul-20	0.10				0.1		0.45
37	1-Nov-20							
38	7-Jul-21	0.10	0.10	0.10	0.1	0.1	0.1	8
39	27-Jun-22	0.1	0.1	0.1	0.1	0.1		7.1
40	9-Oct-23	0.1	0.1			0.1	0.1	
Coefficient of Variation:		1.41	1.90	1.95	1.55	2.35	3.98	0.99
Mann-Kendall Statistic (S):		-78	-18	-88	-62	-124	-4	-13
Confidence Factor:		95.5%	67.2%	97.9%	98.5%	99.7%	55.3%	65.0%
Concentration Trend:		Decreasing	No Trend	Decreasing	Decreasing	Decreasing	No Trend	Stable



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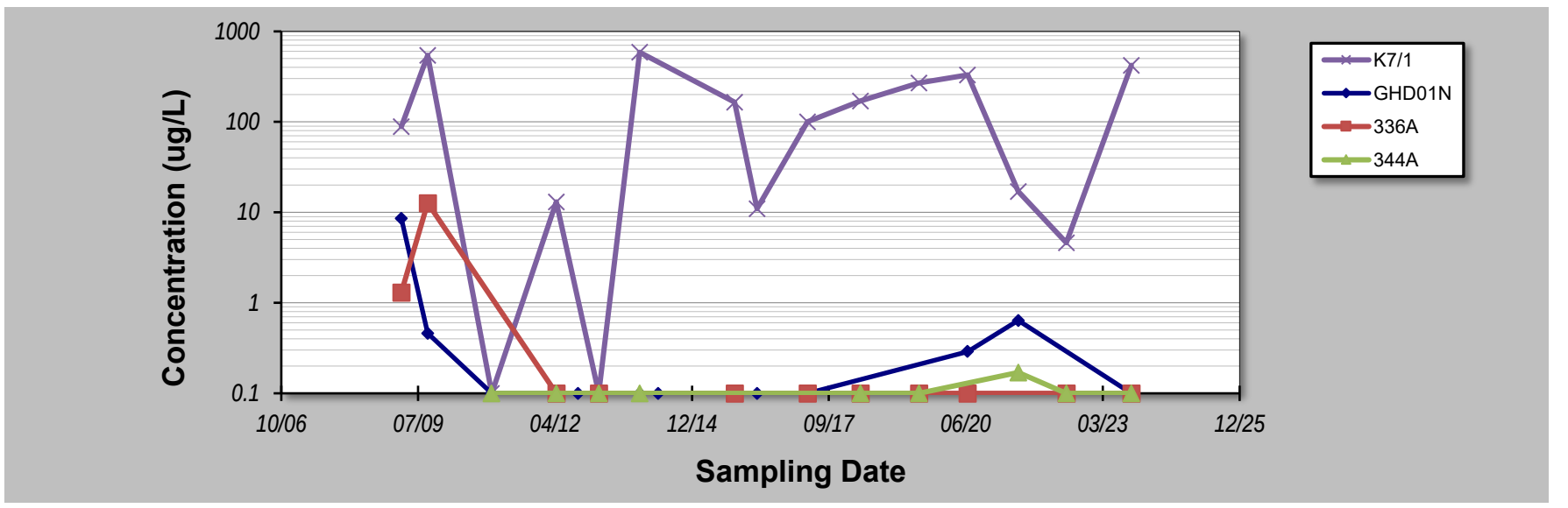
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Total PAHs**
Concentration Units: **ug/L**

Sampling Point ID:	K7/1	GHD01N	336A	344A			

Sampling Event	Sampling Date	TOTAL PAHS CONCENTRATION (ug/L)						
1	5-Mar-09	88.3	8.59	1.3				
2	14-Sep-09	545.4	0.5	12.7				
3	5-Mar-10							
4	24-Dec-10	0.1	0.1		0.1			
5	5-Mar-11							
6	14-Sep-11							
7	11-Apr-12	13	0.1	0.1	0.1			
8	14-Sep-12		0.1					
9	13-Feb-13	0.1	0.1	0.1	0.1			
10	9-Dec-13	588	0.1		0.1			
11	22-Apr-14		0.1					
12	9-Dec-14							
13	5-Mar-15							
14	2-Nov-15	165	0.1	0.1				
15	15-Apr-16	11	0.1					
16	2-Nov-16							
17	18-Apr-17	100	0.1	0.1				
18	2-Nov-17							
19	11-May-18	170		0.1	0.1			
20	2-Nov-18							
21	11-Jul-19	270		0.1	0.1			
22	1-Nov-19							
23	1-Jul-20	330	0.29	0.1				
24	1-Nov-20							
25	7-Jul-21	17	0.64		0.17			
26	23-Jun-22	4.6		0.1	0.1			
27	10-Oct-23	420.00	0.1	0.1	0.1			
28								
29								
30								
Coefficient of Variation:		1.12	2.87	2.79	0.22			
Mann-Kendall Statistic (S):		16	-6	-17	4			
Confidence Factor:		76.7%	60.6%	89.1%	61.9%			
Concentration Trend:		No Trend	No Trend	No Trend	No Trend			



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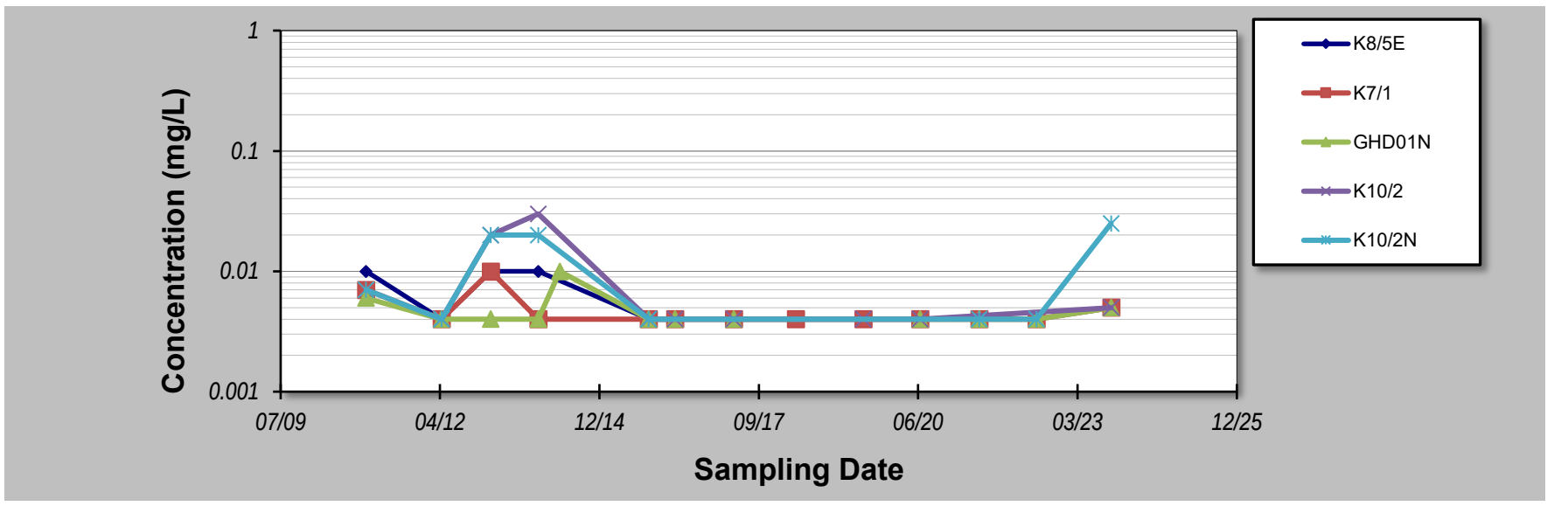
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Weak Acid Dissociable Cyanide**
Concentration Units: **mg/L**

Sampling Point ID:	K10/2	K10/2N	K8/5E	K7/1	GHD01N		
Sampling Event	Sampling Date	WEAK ACID DISSOCIABLE CYANIDE CONCENTRATION (mg/L)						
1	24-Dec-10		0.007	0.01	0.007	0.006		
2	5-Mar-11							
3	14-Sep-11							
4	11-Apr-12	0.004	0.004	0.004	0.004	0.004		
5	14-Sep-12							
6	13-Feb-13	0.02	0.02	0.01	0.01	0.004		
7	9-Dec-13	0.03	0.02	0.01	0.004	0.004		
8	22-Apr-14					0.01		
9	9-Dec-14							
10	5-Mar-15							
11	2-Nov-15	0.004	0.004	0.004	0.004	0.004		
12	15-Apr-16	0.004		0.004	0.004	0.004		
13	2-Nov-16							
14	18-Apr-17	0.004		0.004	0.004	0.004		
15	2-Nov-17							
16	11-May-18				0.004			
17	2-Nov-18							
18	11-Jul-19	0.004			0.004			
19	1-Nov-19							
20	1-Jul-20	0.004		0.004	0.004	0.004		
21	1-Nov-20							
22	7-Jul-21	-	0.004	0.004	0.004	0.004		
23	01-Jul-22	-	0.004	0.004	0.004	0.004		
24	12-Oct-23	0.01	0.03		0.005	0.005		
25								
Coefficient of Variation:		1.09	0.82	0.50	0.37	0.37		
Mann-Kendall Statistic (S):		-3	1	-17	-9	-4		
Confidence Factor:		58.0%	50.0%	92.2%	68.4%	58.0%		
Concentration Trend:		No Trend	No Trend	Prob. Decreasing	Stable	Stable		



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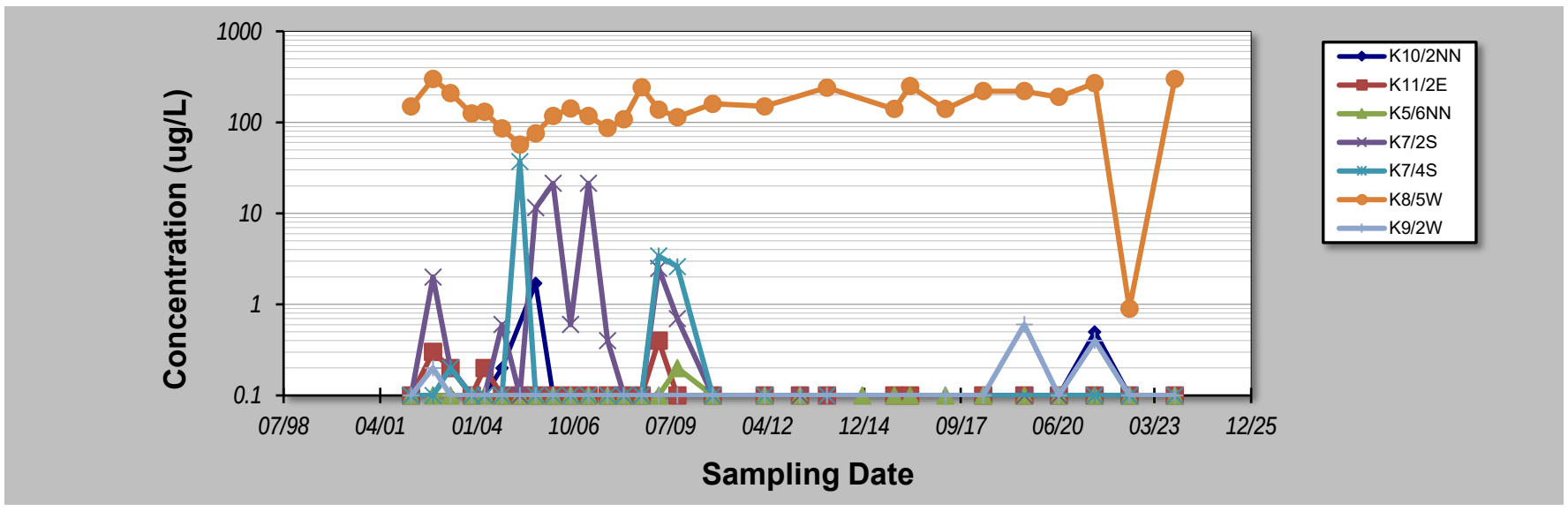
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Acenaphthene**
Concentration Units: **ug/L**

Sampling Point ID:	K10/2NN	K11/2E	K5/6NN	K7/2S	K7/4S	K8/5W	K9/2W
Sampling Event	Sampling Date	ACENAPHTHENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1	0.1	0.1	0.1	150	0.1
2	14-Oct-02	0.1	0.3	0.1	2	0.1	300	0.2
3	15-Apr-03	0.1	0.2	0.1	0.2	0.2	210	0.1
4	17-Nov-03	0.1	0.1	0.1	0.1	0.1	125	0.1
5	31-Mar-04	0.1	0.2	0.1	0.1	0.1	130	0.1
6	27-Sep-04	0.2	0.1	0.1	0.6	0.1	85.4	0.1
7	31-Mar-05		0.1	0.1	0.1	36.9	57.2	0.1
8	12-Sep-05	1.7	0.1	0.1	11.5	0.1	76	0.1
9	9-Mar-06	0.1	0.1	0.1	21.4	0.1	118	0.1
10	6-Sep-06	0.1	0.1	0.1	0.6	0.1	142	0.1
11	9-Mar-07	0.1	0.1	0.1	21.4	0.1	118	0.1
12	22-Sep-07	0.1	0.1	0.1	0.4	0.1	86.5	0.1
13	11-Mar-08	0.1	0.1	0.1	0.1	0.1	108	0.1
14	10-Sep-08		0.1	0.1	0.1	0.1	244	0.1
15	5-Mar-09	0.1	0.4	0.1	2.5	3.4	138	0.1
16	14-Sep-09	0.1	0.1	0.2	0.7	2.6	114	0.1
17	5-Mar-10							
18	14-Sep-10		0.1	0.1	0.1	0.1	160	0.1
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12		0.1	0.1		0.1	150	0.1
22	14-Sep-12							
23	5-Mar-13		0.1	0.1	0.1			0.1
24	9-Dec-13	0.1	0.1		0.1	0.1	240	0.1
25	22-Apr-14							
26	9-Dec-14			0.1				
27	5-Mar-15							
28	2-Nov-15	0.1	0.1	0.1			140	
29	15-Apr-16	0.1	0.1	0.1			250	-
30	2-Nov-16							
31	13-Apr-17			0.1			140	0.1
32	11-May-18	0.1	0.1	0.1			220	0.1
33	2-Nov-18							
34	11-Jul-19	0.1	0.1	0.1	0.1		220	0.6
35	1-Nov-19							
36	1-Jul-20	0.1	0.1	0.1	0.1		190	0.1
37	1-Nov-20							
38	7-Jul-21	0.5	0.1	0.1	0.1	0.1	270	0.4
39	01-Jul-22	0.1	0.1	0.1	0.1	0.1	0.9	0.1
40	12-Oct-23	0.1	0.1	0.1	0.1	0.1	300	0.1
Coefficient of Variation:	**1.78**	**0.56**	**0.18**	**2.39**	**3.84**	**0.46**	**0.83**
Mann-Kendall Statistic (S):	**-3**	**-65**	**2**	**-61**	**-10**	**95**	**17**
Confidence Factor:	**52.1%**	**89.6%**	**50.7%**	**93.1%**	**59.9%**	**96.9%**	**62.9%**
Concentration Trend:	No Trend	Stable	No Trend	Prob. Decreasing	No Trend	Increasing	No Trend



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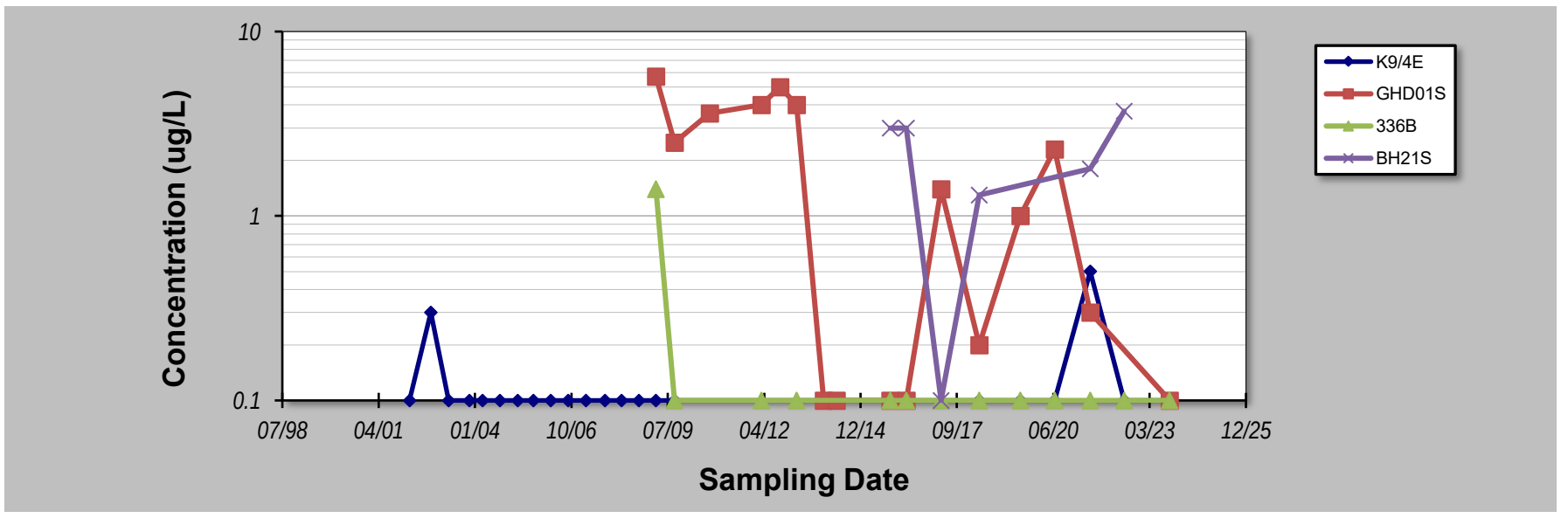
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Acenaphthene**
Concentration Units: **ug/L**

Sampling Point ID:	K9/4E	GHD01S	336B	BH21S			
Sampling Event	Sampling Date	ACENAPHTHENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1						
2	14-Oct-02	0.3						
3	15-Apr-03	0.1						
4	17-Nov-03	0.1						
5	31-Mar-04	0.1						
6	27-Sep-04	0.1						
7	31-Mar-05	0.1						
8	12-Sep-05	0.1						
9	9-Mar-06	0.1						
10	6-Sep-06	0.1						
11	9-Mar-07	0.1						
12	22-Sep-07	0.1						
13	11-Mar-08	0.1						
14	10-Sep-08	0.1						
15	5-Mar-09	0.1	5.7	1.4				
16	14-Sep-09	0.1	2.5	0.1				
17	5-Mar-10							
18	14-Sep-10		3.6					
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12		4	0.1				
22	14-Sep-12		5					
23	5-Mar-13		4	0.1				
24	9-Dec-13		0.1					
25	22-Apr-14		0.1					
26	9-Dec-14							
27	5-Mar-15							
28	2-Nov-15	0.1	0.1	0.1	3			
29	15-Apr-16	0.1	0.1	0.1	3			
30	2-Nov-16							
31	13-Apr-17	-	1.4	0.1	0.1			
32	11-May-18	0.1	0.2	0.1	1.3			
33	2-Nov-18							
34	11-Jul-19	0.1	1	0.1				
35	1-Nov-19							
36	1-Jul-20	0.1	2.3	0.1				
37	1-Nov-20							
38	7-Jul-21	0.5	0.3	0.1	1.8			
39	24-Jun-22	0.1		0.1	3.7			
40	10-Oct-23	0.1	0.1	0.1	4			
Coefficient of Variation:		**0.72**	**1.04**	**1.80**	**0.62**			
Mann-Kendall Statistic (S):		**-1**	**-43**	**-12**	**8**			
Confidence Factor:		**50.0%**	**97.1%**	**74.5%**	**89.8%**			
Concentration Trend:		Stable	Decreasing	No Trend	No Trend			



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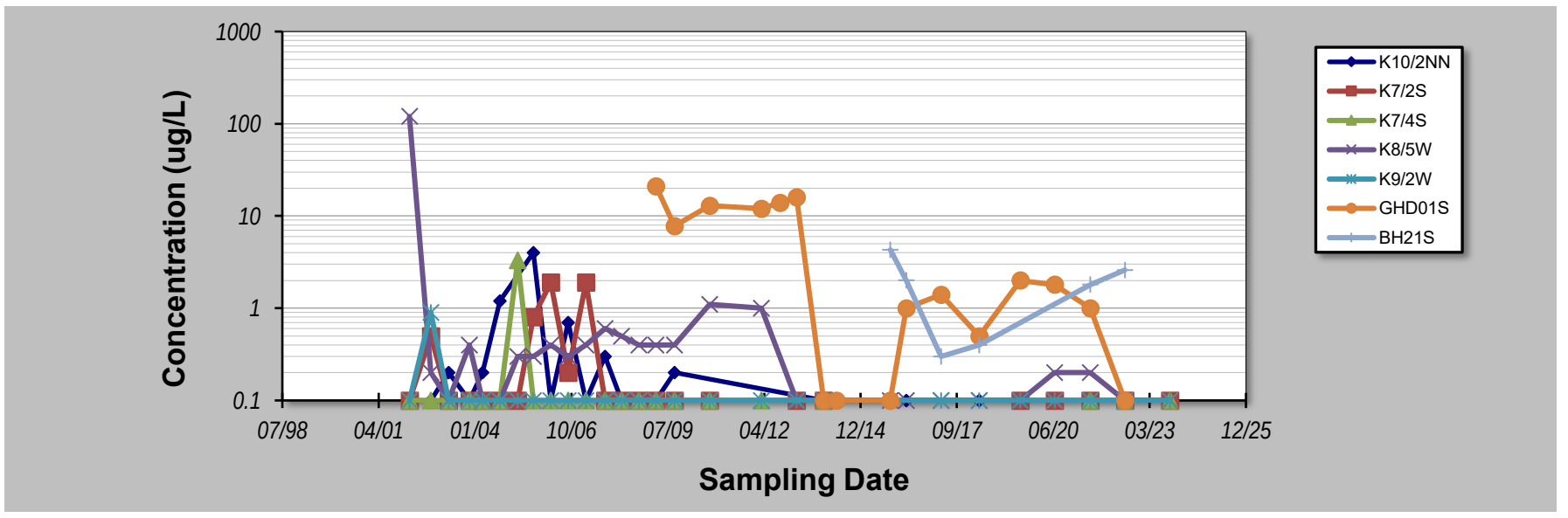
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Acenaphthylene**
Concentration Units: **ug/L**

Sampling Point ID:	K10/2NN	K7/2S	K7/4S	K8/5W	K9/2W	GHD01S	BH21S
Sampling Event	Sampling Date	ACENAPHTHYLENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1	0.1	120	0.1		
2	14-Oct-02	0.1	0.5	0.1	0.2	0.9		
3	15-Apr-03	0.2	0.1	0.1	0.1	0.1		
4	17-Nov-03	0.1	0.1	0.1	0.4	0.1		
5	31-Mar-04	0.2	0.1	0.1	0.1	0.1		
6	27-Sep-04	1.2	0.1	0.1	0.1	0.1		
7	31-Mar-05		0.1	3.3	0.3	0.1		
8	12-Sep-05	4	0.8	0.1	0.3	0.1		
9	9-Mar-06	0.1	1.9	0.1	0.4	0.1		
10	6-Sep-06	0.7	0.2	0.1	0.3	0.1		
11	9-Mar-07	0.1	1.9	0.1	0.4	0.1		
12	22-Sep-07	0.3	0.1	0.1	0.6	0.1		
13	11-Mar-08	0.1	0.1	0.1	0.5	0.1		
14	10-Sep-08		0.1	0.1	0.4	0.1		
15	5-Mar-09	0.1	0.1	0.1	0.4	0.1	21.1	
16	14-Sep-09	0.2	0.1	0.1	0.4	0.1	7.8	
17	5-Mar-10							
18	14-Sep-10		0.1	0.1	1.1	0.1	13	
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12			0.1	1	0.1	12	
22	14-Sep-12						14	
23	5-Mar-13		0.1		0.1	0.1	16	
24	9-Dec-13	0.1	0.1	0.1	0.1	0.1	0.1	
25	22-Apr-14						0.1	
26	9-Dec-14							
27	5-Mar-15							
28	2-Nov-15	0.1			0.1		0.1	4.3
29	15-Apr-16	0.1			0.1	-	1	2
30	2-Nov-16							
31	13-Apr-17				0.1	0.1	1.4	0.3
32	2-Nov-17							
33	11-May-18	0.1			0.1	0.1	0.5	0.4
34	11-Jul-19	0.1	0.1		0.1	0.1	2	
35	1-Nov-19							
36	1-Jul-20	0.1	0.1		0.2	0.1	1.8	
37	1-Nov-20							
38	7-Jul-21	0.1	0.1	0.1	0.2	0.1	1	1.8
39	01-Jul-22	0.1	0.1	0.1	0.1	0.1	0.1	2.6
40	12-Oct-23	0.1	0.1	0.1	0.1	0.1		2
Coefficient of Variation:		2.28	1.73	2.78	5.02	1.19	1.23	0.78
Mann-Kendall Statistic (S):		-58	-42	-9	-83	-24	-43	5
Confidence Factor:		93.4%	84.4%	58.8%	93.8%	68.3%	97.1%	76.5%
Concentration Trend:		Prob. Decreasing	No Trend	No Trend	Prob. Decreasing	No Trend	Decreasing	No Trend



Notes:

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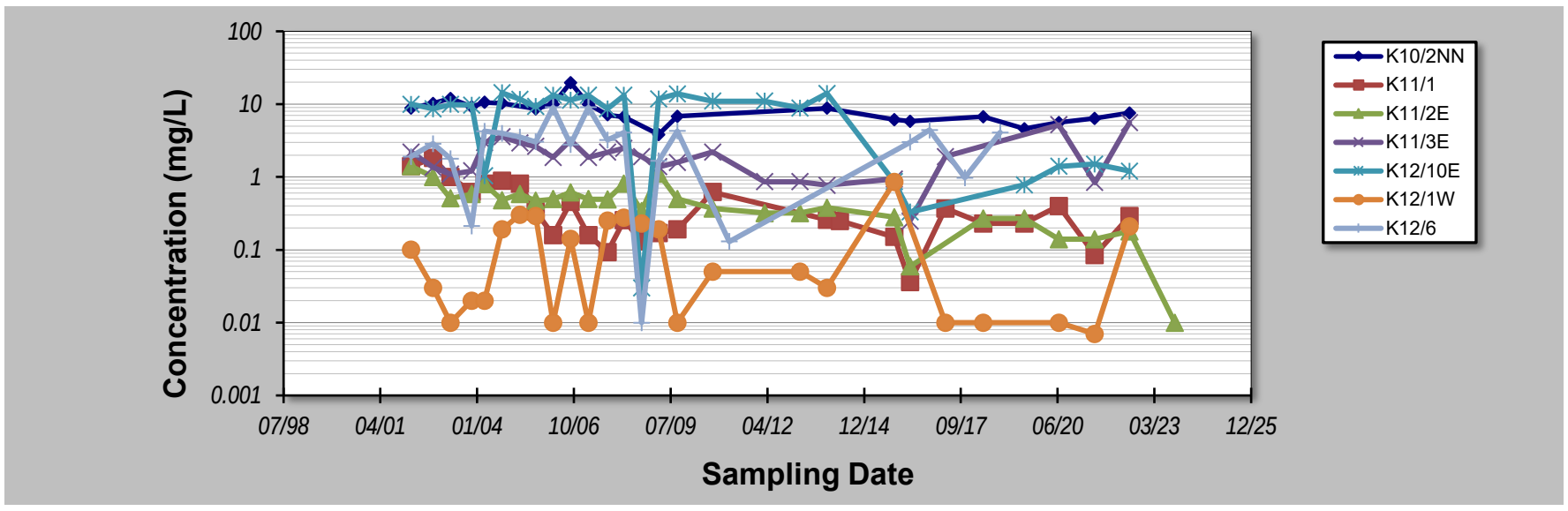
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Ammonia**
Concentration Units: **mg/L**

Sampling Point ID:	K10/2NN	K11/1	K11/2E	K11/3E	K12/10E	K12/1W	K12/6
Sampling Event	Sampling Date	AMMONIA CONCENTRATION (mg/L)						
1	4-Mar-02	8.9	1.4	1.4	2.2	10	0.1	1.9
2	14-Oct-02	10.2	1.82	1	1.35	8.6	0.03	2.87
3	15-Apr-03	12	1	0.51	1.09	9.89	0.01	1.78
4	17-Nov-03	9.24	0.62	0.58	1.21	9.7	0.02	0.213
5	31-Mar-04	10.6	0.81	0.8	2.98	1.04	0.02	4.25
6	27-Sep-04	10.3	0.89	0.48	3.58	14.3	0.19	3.99
7	31-Mar-05		0.805	0.585	2.95	11.7	0.304	3.53
8	12-Sep-05	8.61	0.336	0.47	2.63	9.29	0.292	3.04
9	9-Mar-06	9.97	0.159	0.497	1.85	13.2	0.01	9.02
10	6-Sep-06	19.7	0.453	0.614	3.19	11.4	0.142	2.79
11	9-Mar-07	9.97	0.159	0.497	1.85	13.2	0.01	9.02
12	22-Sep-07	7.14	0.093	0.495	2.19	8.63	0.252	3.23
13	11-Mar-08	6.68	0.255	0.812	2.48	13.2	0.277	4.1
14	10-Sep-08		0.13	0.34	1.91	0.03	0.23	0.01
15	5-Mar-09	3.84	0.17	1.11	1.38	11.8	0.19	1.66
16	14-Sep-09	6.83	0.19	0.5	1.58	13.9	0.01	4.28
17	5-Mar-10							
18	14-Sep-10		0.62	0.37	2.2	11	0.05	
19	5-Mar-11							0.13
20	14-Sep-11							
21	5-Mar-12			0.32	0.86	11		
22	14-Sep-12							
23	5-Mar-13			0.32	0.86	8.9	0.05	
24	9-Dec-13	8.8	0.26	0.38	0.77	14	0.03	
25	22-Apr-14		0.25					
26	2-Nov-15	6.15	0.15	0.28	0.94	0.86	0.85	
27	15-Apr-16	5.8	0.036	0.059	0.25	0.33		3
28	2-Nov-16							4.4
29	13-Apr-17		0.37		1.9		0.01	
30	2-Nov-17							0.98
31	11-May-18	6.7	0.23	0.27			0.01	
32	2-Nov-18							4.1
33	11-Jul-19	4.6	0.23	0.27		0.78		
34	1-Nov-19							
35	1-Jul-20	5.6	0.4	0.14	5.2	1.4	0.01	
36	1-Nov-20							
37	7-Jul-21	6.4	0.085	0.14	0.84	1.5	0.007	
38	01-Jul-22	7.6	0.29	0.18	5.6	1.2	0.21	
39	12-Oct-23	5.5	0.05	0.01	1.7		0.05	
40								
Coefficient of Variation:		0.39	0.95	0.66	0.62	0.64	1.38	0.73
Mann-Kendall Statistic (S):		-98	-117	-256	-36	-65	-14	10
Confidence Factor:		99.8%	99.3%	>99.9%	77.8%	92.0%	61.8%	60.6%
Concentration Trend:		Decreasing	Decreasing	Decreasing	Stable	Prob. Decreasing	No Trend	No Trend



Notes:

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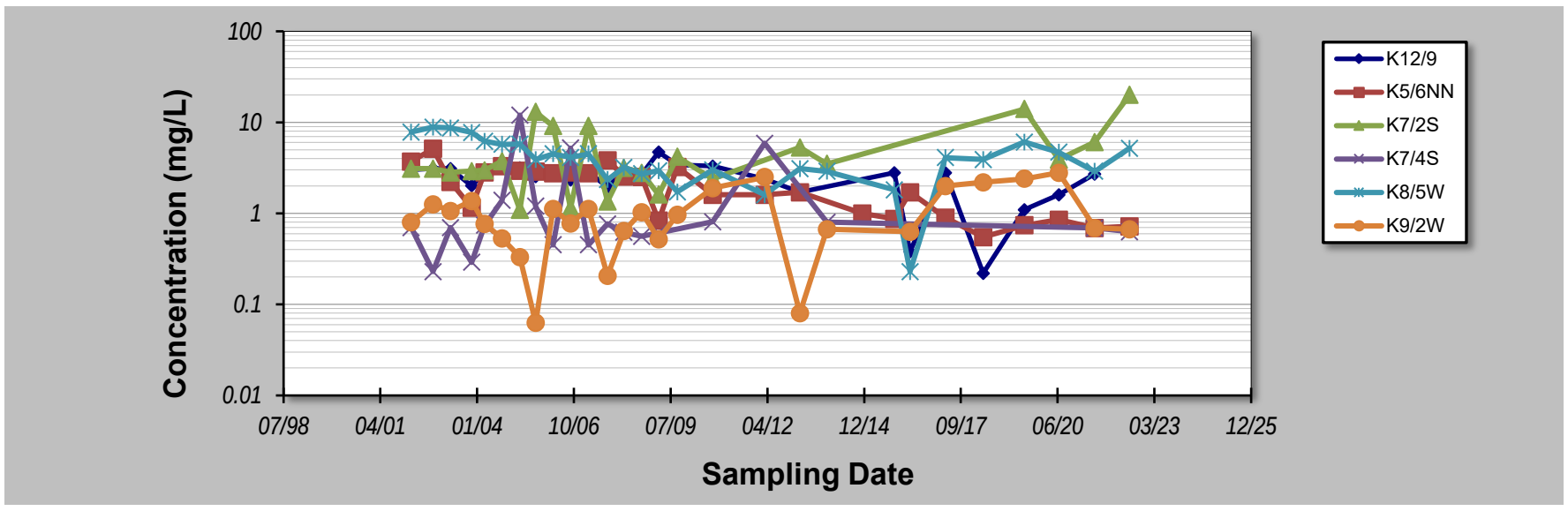
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Ammonia**
Concentration Units: **mg/L**

Sampling Point ID:	K12/7	K12/9	K5/6NN	K7/2S	K7/4S	K8/5W	K9/2W
Sampling Event	Sampling Date	AMMONIA CONCENTRATION (mg/L)						
1	4-Mar-02	3	3	3.7	3.1	0.7	7.8	0.8
2	14-Oct-02	2.61	3.1	5.11	3.11	0.23	8.87	1.26
3	15-Apr-03	1.13	3.1	2.21	2.83	0.7	8.66	1.06
4	17-Nov-03	2.78	2.01	1.16	2.91	0.29	7.75	1.37
5	31-Mar-04	3.1	2.84	2.83	2.98	0.74	6.21	0.77
6	27-Sep-04	7.53	3.47	3.3	3.76	1.39	5.73	0.53
7	31-Mar-05	2.92	3.16	2.95	1.1	12	5.78	0.332
8	12-Sep-05	1.09	2.53	2.88	13	1.2	3.9	0.063
9	9-Mar-06	1.47	2.86	2.75	9.11	0.452	4.51	1.12
10	6-Sep-06	3.53	2.33	2.81	1.14	5.22	4.12	0.774
11	9-Mar-07	1.47	2.86	2.75	9.11	0.452	4.51	1.12
12	22-Sep-07	2.08	1.94	3.84	1.35	0.765	2.35	0.206
13	11-Mar-08	6.33	2.92	2.55	3.16	0.618	3.21	0.642
14	10-Sep-08	3.72	2.67	2.52	2.79	0.56	2.72	1.03
15	5-Mar-09	0.61	4.71	0.83	1.61	0.61	2.94	0.52
16	14-Sep-09	6.78	3.4	3.23	4.18	<0.5	1.72	0.97
17	5-Mar-10							
18	14-Sep-10	1.9	3.3	1.6	2.4	0.81	3	1.9
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12	0.37	2.4	1.6		5.9	1.6	2.5
22	14-Sep-12							
23	5-Mar-13	0.91	1.7	1.7	5.3		3.1	0.08
24	9-Dec-13	0.34			3.5	0.8	2.9	0.67
25	22-Apr-14							
26	9-Dec-14			1				
27	2-Nov-15		2.8	0.87			1.82	
28	15-Apr-16	3.2	0.38	1.7			0.23	0.63
29	2-Nov-16							
30	13-Apr-17	0.46	2.8	0.9			4.1	2
31	2-Nov-17							
32	11-May-18	1.1	0.22	0.55			**3.9**	2.2
33	2-Nov-18							
34	11-Jul-19	0.01	1.1	0.74	14		6.1	2.4
35	1-Nov-19							
36	1-Jul-20	3.5	1.6	0.85	3.9		4.7	2.8
37	1-Nov-20							
38	7-Jul-21	0.01	2.7	0.69	6.1	0.69	2.9	0.69
39	01-Jul-22	0.25	1.4	0.72	20	0.63	5.2	0.67
40	11-Oct-23	0.10		0.35	1.7	0.56	7.5	0.89
Coefficient of Variation:		**0.88**	**0.38**	**0.57**	**0.91**	**1.64**	**0.51**	**0.70**
Mann-Kendall Statistic (S):		**-88**	**-82**	**-209**	**95**	**42**	**-125**	**74**
Confidence Factor:		**96.6%**	**96.3%**	**>99.9%**	**99.4%**	**90.7%**	**99.4%**	**93.6%**
Concentration Trend:		Decreasing	Decreasing	Decreasing	Increasing	Prob. Increasing	Decreasing	Prob. Increasing



Notes:

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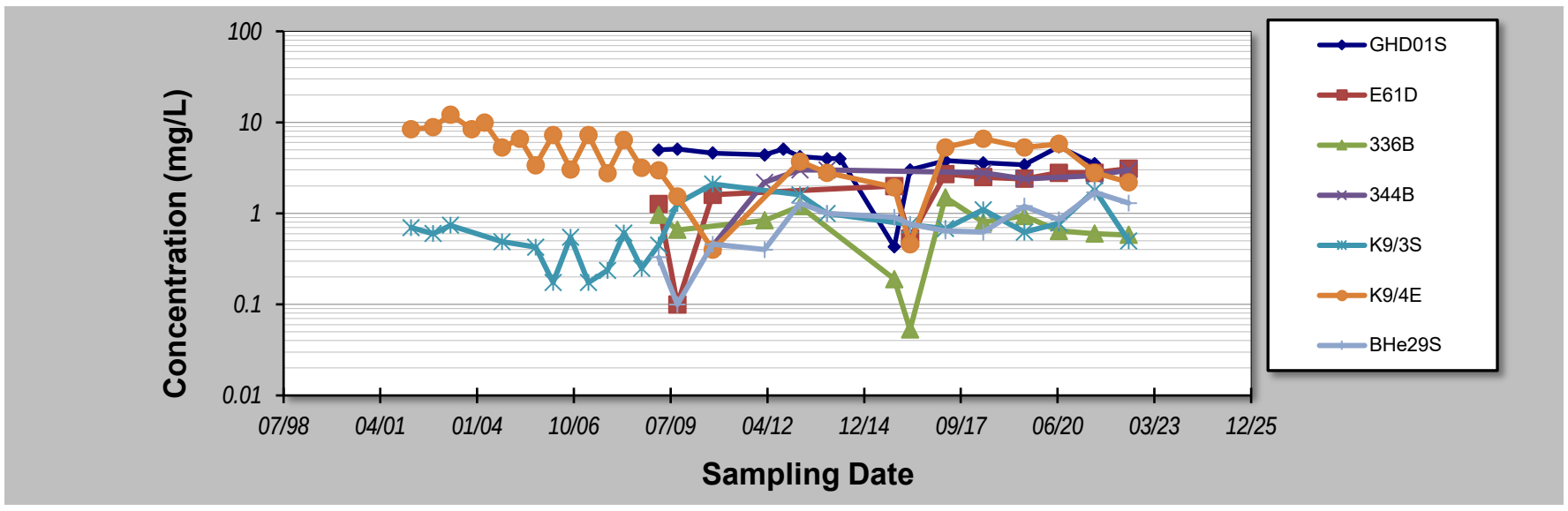
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Ammonia**
Concentration Units: **mg/L**

Sampling Point ID:	K9/3S	K9/4E	BHe29S	GHD01S	E61D	336B	344B
Sampling Event	Sampling Date	AMMONIA CONCENTRATION (mg/L)						
1	4-Mar-02	0.7	8.4					
2	14-Oct-02	0.6	8.84					
3	15-Apr-03	0.74	12.2					
4	17-Nov-03		8.43					
5	31-Mar-04		9.96					
6	27-Sep-04	0.49	5.27					
7	31-Mar-05		6.59					
8	12-Sep-05	0.426	3.37					
9	9-Mar-06	0.174	7.29					
10	6-Sep-06	0.549	3.03					
11	9-Mar-07	0.174	7.29					
12	22-Sep-07	0.237	2.76					
13	11-Mar-08	0.607	6.4					
14	10-Sep-08	0.25	3.15					
15	5-Mar-09	0.45	2.96	0.33	4.98	1.27	0.97	
16	14-Sep-09	1.28	1.54	0.1	5.1	0.1	0.66	
17	5-Mar-10							
18	14-Sep-10	2.1	0.4	0.46	4.6	1.6		0.44
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12			0.4	4.4		0.84	2.2
22	14-Sep-12				5.1			
23	5-Mar-13	1.6	3.7	1.3	4.2		1.2	3
24	9-Dec-13	1	2.8	1	4			3
25	22-Apr-14				4			
26	9-Dec-14							
27	5-Mar-15							
28	2-Nov-15		1.94	0.91	0.43	2	0.19	
29	15-Apr-16	0.75	0.46	0.76	3	0.53	0.053	
30	2-Nov-16							
31	13-Apr-17	0.68	5.3	0.64	3.8	2.7	1.5	
32	11-May-18	1.1	6.6	0.62	3.6	2.50	0.8	2.8
33	2-Nov-18							
34	11-Jul-19	0.62	5.3	1.2	3.4	2.40	0.94	2.4
35	1-Nov-19							
36	1-Jul-20	0.78	5.8	0.85	5.4	2.80	0.64	
37	1-Nov-20							
38	7-Jul-21	1.8	2.8	1.7	3.5	2.80	0.6	2.6
39	21-Jun-22	0.5	2.2	1.3	6.1	3.10	0.58	3
40	13-Oct-23	1.8	2.1	1.2		2.1	0.46	2.5
Coefficient of Variation:		**0.67**	**0.60**	**0.54**	**0.30**	**0.50**	**0.53**	**0.35**
Mann-Kendall Statistic (S):		**93**	**-127**	**58**	**-34**	**51**	**-6**	**17**
Confidence Factor:		**99.3%**	**99.6%**	**100.0%**	**94.9%**	**>99.9%**	**63.1%**	**97.7%**
Concentration Trend:		Increasing	Decreasing	Increasing	Prob. Decreasing	Increasing	Stable	Increasing



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
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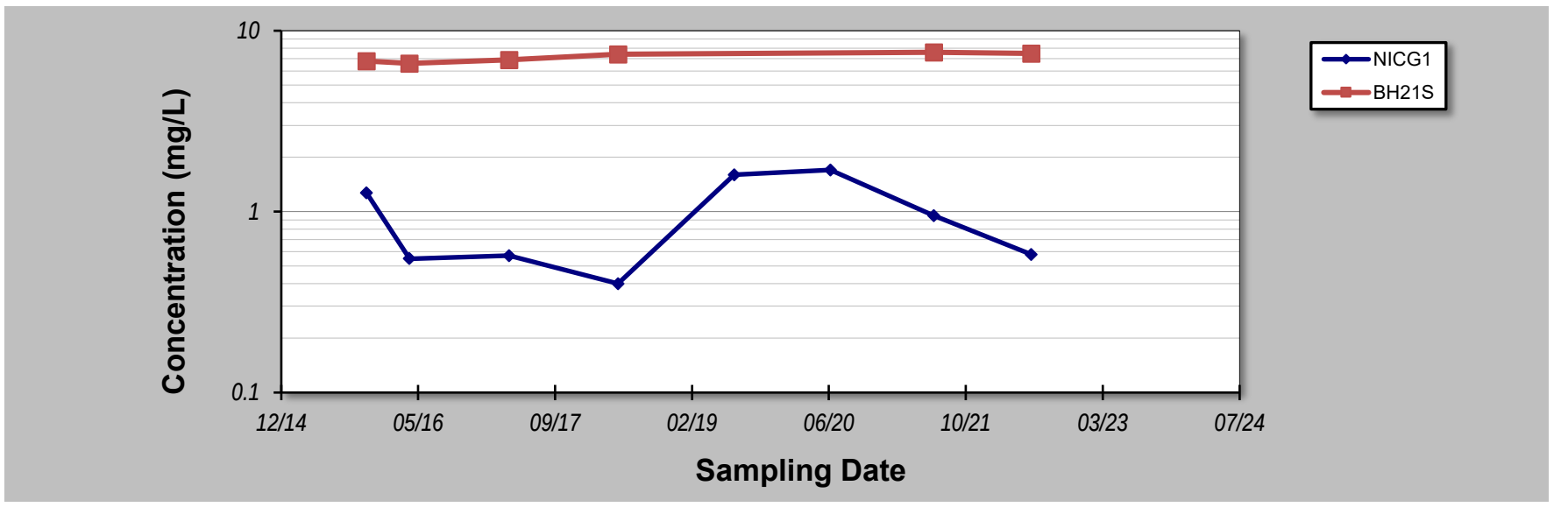
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Ammonia**
Concentration Units: **mg/L**

Sampling Point ID:	BH21S	NICG1					
Sampling Event	Sampling Date	AMMONIA CONCENTRATION (mg/L)					
1	3-Nov-15	6.81	1.27				
2	8-Apr-16	6.6	0.55				
3	7-Apr-17	6.9	0.57				
4	10-May-18	7.4	0.4				
5	8-Jul-19		1.6				
6	23-Jun-20		1.7				
7	6-Jul-21	7.6	0.95				
8	27-Jun-22	7.5	0.58				
9	09-Oct-23	7.4	2.2				
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
Coefficient of Variation:		0.06	0.54				
Mann-Kendall Statistic (S):		17	12				
Confidence Factor:		100.0%	91.1%				
Concentration Trend:		Increasing	Prob. Increasing				



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

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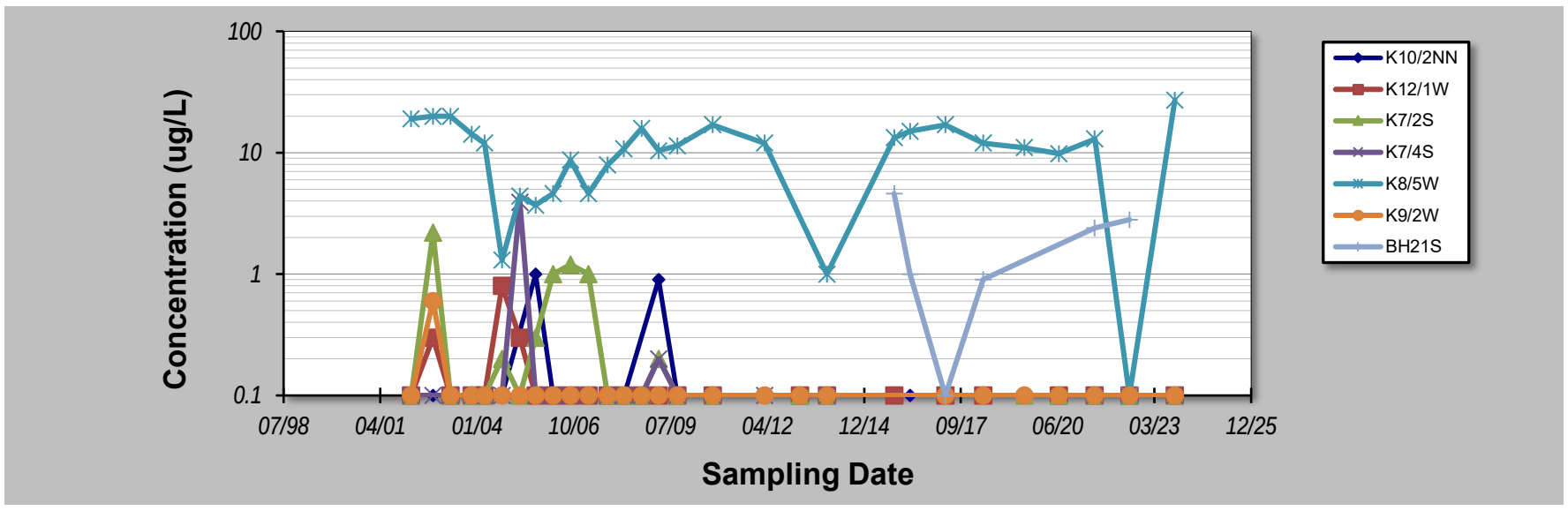
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Anthracene**
Concentration Units: **ug/L**

Sampling Point ID:	K10/2NN	K12/1W	K7/2S	K7/4S	K8/5W	K9/2W	BH21S
Sampling Event	Sampling Date	ANTHRACENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1	0.1	0.1	19	0.1	
2	14-Oct-02	0.1	0.3	2.2	0.1	20	0.6	
3	15-Apr-03	0.1	0.1	0.1	0.1	20	0.1	
4	17-Nov-03	0.1	0.1	0.1	0.1	14.2	0.1	
5	31-Mar-04	0.1	0.1	0.1	0.1	12	0.1	
6	27-Sep-04	0.1	0.8	0.2	0.1	1.3	0.1	
7	31-Mar-05		0.3	0.1	3.9	4.4	0.1	
8	12-Sep-05	1	0.1	0.3	0.1	3.7	0.1	
9	9-Mar-06	0.1	0.1	1	0.1	4.6	0.1	
10	6-Sep-06	0.1	0.1	1.2	0.1	8.7	0.1	
11	9-Mar-07	0.1	0.1	1	0.1	4.6	0.1	
12	22-Sep-07	0.1	0.1	0.1	0.1	7.9	0.1	
13	11-Mar-08	0.1	0.1	0.1	0.1	10.8	0.1	
14	10-Sep-08		0.1	0.1	0.1	15.9	0.1	
15	5-Mar-09	0.9	0.1	0.2	0.2	10.4	0.1	
16	14-Sep-09	0.1	0.1	0.1	0.1	11.4	0.1	
17	5-Mar-10							
18	14-Sep-10		0.1	0.1	0.1	17	0.1	
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12				0.1	12	0.1	
22	14-Sep-12							
23	5-Mar-13		0.1	0.1			0.1	
24	9-Dec-13	0.1	0.1	0.1	0.1	1	0.1	
25	22-Apr-14							
26	9-Dec-14							
27	5-Mar-15							
28	2-Nov-15	0.1	0.1			13.3		4.6
29	15-Apr-16	0.1				15	-	1
30	2-Nov-16							
31	13-Apr-17		0.1			17	0.1	0.1
32	11-May-18	0.1	0.1			12	0.1	0.9
33	2-Nov-18							
34	11-Jul-19	0.1		0.1		11	0.1	
35	1-Nov-19							
36	1-Jul-20	0.1	0.1	0.1		9.8	0.1	
37	1-Nov-20							
38	7-Jul-21	0.1	0.1	0.1	0.1	13	0.1	2.4
39	01-Jul-22	0.1	0.1	0.1	0.1	0.1	0.1	2.8
40	12-Oct-23	0.1	0.1	0.1	0.1	27	0.1	2
Coefficient of Variation:	1.41	1.02	1.58	2.92	0.57	0.81	0.83
Mann-Kendall Statistic (S):	-9	-51	-56	-3	12	-24	7
Confidence Factor:	58.3%	86.3%	91.3%	52.2%	58.5%	68.3%	86.4%
Concentration Trend:	No Trend	No Trend	Prob. Decreasing	No Trend	No Trend	Stable	No Trend



Notes:

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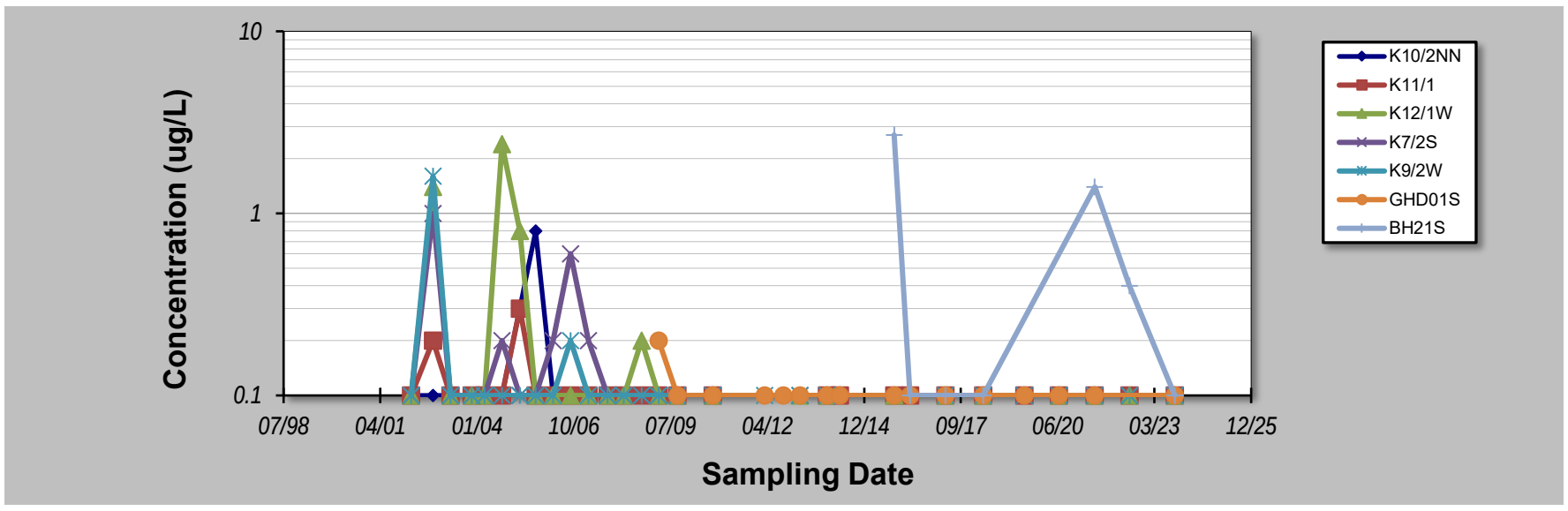
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Benzo(ghi)perylene**
Concentration Units: **ug/L**

Sampling Point ID:	K10/2NN	K11/1	K12/1W	K7/2S	K9/2W	GHD01S	BH21S
Sampling Event	Sampling Date	BENZO(GHI)PERYLENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1	0.1	0.1	0.1		
2	14-Oct-02	0.1	0.2	1.4	1	1.6		
3	15-Apr-03	0.1	0.1	0.1	0.1	0.1		
4	17-Nov-03	0.1	0.1	0.1	0.1	0.1		
5	31-Mar-04	0.1	0.1	0.1	0.1	0.1		
6	27-Sep-04	0.1	0.1	2.4	0.2	0.1		
7	31-Mar-05		0.3	0.8	0.1	0.1		
8	12-Sep-05	0.8	0.1	0.1	0.1	0.1		
9	9-Mar-06	0.1	0.1	0.1	0.2	0.1		
10	6-Sep-06	0.1	0.1	0.1	0.6	0.2		
11	9-Mar-07	0.1	0.1	0.1	0.2	0.1		
12	22-Sep-07	0.1	0.1	0.1	0.1	0.1		
13	11-Mar-08	0.1	0.1	0.1	0.1	0.1		
14	10-Sep-08		0.1	0.2	0.1	0.1		
15	5-Mar-09	0.1	0.1	0.1	0.1	0.1	0.2	
16	14-Sep-09	0.1	0.1	0.1	0.1	0.1	0.1	
17	5-Mar-10							
18	14-Sep-10		0.1	0.1	0.1	0.1	0.1	
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12					0.1	0.1	
22	14-Sep-12						0.1	
23	5-Mar-13			0.1	0.1	0.1	0.1	
24	9-Dec-13	0.1	0.1	0.1	0.1	0.1	0.1	
25	22-Apr-14		0.1				0.1	
26	9-Dec-14							
27	5-Mar-15							
28	2-Nov-15	0.1	0.1	0.1			0.1	2.7
29	15-Apr-16	0.1	0.1			-	0.1	0.1
30	2-Nov-16							
31	13-Apr-17		0.1	0.1		0.1	0.1	0.1
32	11-May-18	0.1	0.1	0.1		0.1	0.1	0.1
33	2-Nov-18							
34	11-Jul-19	0.1	0.1		0.1	0.1	0.1	
35	1-Nov-19							
36	1-Jul-20	0.1	0.1	0.1	0.1	0.1	0.1	
37	1-Nov-20							
38	7-Jul-21	0.1	0.1	0.1	0.1	0.1	0.1	1.4
39	01-Jul-22	0.1	0.1	0.1	0.1	0.1		0.4
40	12-Oct-23	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Coefficient of Variation:	1.12	0.38	1.93	1.20	1.81	0.24	1.43
Mann-Kendall Statistic (S):	-10	-39	-54	-52	-33	-15	-3
Confidence Factor:	59.3%	77.2%	87.8%	89.6%	74.6%	73.3%	61.4%
Concentration Trend:	No Trend	Stable	No Trend	No Trend	No Trend	Stable	No Trend



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
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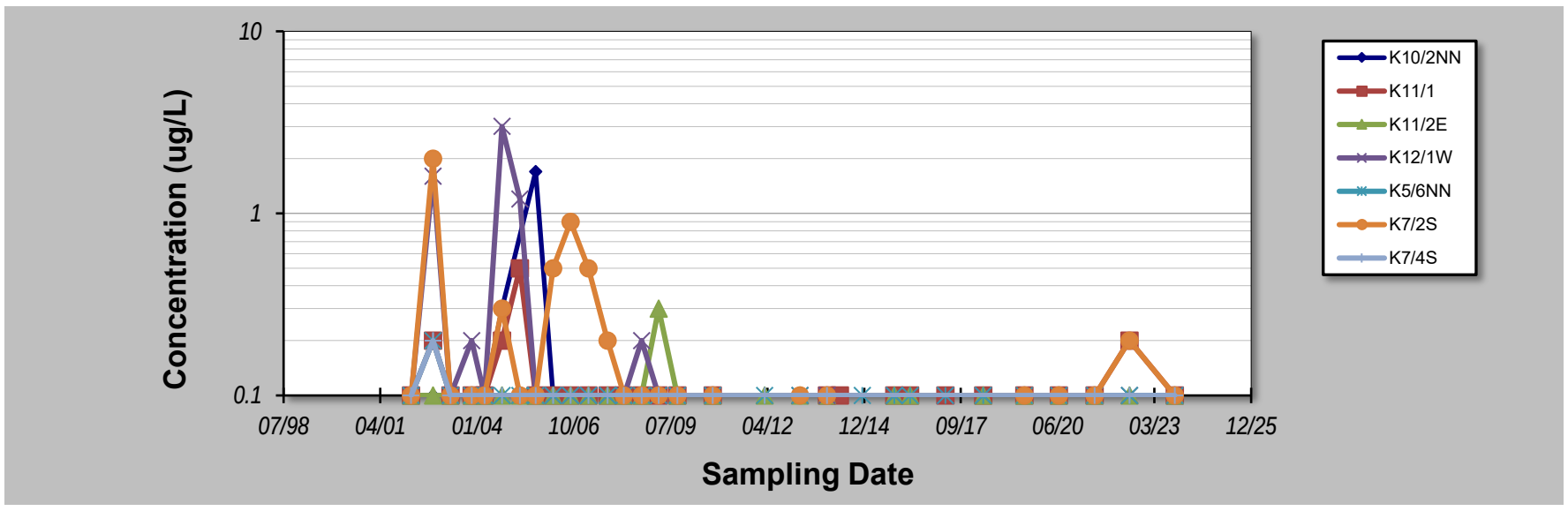
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Benza(a)anthracene**
Concentration Units: **ug/L**

Sampling Point ID:	K10/2NN	K11/1	K11/2E	K12/1W	K5/6NN	K7/2S	K7/4S
Sampling Event	Sampling Date	BENZA(A)ANTHRACENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2	14-Oct-02	0.1	0.2	0.1	1.6	0.2	2	0.2
3	15-Apr-03	0.1	0.1	0.1	0.1	0.1	0.1	0.1
4	17-Nov-03	0.1	0.1	0.1	0.2	0.1	0.1	0.1
5	31-Mar-04	0.1	0.1	0.1	0.1	0.1	0.1	0.1
6	27-Sep-04	0.3	0.2	0.1	3	0.1	0.3	0.1
7	31-Mar-05		0.5	0.1	1.2	0.1	0.1	0.1
8	12-Sep-05	1.7	0.1	0.1	0.1	0.1	0.1	0.1
9	9-Mar-06	0.1	0.1	0.1	0.1	0.1	0.5	0.1
10	6-Sep-06	0.1	0.1	0.1	0.1	0.1	0.9	0.1
11	9-Mar-07	0.1	0.1	0.1	0.1	0.1	0.5	0.1
12	22-Sep-07	0.1	0.1	0.1	0.1	0.1	0.2	0.1
13	11-Mar-08	0.1	0.1	0.1	0.1	0.1	0.1	0.1
14	10-Sep-08		0.1	0.1	0.2	0.1	0.1	0.1
15	5-Mar-09	0.1	0.1	0.3	0.1	0.1	0.1	0.1
16	14-Sep-09	0.1	0.1	0.1	0.1	0.1	0.1	0.1
17	5-Mar-10							
18	14-Sep-10		0.1	0.1	0.1	0.1	0.1	0.1
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12			0.1		0.1		0.1
22	14-Sep-12							
23	5-Mar-13			0.1	0.1	0.1	0.1	
24	9-Dec-13	0.1	0.1	0.1	0.1		0.1	0.1
25	22-Apr-14		0.1					
26	9-Dec-14					0.1		
27	5-Mar-15							
28	2-Nov-15	0.1	0.1	0.1	0.1	0.1		
29	15-Apr-16	0.1	0.1	0.1		0.1		
30	2-Nov-16							
31	13-Apr-17		0.1		0.1	0.1		
32	11-May-18	0.1	0.1	0.1	0.1	0.1		
33	2-Nov-18							
34	11-Jul-19	0.1	0.1	0.1		0.1	0.1	
35	1-Nov-19							
36	1-Jul-20	0.1	0.1	0.1	0.1	0.1	0.1	
37	1-Nov-20							
38	7-Jul-21	0.1	0.1	0.1	0.1	0.1	0.1	0.1
39	01-Jul-22	0.1	0.2	0.1	0.1	0.1	0.2	0.1
40	12-Oct-23	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Coefficient of Variation:		1.88	0.64	0.35	2.04	0.18	1.59	0.20
Mann-Kendall Statistic (S):		-21	-31	1	-72	-26	-40	-19
Confidence Factor:		69.9%	72.2%	50.0%	94.1%	67.9%	83.1%	69.2%
Concentration Trend:		No Trend	Stable	No Trend	Prob. Decreasing	Stable	No Trend	Stable



Notes:

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2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
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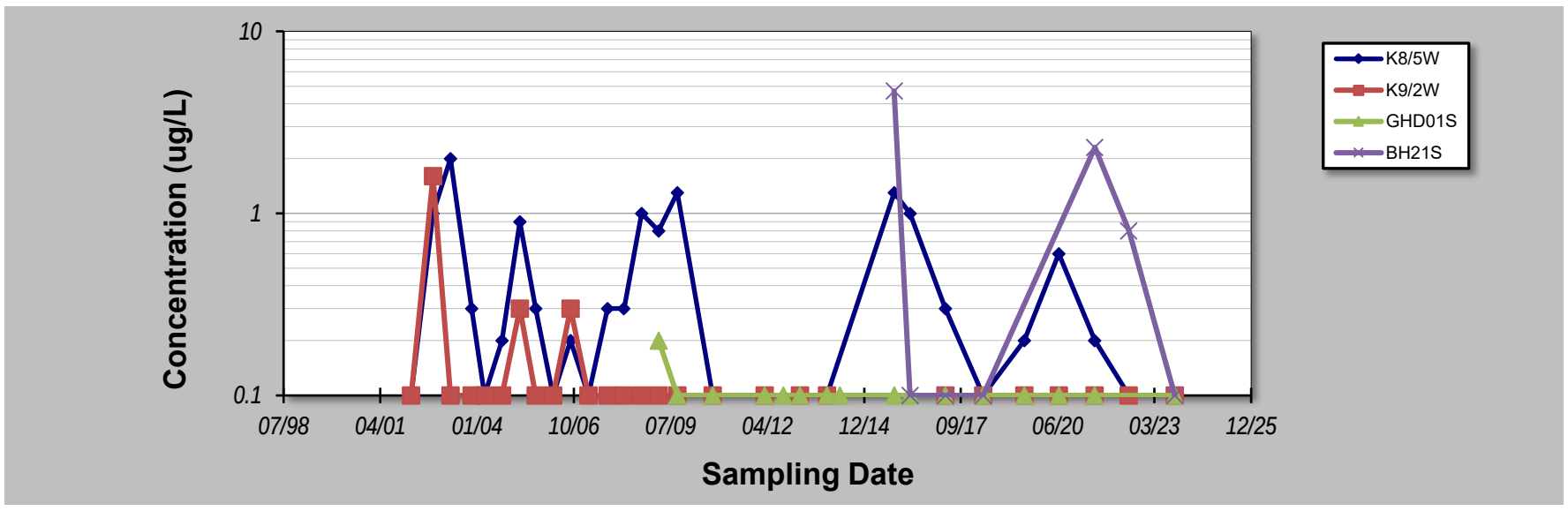
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Benza(a)anthracene**
Concentration Units: **ug/L**

Sampling Point ID:	K8/5W	K9/2W	GHD01S	BH21S			
Sampling Event	Sampling Date	BENZA(A)ANTHRACENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1					
2	14-Oct-02	1	1.6					
3	15-Apr-03	2	0.1					
4	17-Nov-03	0.3	0.1					
5	31-Mar-04	0.1	0.1					
6	27-Sep-04	0.2	0.1					
7	31-Mar-05	0.9	0.3					
8	12-Sep-05	0.3	0.1					
9	9-Mar-06	0.1	0.1					
10	6-Sep-06	0.2	0.3					
11	9-Mar-07	0.1	0.1					
12	22-Sep-07	0.3	0.1					
13	11-Mar-08	0.3	0.1					
14	10-Sep-08	1	0.1					
15	5-Mar-09	0.8	0.1	0.2				
16	14-Sep-09	1.3	0.1	0.1				
17	5-Mar-10							
18	14-Sep-10	0.1	0.1	0.1				
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12	0.1	0.1	0.1				
22	14-Sep-12			0.1				
23	5-Mar-13	0.1	0.1	0.1				
24	9-Dec-13	0.1	0.1	0.1				
25	22-Apr-14			0.1				
26	2-Nov-15	1.3		0.1	4.7			
27	15-Apr-16	1	-	0.1	0.1			
28	2-Nov-16							
29	13-Apr-17	0.3	0.1	0.1	0.1			
30	2-Nov-17							
31	11-May-18	0.1	0.1	0.1	0.1			
32	2-Nov-18							
33	11-Jul-19	0.2	0.1	0.1				
34	1-Nov-19							
35	1-Jul-20	0.6	0.1	0.1				
36	1-Nov-20							
37	7-Jul-21	0.2	0.1	0.1	2.3			
38	24-Jun-22	0.1	0.1		0.8			
39	12-Oct-23	0.1	0.1	0.1	0.1			
40								
Coefficient of Variation:		1.08	1.71	0.24	1.50			
Mann-Kendall Statistic (S):		-47	-48	-15	-3			
Confidence Factor:		80.4%	83.5%	73.3%	61.4%			
Concentration Trend:		No Trend	No Trend	Stable	No Trend			



Notes:

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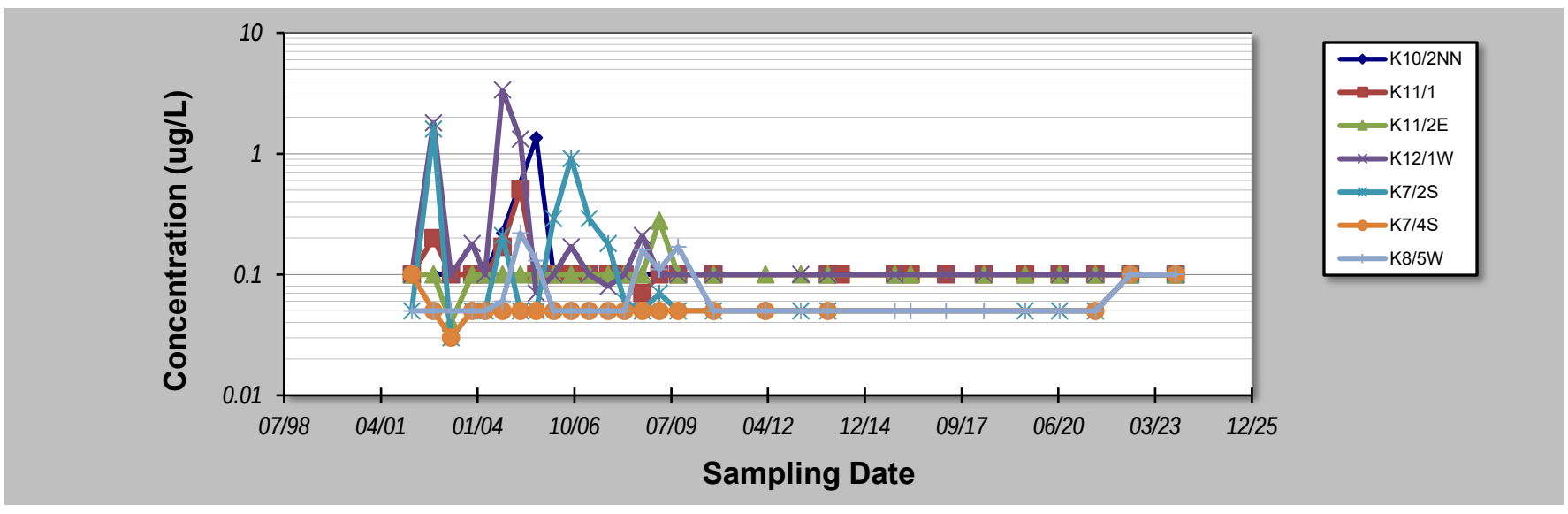
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Benzo(a)pyrene**
Concentration Units: **ug/L**

Sampling Point ID:	K10/2NN	K11/1	K11/2E	K12/1W	K7/2S	K7/4S	K8/5W
Sampling Event	Sampling Date	BENZO(A)PYRENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1	0.1	0.1	0.05	0.1	0.05
2	14-Oct-02	0.1	0.2	0.1	1.8	1.6	0.05	0.05
3	15-Apr-03	0.1	0.1	0.04	0.1	0.03	0.03	0.05
4	17-Nov-03	0.1	0.1	0.1	0.18	0.05	0.05	0.05
5	31-Mar-04	0.1	0.1	0.1	0.1	0.05	0.05	0.05
6	27-Sep-04	0.22	0.17	0.1	3.36	0.21	0.05	0.06
7	31-Mar-05		0.51	0.1	1.32	0.05	0.05	0.22
8	12-Sep-05	1.35	0.1	0.1	0.07	0.05	0.05	0.13
9	9-Mar-06	0.1	0.1	0.1	0.1	0.29	0.05	0.05
10	6-Sep-06	0.1	0.1	0.1	0.17	0.91	0.05	0.05
11	9-Mar-07	0.1	0.1	0.1	0.1	0.29	0.05	0.05
12	22-Sep-07	0.1	0.1	0.1	0.08	0.18	0.05	0.05
13	11-Mar-08	0.1	0.1	0.1	0.1	0.06	0.05	0.05
14	10-Sep-08		0.07	0.1	0.21	0.05	0.05	0.16
15	5-Mar-09	0.1	0.1	0.28	0.1	0.07	0.05	0.11
16	14-Sep-09	0.1	0.1	0.1	0.1	0.05	0.05	0.17
17	5-Mar-10							
18	14-Sep-10		0.1	0.1	0.1	0.05	0.05	0.05
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12			0.1			0.05	0.05
22	14-Sep-12							
23	5-Mar-13			0.1	0.1	0.05		0.05
24	9-Dec-13	0.1	0.1	0.1	0.1	0.05	0.05	0.05
25	22-Apr-14		0.1					
26	9-Dec-14							
27	5-Mar-15							
28	2-Nov-15	0.1	0.1	0.1	0.1			0.05
29	15-Apr-16	0.1	0.1	0.1				0.05
30	13-Apr-17		0.1		0.1			0.05
31	2-Nov-17							
32	11-May-18	0.1	0.1	0.1	0.1			0.05
33	2-Nov-18							
34	11-Jul-19	0.1	0.1	0.1		0.05		0.05
35	1-Nov-19							
36	1-Jul-20	0.1	0.1	0.1	0.1	0.05		0.05
37	1-Nov-20							
38	7-Jul-21	0.1	0.1	0.1	0.1	0.05	0.05	0.05
39	01-Jul-22	0.1	0.1	0.1	0.1	0.1	0.1	0.1
40	12-Oct-23	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Coefficient of Variation:		1.63	0.67	0.35	2.12	1.88	0.33	0.62
Mann-Kendall Statistic (S):		-21	-52	23	-60	-14	35	1
Confidence Factor:		69.9%	84.2%	66.7%	90.2%	62.5%	82.9%	50.0%
Concentration Trend:		No Trend	Stable	No Trend	Prob. Decreasing	No Trend	No Trend	No Trend



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

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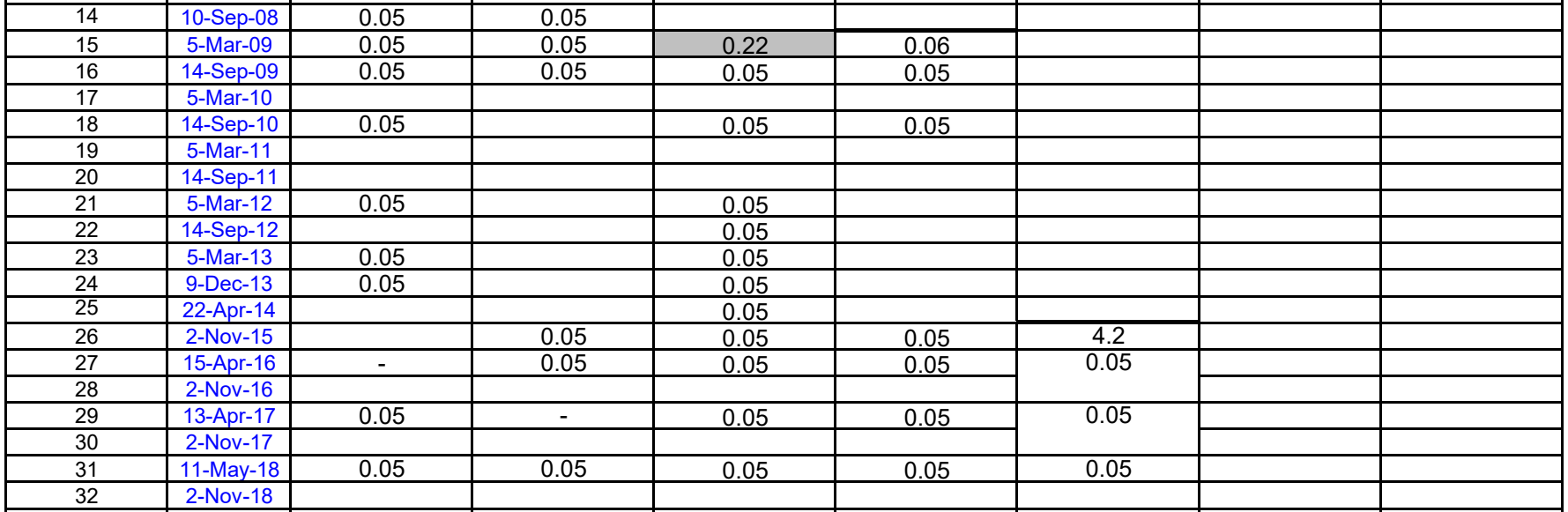
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Benzo(a)pyrene**
Concentration Units: **ug/L**

Sampling Point ID:	K9/2W	K9/4E	GHD01S	E61D	BH21S		
Sampling Event	Sampling Date	BENZO(A)PYRENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.05					
2	14-Oct-02	2.2	0.05					
3	15-Apr-03	0.1	0.04					
4	17-Nov-03	0.05	0.05					
5	31-Mar-04	0.05	0.05					
6	27-Sep-04	0.17	0.05					
7	31-Mar-05	0.35	0.05					
8	12-Sep-05	0.09	0.06					
9	9-Mar-06	0.05	0.05					
10	6-Sep-06	0.39	0.05					
11	9-Mar-07	0.05	0.05					
12	22-Sep-07	0.05	0.05					
13	11-Mar-08	0.05	0.05					
14	10-Sep-08	0.05	0.05					
15	5-Mar-09	0.05	0.05	0.22	0.06			
16	14-Sep-09	0.05	0.05	0.05	0.05			
17	5-Mar-10							
18	14-Sep-10	0.05		0.05	0.05			
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12	0.05		0.05				
22	14-Sep-12			0.05				
23	5-Mar-13	0.05		0.05				
24	9-Dec-13	0.05		0.05				
25	22-Apr-14			0.05				
26	2-Nov-15		0.05	0.05	0.05	4.2		
27	15-Apr-16	-	0.05	0.05	0.05	0.05		
28	2-Nov-16							
29	13-Apr-17	0.05	-	0.05	0.05	0.05		
30	2-Nov-17							
31	11-May-18	0.05	0.05	0.05	0.05	0.05		
32	2-Nov-18							
33	11-Jul-19	0.05	0.05	0.05	0.05			
34	1-Nov-19							
35	1-Jul-20	0.05	0.05	0.05	0.05			
36	1-Nov-20							
37	7-Jul-21	0.05	0.05	0.05	0.05	2.2		
38	24-Jun-22	0.1	0.1		0.1	0.6		
39	10-Oct-23	0.1	0.1	0.1	0.1	0.1		
40								
Coefficient of Variation:		2.49	0.27	0.68	0.33	1.54		
Mann-Kendall Statistic (S):		-76	53	-1	11	0		
Confidence Factor:		94.1%	90.1%	50.0%	74.9%	37.9%		
Concentration Trend:		Prob. Decreasing	Prob. Increasing	Stable	No Trend	No Trend		



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

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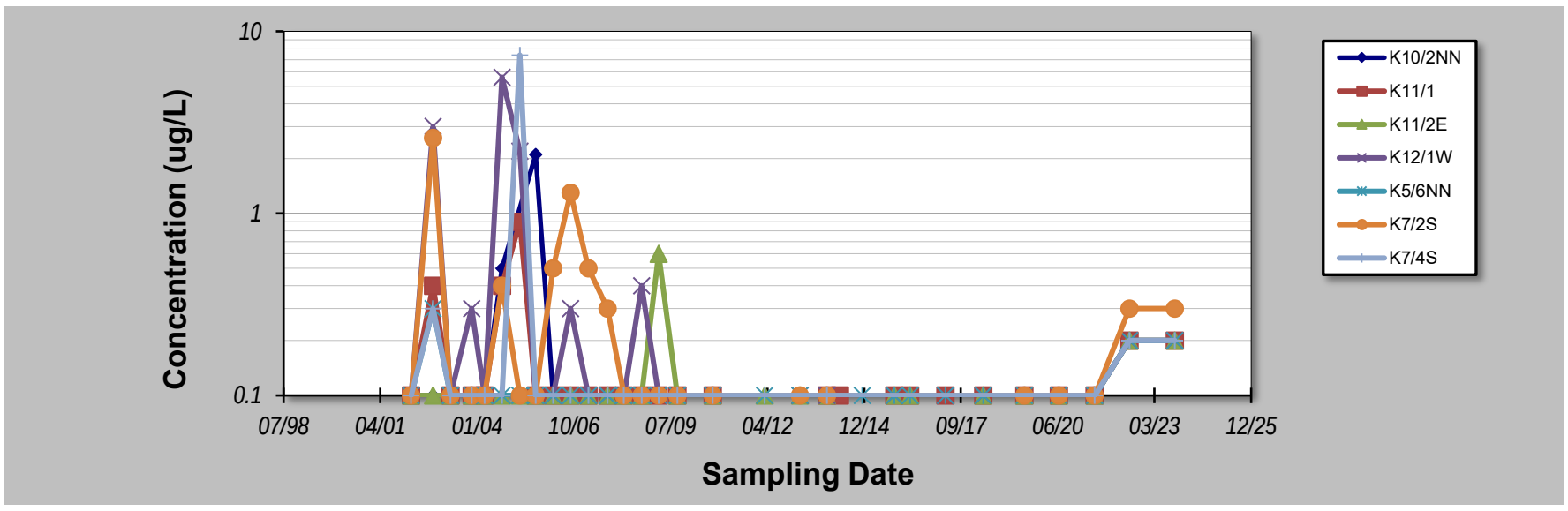
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Benzo(b)&(k)fluoranthene**
Concentration Units: **ug/L**

Sampling Point ID:	K10/2NN	K11/1	K11/2E	K12/1W	K5/6NN	K7/2S	K7/4S
Sampling Event	Sampling Date	BENZO(B)&(K)FLUORANTHENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2	14-Oct-02	0.1	0.4	0.1	3	0.3	2.6	0.3
3	15-Apr-03	0.1	0.1	0.1	0.1	0.1	0.1	0.1
4	17-Nov-03	0.1	0.1	0.1	0.3	0.1	0.1	0.1
5	31-Mar-04	0.1	0.1	0.1	0.1	0.1	0.1	0.1
6	27-Sep-04	0.5	0.4	0.1	5.6	0.1	0.4	0.1
7	31-Mar-05		0.9	0.1	2.2	0.1	0.1	7.4
8	12-Sep-05	2.1	0.1	0.1	0.1	0.1	0.1	0.1
9	9-Mar-06	0.1	0.1	0.1	0.1	0.1	0.5	0.1
10	6-Sep-06	0.1	0.1	0.1	0.3	0.1	1.3	0.1
11	9-Mar-07	0.1	0.1	0.1	0.1	0.1	0.5	0.1
12	22-Sep-07	0.1	0.1	0.1	0.1	0.1	0.3	0.1
13	11-Mar-08	0.1	0.1	0.1	0.1	0.1	0.1	0.1
14	10-Sep-08		0.1	0.1	0.4	0.1	0.1	0.1
15	5-Mar-09	0.1	0.1	0.6	0.1	0.1	0.1	0.1
16	14-Sep-09	0.1	0.1	0.1	0.1	0.1	0.1	0.1
17	5-Mar-10							
18	14-Sep-10		0.1	0.1	0.1	0.1	0.1	0.1
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12			0.1		0.1		0.1
22	14-Sep-12							
23	5-Mar-13			0.1	0.1	0.1	0.1	
24	9-Dec-13	0.1	0.1	0.1	0.1		0.1	0.1
25	22-Apr-14		0.1					
26	9-Dec-14					0.1		
27	5-Mar-15							
28	2-Nov-15	0.1	0.1	0.1	0.1	0.1		
29	15-Apr-16	0.1	0.1	0.1		0.1		
30	2-Nov-16							
31	13-Apr-17		0.1		0.1	0.1		
32	11-May-18	0.1	0.1	0.1	0.1	0.1		
33	2-Nov-18							
34	11-Jul-19	0.1	0.1	0.1		0.1	0.1	
35	1-Nov-19							
36	1-Jul-20	0.1	0.1	0.1	0.1	0.1	0.1	
37	1-Nov-20							
38	7-Jul-21	0.1	0.1	0.1	0.1	0.1	0.1	0.1
39	01-Jul-22	0.2	0.2	0.2	0.2	0.2	0.3	0.2
40	12-Oct-23	0.2	0.2	0.2	0.2	0.2	0.3	0.2
Coefficient of Variation:		1.97	1.06	0.77	2.30	0.39	1.70	3.45
Mann-Kendall Statistic (S):		17	-9	51	-44	26	-22	9
Confidence Factor:		66.2%	56.2%	83.7%	82.7%	67.9%	69.7%	58.8%
Concentration Trend:		No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
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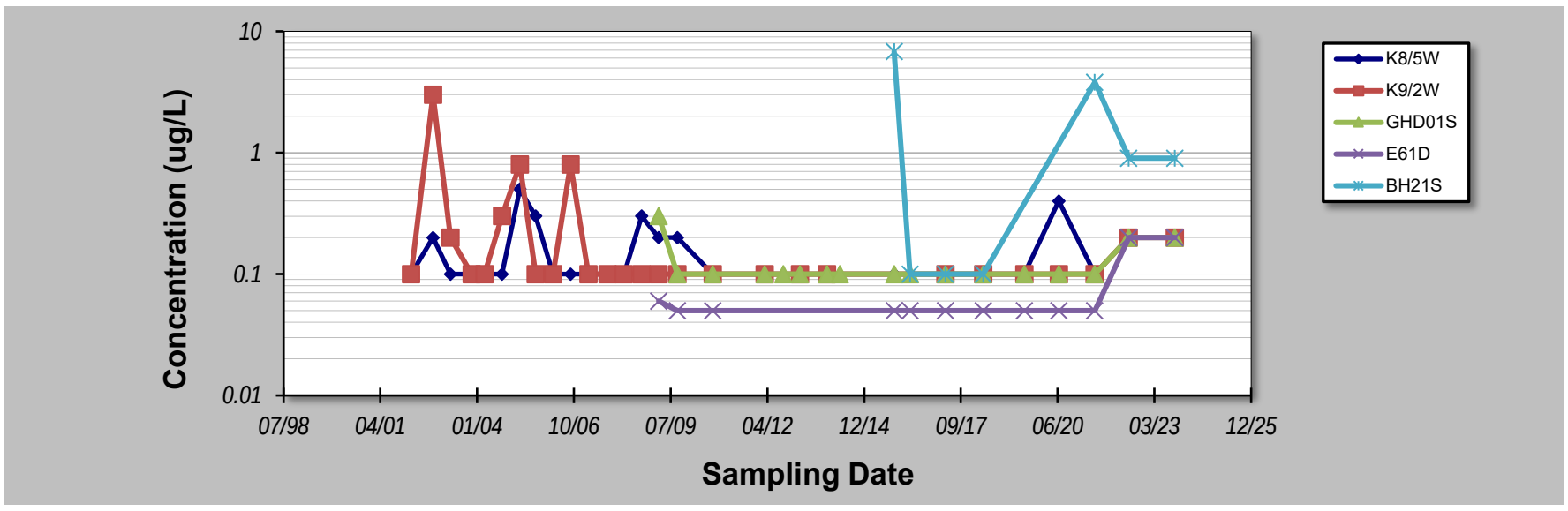
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Benzo(b)&(k)fluoranthene**
Concentration Units: **ug/L**

Sampling Point ID:	K8/5W	K9/2W	GHD01S	E61D	BH21S		
Sampling Event	Sampling Date	BENZO(B)&(K)FLUORANTHENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1					
2	14-Oct-02	0.2	3					
3	15-Apr-03	0.1	0.2					
4	17-Nov-03	0.1	0.1					
5	31-Mar-04	0.1	0.1					
6	27-Sep-04	0.1	0.3					
7	31-Mar-05	0.5	0.8					
8	12-Sep-05	0.3	0.1					
9	9-Mar-06	0.1	0.1					
10	6-Sep-06	0.1	0.8					
11	9-Mar-07	0.1	0.1					
12	22-Sep-07	0.1	0.1					
13	11-Mar-08	0.1	0.1					
14	10-Sep-08	0.3	0.1					
15	5-Mar-09	0.2	0.1	0.3	0.06			
16	14-Sep-09	0.2	0.1	0.1	0.05			
17	5-Mar-10							
18	14-Sep-10	0.1	0.1	0.1	0.05			
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12	0.1	0.1	0.1				
22	14-Sep-12			0.1				
23	5-Mar-13	0.1	0.1	0.1				
24	9-Dec-13	0.1	0.1	0.1				
25	22-Apr-14			0.1				
26	9-Dec-14							
27	5-Mar-15							
28	2-Nov-15	0.1		0.1	0.05	6.8		
29	15-Apr-16	0.1	-	0.1	0.05	0.1		
30	13-Apr-17	0.1	0.1	0.1	0.05	0.1		
31	2-Nov-17							
32	11-May-18	0.1	0.1	0.1	0.05	0.1		
33	2-Nov-18							
34	11-Jul-19	0.1	0.1	0.1	0.05			
35	1-Nov-19							
36	1-Jul-20	0.4	0.1	0.1	0.05			
37	1-Nov-20							
38	7-Jul-21	0.1	0.1	0.1	0.05	3.8		
39	24-Jun-22	0.2	0.2	0.2	0.2	0.9		
40	12-Oct-23	0.2	0.2	0.2	0.2	0.9		
Coefficient of Variation:		0.66	2.07	0.46	0.77	1.41		
Mann-Kendall Statistic (S):		11	-41	12	11	1		
Confidence Factor:		57.4%	79.6%	67.2%	74.9%	50.0%		
Concentration Trend:		No Trend	No Trend	No Trend	No Trend	No Trend		



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

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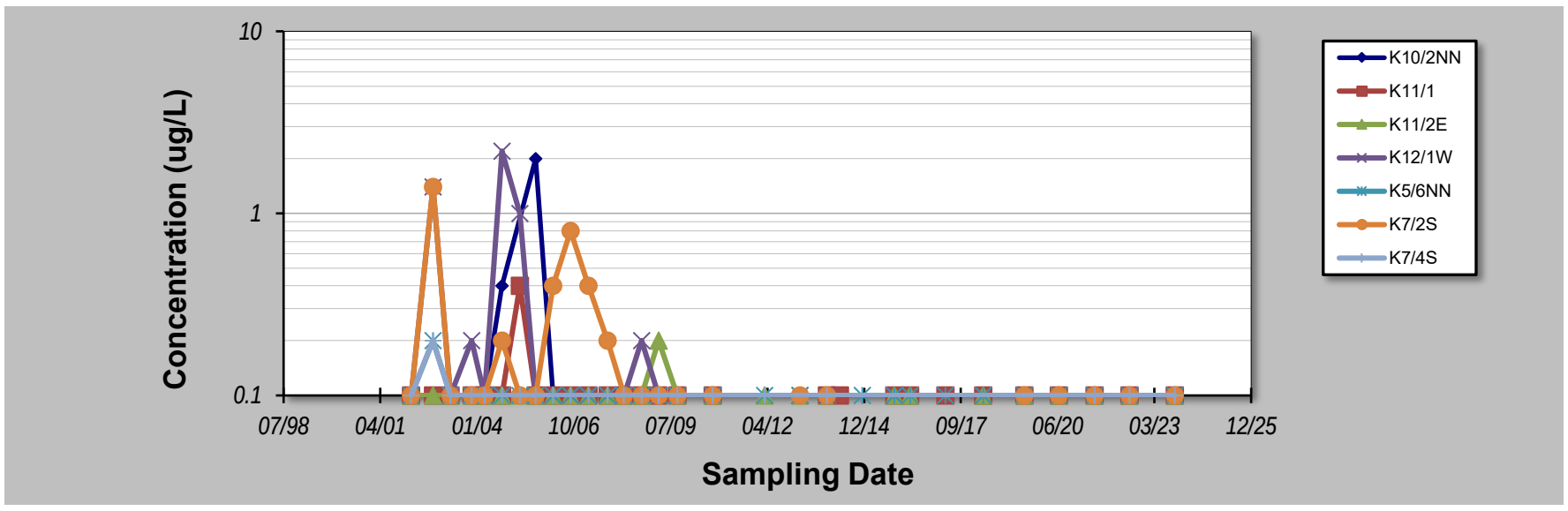
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **12-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Chrysene**
Concentration Units: **ug/L**

Sampling Point ID:	K10/2NN	K11/1	K11/2E	K12/1W	K5/6NN	K7/2S	K7/4S
Sampling Event	Sampling Date	CHRYSENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2	14-Oct-02	0.1	0.1	0.1	1.4	0.2	1.4	0.2
3	15-Apr-03	0.1	0.1	0.1	0.1	0.1	0.1	0.1
4	17-Nov-03	0.1	0.1	0.1	0.2	0.1	0.1	0.1
5	31-Mar-04	0.1	0.1	0.1	0.1	0.1	0.1	0.1
6	27-Sep-04	0.4	0.1	0.1	2.2	0.1	0.2	0.1
7	31-Mar-05		0.4	0.1	1	0.1	0.1	0.1
8	12-Sep-05	2	0.1	0.1	0.1	0.1	0.1	0.1
9	9-Mar-06	0.1	0.1	0.1	0.1	0.1	0.4	0.1
10	6-Sep-06	0.1	0.1	0.1	0.1	0.1	0.8	0.1
11	9-Mar-07	0.1	0.1	0.1	0.1	0.1	0.4	0.1
12	22-Sep-07	0.1	0.1	0.1	0.1	0.1	0.2	0.1
13	11-Mar-08	0.1	0.1	0.1	0.1	0.1	0.1	0.1
14	10-Sep-08		0.1	0.1	0.2	0.1	0.1	0.1
15	5-Mar-09	0.1	0.1	0.2	0.1	0.1	0.1	0.1
16	14-Sep-09	0.1	0.1	0.1	0.1	0.1	0.1	0.1
17	5-Mar-10							
18	14-Sep-10		0.1	0.1	0.1	0.1	0.1	0.1
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12			0.1		0.1		0.1
22	14-Sep-12							
23	5-Mar-13			0.1	0.1	0.1	0.1	
24	9-Dec-13	0.1	0.1	0.1	0.1		0.1	0.1
25	22-Apr-14		0.1					
26	9-Dec-14					0.1		
27	5-Mar-15							
28	2-Nov-15	0.1	0.1	0.1	0.1	0.1		
29	15-Apr-16	0.1	0.1	0.1		0.1		
30	2-Nov-16							
31	13-Apr-17		0.1		0.1	0.1		
32	11-May-18	0.1	0.1	0.1	0.1	0.1		
33	2-Nov-18							
34	11-Jul-19	0.1	0.1	0.1		0.1	0.1	
35	1-Nov-19							
36	1-Jul-20	0.1	0.1	0.1	0.1	0.1	0.1	
37	1-Nov-20							
38	7-Jul-21	0.1	0.1	0.1	0.1	0.1	0.1	0.1
39	01-Jul-22	0.1	0.1	0.1	0.1	0.1	0.1	0.1
40	12-Oct-23	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Coefficient of Variation:		2.04	0.51	0.18	1.82	0.18	1.38	0.20
Mann-Kendall Statistic (S):		-21	-15	1	-72	-26	-55	-19
Confidence Factor:		69.9%	60.8%	50.0%	94.1%	67.9%	90.9%	69.2%
Concentration Trend:		No Trend	Stable	No Trend	Prob. Decreasing	Stable	Prob. Decreasing	Stable



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

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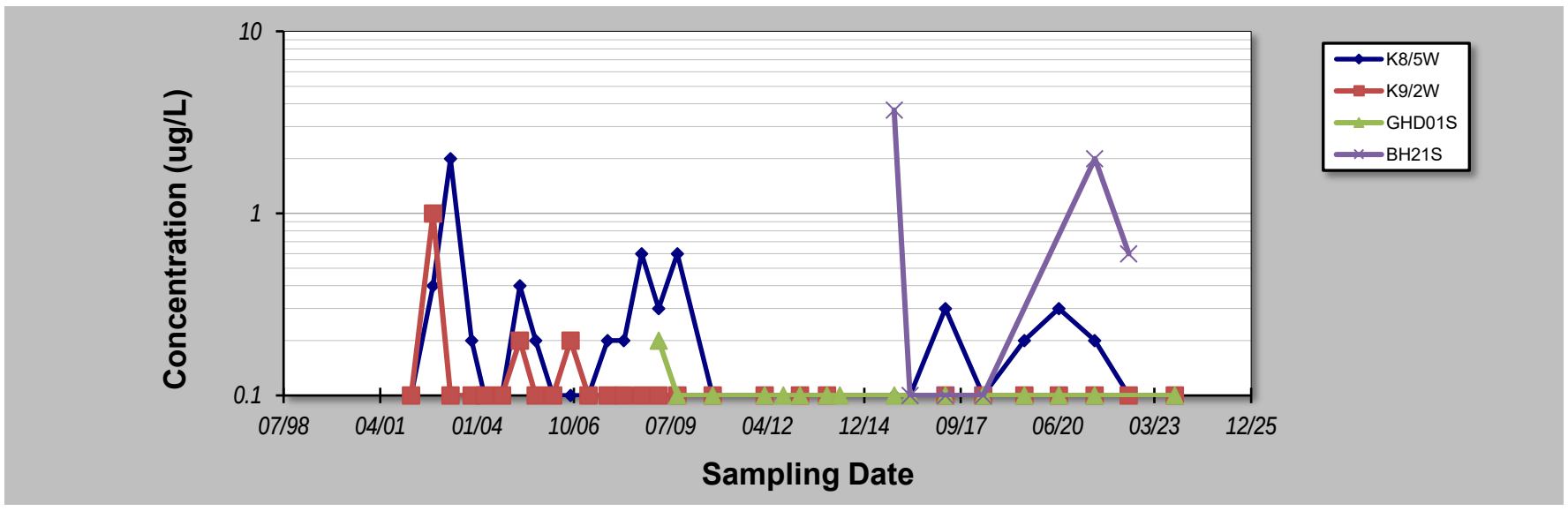
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Chrysene**
Concentration Units: **ug/L**

Sampling Point ID:	K8/5W	K9/2W	GHD01S	BH21S			
Sampling Event	Sampling Date	CHRYSENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1					
2	14-Oct-02	0.4	1					
3	15-Apr-03	2	0.1					
4	17-Nov-03	0.2	0.1					
5	31-Mar-04	0.1	0.1					
6	27-Sep-04	0.1	0.1					
7	31-Mar-05	0.4	0.2					
8	12-Sep-05	0.2	0.1					
9	9-Mar-06	0.1	0.1					
10	6-Sep-06	0.1	0.2					
11	9-Mar-07	0.1	0.1					
12	22-Sep-07	0.2	0.1					
13	11-Mar-08	0.2	0.1					
14	10-Sep-08	0.6	0.1					
15	5-Mar-09	0.3	0.1	0.2				
16	14-Sep-09	0.6	0.1	0.1				
17	5-Mar-10							
18	14-Sep-10	0.1	0.1	0.1				
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12	0.1	0.1	0.1				
22	14-Sep-12			0.1				
23	5-Mar-13	0.1	0.1	0.1				
24	9-Dec-13	0.1	0.1	0.1				
25	22-Apr-14			0.1				
26	9-Dec-14							
27	5-Mar-15							
28	2-Nov-15	0.1		0.1	3.7			
29	15-Apr-16	0.1	-	0.1	0.1			
30	13-Apr-17	0.3	0.1	0.1	0.1			
31	2-Nov-17							
32	11-May-18	0.1	0.1	0.1	0.1			
33	2-Nov-18							
34	11-Jul-19	0.2	0.1	0.1				
35	1-Nov-19							
36	1-Jul-20	0.3	0.1	0.1				
37	1-Nov-20							
38	7-Jul-21	0.2	0.1	0.1	2			
39	24-Jun-22	0.1	0.1		0.6			
40	12-Oct-23	0.1	0.1	0.1	4			
Coefficient of Variation:		1.39	1.23	0.24	1.34			
Mann-Kendall Statistic (S):		-45	-48	-15	6			
Confidence Factor:		79.4%	83.5%	73.3%	81.5%			
Concentration Trend:		No Trend	No Trend	Stable	No Trend			



Notes:

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2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

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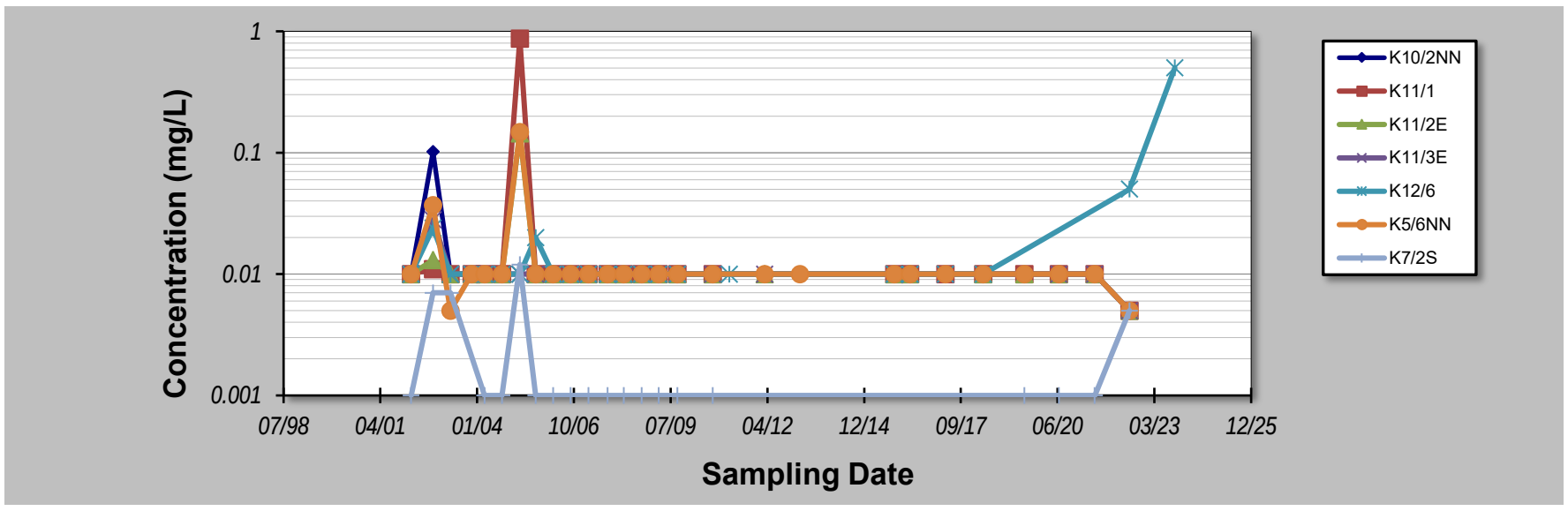
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Chromium**
Concentration Units: **mg/L**

Sampling Point ID:	K10/2NN	K11/1	K11/2E	K11/3E	K12/6	K5/6NN	K7/2S
Sampling Event	Sampling Date	CHROMIUM CONCENTRATION (mg/L)						
1	4-Mar-02	0.01	0.01	0.01	0.01	0.01	0.01	0.001
2	14-Oct-02	0.102	0.011	0.013	0.028	0.024	0.037	0.007
3	15-Apr-03	0.01	0.01	0.01	0.01	0.01	0.005	0.007
4	17-Nov-03	0.01	0.01	0.01	0.01	0.01	0.01	
5	31-Mar-04	0.01	0.01	0.01	0.01	0.01	0.01	0.001
6	27-Sep-04	0.01	0.01	0.01	0.01	0.01	0.01	0.001
7	31-Mar-05		0.867	0.144	0.01	0.01	0.148	0.012
8	12-Sep-05	0.01	0.01	0.01	0.01	0.02	0.01	0.001
9	9-Mar-06	0.01	0.01	0.01	0.01	0.01	0.01	0.001
10	6-Sep-06	0.01	0.01	0.01	0.01	0.01	0.01	0.001
11	9-Mar-07	0.01	0.01	0.01	0.01	0.01	0.01	0.001
12	22-Sep-07	0.01	0.01	0.01	0.01	0.01	0.01	0.001
13	11-Mar-08	0.01	0.01	0.01	0.01	0.01	0.01	0.001
14	10-Sep-08		0.01	0.01	0.01	0.01	0.01	0.001
15	5-Mar-09	0.01	0.01	0.01	0.01	0.01	0.01	0.001
16	14-Sep-09	0.01	0.01	0.01	0.01	0.01	0.01	0.001
17	5-Mar-10							
18	14-Sep-10		0.01	0.01	0.01		0.01	0.001
19	5-Mar-11					0.01		
20	14-Sep-11							
21	5-Mar-12			0.01	0.01		0.01	
22	14-Sep-12							
23	5-Mar-13						0.01	
24	9-Dec-13							
25	22-Apr-14							
26	9-Dec-14							
27	5-Mar-15							
28	2-Nov-15	0.01	0.01	0.01	0.01	0.01	0.01	
29	15-Apr-16	0.01	0.01	0.01	0.01	0.01	0.01	
30	13-Apr-17		0.01		0.01	0.01	0.01	
31	2-Nov-17							
32	11-May-18	0.01	0.01	0.01		0.01	0.01	
33	2-Nov-18							
34	11-Jul-19	0.01	0.01	0.01			0.01	0.001
35	1-Nov-19							
36	1-Jul-20	0.01	0.01	0.01	0.01		0.01	0.001
37	1-Nov-20							
38	7-Jul-21	0.01	0.01	0.01	0.01		0.01	0.001
39	01-Jul-22	0.005	0.005	0.005	0.005	0.05	0.005	0.005
40	12-Oct-23	0.005	0.005	0.005	0.005	0.5	0.005	0.005
Coefficient of Variation:		1.43	3.89	1.76	0.37	2.99	1.71	1.28
Mann-Kendall Statistic (S):		-16	-30	-30	-19	18	-12	-3
Confidence Factor:		67.3%	74.9%	74.9%	67.1%	67.2%	59.0%	52.6%
Concentration Trend:		No Trend	No Trend	No Trend	Stable	No Trend	No Trend	No Trend



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
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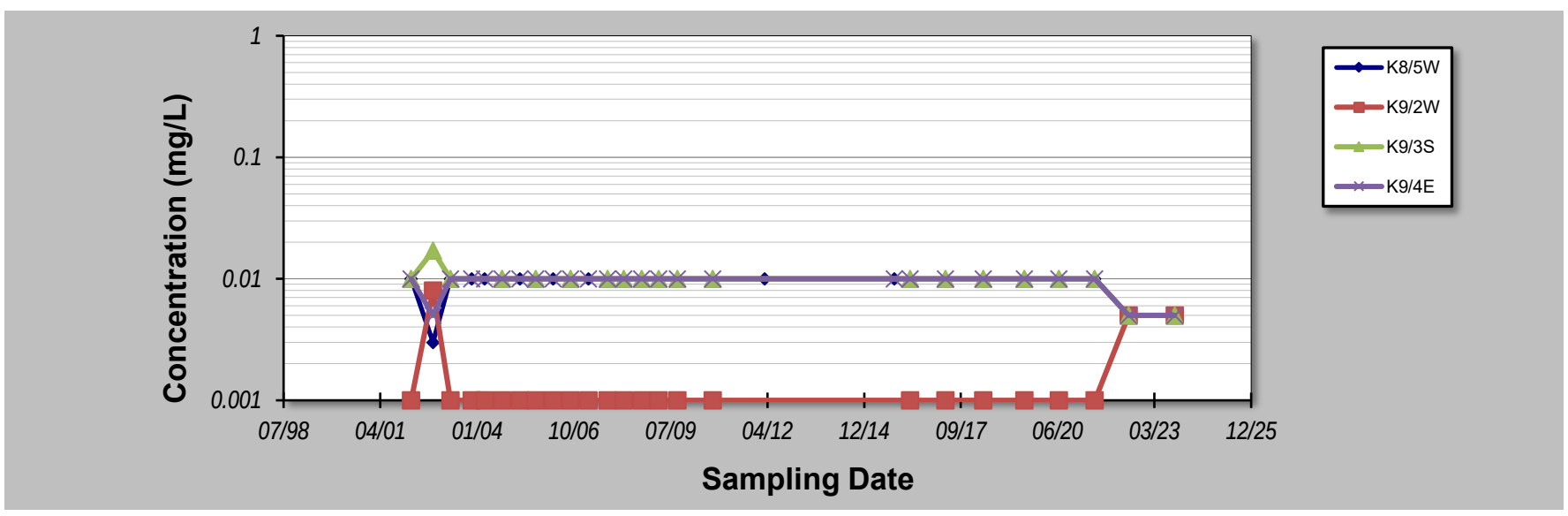
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Chromium**
Concentration Units: **mg/L**

Sampling Point ID:	K7/4S	K8/5W	K9/2W	K9/3S	K9/4E		
Sampling Event	Sampling Date	CHROMIUM CONCENTRATION (mg/L)						
1	4-Mar-02	0.01	0.01	0.001	0.01	0.01		
2	14-Oct-02	0.005	0.003	0.008	0.017	0.005		
3	15-Apr-03	0.013	0.01	0.001	0.01	0.01		
4	17-Nov-03		0.01	0.001		0.01		
5	31-Mar-04	0.01	0.01	0.001		0.01		
6	27-Sep-04	0.01	0.01	0.001	0.01	0.01		
7	31-Mar-05	0.04	0.01	0.001		0.01		
8	12-Sep-05	0.01	0.01	0.001	0.01	0.01		
9	9-Mar-06	0.01	0.01	0.001		0.01		
10	6-Sep-06	0.01	0.01	0.001	0.01	0.01		
11	9-Mar-07	0.01	0.01	0.001		0.01		
12	22-Sep-07	0.01	0.01	0.001	0.01	0.01		
13	11-Mar-08	0.01	0.01	0.001	0.01	0.01		
14	10-Sep-08	0.01	0.01	0.001	0.01	0.01		
15	5-Mar-09	0.01	0.01	0.001	0.01	0.01		
16	14-Sep-09	0.01	0.01	0.001	0.01	0.01		
17	5-Mar-10							
18	14-Sep-10	0.01	0.01	0.001	0.01	0.01		
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12	0.01	0.01					
22	2-Nov-15		0.01			0.01		
23	15-Apr-16			0.001	0.01	0.01		
24	2-Nov-16							
25	13-Apr-17		0.01	0.001	0.01	0.01		
26	2-Nov-17							
27	11-May-18		0.01	0.001	0.01	0.01		
28	2-Nov-18							
29	11-Jul-19		0.01	0.001	0.01	0.01		
30	1-Nov-19							
31	1-Jul-20		0.01	0.001	0.01	0.01		
32	1-Nov-20							
33	7-Jul-21	0.01	0.01	0.001	0.01	0.01		
34	23-Jun-22	0.005	0.005	0.005	0.005	0.005		
35	11-Oct-23	0.010	0.005	0.005	0.005	0.005		
36								
37								
38								
39								
40								
Coefficient of Variation:		**0.64**	**0.20**	**1.08**	**0.23**	**0.17**		
Mann-Kendall Statistic (S):		**-4**	**-23**	**22**	**-51**	**-25**		
Confidence Factor:		**54.1%**	**68.4%**	**68.6%**	**94.8%**	**70.0%**		
Concentration Trend:		Stable	Stable	No Trend	Prob. Decreasing	Stable		



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
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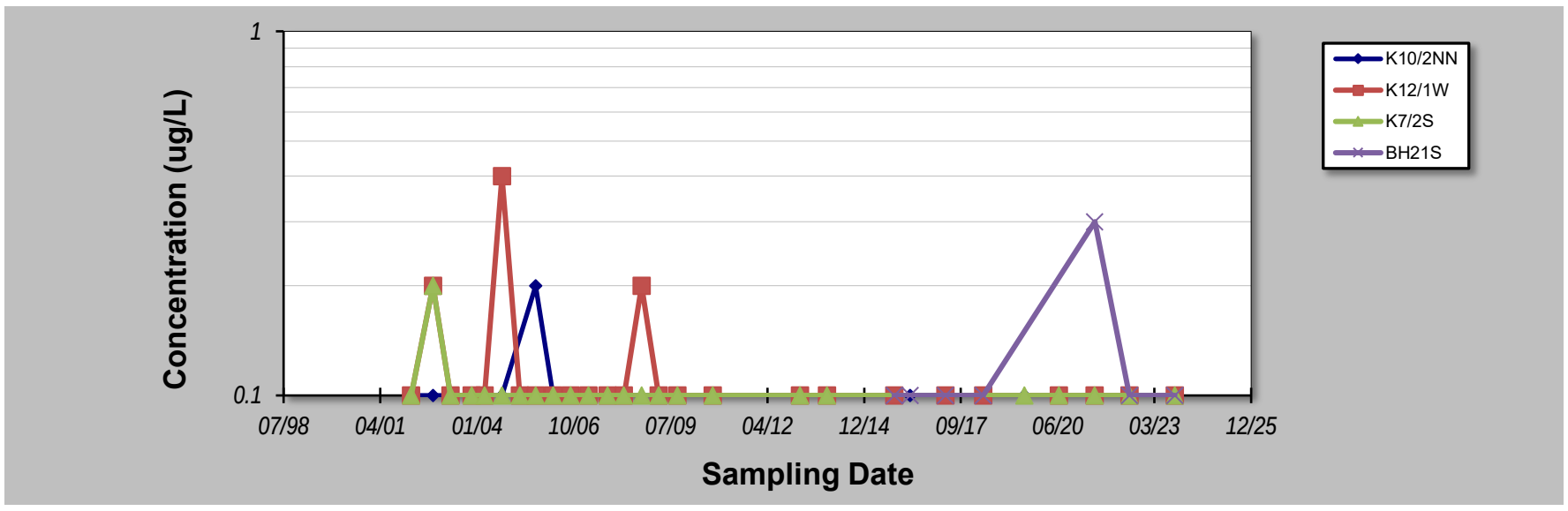
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Dibenza(ah)anthracene**
Concentration Units: **ug/L**

Sampling Point ID:	K10/2NN	K12/1W	K7/2S	BH21S			
Sampling Event	Sampling Date	DIBENZA(AH)ANTHRACENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1	0.1				
2	14-Oct-02	0.1	0.2	0.2				
3	15-Apr-03	0.1	0.1	0.1				
4	17-Nov-03	0.1	0.1	0.1				
5	31-Mar-04	0.1	0.1	0.1				
6	27-Sep-04	0.1	0.4	0.1				
7	31-Mar-05		0.1	0.1				
8	12-Sep-05	0.2	0.1	0.1				
9	9-Mar-06	0.1	0.1	0.1				
10	6-Sep-06	0.1	0.1	0.1				
11	9-Mar-07	0.1	0.1	0.1				
12	22-Sep-07	0.1	0.1	0.1				
13	11-Mar-08	0.1	0.1	0.1				
14	10-Sep-08		0.2	0.1				
15	5-Mar-09	0.1	0.1	0.1				
16	14-Sep-09	0.1	0.1	0.1				
17	5-Mar-10							
18	14-Sep-10		0.1	0.1				
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12							
22	14-Sep-12							
23	5-Mar-13		0.1	0.1				
24	9-Dec-13	0.1	0.1	0.1				
25	2-Nov-15	0.1	0.1		0.1			
26	15-Apr-16	0.1			0.1			
27	2-Nov-16							
28	13-Apr-17		0.1		0.1			
29	2-Nov-17							
30	11-May-18	0.1	0.1		0.1			
31	2-Nov-18							
32	11-Jul-19	0.1		0.1				
33	1-Nov-19							
34	1-Jul-20	0.1	0.1	0.1				
35	1-Nov-20							
36	7-Jul-21	0.1	0.1	0.1	0.3			
37	01-Jul-22	0.1	0.1	0.1	0.1			
38	12-Oct-23	0.1	0.1	0.1	0.1			
39								
40								
Coefficient of Variation:		0.20	0.53	0.20	0.59			
Mann-Kendall Statistic (S):		-10	-37	-21	2			
Confidence Factor:		59.3%	78.4%	68.9%	55.7%			
Concentration Trend:		Stable	Stable	Stable	No Trend			



Notes:

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2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
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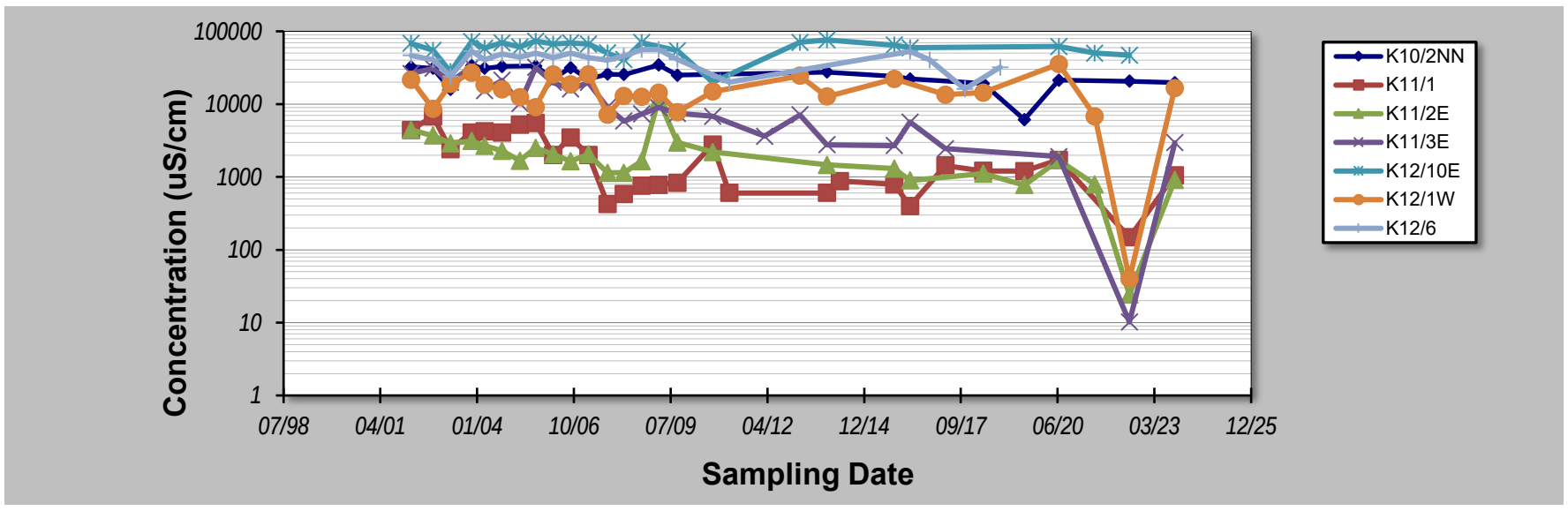
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **EC**
Concentration Units: **uS/cm**

Sampling Point ID:	K10/2NN	K11/1	K11/2E	K11/3E	K12/10E	K12/1W	K12/6
Sampling Event	Sampling Date	EC CONCENTRATION (uS/cm)						
1	4-Mar-02	32400	4400	4400	26400	68200	21600	46700
2	14-Oct-02	31000	6800	3700	31000	55000	8600	41000
3	15-Apr-03	16000	2400	2900	20000	28000	19000	24000
4	17-Nov-03	33900	4080	3120	32900	72700	27000	53700
5	31-Mar-04	31100	4220	2690	15320	58800	18440	40500
6	27-Sep-04	32800	4050	2290	21200	69700	15900	49000
7	31-Mar-05		5200	1669	10260	61200	12500	43900
8	12-Sep-05	33400	5540	2520	31900	73100	9120	50200
9	9-Mar-06	22370	2010	2047	19910	67000	25700	43320
10	6-Sep-06	31800	3500	1644	16100	69100	18690	50500
11	9-Mar-07	22370	2010	2047	19910	67000	25700	43320
12	22-Sep-07	25800	426	1138	9040	50500	7150	40300
13	11-Mar-08	25500	584	1145	5860	40900	12990	45600
14	10-Sep-08		755	1650	7320	70000	12660	56000
15	5-Mar-09	34500	782	11660	8960		14390	56300
16	14-Sep-09	25000	836	2980	7500	54200	7800	41100
17	5-Mar-10							
18	14-Sep-10		2800	2200	6800	20000	14900	
19	5-Mar-11		605					20000
20	14-Sep-11							
21	5-Mar-12				3630			
22	14-Sep-12							
23	5-Mar-13				7140	70400	24500	
24	9-Dec-13	27600	605	1460	2770	76100	12700	
25	22-Apr-14		880					
26	2-Nov-15	24005	790	1300	2700	64690	22294	
27	15-Apr-16	22173	398	897	5694	59636		53240
28	2-Nov-16							40755
29	13-Apr-17		1437		2453		13548	
30	2-Nov-17							16114
31	11-May-18	19220	1210	1110			14360	
32	2-Nov-18							32040
33	11-Jul-19	6140	1205	777				
34	1-Nov-19							
35	1-Jul-20	21298	1722	1705	1906	62066	35565	
36	1-Nov-20							
37	7-Jul-21			792		50143	6819	
38	01-Jul-22	20649	148	24.3	10.2	47123	39.8	
39	12-Oct-23	19,665	1,052	915	2,963		16,648	
40								
Coefficient of Variation:	**0.28**	**0.85**	**0.96**	**0.82**	**0.24**	**0.48**	**0.26**
Mann-Kendall Statistic (S):	**-108**	**-162**	**-200**	**-252**	**-32**	**-44**	**-27**
Confidence Factor:	**99.9%**	**99.9%**	**>99.9%**	**>99.9%**	**79.2%**	**82.7%**	**78.1%**
Concentration Trend:	Decreasing	Decreasing	Decreasing	Decreasing	Stable	Stable	Stable



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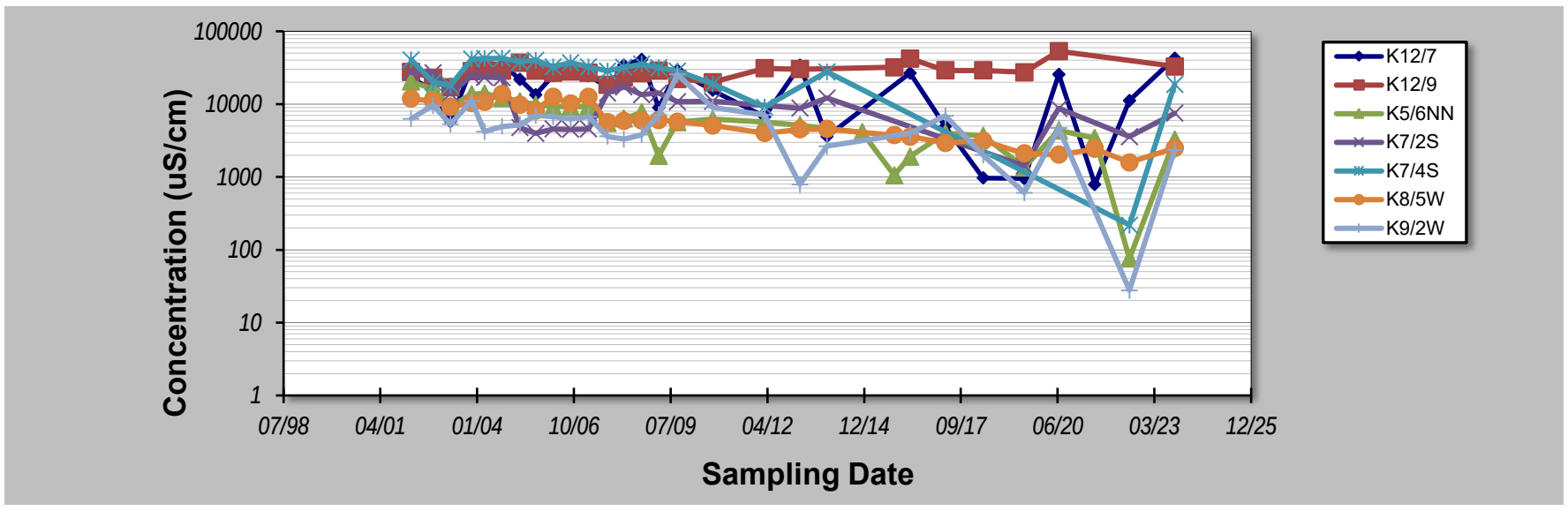
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **EC**
Concentration Units: **uS/cm**

Sampling Point ID:	K12/7	K12/9	K5/6NN	K7/2S	K7/4S	K8/5W	K9/2W
Sampling Event	Sampling Date	EC CONCENTRATION (uS/cm)						
1	4-Mar-02	23500	27800	20400	27500	40500	11900	6300
2	14-Oct-02	15000	23000	16000	27000	20000	11000	9600
3	15-Apr-03	5800	17000	9400	14000	18000	9200	5300
4	17-Nov-03	31800	28500	13680	24300	41500	10380	11030
5	31-Mar-04	28200	29200	14020	23340	42300	10770	4210
6	27-Sep-04	35300	28800	12100	23200	42500	13900	4940
7	31-Mar-05	22000	36800	10890	4750	38100	9820	5200
8	12-Sep-05	13520	29000	9840	3980	40100	8210	6970
9	9-Mar-06	24730	26900	9220	4560	32600	12580	6750
10	6-Sep-06	32700	28100	9250	4510	37100	10160	6230
11	9-Mar-07	24730	26900	9220	4560	32600	12580	6750
12	22-Sep-07	17040	18500	5490	14270	28600	5640	3600
13	11-Mar-08	34000	23500	6350	17300	32000	5920	3300
14	10-Sep-08	41300	26700	7720	13550	35400	5990	3800
15	5-Mar-09	8920	29000	1965	14250	31700	6040	7190
16	14-Sep-09	29100	22300	5650	10810	28400	5730	25500
17	5-Mar-10							
18	14-Sep-10	15500	20000	6200	10900	19000	5100	9000
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12	6740	31100	5710		9070	4000	7100
22	14-Sep-12							
23	5-Mar-13	34100	30200	5140	8800		4510	790
24	9-Dec-13	3600			12100	27700	4560	2650
25	22-Apr-14							
26	9-Dec-14			4110				
27	2-Nov-15		32100	1055			3750	
28	15-Apr-16	26711	42436	1900			3568	3990
29	2-Nov-16							
30	13-Apr-17	4941	29127	3989			2948	6920
31	2-Nov-17							
32	11-May-18	970	29100	3660			3140	2000
33	2-Nov-18							
34	11-Jul-19	954	27470	1352	1418		2106	608
35	1-Nov-19							
36	1-Jul-20	25765	53347	4342	8757		2022	4686
37	1-Nov-20							
38	7-Jul-21	793		3426			2435	
39	01-Jul-22	11214		75.9	3570	219.1	1592	27.9
40	11-Oct-23	43,003	32,841	3,279	7,520	18,725	2,490	2,358
Coefficient of Variation:		**0.64**	**0.25**	**0.69**	**0.65**	**0.39**	**0.57**	**0.82**
Mann-Kendall Statistic (S):		**-69**	**93**	**-317**	**-112**	**-113**	**-317**	**-120**
Confidence Factor:		**91.0%**	**97.9%**	**>99.9%**	**99.9%**	**>99.9%**	**>99.9%**	**99.4%**
Concentration Trend:		Prob. Decreasing	Increasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing



Notes:

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3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

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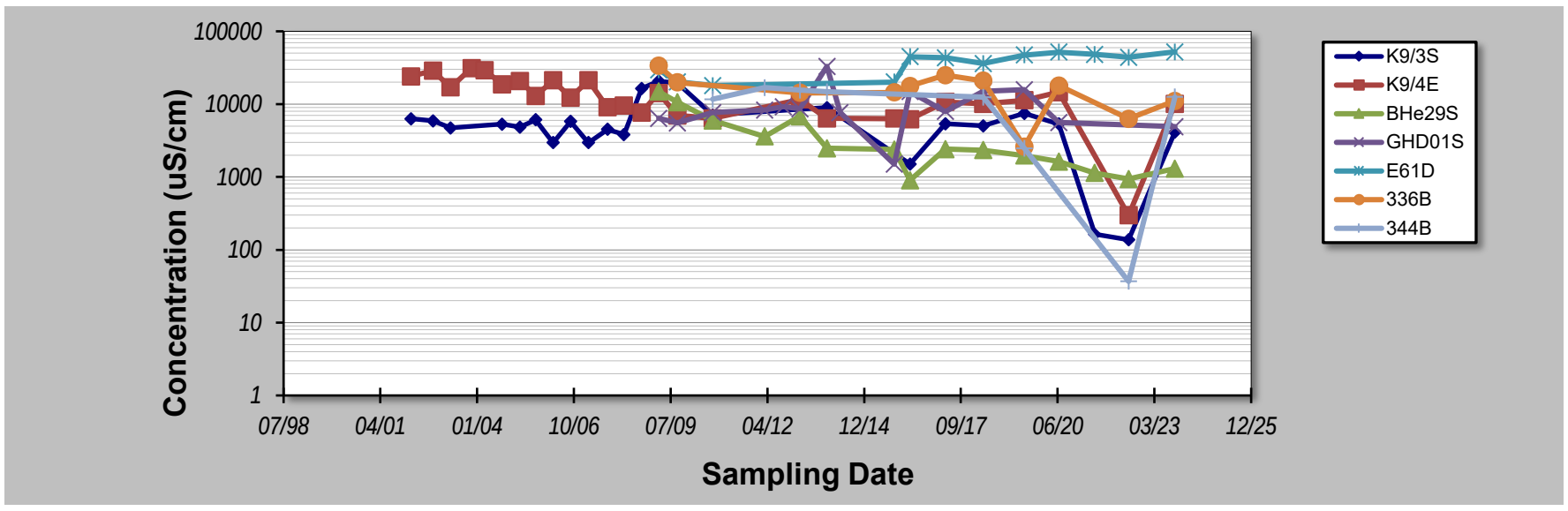
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **EC**
Concentration Units: **uS/cm**

Sampling Point ID:	K9/3S	K9/4E	BHe29S	GHD01S	E61D	336B	344B
Sampling Event	Sampling Date	EC CONCENTRATION (uS/cm)						
1	4-Mar-02	6300	24100					
2	14-Oct-02	5900	29000					
3	15-Apr-03	4700	17000					
4	17-Nov-03		31400					
5	31-Mar-04		29300					
6	27-Sep-04	5300	18700					
7	31-Mar-05	4850	20900					
8	12-Sep-05	6100	13020					
9	9-Mar-06	2960	21210					
10	6-Sep-06	5790	12350					
11	9-Mar-07	2960	21210					
12	22-Sep-07	4510	9020					
13	11-Mar-08	3820	9520					
14	10-Sep-08	16450	7640					
15	5-Mar-09	20660	14280	14860	6380	29600	33700	
16	14-Sep-09	19500	6980	10680	5500	20200	19900	
17	5-Mar-10							
18	14-Sep-10	7100	6400	6000	7700	18000		11700
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12			3600	8330			16900
22	14-Sep-12				9250			
23	5-Mar-13		11600	6810	8600		14300	15600
24	9-Dec-13	8940	6390	2470	33000			14800
25	22-Apr-14				7660			
26	2-Nov-15		6350	2380	1500	20100	14500	
27	15-Apr-16	1500	6243	900	14888	44933	17719	
28	2-Nov-16							
29	13-Apr-17	5390	10725	2418	7930	43591	25012	
30	2-Nov-17							
31	11-May-18	5020	10150	2340	14990	36280	20980	12460
32	2-Nov-18							
33	11-Jul-19	7470	11310	1968	15801	47318	2614	2483
34	1-Nov-19							
35	1-Jul-20	5346	14561	1633	5616	51926	17989	
36	1-Nov-20							
37	7-Jul-21	163.3		1137		48081		
38	21-Jun-22	137.2	296.7	938		44047	6288	36.8
39	13-Oct-23	4,128	10,040	1,297	4,922	52,319	11,101	12,539
40								
Coefficient of Variation:		**0.81**	**0.57**	**1.02**	**0.74**	**0.34**	**0.51**	**0.57**
Mann-Kendall Statistic (S):		**-41**	**-190**	**-81**	**11**	**40**	**-19**	**-12**
Confidence Factor:		**83.8%**	**>99.9%**	**>99.9%**	**68.7%**	**99.7%**	**91.8%**	**91.1%**
Concentration Trend:		Stable	Decreasing	Decreasing	No Trend	Increasing	Prob. Decreasing	Prob. Decreasing



Notes:

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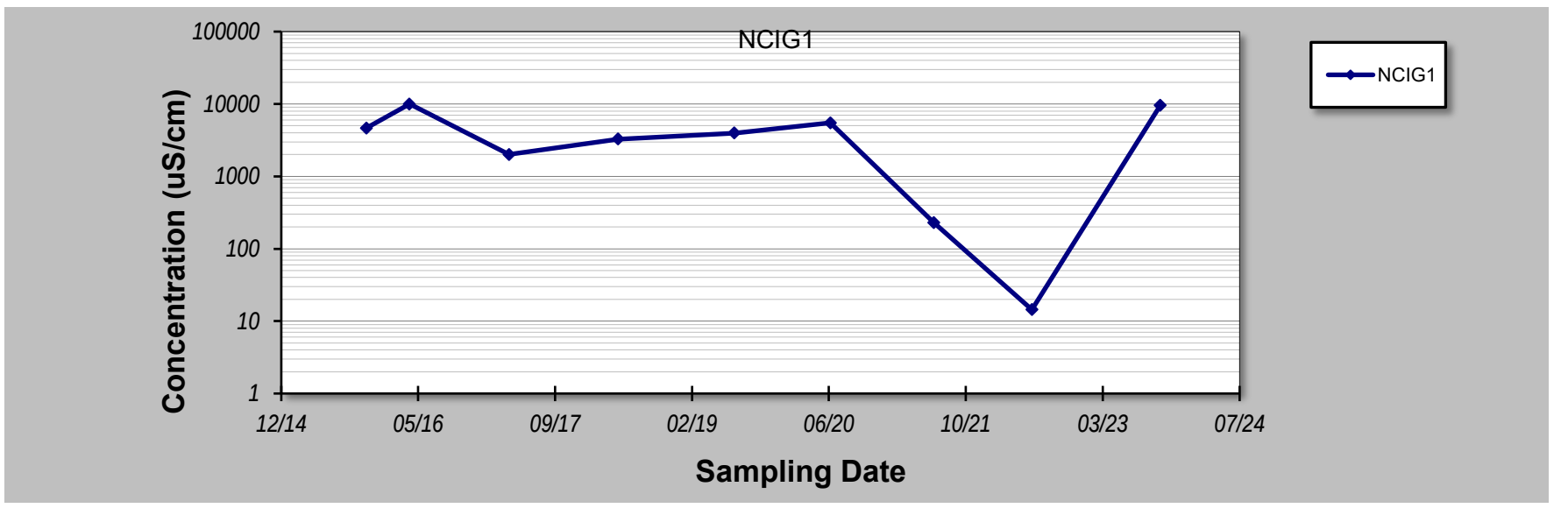
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **EC**
Concentration Units: **uS/cm**

Sampling Point ID: **NCIG1**

Sampling Event	Sampling Date	EC CONCENTRATION (uS/cm)
1	3-Nov-15	4650
2	8-Apr-16	10007
3	7-Apr-17	2012
4	10-May-18	3280
5	8-Jul-19	3972
6	23-Jun-20	5467
7	6-Jul-21	230
8	29-Jun-22	14.4
9	11-Oct-23	9,555
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
Coefficient of Variation:		0.82
Mann-Kendall Statistic (S):		-6
Confidence Factor:		69.4%
Concentration Trend:		Stable



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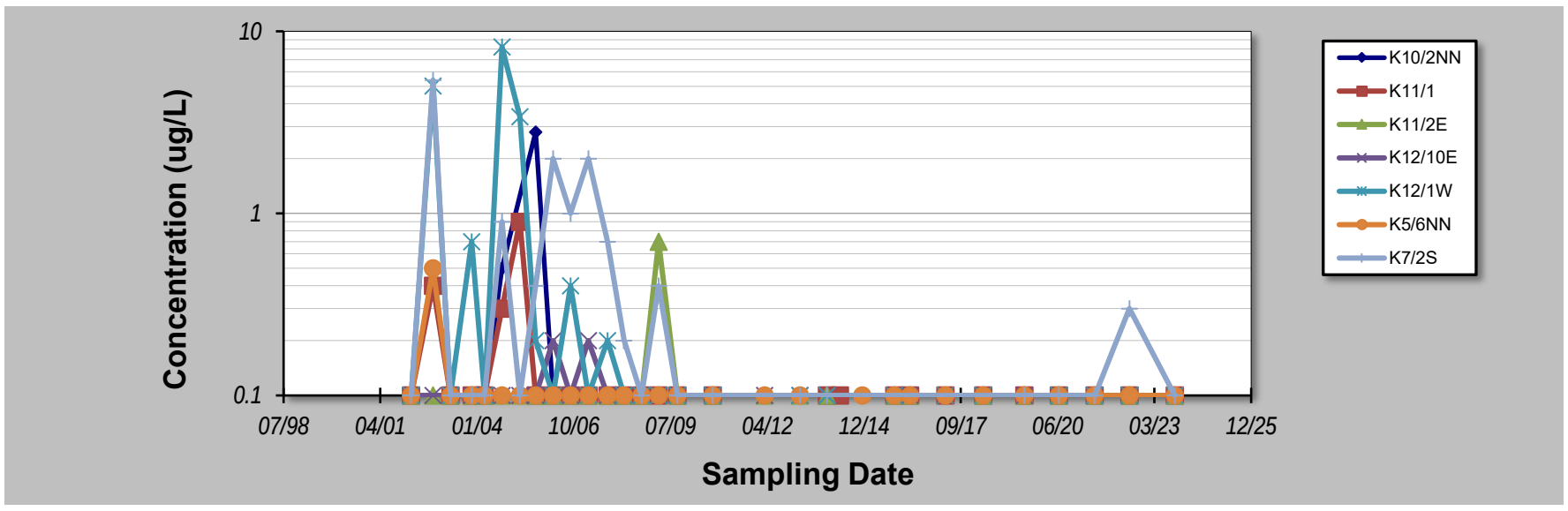
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Fluoranthene**
Concentration Units: **ug/L**

Sampling Point ID:	K10/2NN	K11/1	K11/2E	K12/10E	K12/1W	K5/6NN	K7/2S
Sampling Event	Sampling Date	FLUORANTHENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2	14-Oct-02	0.1	0.4	0.1	0.1	5	0.5	5.4
3	15-Apr-03	0.1	0.1	0.1	0.1	0.1	0.1	0.1
4	17-Nov-03	0.1	0.1	0.1	0.1	0.7	0.1	0.1
5	31-Mar-04	0.1	0.1	0.1	0.1	0.1	0.1	0.1
6	27-Sep-04	0.5	0.3	0.1	0.1	8.2	0.1	0.9
7	31-Mar-05		0.9	0.1	0.1	3.4	0.1	0.1
8	12-Sep-05	2.8	0.1	0.1	0.1	0.2	0.1	0.4
9	9-Mar-06	0.1	0.1	0.1	0.2	0.1	0.1	2
10	6-Sep-06	0.1	0.1	0.1	0.1	0.4	0.1	1
11	9-Mar-07	0.1	0.1	0.1	0.2	0.1	0.1	2
12	22-Sep-07	0.1	0.1	0.1	0.1	0.2	0.1	0.7
13	11-Mar-08	0.1	0.1	0.1	0.1	0.1	0.1	0.2
14	10-Sep-08		0.1	0.1	0.1	0.1	0.1	0.1
15	5-Mar-09	0.1	0.1	0.7	0.1	0.1	0.1	0.4
16	14-Sep-09	0.1	0.1	0.1	0.1	0.1	0.1	0.1
17	5-Mar-10							
18	14-Sep-10		0.1	0.1	0.1	0.1	0.1	0.1
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12			0.1	0.1		0.1	
22	14-Sep-12							
23	5-Mar-13			0.1	0.1	0.1	0.1	0.1
24	9-Dec-13	0.1	0.1	0.1	0.1	0.1		0.1
25	22-Apr-14		0.1					
26	9-Dec-14						0.1	
27	2-Nov-15	0.1	0.1	0.1	0.1	0.1	0.1	
28	15-Apr-16	0.1	0.1	0.1	0.1		0.1	
29	2-Nov-16							
30	13-Apr-17		0.1			0.1	0.1	
31	2-Nov-17							
32	11-May-18	0.1	0.1	0.1		0.1	0.1	
33	2-Nov-18							
34	11-Jul-19	0.1	0.1	0.1	0.1		0.1	0.1
35	1-Nov-19							
36	1-Jul-20	0.1	0.1	0.1	0.1	0.1	0.1	0.1
37	1-Nov-20							
38	7-Jul-21	0.1	0.1	0.1	0.1	0.1	0.1	0.1
39	01-Jul-22	0.1	0.1	0.1	0.1	0.1	0.1	0.3
40	12-Oct-23	0.1	0.1	0.1		0.1	0.1	0.1
Coefficient of Variation:		2.41	1.11	0.93	0.25	2.46	0.65	1.90
Mann-Kendall Statistic (S):		-21	-56	1	-14	-103	-26	-55
Confidence Factor:		69.9%	86.0%	50.0%	61.2%	98.8%	67.9%	90.9%
Concentration Trend:		No Trend	No Trend	No Trend	Stable	Decreasing	Stable	Prob. Decreasing



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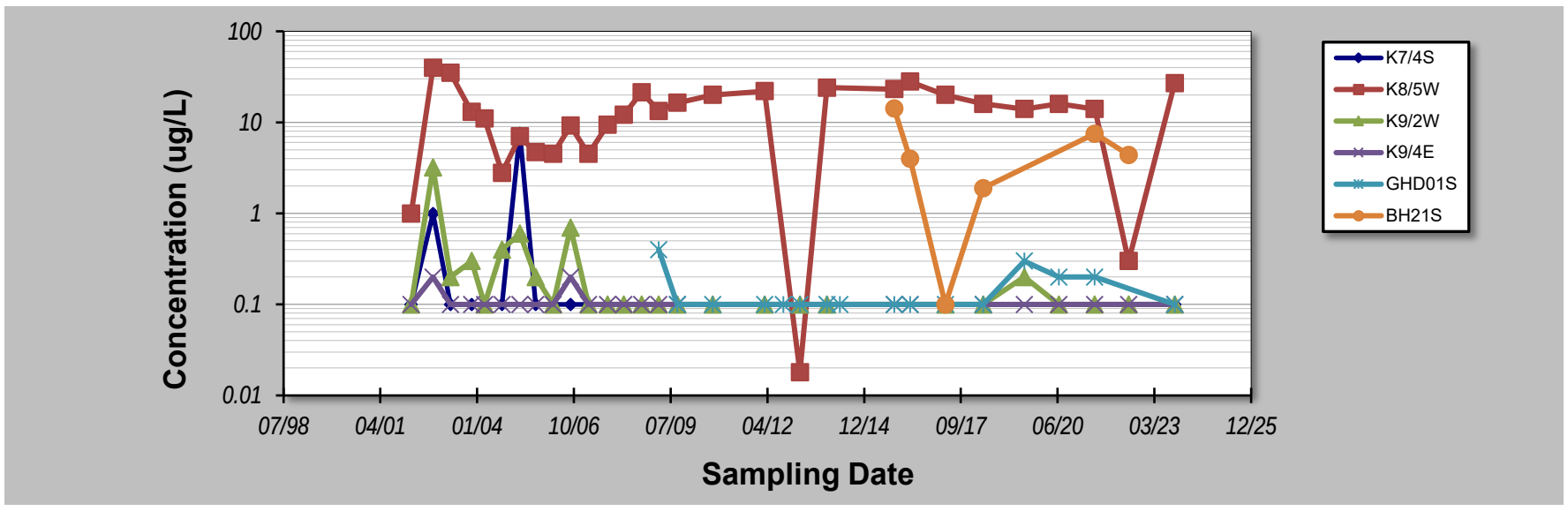
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Fluoranthene**
Concentration Units: **ug/L**

Sampling Point ID:	K7/4S	K8/5W	K9/2W	K9/4E	GHD01S	BH21S	
Sampling Event	Sampling Date	FLUORANTHENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	1	0.1	0.1			
2	14-Oct-02	1	40	3.2	0.2			
3	15-Apr-03	0.1	35	0.2	0.1			
4	17-Nov-03	0.1	13	0.3	0.1			
5	31-Mar-04	0.1	11	0.1	0.1			
6	27-Sep-04	0.1	2.8	0.4	0.1			
7	31-Mar-05	7.6	7	0.6	0.1			
8	12-Sep-05	0.1	4.7	0.2	0.1			
9	9-Mar-06	0.1	4.5	0.1	0.1			
10	6-Sep-06	0.1	9.2	0.7	0.2			
11	9-Mar-07	0.1	4.5	0.1	0.1			
12	22-Sep-07	0.1	9.4	0.1	0.1			
13	11-Mar-08	0.1	12.2	0.1	0.1			
14	10-Sep-08	0.1	21.5	0.1	0.1			
15	5-Mar-09	0.1	13.4	0.1	0.1	0.4		
16	14-Sep-09	0.1	16.4	0.1	0.1	0.1		
17	5-Mar-10							
18	14-Sep-10	0.1	20	0.1		0.1		
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12	0.1	22	0.1		0.1		
22	14-Sep-12					0.1		
23	5-Mar-13		0.018	0.1		0.1		
24	9-Dec-13	0.1	24	0.1		0.1		
25	22-Apr-14					0.1		
26	9-Dec-14							
27	5-Mar-15							
28	2-Nov-15		23.2		0.1	0.1	14.2	
29	15-Apr-16		28	-	0.1	0.1	4	
30	2-Nov-16							
31	13-Apr-17		20	0.1	-	0.1	0.1	
32	11-May-18		16	0.1	0.1	0.1	1.9	
33	2-Nov-18							
34	11-Jul-19		14	0.2	0.1	0.3		
35	1-Nov-19							
36	1-Jul-20		16	0.1	0.1	0.2		
37	1-Nov-20							
38	7-Jul-21	0.1	14	0.1	0.1	0.2	7.5	
39	23-Jun-22	0.1	0.3	0.1	0.1		4.4	
40	11-Oct-23	0.1	27	0.1	0.1	0.1	4	
Coefficient of Variation:		**3.32**	**0.69**	**2.11**	**0.26**	**0.62**	**0.94**	
Mann-Kendall Statistic (S):		**-27**	**82**	**-101**	**-26**	**13**	**5**	
Confidence Factor:		**76.6%**	**93.5%**	**98.2%**	**73.0%**	**70.3%**	**76.5%**	
Concentration Trend:		No Trend	Prob. Increasing	Decreasing	Stable	No Trend	No Trend	



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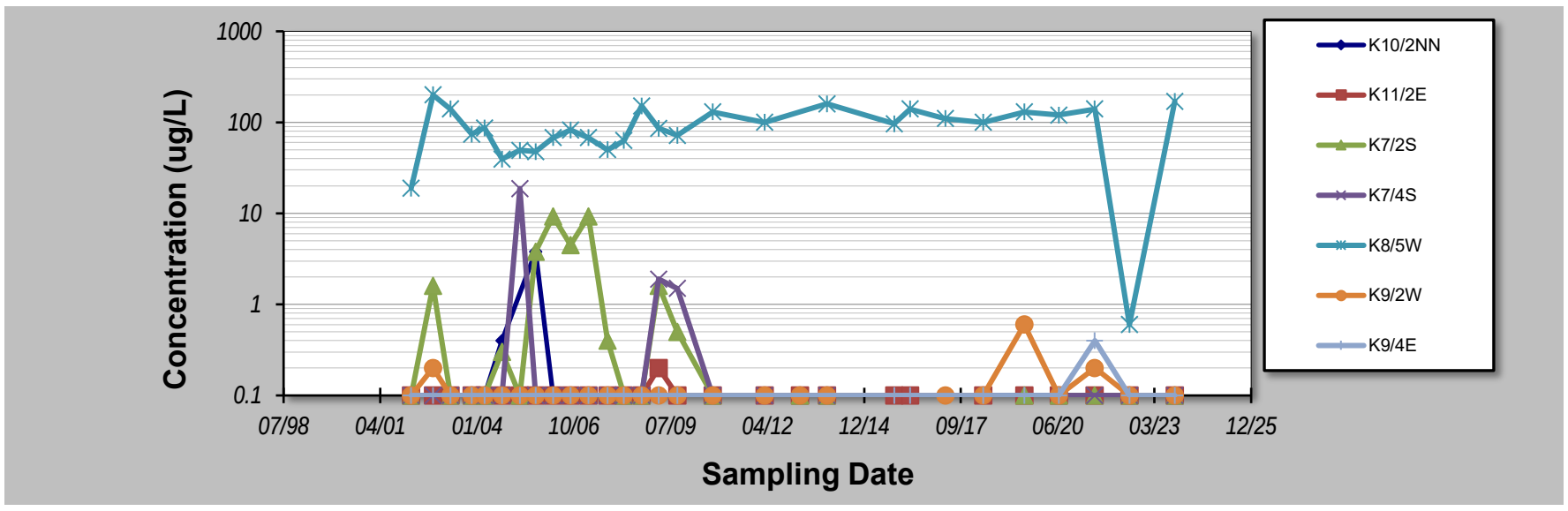
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Fluorene**
Concentration Units: **ug/L**

Sampling Point ID:	K10/2NN	K11/2E	K7/2S	K7/4S	K8/5W	K9/2W	K9/4E
Sampling Event	Sampling Date	FLUORENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1	0.1	0.1	19	0.1	0.1
2	14-Oct-02	0.1	0.1	1.6	0.1	200	0.2	0.1
3	15-Apr-03	0.1	0.1	0.1	0.1	140	0.1	0.1
4	17-Nov-03	0.1	0.1	0.1	0.1	74.4	0.1	0.1
5	31-Mar-04	0.1	0.1	0.1	0.1	87	0.1	0.1
6	27-Sep-04	0.4	0.1	0.3	0.1	39.4	0.1	0.1
7	31-Mar-05		0.1	0.1	18.7	49.4	0.1	0.1
8	12-Sep-05	3.8	0.1	3.8	0.1	47.9	0.1	0.1
9	9-Mar-06	0.1	0.1	9.3	0.1	68	0.1	0.1
10	6-Sep-06	0.1	0.1	4.5	0.1	82.5	0.1	0.1
11	9-Mar-07	0.1	0.1	9.3	0.1	68	0.1	0.1
12	22-Sep-07	0.1	0.1	0.4	0.1	50	0.1	0.1
13	11-Mar-08	0.1	0.1	0.1	0.1	63	0.1	0.1
14	10-Sep-08		0.1	0.1	0.1	152	0.1	0.1
15	5-Mar-09	0.1	0.2	1.6	1.9	86.1	0.1	0.1
16	14-Sep-09	0.1	0.1	0.5	1.5	71.8	0.1	0.1
17	5-Mar-10							
18	14-Sep-10		0.1	0.1	0.1	130	0.1	
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12		0.1		0.1	100	0.1	
22	14-Sep-12							
23	5-Mar-13		0.1	0.1			0.1	
24	9-Dec-13	0.1	0.1	0.1	0.1	160	0.1	
25	2-Nov-15	0.1	0.1			96.2		0.1
26	15-Apr-16	0.1	0.1			140	-	0.1
27	2-Nov-16							
28	13-Apr-17					110	0.1	-
29	2-Nov-17							
30	11-May-18	0.1	0.1			100	0.1	0.1
31	2-Nov-18							
32	11-Jul-19	0.1	0.1	0.1		130	0.6	0.1
33	1-Nov-19							
34	1-Jul-20	0.1	0.1	0.1		120	0.1	0.1
35	1-Nov-20							
36	7-Jul-21	0.1	0.1	0.1	0.1	140	0.2	0.4
37	01-Jul-22	0.1	0.1	0.1	0.1	0.6	0.1	0.1
38	12-Oct-23	0.1	0.1	0.1	0.1	170.00	0.1	0.1
39								
40								
Coefficient of Variation:		2.82	0.18	1.98	3.63	0.50	0.78	0.54
Mann-Kendall Statistic (S):		-21	1	-47	4	116	16	19
Confidence Factor:		69.9%	50.0%	87.2%	53.3%	98.9%	62.2%	67.1%
Concentration Trend:		No Trend	No Trend	No Trend	No Trend	Increasing	No Trend	No Trend



Notes:

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2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
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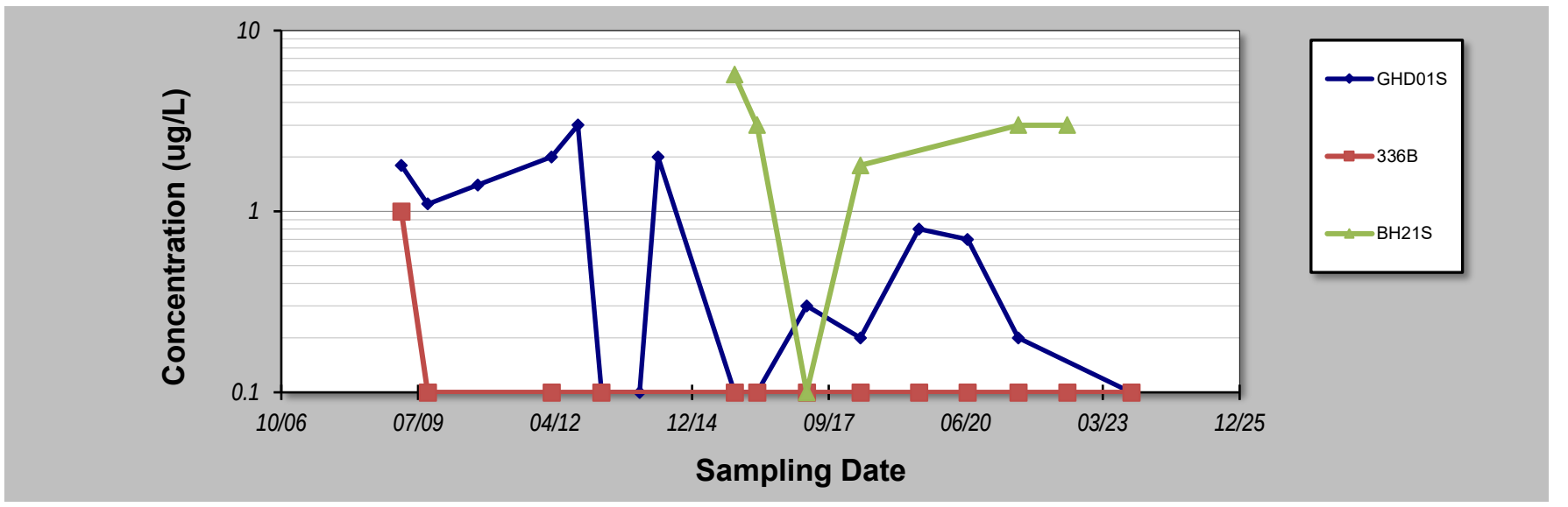
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Fluorene**
Concentration Units: **ug/L**

Sampling Point ID:	GHD01S	336B	BH21S				
Sampling Event	Sampling Date	FLUORENE CONCENTRATION (ug/L)						
1	5-Mar-09	1.8	1					
2	14-Sep-09	1.1	0.1					
3	5-Mar-10							
4	14-Sep-10	1.4						
5	5-Mar-11							
6	14-Sep-11							
7	5-Mar-12	2	0.1					
8	14-Sep-12	3						
9	5-Mar-13	0.1	0.1					
10	9-Dec-13	0.1						
11	22-Apr-14	2						
12	9-Dec-14							
13	5-Mar-15							
14	2-Nov-15	0.1	0.1	5.7				
15	15-Apr-16	0.1	0.1	3				
16	2-Nov-16							
17	13-Apr-17	0.3	0.1	0.1				
18	2-Nov-17							
19	11-May-18	0.2	0.1	1.8				
20	2-Nov-18							
21	11-Jul-19	0.8	0.1					
22	1-Nov-19							
23	1-Jul-20	0.7	0.1					
24	1-Nov-20							
25	7-Jul-21	0.2	0.1	3				
26	28-Jun-22		0.1	3				
27	9-Oct-23	0.1	0.1	3				
28								
29								
30								
Coefficient of Variation:		1.04	1.47	0.66				
Mann-Kendall Statistic (S):		-34	-12	4				
Confidence Factor:		93.0%	74.5%	70.3%				
Concentration Trend:		Prob. Decreasing	No Trend	No Trend				



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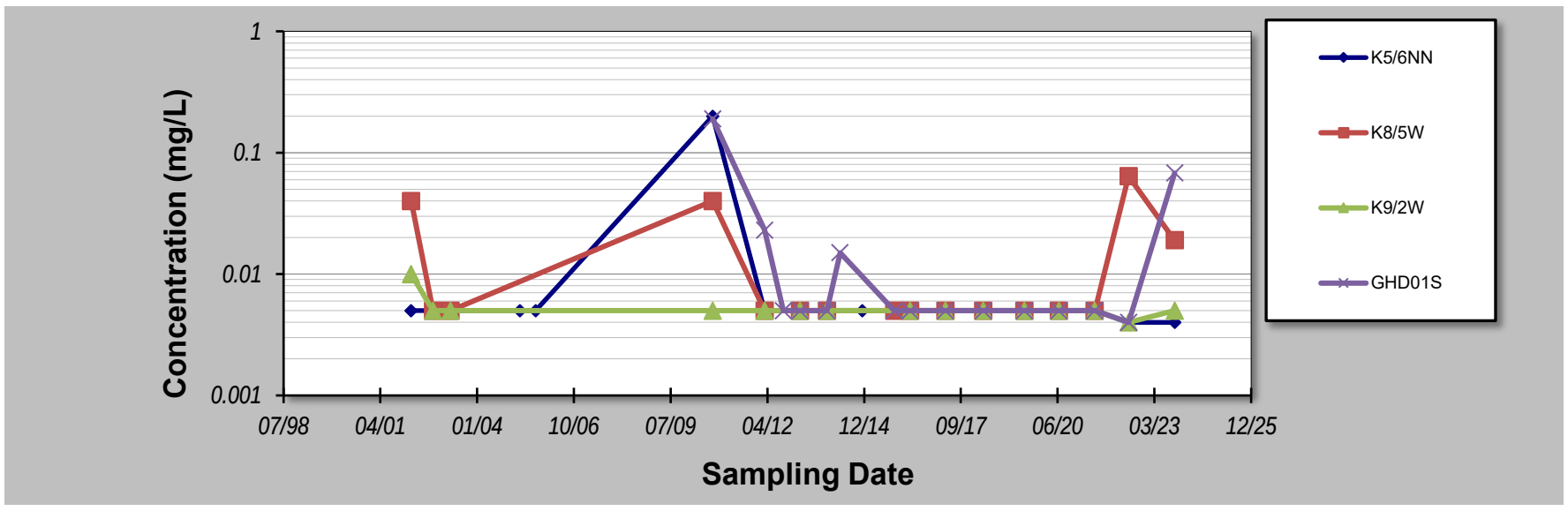
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Free cyanide**
Concentration Units: **mg/L**

Sampling Point ID:	K5/6NN	K8/5W	K9/2W	GHD01S			
Sampling Event	Sampling Date	FREE CYANIDE CONCENTRATION (mg/L)						
1	4-Mar-02	0.005	0.04	0.01				
2	14-Oct-02	0.005	0.005	0.005				
3	15-Apr-03	0.005	0.005	0.005				
4	17-Nov-03							
5	31-Mar-04							
6	27-Sep-04							
7	31-Mar-05	0.005						
8	12-Sep-05	0.005						
9	9-Mar-06							
10	6-Sep-06							
11	9-Mar-07							
12	22-Sep-07							
13	11-Mar-08							
14	10-Sep-08							
15	5-Mar-09							
16	14-Sep-09							
17	5-Mar-10							
18	14-Sep-10	0.2	0.04	0.005	0.19			
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12	0.005	0.005	0.005	0.023			
22	14-Sep-12				0.005			
23	5-Mar-13	0.005	0.005	0.005	0.005			
24	9-Dec-13		0.005	0.005	0.005			
25	22-Apr-14				0.015			
26	9-Dec-14	0.005						
27	2-Nov-15	0.005	0.005		0.005			
28	15-Apr-16	0.005	0.005	0.005	0.005			
29	2-Nov-16							
30	13-Apr-17	0.005	0.005	0.005	0.005			
31	2-Nov-17							
32	11-May-18	0.005	0.005	0.005	0.005			
33	2-Nov-18							
34	11-Jul-19	0.005	0.005	0.005	0.005			
35	1-Nov-19							
36	1-Jul-20	0.005	0.005	0.005	0.005			
37	1-Nov-20							
38	7-Jul-21	0.005	0.005	0.005	0.005			
39	22-Jun-22	0.004	0.064	0.004	0.004			
40	10-Oct-23	0.004	0.02	0.005	0.07			
Coefficient of Variation:		**2.93**	**1.29**	**0.25**	**2.10**			
Mann-Kendall Statistic (S):		**-37**	**3**	**-25**	**-28**			
Confidence Factor:		**91.2%**	**53.6%**	**88.0%**	**90.8%**			
Concentration Trend:		Prob. Decreasing	No Trend	Stable	Prob. Decreasing			



Notes:

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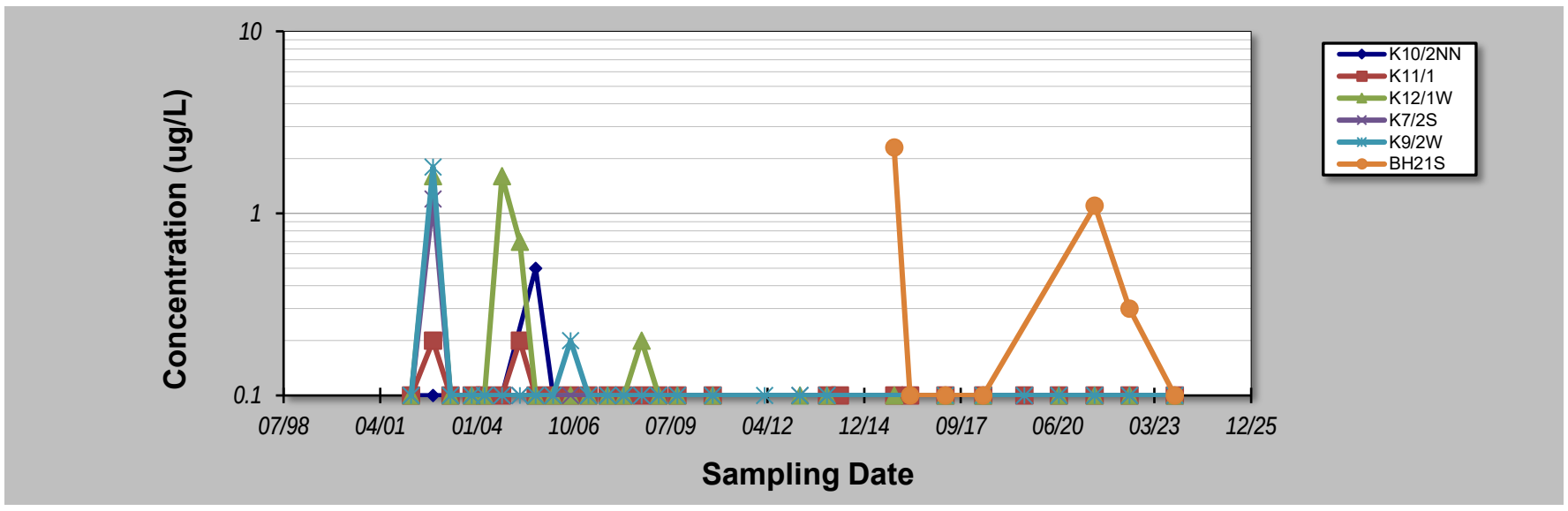
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Indeno(1.2.3-cd)pyrene**
Concentration Units: **ug/L**

Sampling Point ID:	K10/2NN	K11/1	K12/1W	K7/2S	K9/2W	BH21S	
Sampling Event	Sampling Date	INDENO(1.2.3-CD)PYRENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1	0.1	0.1	0.1		
2	14-Oct-02	0.1	0.2	1.6	1.2	1.8		
3	15-Apr-03	0.1	0.1	0.1	0.1	0.1		
4	17-Nov-03	0.1	0.1	0.1	0.1	0.1		
5	31-Mar-04	0.1	0.1	0.1	0.1	0.1		
6	27-Sep-04	0.1	0.1	1.6	0.1	0.1		
7	31-Mar-05		0.2	0.7	0.1	0.1		
8	12-Sep-05	0.5	0.1	0.1	0.1	0.1		
9	9-Mar-06	0.1	0.1	0.1	0.1	0.1		
10	6-Sep-06	0.1	0.1	0.1	0.1	0.2		
11	9-Mar-07	0.1	0.1	0.1	0.1	0.1		
12	22-Sep-07	0.1	0.1	0.1	0.1	0.1		
13	11-Mar-08	0.1	0.1	0.1	0.1	0.1		
14	10-Sep-08		0.1	0.2	0.1	0.1		
15	5-Mar-09	0.1	0.1	0.1	0.1	0.1		
16	14-Sep-09	0.1	0.1	0.1	0.1	0.1		
17	5-Mar-10							
18	14-Sep-10		0.1	0.1	0.1	0.1		
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12					0.1		
22	14-Sep-12							
23	5-Mar-13			0.1	0.1	0.1		
24	9-Dec-13	0.1	0.1	0.1	0.1	0.1		
25	22-Apr-14		0.1					
26	9-Dec-14							
27	5-Mar-15							
28	2-Nov-15	0.1	0.1	0.1			2.3	
29	15-Apr-16	0.1	0.1			-	0.1	
30	13-Apr-17		0.1	0.1		0.1	0.1	
31	2-Nov-17							
32	11-May-18	0.1	0.1	0.1		0.1	0.1	
33	2-Nov-18							
34	11-Jul-19	0.1	0.1		0.1	0.1		
35	1-Nov-19							
36	1-Jul-20	0.1	0.1	0.1	0.1	0.1		
37	1-Nov-20							
38	7-Jul-21	0.1	0.1	0.1	0.1	0.1	1.1	
39	01-Jul-22	0.1	0.1	0.1	0.1	0.1	0.3	
40	12-Oct-23	0.1	0.1	0.1	0.1	0.1	0.1	
Coefficient of Variation:		0.71	0.24	1.72	1.54	1.96	1.43	
Mann-Kendall Statistic (S):		-10	-40	-55	-21	-33	-3	
Confidence Factor:		59.3%	77.8%	88.2%	68.9%	74.6%	61.4%	
Concentration Trend:		Stable	Stable	No Trend	No Trend	No Trend	No Trend	



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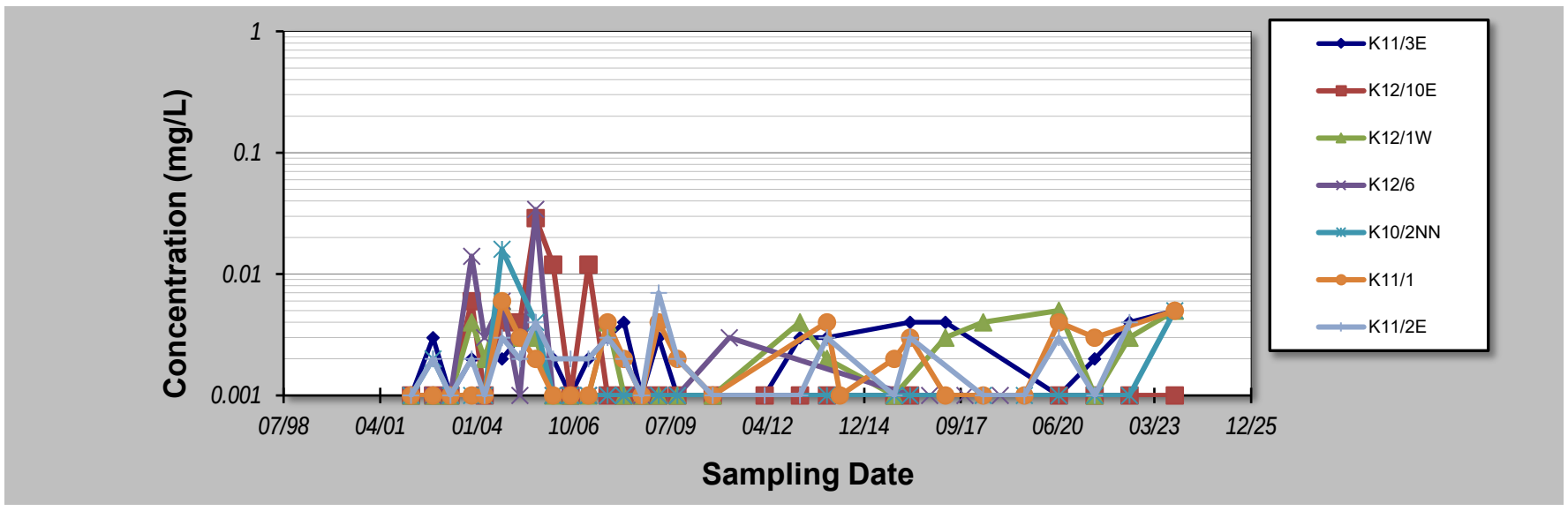
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Molybdenum**
Concentration Units: **mg/L**

Sampling Point ID:	K10/2NN	K11/1	K11/2E	K11/3E	K12/10E	K12/1W	K12/6
Sampling Event	Sampling Date	MOLYBDENUM CONCENTRATION (mg/L)						
1	4-Mar-02	0.001	0.001	0.001	0.001	0.001	0.001	0.001
2	14-Oct-02	0.002	0.001	0.002	0.003	0.001	0.001	0.001
3	15-Apr-03	0.001	0.001	0.001	0.001	0.001	0.001	0.001
4	17-Nov-03	0.001	0.001	0.002	0.002	0.006	0.004	0.014
5	31-Mar-04	0.001	0.001	0.001	0.002	0.001	0.002	0.003
6	27-Sep-04	0.016	0.006	0.003	0.002	0.004	0.006	0.006
7	31-Mar-05		0.003	0.002	0.003	0.004	0.003	0.001
8	12-Sep-05	0.004	0.002	0.004	0.002	0.029	0.003	0.034
9	9-Mar-06	0.001	0.001	0.002	0.002	0.012	0.001	0.001
10	6-Sep-06	0.001	0.001	0.002	0.001	0.001	0.001	0.001
11	9-Mar-07	0.001	0.001	0.002	0.002	0.012	0.001	0.001
12	22-Sep-07	0.001	0.004	0.003	0.003	0.001	0.004	0.001
13	11-Mar-08	0.001	0.002	0.002	0.004	0.001	0.001	0.001
14	10-Sep-08		0.001	0.001	0.001	0.001	0.001	0.001
15	5-Mar-09	0.001	0.004	0.007	0.003	0.001	0.001	0.001
16	14-Sep-09	0.001	0.002	0.002	0.001	0.001	0.001	0.001
17	5-Mar-10							
18	14-Sep-10		0.001	0.001	0.001	0.001	0.001	
19	5-Mar-11							0.003
20	14-Sep-11							
21	5-Mar-12			0.001	0.001	0.001		
22	5-Mar-13			0.001	0.003	0.001	0.004	
23	9-Dec-13	0.001	0.004	0.003	0.003	0.001	0.002	
24	22-Apr-14		0.001					
25	9-Dec-14							
26	5-Mar-15							
27	2-Nov-15	0.001	0.002	0.001		0.001	0.001	
28	15-Apr-16	0.001	0.003	0.003	0.004	0.001		0.001
29	2-Nov-16							0.001
30	13-Apr-17		0.001		0.004		0.003	
31	2-Nov-17							0.001
32	11-May-18	0.001	0.001	0.001			0.004	
33	2-Nov-18							0.001
34	11-Jul-19	0.001	0.001	0.001				
35	1-Nov-19							
36	1-Jul-20	0.001	0.004	0.003	0.001	0.001	0.005	
37	1-Nov-20							
38	7-Jul-21	0.001	0.003	0.001	0.002	0.001	0.001	
39	01-Jul-22	0.001	0.005	0.004	0.004	0.001	0.003	
40	12-Oct-23	0.005	0.005	<0.005	0.005	0.001	0.005	
Coefficient of Variation:		1.61	0.69	0.65	0.51	1.82	0.68	2.09
Mann-Kendall Statistic (S):		-18	94	3	81	-67	53	-31
Confidence Factor:		67.2%	97.4%	51.6%	96.1%	92.7%	87.3%	81.5%
Concentration Trend:		No Trend	Increasing	No Trend	Increasing	Prob. Decreasing	No Trend	No Trend



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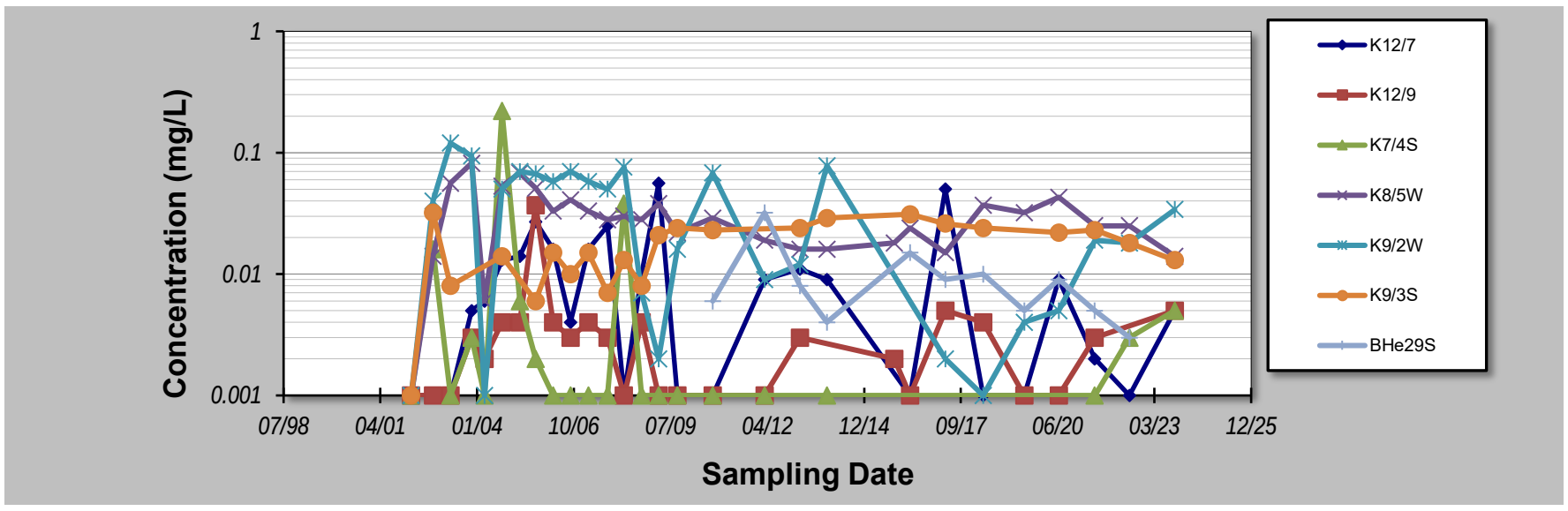
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Molybdenum**
Concentration Units: **mg/L**

Sampling Point ID:	K12/7	K12/9	K7/4S	K8/5W	K9/2W	K9/3S	BHe29S
Sampling Event	Sampling Date	MOLYBDENUM CONCENTRATION (mg/L)						
1	4-Mar-02	0.001	0.001	0.001	0.001	0.001	0.001	
2	14-Oct-02	0.001	0.001	0.016	0.014	0.04	0.032	
3	15-Apr-03	0.001	0.001	0.001	0.056	0.12	0.008	
4	17-Nov-03	0.005	0.003	0.003	0.082	0.094		
5	31-Mar-04	0.006	0.002	0.001	0.006	0.001		
6	27-Sep-04	0.013	0.004	0.22	0.053	0.05	0.014	
7	31-Mar-05	0.014	0.004	0.006	0.068	0.07		
8	12-Sep-05	0.027	0.037	0.002	0.051	0.067	0.006	
9	9-Mar-06	0.016	0.004	0.001	0.033	0.058	0.015	
10	6-Sep-06	0.004	0.003	0.001	0.041	0.07	0.01	
11	9-Mar-07	0.016	0.004	0.001	0.033	0.058	0.015	
12	22-Sep-07	0.025	0.003	0.001	0.028	0.05	0.007	
13	11-Mar-08	0.001	0.001	0.038	0.03	0.076	0.013	
14	10-Sep-08	0.01	0.004	0.001	0.028	0.007	0.008	
15	5-Mar-09	0.056	0.001	0.001	0.038	0.002	0.021	0.02
16	14-Sep-09	0.001	0.001	0.001	0.022	0.016	0.024	0.022
17	5-Mar-10							
18	14-Sep-10	0.001	0.001	0.001	0.029	0.068	0.023	0.006
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12	0.009	0.001	0.001	0.019	0.009		0.032
22	14-Sep-12							
23	5-Mar-13	0.011	0.003		0.016	0.012	0.024	0.008
24	9-Dec-13	0.009		0.001	0.016	0.078	0.029	0.004
25	22-Apr-14							
26	9-Dec-14							
27	5-Mar-15							
28	2-Nov-15		0.002		0.018			
29	15-Apr-16	0.001	0.001		0.024		0.031	0.015
30	13-Apr-17	0.05	0.005		0.015	0.002	0.026	0.009
31	2-Nov-17							
32	11-May-18	0.001	0.004		0.037	0.001	0.024	0.01
33	2-Nov-18							
34	11-Jul-19	0.001	0.001		0.032	0.004	-	0.005
35	1-Nov-19							
36	1-Jul-20	0.009	0.001		0.043	0.005	0.022	0.009
37	1-Nov-20							
38	7-Jul-21	0.002	0.003	0.001	0.025	0.019	0.023	0.005
39	01-Jul-22	0.001		0.003	0.025	0.018	0.018	0.003
40	11-Oct-23	0.005	0.005	0.005	0.014	0.034	0.01	0.005
Coefficient of Variation:		1.32	1.82	3.35	0.58	0.90	0.49	0.85
Mann-Kendall Statistic (S):		-16	9	-23	-97	-72	84	-29
Confidence Factor:		61.5%	56.6%	73.0%	96.5%	93.0%	98.6%	98.7%
Concentration Trend:		No Trend	No Trend	No Trend	Decreasing	Prob. Decreasing	Increasing	Decreasing



Notes:

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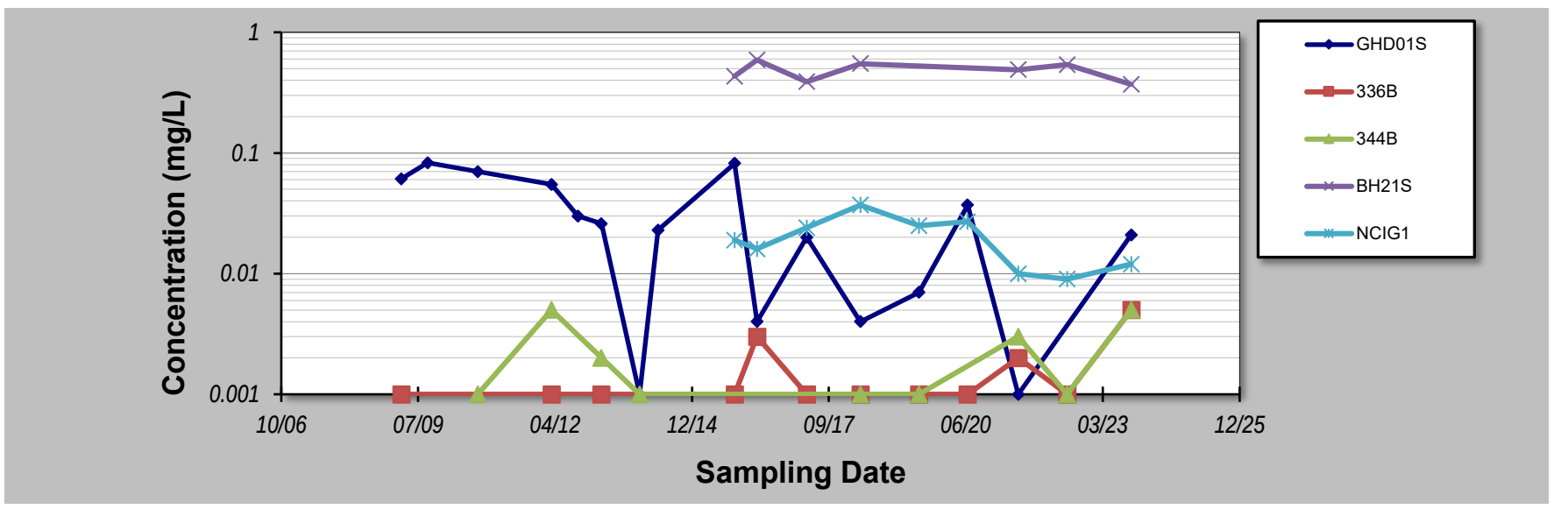
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Molybdenum**
Concentration Units: **mg/L**

Sampling Point ID:	GHD01S	336B	344B	BH21S	NCIG1		
Sampling Event	Sampling Date	MOLYBDENUM CONCENTRATION (mg/L)						
1	5-Mar-09	0.061	0.001					
2	14-Sep-09	0.083	0.001					
3	5-Mar-10							
4	14-Sep-10	0.07		0.001				
5	5-Mar-11							
6	14-Sep-11							
7	5-Mar-12	0.055	0.001	0.005				
8	14-Sep-12	0.03						
9	5-Mar-13	0.026	0.001	0.002				
10	9-Dec-13	0.001		0.001				
11	22-Apr-14	0.023						
12	9-Dec-14							
13	5-Mar-15							
14	2-Nov-15	0.082	0.001		0.433	0.019		
15	15-Apr-16	0.004	0.003		0.59	0.016		
16	2-Nov-16							
17	13-Apr-17	0.02	0.001		0.39	0.024		
18	2-Nov-17							
19	11-May-18	0.004	0.001	0.001	0.55	0.037		
20	2-Nov-18							
21	11-Jul-19	0.007	0.001	0.001		0.025		
22	1-Nov-19							
23	1-Jul-20	0.037	0.001			0.027		
24	1-Nov-20							
25	7-Jul-21	0.001	0.002	0.003	0.49	0.01		
26	28-Jun-22		0.001	0.001	0.54	0.009		
27	9-Oct-23	0.021	0.005	0.005	0.37	0.01		
28								
29								
30								
Coefficient of Variation:		0.88	0.78	0.77	0.18	0.46		
Mann-Kendall Statistic (S):		-56	6	3	-5	-8		
Confidence Factor:		99.4%	63.1%	58.0%	71.9%	76.2%		
Concentration Trend:		Decreasing	No Trend	No Trend	Stable	Stable		



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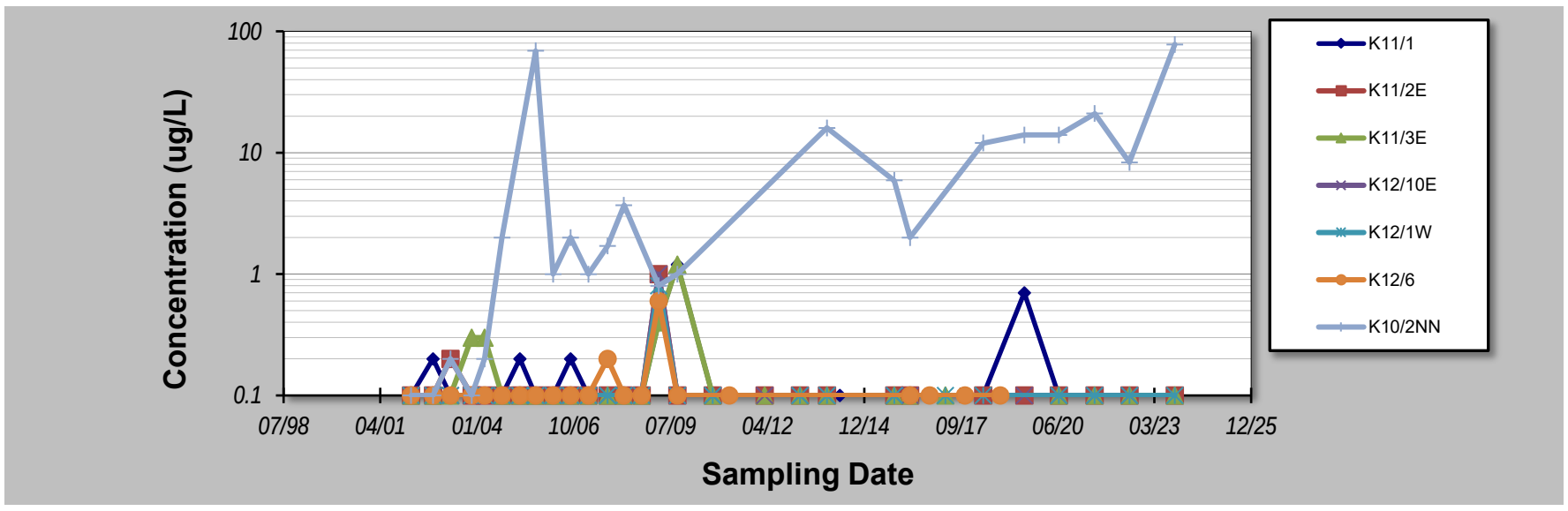
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Naphthalene**
Concentration Units: **ug/L**

Sampling Point ID:	K10/2NN	K11/1	K11/2E	K11/3E	K12/10E	K12/1W	K12/6
Sampling Event	Sampling Date	NAPHTHALENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2	14-Oct-02	0.1	0.2	0.1	0.1	0.1	0.1	0.1
3	15-Apr-03	0.2	0.1	0.2	0.1	0.1	0.1	0.1
4	17-Nov-03	0.1	0.1	0.1	0.3	0.1	0.1	0.1
5	31-Mar-04	0.2	0.1	0.1	0.3	0.1	0.1	0.1
6	27-Sep-04	2	0.1	0.1	0.1	0.1	0.1	0.1
7	31-Mar-05		0.2	0.1	0.1	0.1	0.1	0.1
8	12-Sep-05	69	0.1	0.1	0.1	0.1	0.1	0.1
9	9-Mar-06	1	0.1	0.1	0.1	0.1	0.1	0.1
10	6-Sep-06	2	0.2	0.1	0.1	0.1	0.1	0.1
11	9-Mar-07	1	0.1	0.1	0.1	0.1	0.1	0.1
12	22-Sep-07	1.7	0.1	0.1	0.1	0.1	0.1	0.2
13	11-Mar-08	3.7	0.1	0.1	0.1	0.1	0.1	0.1
14	10-Sep-08		0.1	0.1	0.1	0.1	0.1	0.1
15	5-Mar-09	0.8	0.4	1	0.4	1	0.8	0.6
16	14-Sep-09	1	1.2	0.1	1.2	0.1	0.1	0.1
17	5-Mar-10							
18	14-Sep-10		0.1	0.1	0.1	0.1	0.1	
19	5-Mar-11							0.1
20	14-Sep-11							
21	5-Mar-12			0.1	0.1	0.1		
22	14-Sep-12							
23	5-Mar-13			0.1	0.1	0.1	0.1	
24	9-Dec-13	16	0.1	0.1	0.1	0.1	0.1	
25	22-Apr-14		0.1					
26	2-Nov-15	5.9	0.1	0.1	0.1	0.1	0.1	
27	15-Apr-16	2	0.1	0.1	0.1	0.1		0.1
28	2-Nov-16							0.1
29	13-Apr-17		0.1		0.1		0.1	
30	2-Nov-17							0.1
31	11-May-18	12	0.1	0.1			0.1	
32	2-Nov-18							0.1
33	11-Jul-19	14	0.7	0.1		0.1		
34	1-Nov-19							
35	1-Jul-20	14	0.1	0.1	0.1	0.1	0.1	
36	1-Nov-20							
37	7-Jul-21	21	0.1	0.1	0.1	0.1	0.1	
38	01-Jul-22	8.3	0.1	0.1	0.1	0.1	0.1	
39	12-Oct-23	78.00	0.1	0.1	0.1		0.1	
40								
Coefficient of Variation:		1.87	1.29	1.26	1.32	1.31	1.08	0.86
Mann-Kendall Statistic (S):		156	-16	-21	-27	3	3	11
Confidence Factor:		>99.9%	61.5%	65.2%	70.4%	51.7%	51.7%	61.8%
Concentration Trend:		Increasing	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend



Notes:

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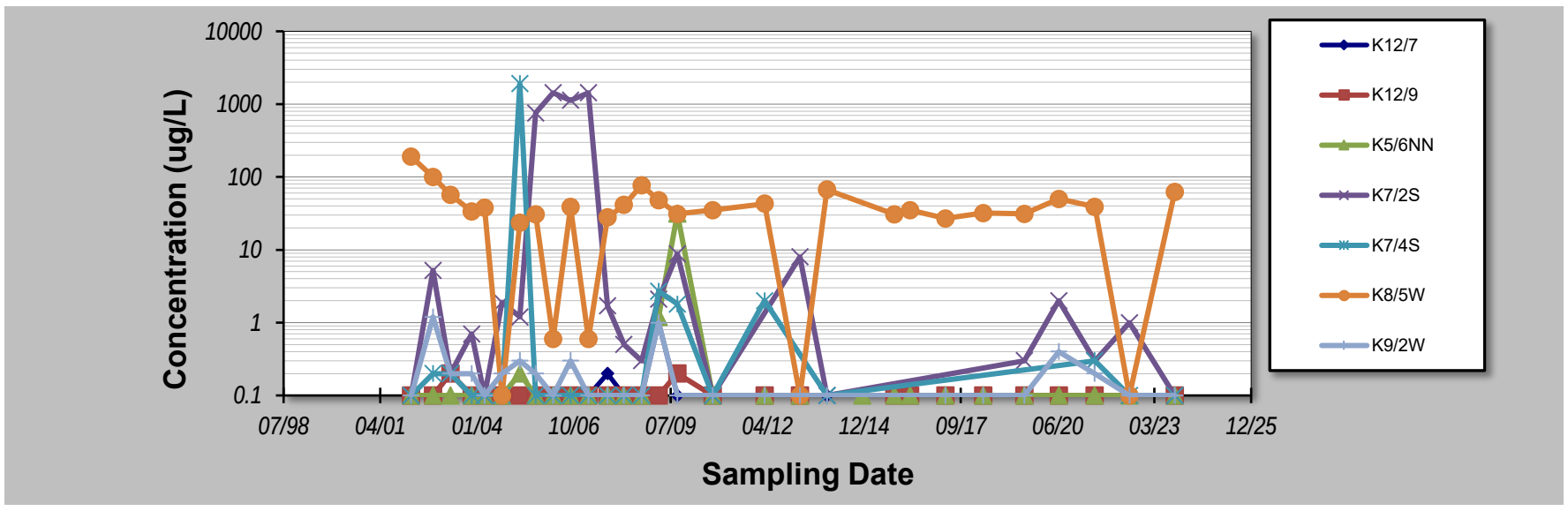
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Naphthalene**
Concentration Units: **ug/L**

Sampling Point ID:	K12/7	K12/9	K5/6NN	K7/2S	K7/4S	K8/5W	K9/2W
Sampling Event	Sampling Date	NAPHTHALENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1	0.1	0.1	0.1	190	0.1
2	14-Oct-02	0.1	0.1	0.1	5.2	0.2	100	1.2
3	15-Apr-03	0.2	0.2	0.1	0.2	0.2	57	0.2
4	17-Nov-03	0.1	0.1	0.1	0.7	0.1	33.8	0.2
5	31-Mar-04	0.1	0.1	0.1	0.1	0.1	38	0.1
6	27-Sep-04	0.1	0.1	0.1	1.9	0.1	0.1	0.2
7	31-Mar-05	0.1	0.1	0.2	1.2	1910	23.5	0.3
8	12-Sep-05	0.1	0.1	0.1	759	0.1	30.7	0.2
9	9-Mar-06	0.1	0.1	0.1	1430	0.1	0.6	0.1
10	6-Sep-06	0.1	0.1	0.1	1130	0.1	38.6	0.3
11	9-Mar-07	0.1	0.1	0.1	1430	0.1	0.6	0.1
12	22-Sep-07	0.2	0.1	0.1	1.7	0.1	27.8	0.1
13	11-Mar-08	0.1	0.1	0.1	0.5	0.1	41.2	0.1
14	10-Sep-08	0.1	0.1	0.1	0.3	0.1	77.2	0.1
15	5-Mar-09	1	0.1	1.2	2.1	2.7	48.1	1
16	14-Sep-09	0.1	0.2	31.3	8.8	1.8	31	0.1
17	5-Mar-10							
18	14-Sep-10	0.1	0.1	0.1	0.1	0.1	35	0.1
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12	0.1	0.1	0.1		2	43	0.1
22	14-Sep-12							
23	5-Mar-13	0.1	0.1	0.1	8		0.1	0.1
24	9-Dec-13	0.1			0.1	0.1	67	0.1
25	22-Apr-14							
26	9-Dec-14			0.1				
27	2-Nov-15		0.1	0.1			30.6	
28	15-Apr-16	0.1	0.1	0.1			35	-
29	2-Nov-16							
30	13-Apr-17	0.1	0.1	0.1			27	0.1
31	2-Nov-17							
32	11-May-18	0.1	0.1	0.1			32	0.1
33	2-Nov-18							
34	11-Jul-19	0.1	0.1	0.1	0.3		31	0.1
35	1-Nov-19							
36	1-Jul-20	0.1	0.1	0.1	2		50	0.4
37	1-Nov-20							
38	7-Jul-21	0.1	0.1	0.1	0.3	0.3	39	0.2
39	01-Jul-22	0.1		0.1	1	0.1	0.1	0.1
40	11-Oct-23	0.1	0.1	0.1	0.1	0.1	62.00	0.1
Coefficient of Variation:		1.23	0.25	4.76	2.34	4.67	0.90	1.22
Mann-Kendall Statistic (S):		-25	-18	-11	-24	3	-22	-68
Confidence Factor:		68.1%	63.7%	57.4%	71.4%	52.2%	65.2%	91.8%
Concentration Trend:		No Trend	Stable	No Trend	No Trend	No Trend	Stable	Prob. Decreasing



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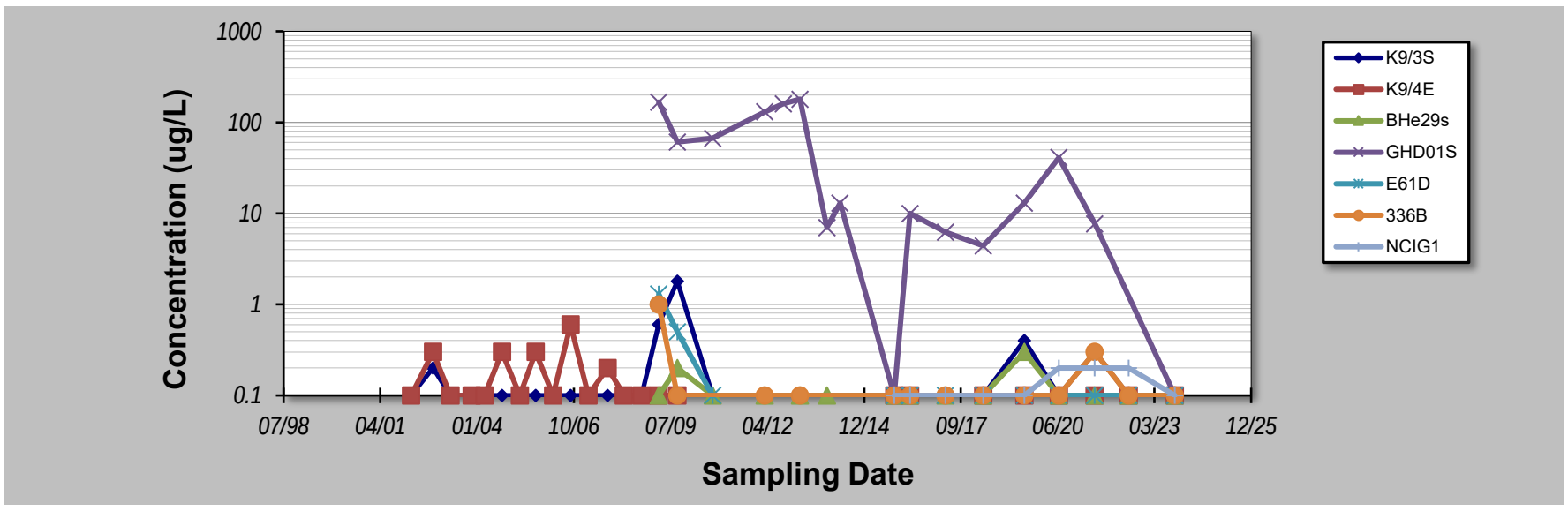
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Naphthalene**
Concentration Units: **ug/L**

Sampling Point ID:	K9/3S	K9/4E	BHe29s	GHD01S	E61D	336B	NCIG1
Sampling Event	Sampling Date	NAPHTHALENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1					
2	14-Oct-02	0.2	0.3					
3	15-Apr-03	0.1	0.1					
4	17-Nov-03		0.1					
5	31-Mar-04		0.1					
6	27-Sep-04	0.1	0.3					
7	31-Mar-05		0.1					
8	12-Sep-05	0.1	0.3					
9	9-Mar-06	0.1	0.1					
10	6-Sep-06	0.1	0.6					
11	9-Mar-07	0.1	0.1					
12	22-Sep-07	0.1	0.2					
13	11-Mar-08	0.1	0.1					
14	10-Sep-08	0.1	0.1					
15	5-Mar-09	0.6	0.1	0.1	167	1.3	1	
16	14-Sep-09	1.8	0.1	0.2	60.9	0.5	0.1	
17	5-Mar-10							
18	14-Sep-10	0.1		0.1	67	0.1		
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12			0.1	130		0.1	
22	14-Sep-12				160			
23	5-Mar-13	0.1		0.1	180		0.1	
24	9-Dec-13			0.1	7			
25	22-Apr-14				13			
26	2-Nov-15		0.1	0.1	0.1	0.1	0.1	0.1
27	15-Apr-16	0.1	0.1	0.1	10	0.1	0.1	0.1
28	2-Nov-16							
29	13-Apr-17	0.1	-	0.1	6.2	0.1	0.1	0.1
30	2-Nov-17							
31	11-May-18	0.1	0.1	0.1	4.4	0.1	0.1	0.1
32	2-Nov-18							
33	11-Jul-19	0.4	0.1	0.3	13	0.1	0.1	0.1
34	1-Nov-19							
35	1-Jul-20	0.1	0.1	0.1	41	0.1	0.1	0.2
36	1-Nov-20							
37	7-Jul-21	0.3	0.1	0.1	7.7	0.1	0.3	0.2
38	21-Jun-22	0.1	0.1	0.1		0.1	0.1	0.2
39	13-Oct-23	0.1	0.1	0.1	0.1	0.1	0.1	0.1
40								
Coefficient of Variation:		1.65	0.79	0.47	1.23	1.52	1.36	0.38
Mann-Kendall Statistic (S):		14	-50	-5	-54	-21	-5	12
Confidence Factor:		63.3%	88.7%	57.7%	99.2%	91.3%	59.4%	87.0%
Concentration Trend:		No Trend	Stable	Stable	Decreasing	Prob. Decreasing	No Trend	No Trend



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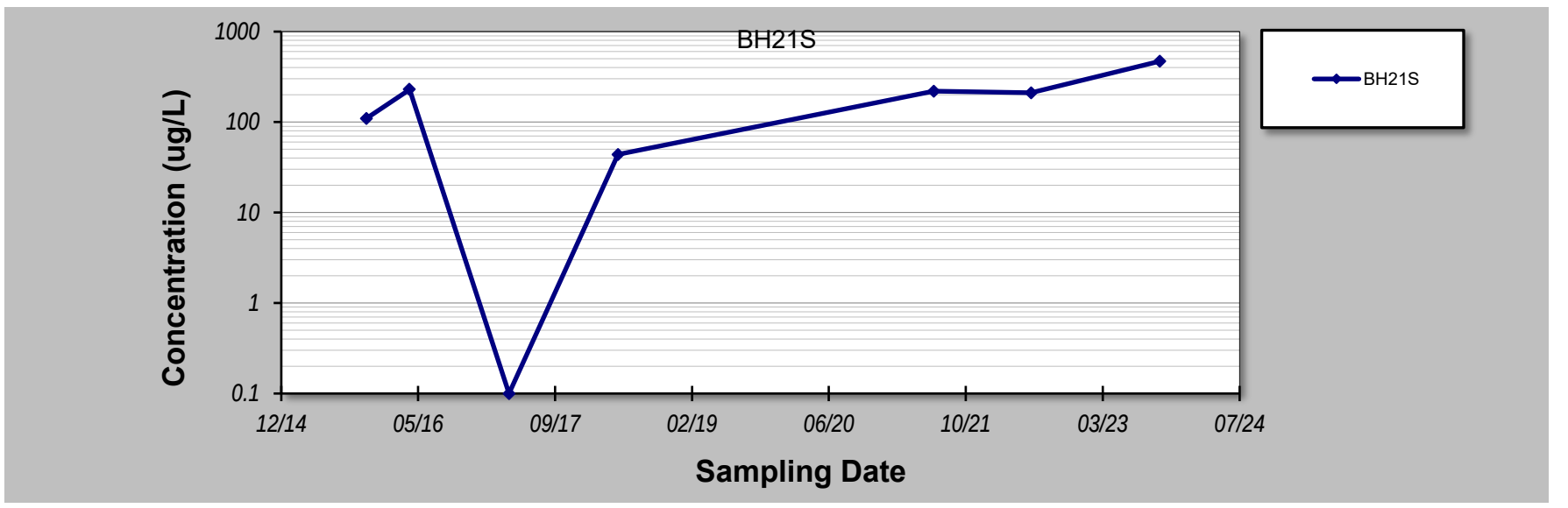
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Naphthalene**
Concentration Units: **ug/L**

Sampling Point ID: **BH21S**

Sampling Event	Sampling Date	NAPHTHALENE CONCENTRATION (ug/L)						
1	3-Nov-15	110						
2	8-Apr-16	230						
3	7-Apr-17	0.1						
4	10-May-18	44						
5	8-Jul-19							
6	23-Jun-20							
7	6-Jul-21	220						
8	27-Jun-22	210						
9	09-Oct-23	470.00						
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		1.16	0.00					
Mann-Kendall Statistic (S):		-8	0					
Confidence Factor:		72.9%						
Concentration Trend:		No Trend						



Notes:

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3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

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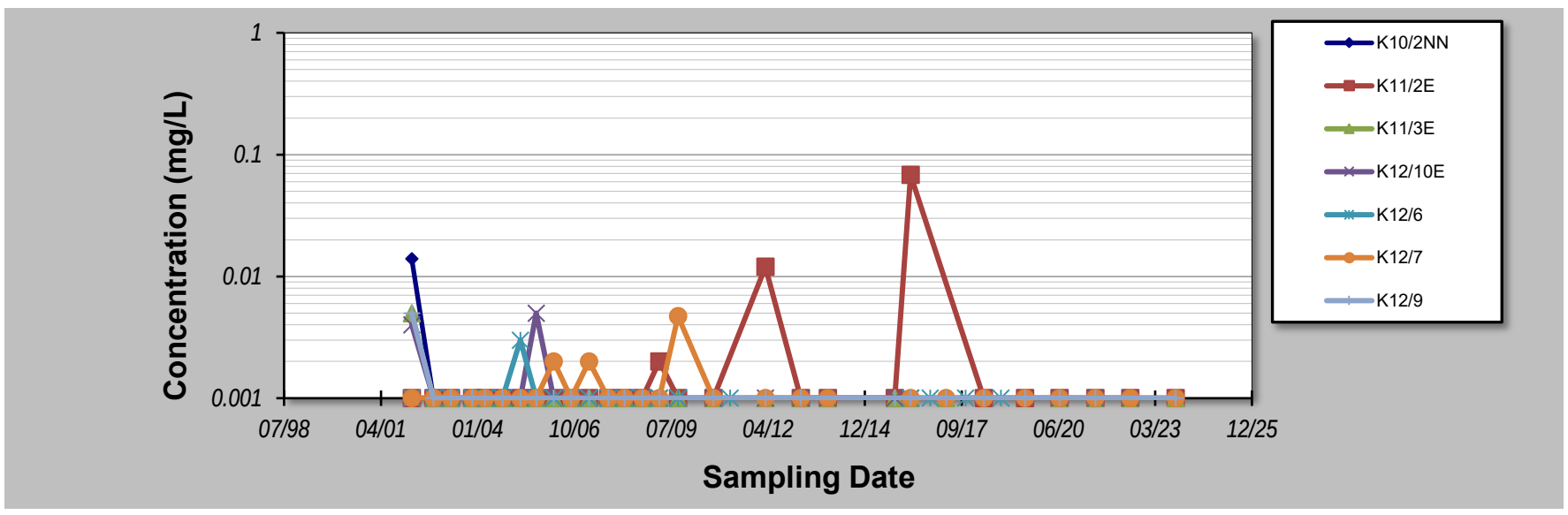
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Lead**
Concentration Units: **mg/L**

Sampling Point ID:	K10/2NN	K11/2E	K11/3E	K12/10E	K12/6	K12/7	K12/9
Sampling Event	Sampling Date	LEAD CONCENTRATION (mg/L)						
1	4-Mar-02	0.014	0.001	0.005	0.004	0.001	0.001	0.005
2	14-Oct-02	0.001	0.001	0.001	0.001	0.001	0.001	0.001
3	15-Apr-03	0.001	0.001	0.001	0.001	0.001	0.001	0.001
4	17-Nov-03	0.001	0.001	0.001	0.001	0.001	0.001	0.001
5	31-Mar-04	0.001	0.001	0.001	0.001	0.001	0.001	0.001
6	27-Sep-04	0.001	0.001	0.001	0.001	0.001	0.001	0.001
7	31-Mar-05		0.001	0.001	0.001	0.003	0.001	0.001
8	12-Sep-05	0.001	0.001	0.001	0.005	0.001	0.001	0.001
9	9-Mar-06	0.001	0.001	0.001	0.001	0.001	0.002	0.001
10	6-Sep-06	0.001	0.001	0.001	0.001	0.001	0.001	0.001
11	9-Mar-07	0.001	0.001	0.001	0.001	0.001	0.002	0.001
12	22-Sep-07	0.001	0.001	0.001	0.001	0.001	0.001	0.001
13	11-Mar-08	0.001	0.001	0.001	0.001	0.001	0.001	0.001
14	10-Sep-08		0.001	0.001	0.001	0.001	0.001	0.001
15	5-Mar-09	0.001	0.002	0.001	0.001	0.001	0.001	0.001
16	14-Sep-09	0.001	0.001	0.001	0.001	0.001	0.0047	
17	5-Mar-10							
18	14-Sep-10		0.001	0.001	0.001		0.001	0.001
19	5-Mar-11					0.001		
20	14-Sep-11							
21	5-Mar-12		0.012	0.001	0.001		0.001	0.001
22	14-Sep-12							
23	5-Mar-13		0.001	0.001	0.001		0.001	0.001
24	9-Dec-13	0.001	0.001	0.001	0.001		0.001	
25	2-Nov-15	0.001	0.001	0.001	0.001			0.001
26	15-Apr-16	0.001	0.068	0.001	0.001	0.001	0.001	0.001
27	2-Nov-16					0.001		
28	13-Apr-17			0.001			0.001	0.001
29	2-Nov-17					0.001		
30	11-May-18	0.001	0.001				0.001	0.001
31	2-Nov-18					0.001		
32	11-Jul-19	0.001	0.001				0.001	0.001
33	1-Nov-19							
34	1-Jul-20	0.001	0.001	0.001	0.001		0.001	0.001
35	1-Nov-20							
36	7-Jul-21	0.001	0.001	0.001	0.001		0.001	0.001
37	01-Jul-22	0.001	0.001	0.001	0.001		0.001	
38	12-Oct-23	0.001	0.001	0.001			0.001	0.001
39								
40								
Coefficient of Variation:		1.73	3.34	0.67	0.77	0.40	0.61	0.68
Mann-Kendall Statistic (S):		-22	26	-26	-33	-8	-13	-25
Confidence Factor:		70.8%	68.8%	69.7%	77.1%	58.3%	59.3%	70.0%
Concentration Trend:		No Trend	No Trend	Stable	Stable	Stable	Stable	Stable



Notes:

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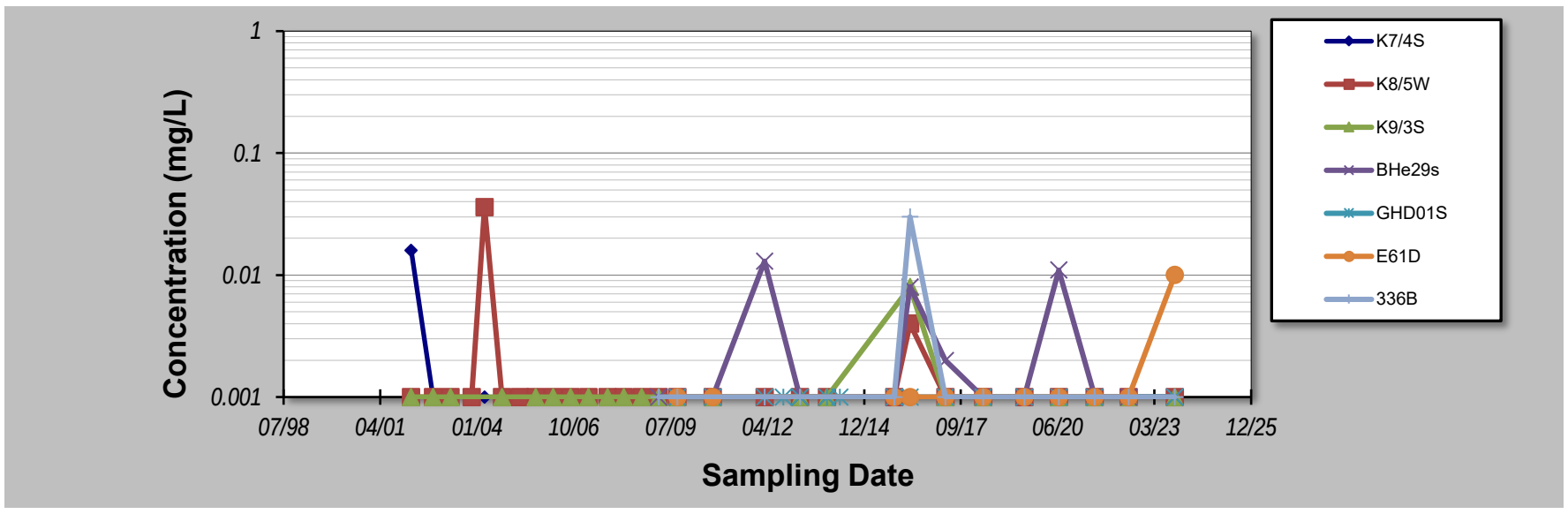
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Lead**
Concentration Units: **mg/L**

Sampling Point ID:	K7/4S	K8/5W	K9/3S	BHe29s	GHD01S	E61D	336B
Sampling Event	Sampling Date	LEAD CONCENTRATION (mg/L)						
1	4-Mar-02	0.016	0.001	0.001				
2	14-Oct-02	0.001	0.001	0.001				
3	15-Apr-03	0.001	0.001	0.001				
4	17-Nov-03	0.001	0.001					
5	31-Mar-04	0.001	0.036					
6	27-Sep-04	0.001	0.001	0.001				
7	31-Mar-05	0.001	0.001					
8	12-Sep-05	0.001	0.001	0.001				
9	9-Mar-06	0.001	0.001	0.001				
10	6-Sep-06	0.001	0.001	0.001				
11	9-Mar-07	0.001	0.001	0.001				
12	22-Sep-07	0.001	0.001	0.001				
13	11-Mar-08	0.001	0.001	0.001				
14	10-Sep-08	0.001	0.001	0.001				
15	5-Mar-09	0.001	0.001	0.001	0.001	0.007	0.004	0.001
16	14-Sep-09	0.001	0.001	0.001	0.001	0.001	0.001	0.001
17	5-Mar-10							
18	14-Sep-10		0.001	0.001	0.001	0.001	0.001	
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12		0.001		0.013	0.001		0.001
22	14-Sep-12					0.001		
23	5-Mar-13		0.001	0.001	0.001	0.001		0.001
24	9-Dec-13		0.001	0.001	0.001	0.001		
25	22-Apr-14					0.001		
26	2-Nov-15		0.001		0.001	0.001	0.001	0.001
27	15-Apr-16		0.004	0.008	0.008	0.001	0.001	0.03
28	2-Nov-16							
29	13-Apr-17		0.001	0.001	0.002	0.001	0.001	0.001
30	2-Nov-17							
31	11-May-18		0.001	0.001	0.001	0.001	0.001	0.001
32	2-Nov-18							
33	11-Jul-19		0.001	-	0.001	0.001	0.001	0.001
34	1-Nov-19							
35	1-Jul-20		0.001	0.001	0.011	0.001	0.001	0.001
36	1-Nov-20							
37	7-Jul-21	0.001	0.001	0.001	0.001	0.001	0.001	0.001
38	23-Jun-22	0.001	0.001	0.001	0.001		0.001	0.001
39	11-Oct-23	0.001	0.001	0.001	0.001	0.001	0.01	0.001
40								
Coefficient of Variation:		1.92	2.81	1.12	1.36	0.00	1.49	2.49
Mann-Kendall Statistic (S):		-18	-7	10	0	-15	-1	-2
Confidence Factor:		72.2%	54.5%	59.3%	48.0%	75.2%	50.0%	52.4%
Concentration Trend:		No Trend	No Trend	No Trend	No Trend	Stable	No Trend	No Trend



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
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3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

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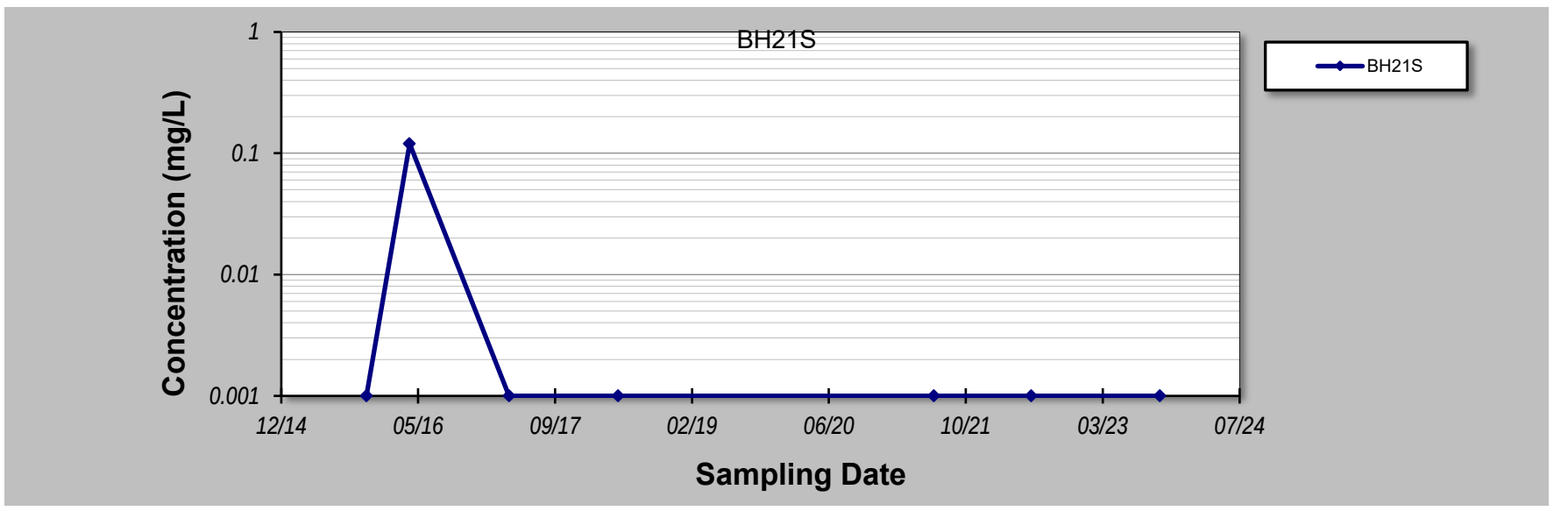
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Lead**
Concentration Units: **mg/L**

Sampling Point ID: **BH21S**

Sampling Event	Sampling Date	LEAD CONCENTRATION (mg/L)						
1	3-Nov-15	0.001						
2	8-Apr-16	0.12						
3	7-Apr-17	0.001						
4	10-May-18	0.001						
5	8-Jul-19							
6	23-Jun-20							
7	6-Jul-21	0.001						
8	27-Jun-22	0.001						
9	09-Oct-23	0.001						
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		1.60	0.00					
Mann-Kendall Statistic (S):		17	0					
Confidence Factor:		92.2%						
Concentration Trend:		Prob. Increasing						



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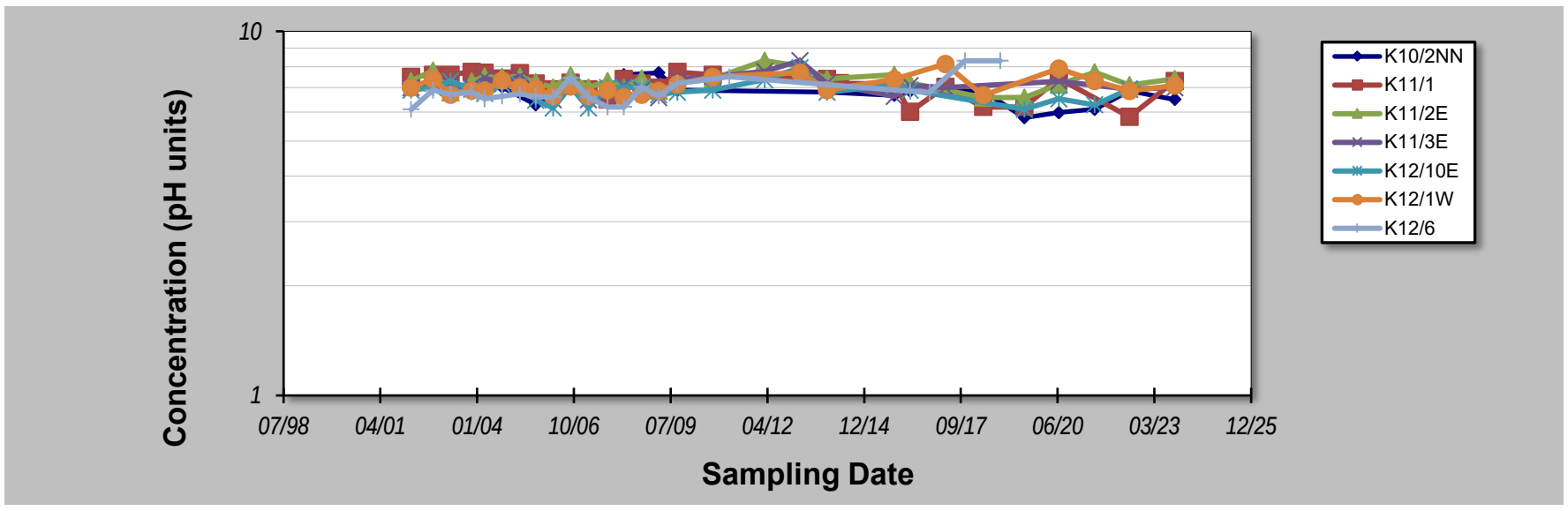
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **pH**
Concentration Units: **pH units**

Sampling Point ID:	K10/2NN	K11/1	K11/2E	K11/3E	K12/10E	K12/1W	K12/6
Sampling Event	Sampling Date	PH CONCENTRATION (pH units)						
1	4-Mar-02	7.1	7.5	7.3	7	6.9	7	6.1
2	14-Oct-02	7.2	7.6	7.8	7.2	7	7.4	6.9
3	15-Apr-03	7.1	7.6	6.8	7.1	7.3	6.7	6.7
4	17-Nov-03	6.98	7.74	7.29	7.03	6.93	6.88	6.81
5	31-Mar-04	7.1	7.7	7.51	7.45	6.75	6.87	6.53
6	27-Sep-04	7.03	7.42	7.49	7.21	7.15	7.32	6.64
7	31-Mar-05		7.68	7.52	7.52	7.13	7.02	6.73
8	12-Sep-05	6.29	7.18	7.24	6.87	6.47	6.94	6.62
9	9-Mar-06	6.63	6.93	7.01	6.48	6.16	6.65	6.6
10	6-Sep-06	6.94	7.22	7.57	7.01	7.05	7.05	7.46
11	9-Mar-07	6.63	6.93	7.01	6.48	6.16	6.65	6.6
12	22-Sep-07	6.7	6.5	7.3	6.7	7	6.9	6.2
13	11-Mar-08	7.6	7.4	7	7.1	7	6.6	6.2
14	10-Sep-08		7.19	7.42	6.89	7.02	6.69	7.03
15	5-Mar-09	7.69	7	6.87	6.58	6.7	6.86	6.65
16	14-Sep-09	6.89	7.73	7.19	7.4	6.81	7.15	7.2
17	5-Mar-10							
18	14-Sep-10		7.6	7.4	7.5	6.9	7.5	
19	5-Mar-11							7.5
20	14-Sep-11							
21	5-Mar-12			8.31	7.76	7.36		
22	14-Sep-12							
23	5-Mar-13			8.02	8.3	7.94	7.7	
24	9-Dec-13	6.8	7.4	7.4	7.2	6.8	6.9	
25	22-Apr-14		7.2					
26	2-Nov-15	6.67	7.18	7.6	6.63	7.11	7.38	
27	15-Apr-16	6.85	6.02	7.21	7.1	6.9		6.8
28	2-Nov-16							6.81
29	13-Apr-17		7.04		7		8.14	
30	2-Nov-17							8.3
31	11-May-18	6.87	6.2	6.58			6.67	
32	2-Nov-18							8.3
33	11-Jul-19	5.79	6.2	6.58		6.11		
34	1-Nov-19							
35	1-Jul-20	5.98	7.42	7.14	7.28	6.52	7.91	
36	1-Nov-20							
37	7-Jul-21	6.11		7.72		6.28	7.3	
38	01-Jul-22	6.87	5.82	7.12	6.93	6.95	6.86	
39	12-Oct-23	6.5	7.3	7.4	7		7.1	
40								
Coefficient of Variation:		0.07	0.08	0.05	0.06	0.06	0.06	0.09
Mann-Kendall Statistic (S):		-100	-137	-28	5	-46	50	72
Confidence Factor:		99.6%	99.8%	70.2%	53.5%	83.8%	85.8%	98.5%
Concentration Trend:		Decreasing	Decreasing	Stable	No Trend	Stable	No Trend	Increasing



Notes:

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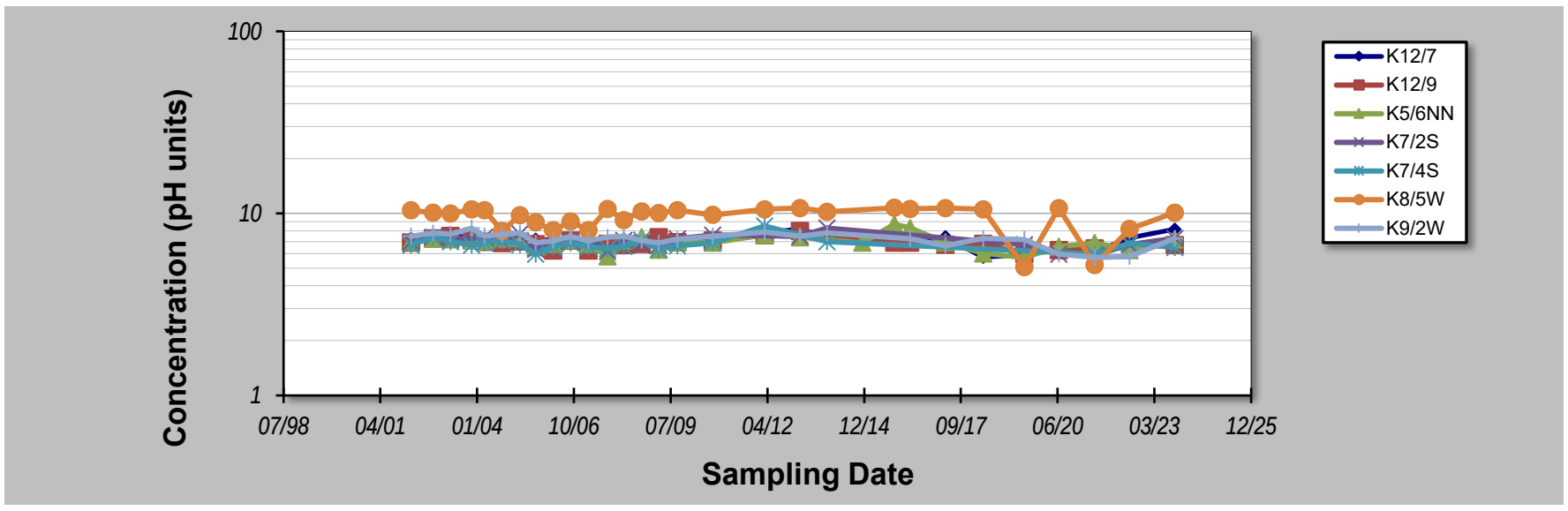
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **pH**
Concentration Units: **pH units**

Sampling Point ID:	K12/7	K12/9	K5/6NN	K7/2S	K7/4S	K8/5W	K9/2W
Sampling Event	Sampling Date	PH CONCENTRATION (pH units)						
1	4-Mar-02	7.3	6.9	7	7	6.7	10.4	7.5
2	14-Oct-02	7.5	7.3	7.3	7.4	7.4	10.1	7.8
3	15-Apr-03	7.7	7.5	7.2	7.3	7	10	7.7
4	17-Nov-03	7.22	7.12	7.1	7.28	6.7	10.5	8.29
5	31-Mar-04	7.29	6.97	7.05	7.38	6.87	10.43	7.5
6	27-Sep-04	7.11	6.86	7.29	7.02	7.09	8.02	7.64
7	31-Mar-05	7.24	7.03	7.33	7.73	6.74	9.75	7.8
8	12-Sep-05	7.21	6.76	6.51	6.35	5.98	8.92	6.9
9	9-Mar-06	7.1	6.24	6.8	7.21	6.57	8.07	7.08
10	6-Sep-06	7.37	7.11	7.16	7.02	6.88	9.04	7.47
11	9-Mar-07	7.1	6.24	6.8	7.21	6.57	8.07	7.08
12	22-Sep-07	7	6.8	5.8	6.2	6.4	10.6	7.4
13	11-Mar-08	6.8	6.7	7.1	7.1	6.6	9.2	7.5
14	10-Sep-08	6.84	6.81	7.41	6.66	7.12	10.24	7.12
15	5-Mar-09	7.41	7.38	6.32	6.7	6.33	10.04	6.87
16	14-Sep-09	7.14	6.93	6.98	7.26	6.63	10.42	7.21
17	5-Mar-10							
18	14-Sep-10	7.2	7.1	6.9	7.6	6.9	9.8	7.5
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12	7.87	7.58	7.65		8.52	10.5	7.91
22	14-Sep-12							
23	5-Mar-13	8.2	8	7.4	7.5		10.7	7.5
24	9-Dec-13	7.4			8.3	7	10.2	7.8
25	9-Dec-14			6.9				
26	5-Mar-15							
27	2-Nov-15		6.9	8.71			10.7	
28	15-Apr-16	7.12	6.9	8.3			10.6	7.27
29	2-Nov-16							
30	13-Apr-17	7.42	6.74	6.93			10.7	6.65
31	2-Nov-17							
32	11-May-18	5.74	6.8	6.03			10.54	7.3
33	2-Nov-18							
34	11-Jul-19	5.95	6	5.72	6.74		5.08	7.19
35	1-Nov-19							
36	1-Jul-20	6.54	6.28	6.57	5.98		10.7	5.99
37	1-Nov-20							
38	7-Jul-21	6.12	6.41	6.88	5.89	5.98	5.2	5.73
39	01-Jul-22	7.33		6.29	6.74	6.86	8.21	5.8
40	11-Oct-23	8.17	6.71	7.2	7.28	6.5	10.1	7.3
Coefficient of Variation:		0.08	0.06	0.09	0.08	0.08	0.16	0.08
Mann-Kendall Statistic (S):		-55	-94	-58	-42	-29	54	-141
Confidence Factor:		85.6%	97.4%	85.6%	84.4%	78.3%	83.8%	99.8%
Concentration Trend:		Stable	Decreasing	Stable	Stable	Stable	No Trend	Decreasing



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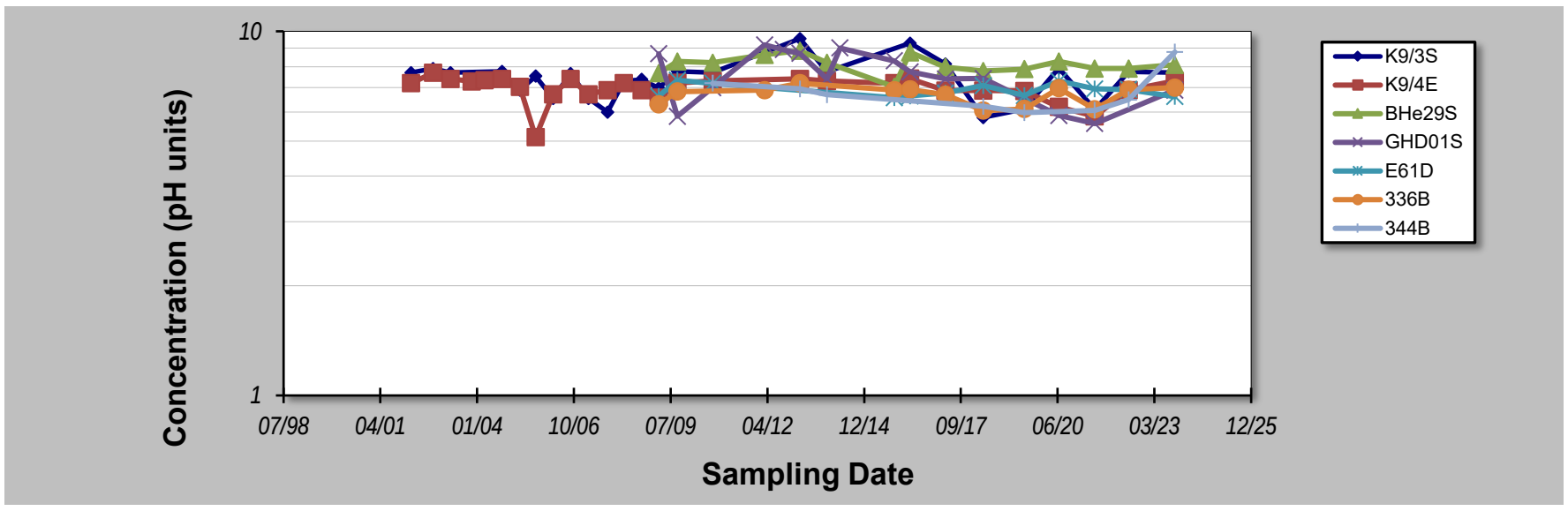
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **pH**
Concentration Units: **pH units**

Sampling Point ID:	K9/3S	K9/4E	BHe29S	GHD01S	E61D	336B	344B
Sampling Event	Sampling Date	PH CONCENTRATION (pH units)						
1	4-Mar-02	7.7	7.2					
2	14-Oct-02	7.9	7.7					
3	15-Apr-03	7.7	7.4					
4	17-Nov-03		7.28					
5	31-Mar-04		7.35					
6	27-Sep-04	7.76	7.4					
7	31-Mar-05	6.89	7.04					
8	12-Sep-05	7.53	5.12					
9	9-Mar-06	6.54	6.72					
10	6-Sep-06	7.66	7.4					
11	9-Mar-07	6.54	6.72					
12	22-Sep-07	6	6.9					
13	11-Mar-08	7.3	7.2					
14	10-Sep-08	7.37	6.89					
15	5-Mar-09	6.99	6.58	7.7	8.7	6.6	6.3	
16	14-Sep-09	7.77	7.22	8.3	5.8	7.3	6.8	
17	5-Mar-10							
18	14-Sep-10	7.7	7.3	8.2	7.0	7.2		7.2
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12			8.62	9.18		6.9	
22	14-Sep-12				8.91			
23	5-Mar-13	9.55	7.4	8.85	8.7		7.2	7.0
24	9-Dec-13	7.74	7.3	8.2	7.4			6.7
25	22-Apr-14				9			
26	2-Nov-15		7.2	7.04	8.3	6.57	6.9	
27	15-Apr-16	9.28	7.41	8.76	7.74	6.65	6.9	
28	2-Nov-16							
29	13-Apr-17	8.14	6.88	7.98	7.4	6.77	6.7	
30	2-Nov-17							
31	11-May-18	5.8	6.88	7.78	7.42	7.1	6.06	6.22
32	2-Nov-18							
33	11-Jul-19	6.12	6.86	7.87		6.66	6.12	5.98
34	1-Nov-19							
35	1-Jul-20	7.93	6.2	8.26	5.87	7.31	6.98	
36	1-Nov-20							
37	7-Jul-21	6.09	5.84	7.91	5.58	6.95	6.11	6.07
38	21-Jun-22	7.75	6.89	7.91		6.92	6.91	6.49
39	13-Oct-23	7.7	7.3	8.1	6.9	6.62	7	8.77
40								
Coefficient of Variation:		0.12	0.08	0.06	0.16	0.04	0.06	0.13
Mann-Kendall Statistic (S):		7	-85	-13	-36	-2	7	-6
Confidence Factor:		55.5%	95.1%	72.1%	95.9%	52.7%	64.0%	72.6%
Concentration Trend:		No Trend	Decreasing	Stable	Decreasing	Stable	No Trend	Stable



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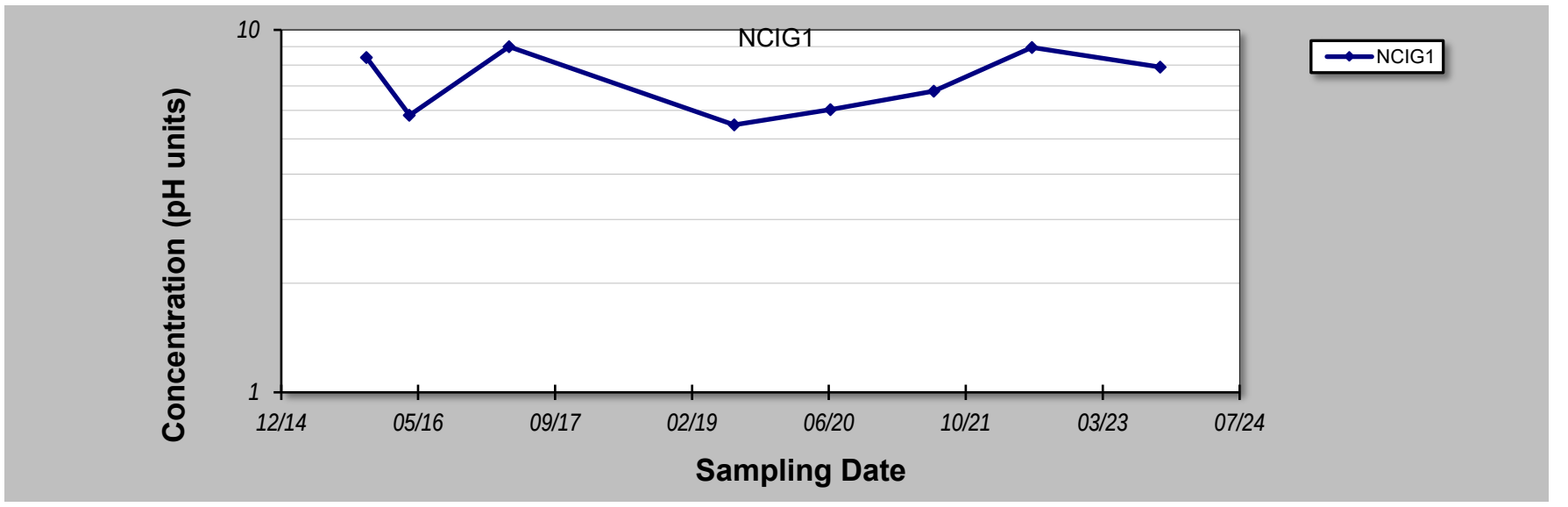
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **pH**
Concentration Units: **pH units**

Sampling Point ID: **NCIG1**

Sampling Event	Sampling Date	PH CONCENTRATION (pH units)
1	3-Nov-15	8.4
2	8-Apr-16	5.82
3	7-Apr-17	8.99
4	10-May-18	
5	8-Jul-19	5.47
6	23-Jun-20	6.03
7	6-Jul-21	6.77
8	29-Jun-22	8.94
9	11-Oct-23	7.9
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
Coefficient of Variation:		0.20
Mann-Kendall Statistic (S):		4
Confidence Factor:		64.0%
Concentration Trend:		No Trend



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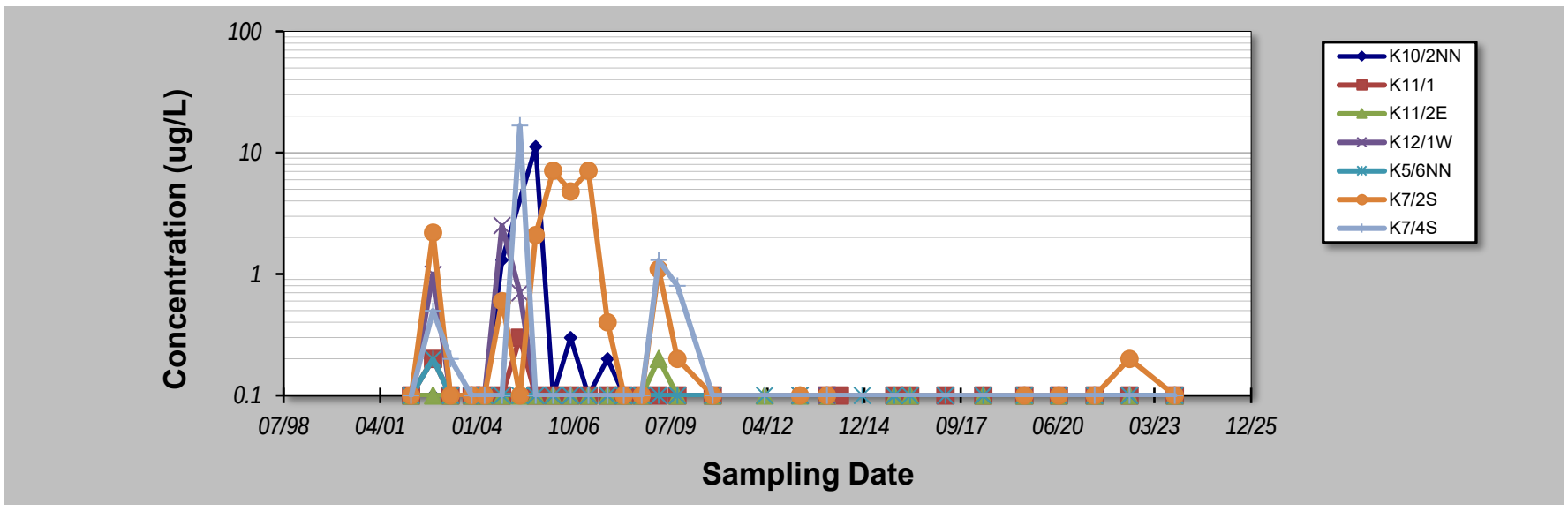
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Phenanthrene**
Concentration Units: **ug/L**

Sampling Point ID:	K10/2NN	K11/1	K11/2E	K12/1W	K5/6NN	K7/2S	K7/4S
Sampling Event	Sampling Date	PHENANTHRENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2	14-Oct-02	0.1	0.2	0.1	1	0.2	2.2	0.5
3	15-Apr-03	0.1	0.1	0.1	0.1	0.1	0.1	0.2
4	17-Nov-03	0.1	0.1	0.1	0.1	0.1	0.1	0.1
5	31-Mar-04	0.1	0.1	0.1	0.1	0.1	0.1	0.1
6	27-Sep-04	1.3	0.1	0.1	2.5	0.1	0.6	0.1
7	31-Mar-05		0.3	0.1	0.7	0.1	0.1	16.8
8	12-Sep-05	11.2	0.1	0.1	0.1	0.1	2.1	0.1
9	9-Mar-06	0.1	0.1	0.1	0.1	0.1	7.1	0.1
10	6-Sep-06	0.3	0.1	0.1	0.1	0.1	4.8	0.1
11	9-Mar-07	0.1	0.1	0.1	0.1	0.1	7.1	0.1
12	22-Sep-07	0.2	0.1	0.1	0.1	0.1	0.4	0.1
13	11-Mar-08	0.1	0.1	0.1	0.1	0.1	0.1	0.1
14	10-Sep-08		0.1	0.1	0.1	0.1	0.1	0.1
15	5-Mar-09	0.1	0.1	0.2	0.1	0.1	1.1	1.3
16	14-Sep-09	0.1	0.1	0.1	0.1	0.1	0.2	0.8
17	5-Mar-10							
18	14-Sep-10		0.1	0.1	0.1	0.1	0.1	0.1
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12			0.1		0.1		0.1
22	14-Sep-12							
23	5-Mar-13			0.1	0.1	0.1	0.1	
24	9-Dec-13	0.1	0.1	0.1	0.1		0.1	0.1
25	22-Apr-14		0.1					
26	9-Dec-14					0.1		
27	5-Mar-15							
28	2-Nov-15	0.1	0.1	0.1	0.1	0.1		
29	15-Apr-16	0.1	0.1	0.1		0.1		
30	2-Nov-16							
31	13-Apr-17		0.1		0.1	0.1		
32	11-May-18	0.1	0.1	0.1	0.1	0.1		
33	2-Nov-18							
34	11-Jul-19	0.1	0.1	0.1		0.1	0.1	
35	1-Nov-19							
36	1-Jul-20	0.1	0.1	0.1	0.1	0.1	0.1	
37	1-Nov-20							
38	7-Jul-21	0.1	0.1	0.1	0.1	0.1	0.1	0.1
39	01-Jul-22	0.1	0.1	0.1	0.1	0.1	0.2	0.1
40	12-Oct-23	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Coefficient of Variation:		3.57	0.38	0.18	2.02	0.18	1.88	3.66
Mann-Kendall Statistic (S):		-34	-39	1	-52	-26	-43	-27
Confidence Factor:		80.6%	77.2%	50.0%	86.8%	67.9%	85.0%	76.6%
Concentration Trend:		No Trend	Stable	No Trend	No Trend	Stable	No Trend	No Trend



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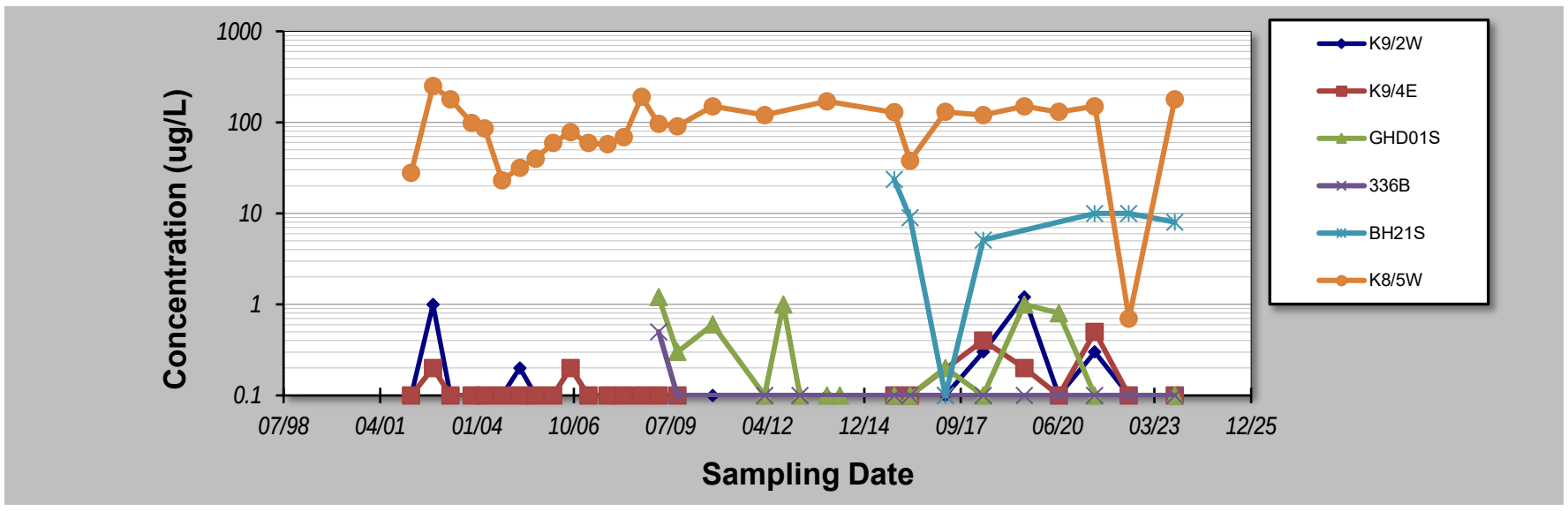
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Phenanthrene**
Concentration Units: **ug/L**

Sampling Point ID:	K8/5W	K9/2W	K9/4E	GHD01S	336B	BH21S	
Sampling Event	Sampling Date	PHENANTHRENE CONCENTRATION (ug/L)						
1	4-Mar-02	28	0.1	0.1				
2	14-Oct-02	250	1	0.2				
3	15-Apr-03	180	0.1	0.1				
4	17-Nov-03	98.8	0.1	0.1				
5	31-Mar-04	86	0.1	0.1				
6	27-Sep-04	23.2	0.1	0.1				
7	31-Mar-05	31.6	0.2	0.1				
8	12-Sep-05	39.8	0.1	0.1				
9	9-Mar-06	59.2	0.1	0.1				
10	6-Sep-06	78.2	0.2	0.2				
11	9-Mar-07	59.2	0.1	0.1				
12	22-Sep-07	57.3	0.1	0.1				
13	11-Mar-08	68.7	0.1	0.1				
14	10-Sep-08	191	0.1	0.1				
15	5-Mar-09	96.1	0.1	0.1	1.2	0.5		
16	14-Sep-09	90.5	0.1	0.1	0.3	0.1		
17	5-Mar-10							
18	14-Sep-10	150	0.1		0.6			
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12	120	0.1		0.1	0.1		
22	14-Sep-12				1			
23	5-Mar-13		0.1		0.1	0.1		
24	9-Dec-13	170	0.1		0.1			
25	22-Apr-14				0.1			
26	2-Nov-15	129		0.1	0.1	0.1	23.6	
27	15-Apr-16	38	-	0.1	0.1	0.1	9	
28	2-Nov-16							
29	13-Apr-17	130	0.1	-	0.2	0.1	0.1	
30	2-Nov-17							
31	11-May-18	120	0.3	0.4	0.1	0.1	5.1	
32	2-Nov-18							
33	11-Jul-19	150	1.2	0.2	1	0.1		
34	1-Nov-19							
35	1-Jul-20	130	0.1	0.1	0.8	0.1		
36	1-Nov-20							
37	7-Jul-21	150	0.3	0.5	0.1	0.1	10	
38	24-Jun-22	0.7	0.1	0.1		0.1	10	
39	12-Oct-23	180.00	0.1	0.1	0.1	0.1	8.00	
40								
Coefficient of Variation:		0.58	1.37	0.72	1.07	0.85	0.76	
Mann-Kendall Statistic (S):		91	13	26	-23	-12	-2	
Confidence Factor:		96.3%	59.8%	73.0%	83.6%	74.5%	55.7%	
Concentration Trend:		Increasing	No Trend	No Trend	No Trend	Stable	Stable	



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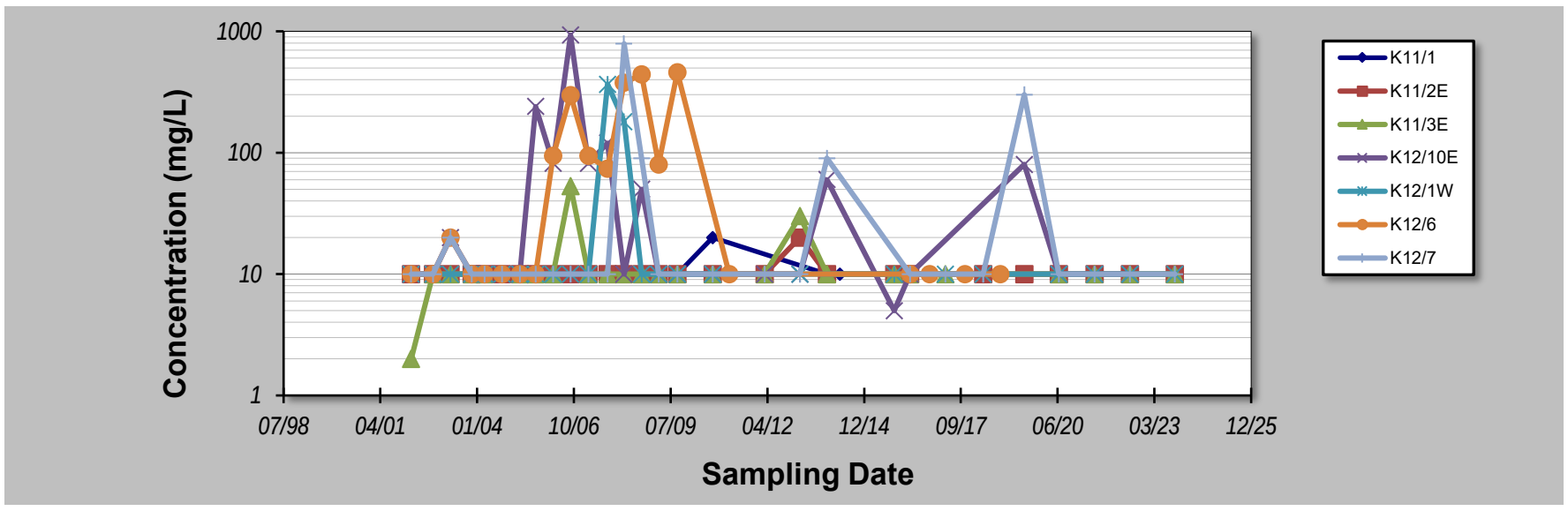
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Phenols**
Concentration Units: **mg/L**

Sampling Point ID:	K11/1	K11/2E	K11/3E	K12/10E	K12/1W	K12/6	K12/7
Sampling Event	Sampling Date	PHENOLS CONCENTRATION (mg/L)						
1	4-Mar-02	10	10	2	10	10	10	10
2	14-Oct-02	10	10	10	10	10	10	10
3	15-Apr-03	10	10	10	20	10	20	20
4	17-Nov-03	10	10	10	10	10	10	10
5	31-Mar-04	10	10	10	10	10	10	10
6	27-Sep-04	10	10		10	10	10	10
7	31-Mar-05	10	10	10	10	10	10	10
8	12-Sep-05	10	10	10	240	10	10	10
9	9-Mar-06	10	10	10	82	10	94	10
10	6-Sep-06	10	10	53	932	10	299	10
11	9-Mar-07	10	10	10	82	10	94	10
12	22-Sep-07	10	10	10	120	367	74	10
13	11-Mar-08	10	10	10	10	180	378	790
14	10-Sep-08	10	10	10	50	10	440	90
15	5-Mar-09	10	10	10	10	10	80	10
16	14-Sep-09	10	10	10	10	10	460	10
17	5-Mar-10							
18	14-Sep-10	20	10	10	10	10		10
19	5-Mar-11						10	
20	5-Mar-12		10	10	10			10
21	14-Sep-12							
22	5-Mar-13		20	30	10	10		10
23	9-Dec-13	10	10	10	60			90
24	22-Apr-14	10						
25	9-Dec-14							
26	5-Mar-15							
27	2-Nov-15	10	10	10	5	10		
28	15-Apr-16	10	10	10	10		10	10
29	2-Nov-16						10	
30	13-Apr-17	10		10		10		10
31	2-Nov-17						10	
32	11-May-18	10	10			10		10
33	2-Nov-18						10	
34	11-Jul-19	10	10		80			300
35	1-Nov-19							
36	1-Jul-20	10	10	10	10	10		10
37	1-Nov-20							
38	7-Jul-21	10	10	10	10	10		10
39	06-Jul-22	10	10	10	10	10		10
40	13-Oct-23	10	10	10		10		10
Coefficient of Variation:		0.18	0.18	0.77	2.60	2.50	1.56	2.86
Mann-Kendall Statistic (S):		5	9	22	-36	-3	25	6
Confidence Factor:		53.1%	56.2%	67.7%	77.8%	51.9%	76.3%	53.9%
Concentration Trend:		No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend



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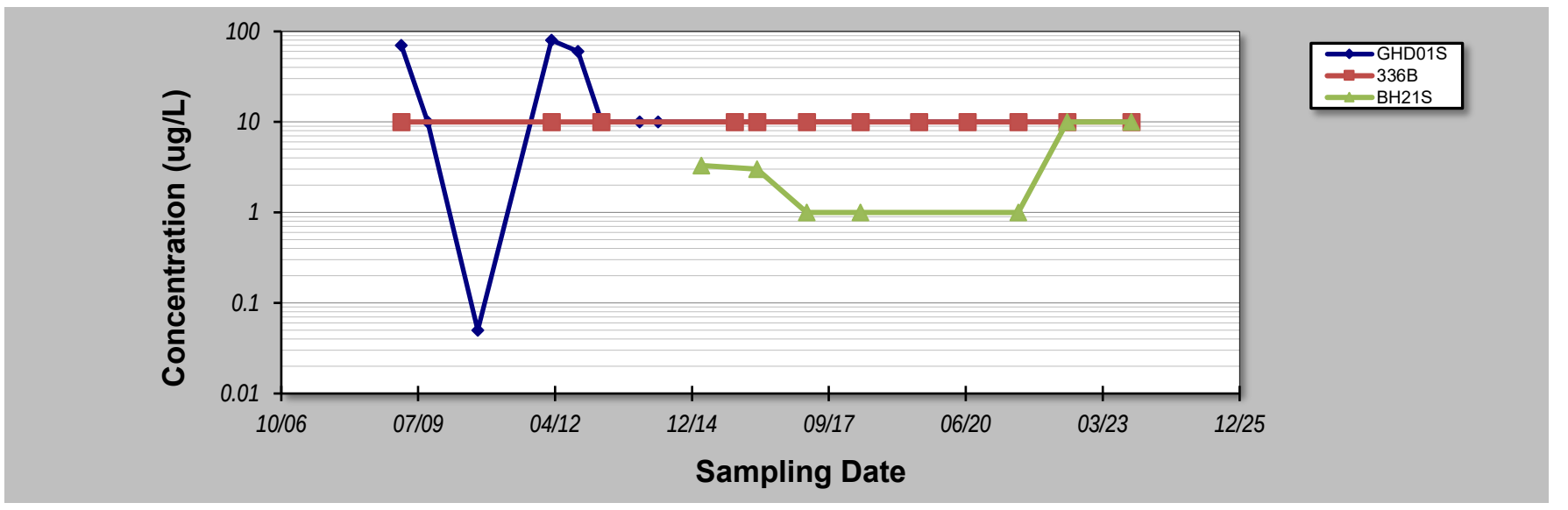
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Phenols**
Concentration Units: **ug/L**

Sampling Point ID:	GHD01S	336B	BH21S				
Sampling Event	Sampling Date	PHENOLS CONCENTRATION (ug/L)						
1	5-Mar-09	70	10					
2	14-Sep-09	10	370					
3	5-Mar-10							
4	14-Sep-10	0.05						
5	5-Mar-11							
6	14-Sep-11							
7	5-Mar-12	80	10					
8	14-Sep-12	60						
9	5-Mar-13	10	10					
10	9-Dec-13	10						
11	22-Apr-14	10						
12	9-Dec-14							
13	5-Mar-15			3.3				
14	2-Nov-15	10	10					
15	15-Apr-16	10	10	3				
16	2-Nov-16							
17	13-Apr-17	10	10	1				
18	2-Nov-17							
19	11-May-18	10	10	1				
20	2-Nov-18							
21	11-Jul-19	10	10					
22	1-Nov-19							
23	1-Jul-20	10	10					
24	1-Nov-20							
25	7-Jul-21	10	10	1				
26	28-Jun-22		10	10				
27	9-Oct-23	10	10	10				
28								
29								
30								
Coefficient of Variation:		1.21	0.00	0.98				
Mann-Kendall Statistic (S):		-22	-10	3				
Confidence Factor:		82.5%	72.7%	61.4%				
Concentration Trend:		No Trend	Stable	No Trend				



Notes:

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2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

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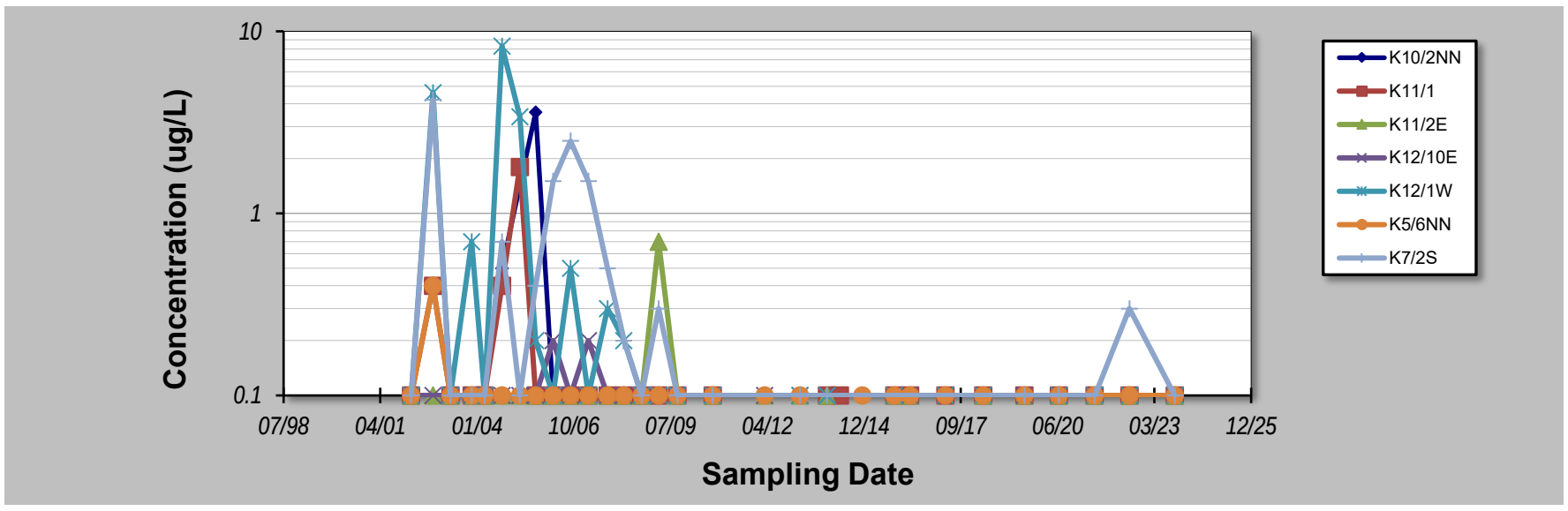
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Pyrene**
Concentration Units: **ug/L**

Sampling Point ID:	K10/2NN	K11/1	K11/2E	K12/10E	K12/1W	K5/6NN	K7/2S
Sampling Event	Sampling Date	PYRENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2	14-Oct-02	0.1	0.4	0.1	0.1	4.6	0.4	4.2
3	15-Apr-03	0.1	0.1	0.1	0.1	0.1	0.1	0.1
4	17-Nov-03	0.1	0.1	0.1	0.1	0.7	0.1	0.1
5	31-Mar-04	0.1	0.1	0.1	0.1	0.1	0.1	0.1
6	27-Sep-04	0.5	0.4	0.1	0.1	8.3	0.1	0.7
7	31-Mar-05		1.8	0.1	0.1	3.4	0.1	0.1
8	12-Sep-05	3.6	0.1	0.1	0.1	0.2	0.1	0.4
9	9-Mar-06	0.1	0.1	0.1	0.2	0.1	0.1	1.5
10	6-Sep-06	0.1	0.1	0.1	0.1	0.5	0.1	2.5
11	9-Mar-07	0.1	0.1	0.1	0.2	0.1	0.1	1.5
12	22-Sep-07	0.1	0.1	0.1	0.1	0.3	0.1	0.5
13	11-Mar-08	0.1	0.1	0.1	0.1	0.2	0.1	0.2
14	10-Sep-08		0.1	0.1	0.1	0.1	0.1	0.1
15	5-Mar-09	0.1	0.1	0.7	0.1	0.1	0.1	0.3
16	14-Sep-09	0.1	0.1	0.1	0.1	0.1	0.1	0.1
17	5-Mar-10							
18	14-Sep-10		0.1	0.1	0.1	0.1	0.1	0.1
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12			0.1	0.1		0.1	
22	14-Sep-12							
23	5-Mar-13			0.1	0.1	0.1	0.1	0.1
24	9-Dec-13	0.1	0.1	0.1	0.1	0.1		0.1
25	22-Apr-14		0.1					
26	9-Dec-14						0.1	
27	5-Mar-15							
28	2-Nov-15	0.1	0.1	0.1	0.1	0.1	0.1	
29	15-Apr-16	0.1	0.1	0.1	0.1		0.1	
30	13-Apr-17		0.1			0.1	0.1	
31	2-Nov-17							
32	11-May-18	0.1	0.1	0.1		0.1	0.1	
33	2-Nov-18							
34	11-Jul-19	0.1	0.1	0.1	0.1		0.1	0.1
35	1-Nov-19							
36	1-Jul-20	0.1	0.1	0.1	0.1	0.1	0.1	0.1
37	1-Nov-20							
38	7-Jul-21	0.1	0.1	0.1	0.1	0.1	0.1	0.1
39	01-Jul-22	0.1	0.1	0.1	0.1	0.1	0.1	0.3
40	12-Oct-23	0.1	0.1	0.1		0.1	0.1	0.1
Coefficient of Variation:		2.71	1.79	0.93	0.25	2.43	0.50	1.74
Mann-Kendall Statistic (S):		-21	-55	1	-14	-109	-26	-55
Confidence Factor:		69.9%	85.6%	50.0%	61.2%	99.2%	67.9%	90.9%
Concentration Trend:		No Trend	No Trend	No Trend	Stable	Decreasing	Stable	Prob. Decreasing



Notes:

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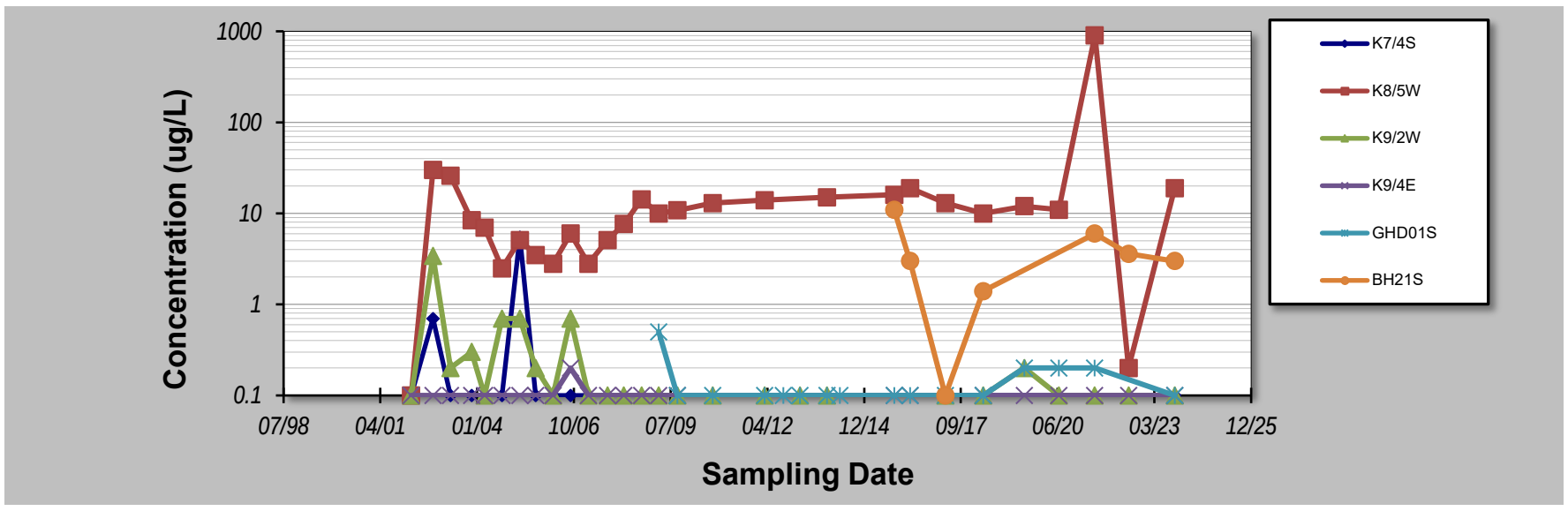
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Pyrene**
Concentration Units: **ug/L**

Sampling Point ID:	K7/4S	K8/5W	K9/2W	K9/4E	GHD01S	BH21S	
Sampling Event	Sampling Date	PYRENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1	0.1	0.1			
2	14-Oct-02	0.7	30	3.4	0.1			
3	15-Apr-03	0.1	26	0.2	0.1			
4	17-Nov-03	0.1	8.4	0.3	0.1			
5	31-Mar-04	0.1	7	0.1	0.1			
6	27-Sep-04	0.1	2.5	0.7	0.1			
7	31-Mar-05	5.5	5.1	0.7	0.1			
8	12-Sep-05	0.1	3.5	0.2	0.1			
9	9-Mar-06	0.1	2.8	0.1	0.1			
10	6-Sep-06	0.1	6	0.7	0.2			
11	9-Mar-07	0.1	2.8	0.1	0.1			
12	22-Sep-07	0.1	5.1	0.1	0.1			
13	11-Mar-08	0.1	7.7	0.1	0.1			
14	10-Sep-08	0.1	14.3	0.1	0.1			
15	5-Mar-09	0.1	10	0.1	0.1	0.5		
16	14-Sep-09	0.1	10.8	0.1	0.1	0.1		
17	5-Mar-10							
18	14-Sep-10	0.1	13	0.1		0.1		
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12	0.1	14	0.1		0.1		
22	14-Sep-12					0.1		
23	5-Mar-13			0.1		0.1		
24	9-Dec-13	0.1	15	0.1		0.1		
25	22-Apr-14					0.1		
26	2-Nov-15		16		0.1	0.1	11	
27	15-Apr-16		19	-	0.1	0.1	3	
28	2-Nov-16							
29	13-Apr-17		13	0.1	-	0.1	0.1	
30	2-Nov-17							
31	11-May-18		10	0.1	0.1	0.1	1.4	
32	2-Nov-18							
33	11-Jul-19		12	0.2	0.1	0.2		
34	1-Nov-19							
35	1-Jul-20		11	0.1	0.1	0.2		
36	1-Nov-20							
37	7-Jul-21	0.1	901	0.1	0.1	0.2	6	
38	23-Jun-22	0.1	0.2	0.1	0.1		3.6	
39	11-Oct-23	0.1	19.00	0.1	0.1	0.1	3.00	
40								
Coefficient of Variation:		3.09	3.98	2.10	0.20	0.72	0.89	
Mann-Kendall Statistic (S):		-27	117	-104	-5	15	-2	
Confidence Factor:		76.6%	99.0%	98.5%	53.9%	73.3%	55.7%	
Concentration Trend:		No Trend	Increasing	Decreasing	Stable	No Trend	Stable	



Notes:

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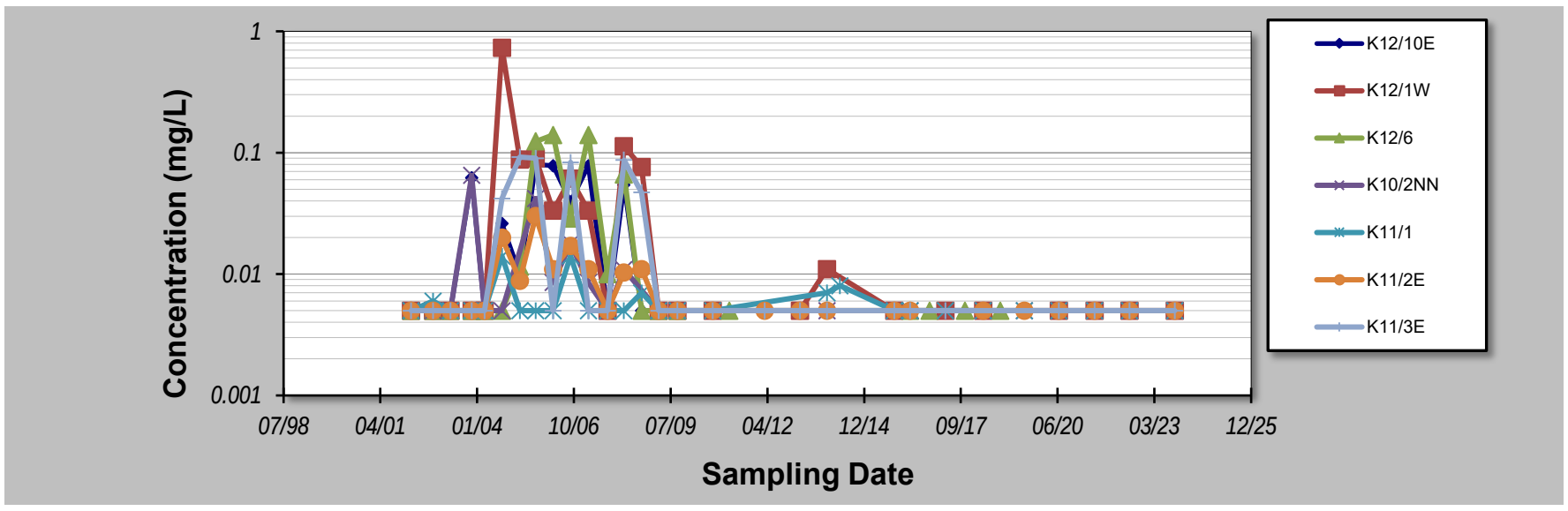
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Total cyanide**
Concentration Units: **mg/L**

Sampling Point ID:	K10/2NN	K11/1	K11/2E	K11/3E	K12/10E	K12/1W	K12/6
Sampling Event	Sampling Date	TOTAL CYANIDE CONCENTRATION (mg/L)						
1	4-Mar-02	0.005	0.005	0.005	0.005	0.005	0.005	0.005
2	14-Oct-02	0.005	0.006	0.005	0.005	0.005	0.005	0.005
3	15-Apr-03	0.005	0.005	0.005	0.005	0.005	0.005	0.005
4	17-Nov-03	0.065	0.005	0.005	0.005	0.062	0.005	0.005
5	31-Mar-04	0.005	0.005	0.005	0.005	0.005	0.005	0.005
6	27-Sep-04	0.005	0.014	0.02	0.042	0.026	0.73	0.005
7	31-Mar-05		0.005	0.0088	0.092	0.0099	0.0878	0.0115
8	12-Sep-05	0.042	0.005	0.03	0.09	0.08	0.09	0.124
9	9-Mar-06	0.0085	0.005	0.011	0.005	0.078	0.0332	0.14
10	6-Sep-06	0.0179	0.0141	0.017	0.083	0.0393	0.0612	0.0287
11	9-Mar-07	0.0085	0.005	0.011	0.005	0.078	0.0332	0.14
12	22-Sep-07	0.005	0.005	0.005	0.005	0.005	0.005	0.01
13	11-Mar-08	0.0109	0.005	0.0103	0.0869	0.0545	0.113	0.0659
14	10-Sep-08		0.007	0.011	0.047	0.005	0.076	0.005
15	5-Mar-09	0.005	0.005	0.005	0.005	0.005	0.005	0.005
16	14-Sep-09	0.005	0.005	0.005	0.005	0.005	0.005	0.005
17	5-Mar-10							
18	14-Sep-10		0.005	0.005	0.005	0.005	0.005	
19	5-Mar-11							0.005
20	14-Sep-11							
21	5-Mar-12			0.005	0.005	0.005		
22	14-Sep-12							
23	5-Mar-13			0.005	0.005	0.005	0.005	
24	9-Dec-13	0.005	0.007	0.005	0.005	0.005	0.011	
25	22-Apr-14		0.008					
26	2-Nov-15	0.005	0.005	0.005	0.005	0.005	0.005	
27	15-Apr-16	0.005	0.005	0.005	0.005	0.005		0.005
28	2-Nov-16							0.005
29	13-Apr-17		0.005		0.005		0.005	
30	2-Nov-17							0.005
31	11-May-18	0.005	0.005	0.005			0.005	
32	2-Nov-18							0.005
33	11-Jul-19	0.005	0.005	0.005		0.005		
34	1-Nov-19							
35	1-Jul-20	0.005	0.005	0.005	0.005	0.005	0.005	
36	1-Nov-20							
37	7-Jul-21	0.005	0.005	0.005	0.005	0.005	0.005	
38	01-Jul-22	0.005	0.005	0.005	0.005	0.005	0.005	
39	12-Oct-23	0.005	0.005	0.005	0.005		0.005	
40								
Coefficient of Variation:		1.39	0.41	0.75	1.52	1.34	2.80	1.66
Mann-Kendall Statistic (S):		-52	-34	-83	-55	-77	-64	-14
Confidence Factor:		91.0%	74.1%	94.7%	86.8%	95.3%	91.7%	65.1%
Concentration Trend:		Prob. Decreasing	Stable	Prob. Decreasing	No Trend	Decreasing	Prob. Decreasing	No Trend



Notes:

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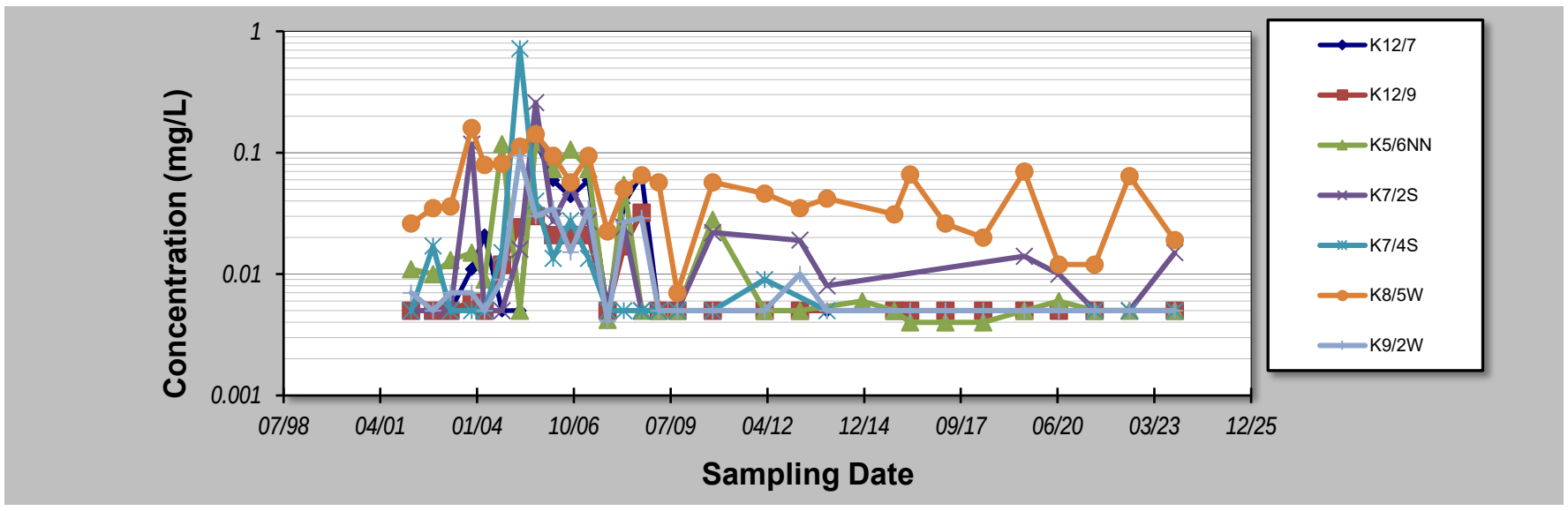
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Total cyanide**
Concentration Units: **mg/L**

Sampling Point ID:	K12/7	K12/9	K5/6NN	K7/2S	K7/4S	K8/5W	K9/2W
Sampling Event	Sampling Date	TOTAL CYANIDE CONCENTRATION (mg/L)						
1	4-Mar-02	0.005	0.005	0.011	0.005	0.005	0.026	0.007
2	14-Oct-02	0.005	0.005	0.01	0.005	0.017	0.035	0.005
3	15-Apr-03	0.005	0.005	0.013	0.005	0.005	0.036	0.007
4	17-Nov-03	0.011	0.006	0.015	0.118	0.005	0.16	0.007
5	31-Mar-04	0.021	0.005	0.009	0.005	0.005	0.079	0.005
6	27-Sep-04	0.005	0.012	0.118	0.005	0.015	0.081	0.009
7	31-Mar-05	0.005	0.0243	0.005	0.016	0.718	0.112	0.0942
8	12-Sep-05	0.127	0.03	0.123	0.259	0.04	0.142	0.03
9	9-Mar-06	0.059	0.021	0.0735	0.0272	0.0135	0.0943	0.0346
10	6-Sep-06	0.0435	0.0209	0.106	0.0522	0.0276	0.0571	0.0152
11	9-Mar-07	0.059	0.021	0.0735	0.0272	0.0135	0.0943	0.0346
12	22-Sep-07	0.005	0.005	0.0042	0.005	0.005	0.0224	0.0041
13	11-Mar-08	0.0385	0.0169	0.0541	0.0244	0.005	0.0503	0.0267
14	10-Sep-08	0.066	0.032	0.005	0.005	0.005	0.065	0.029
15	5-Mar-09	0.005	0.005	0.005	0.005	0.005	0.057	0.005
16	14-Sep-09	0.005	0.005	0.005	0.005	0.005	0.007	0.005
17	5-Mar-10							
18	14-Sep-10	0.005	0.005	0.028	0.022	0.005	0.057	0.005
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12	0.005	0.005	0.005		0.009	0.046	0.005
22	14-Sep-12							
23	5-Mar-13	0.005	0.005	0.005	0.019		0.035	0.01
24	9-Dec-13	0.005			0.008	0.005	0.042	0.005
25	9-Dec-14			0.006				
26	5-Mar-15							
27	2-Nov-15		0.005	0.005			0.031	
28	15-Apr-16	0.005	0.005	0.004			0.066	0.005
29	2-Nov-16							
30	13-Apr-17	0.005	0.005	0.004			0.026	0.005
31	2-Nov-17							
32	11-May-18	0.005	0.005	0.004			0.02	0.005
33	2-Nov-18							
34	11-Jul-19	0.005	0.005	0.005	0.014		0.07	0.005
35	1-Nov-19							
36	1-Jul-20	0.005	0.005	0.006	0.01		0.012	0.005
37	1-Nov-20							
38	7-Jul-21	0.005	0.005	0.005	0.005	0.005	0.012	0.005
39	01-Jul-22	0.005		0.005	0.005	0.005	0.064	0.005
40	11-Oct-23	0.005	0.005	0.005	0.02	0.005	0.02	0.005
Coefficient of Variation:	1.52	0.86	1.49	1.97	3.60	0.68	1.36
Mann-Kendall Statistic (S):	-75	-77	-158	-12	-55	-137	-107
Confidence Factor:	92.8%	94.3%	99.9%	60.6%	93.6%	99.5%	98.2%
Concentration Trend:	Prob. Decreasing	Prob. Decreasing	Decreasing	No Trend	Prob. Decreasing	Decreasing	Decreasing



Notes:

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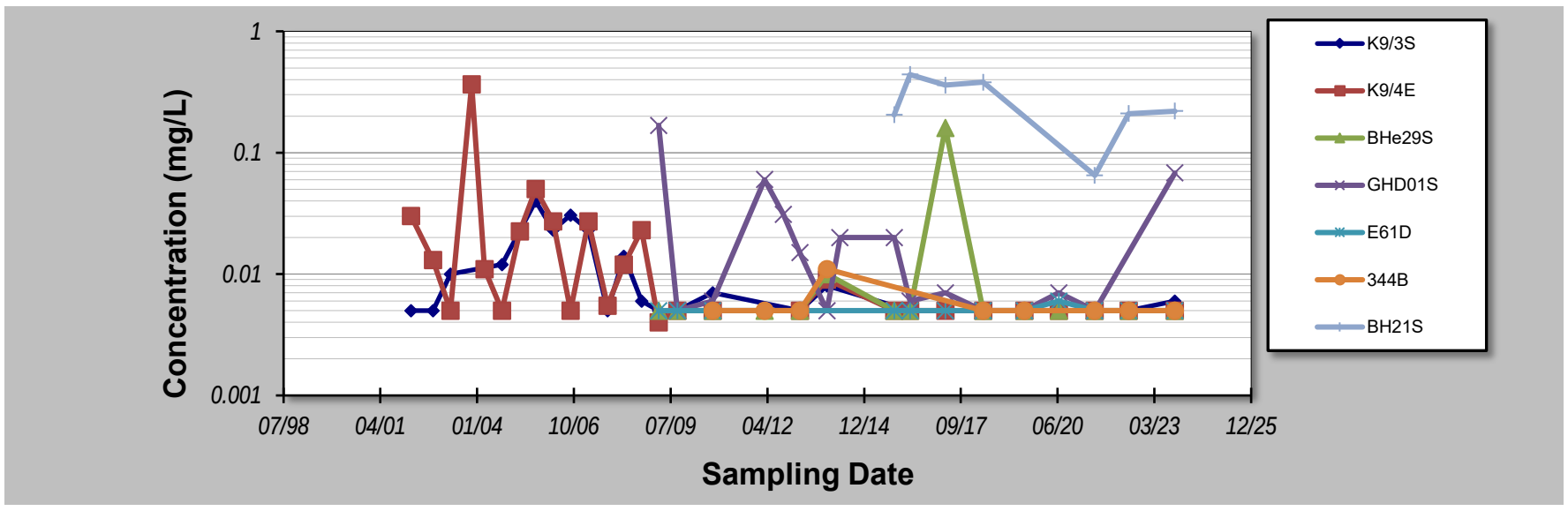
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Total cyanide**
Concentration Units: **mg/L**

Sampling Point ID:	K9/3S	K9/4E	BHe29S	GHD01S	E61D	344B	BH21S
Sampling Event	Sampling Date	TOTAL CYANIDE CONCENTRATION (mg/L)						
1	4-Mar-02	0.005	0.03					
2	14-Oct-02	0.005	0.013					
3	15-Apr-03	0.01	0.005					
4	17-Nov-03		0.367					
5	31-Mar-04		0.011					
6	27-Sep-04	0.012	0.005					
7	31-Mar-05		0.0225					
8	12-Sep-05	0.04	0.05					
9	9-Mar-06	0.023	0.0272					
10	6-Sep-06	0.0306	0.005					
11	9-Mar-07	0.023	0.0272					
12	22-Sep-07	0.005	0.0055					
13	11-Mar-08	0.014	0.012					
14	10-Sep-08	0.006	0.023					
15	5-Mar-09	0.005	0.004	0.005	0.168	0.005		
16	14-Sep-09	0.005	0.005	0.005	0.005	0.005		
17	5-Mar-10							
18	14-Sep-10	0.007	0.005	0.005	0.006	0.005	0.005	
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12			0.005	0.06		0.005	
22	14-Sep-12				0.031			
23	5-Mar-13	0.005	0.005	0.005	0.015		0.005	
24	9-Dec-13	0.008	0.009	0.01	0.005		0.011	
25	22-Apr-14				0.02			
26	2-Nov-15		0.005	0.005	0.02	0.005		0.205
27	15-Apr-16	0.005	0.005	0.005	0.006	0.005		0.44
28	2-Nov-16							
29	13-Apr-17	0.005	0.005	0.16	0.007	0.005		0.36
30	2-Nov-17							
31	11-May-18	0.005	0.005	0.005	0.005	0.005	0.005	0.38
32	2-Nov-18							
33	11-Jul-19	0.005	0.005	0.005	0.005	0.005	0.005	
34	1-Nov-19							
35	1-Jul-20	0.005	0.005	0.005	0.007	0.006		
36	1-Nov-20							
37	7-Jul-21	0.005	0.005	0.005	0.005	0.005	0.005	0.065
38	21-Jun-22	0.005	0.005	0.005		0.005	0.005	0.21
39	13-Oct-23	0.006	0.005	0.005	0.068	0.005	0.005	0.220
40								
Coefficient of Variation:		0.93	2.82	2.55	1.57	0.06	0.35	0.48
Mann-Kendall Statistic (S):		-82	-150	-1	-25	5	-2	-3
Confidence Factor:		97.8%	99.9%	50.0%	85.7%	60.6%	54.0%	61.4%
Concentration Trend:		Decreasing	Decreasing	No Trend	No Trend	No Trend	Stable	Stable



Notes:

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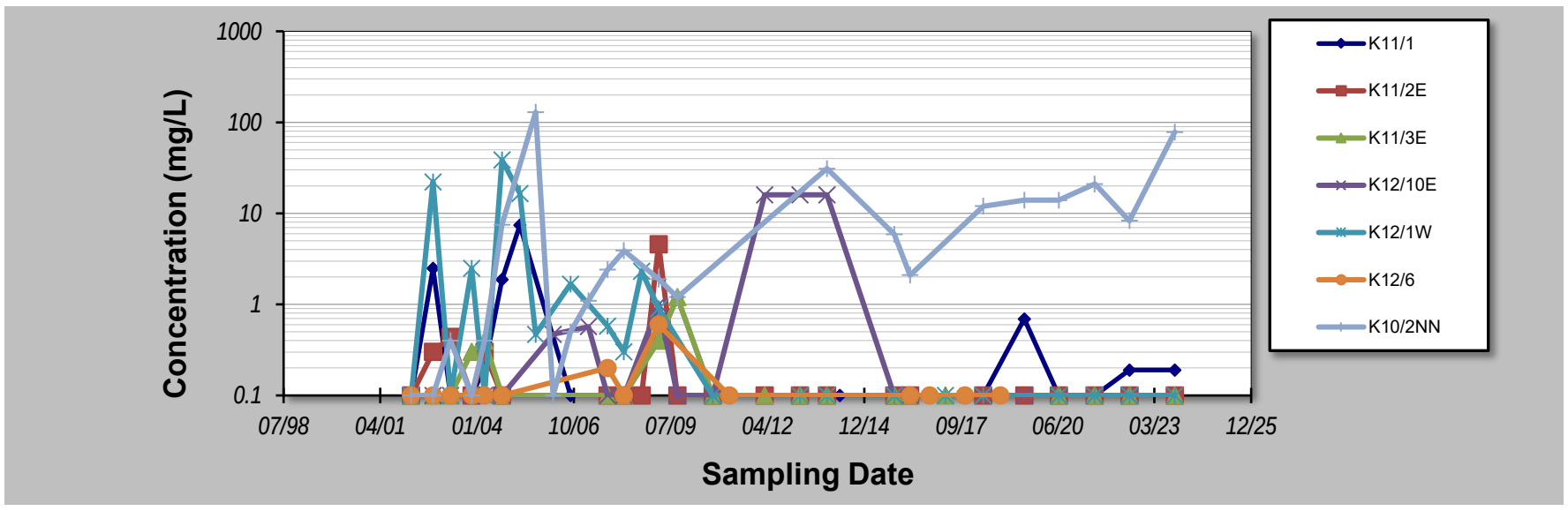
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Total PAHs**
Concentration Units: **mg/L**

Sampling Point ID:	K10/2NN	K11/1	K11/2E	K11/3E	K12/10E	K12/1W	K12/6
Sampling Event	Sampling Date	TOTAL PAHS CONCENTRATION (mg/L)						
1	4-Mar-02	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2	14-Oct-02	0.1	2.5	0.3	0.1	0.1	22.1	0.1
3	15-Apr-03	0.4	0.1	0.44	0.1	0.1	0.1	0.1
4	17-Nov-03	0.1	0.1	0.1	0.3	0.1	2.48	0.1
5	31-Mar-04	0.4	0.2	0.3	0.4	0.1	0.1	0.1
6	27-Sep-04	7.52	1.87	0.1	0.1	0.1	38.56	0.1
7	31-Mar-05		7.41				16.52	-
8	12-Sep-05	129.45					0.47	-
9	9-Mar-06	0.1				0.47		-
10	6-Sep-06	0.5	0.1				1.67	-
11	9-Mar-07	1.1				0.57		-
12	22-Sep-07	2.4	0.1	0.1	0.1	0.1	0.58	0.2
13	11-Mar-08	3.9	0.1	0.1	0.1	0.1	0.3	0.1
14	10-Sep-08			0.1			2.31	-
15	5-Mar-09	1.9	0.4	4.58	0.4	1	0.9	0.6
16	14-Sep-09	1.2	1.2	0.1	1.2	0.1	0	0
17	5-Mar-10							
18	14-Sep-10		0.1	0.1	0.1	0.1	0.1	
19	5-Mar-11							0.1
20	14-Sep-11							
21	5-Mar-12			0.1	0.1	16		
22	14-Sep-12							
23	5-Mar-13			0.1	0.1	16	0.1	
24	9-Dec-13	31	0.1	0.1	0.1	16	0.1	
25	22-Apr-14		0.1					
26	2-Nov-15	5.9	0.1	0.1	0.1	0.1	0.1	
27	15-Apr-16	2.1	0.1	0.1	0.1	0.1		0.1
28	2-Nov-16							0.1
29	13-Apr-17		0.1		0.1		0.1	
30	2-Nov-17							0.1
31	11-May-18	12	0.1	0.1			0.1	
32	2-Nov-18							0.1
33	11-Jul-19	14	0.69	0.1		0.1		
34	1-Nov-19							
35	1-Jul-20	14	0.1	0.1	0.1	0.1	0.1	
36	1-Nov-20							
37	7-Jul-21	21	0.1	0.1	0.1	0.1	0.1	
38	01-Jul-22	8.3	0.19	0.1	0.1	0.1	0.1	
39	12-Oct-23	78.00	0.19	0.10	0.10		0.10	
40								
Coefficient of Variation:		**2.07**	**2.32**	**2.85**	**1.32**	**2.37**	**2.53**	**1.01**
Mann-Kendall Statistic (S):		**151**	**-22**	**-53**	**-27**	**16**	**-100**	**-1**
Confidence Factor:		**>99.9%**	**69.7%**	**91.4%**	**78.1%**	**66.2%**	**99.4%**	**50.0%**
Concentration Trend:		Increasing	No Trend	Prob. Decreasing	No Trend	No Trend	Decreasing	No Trend



Notes:

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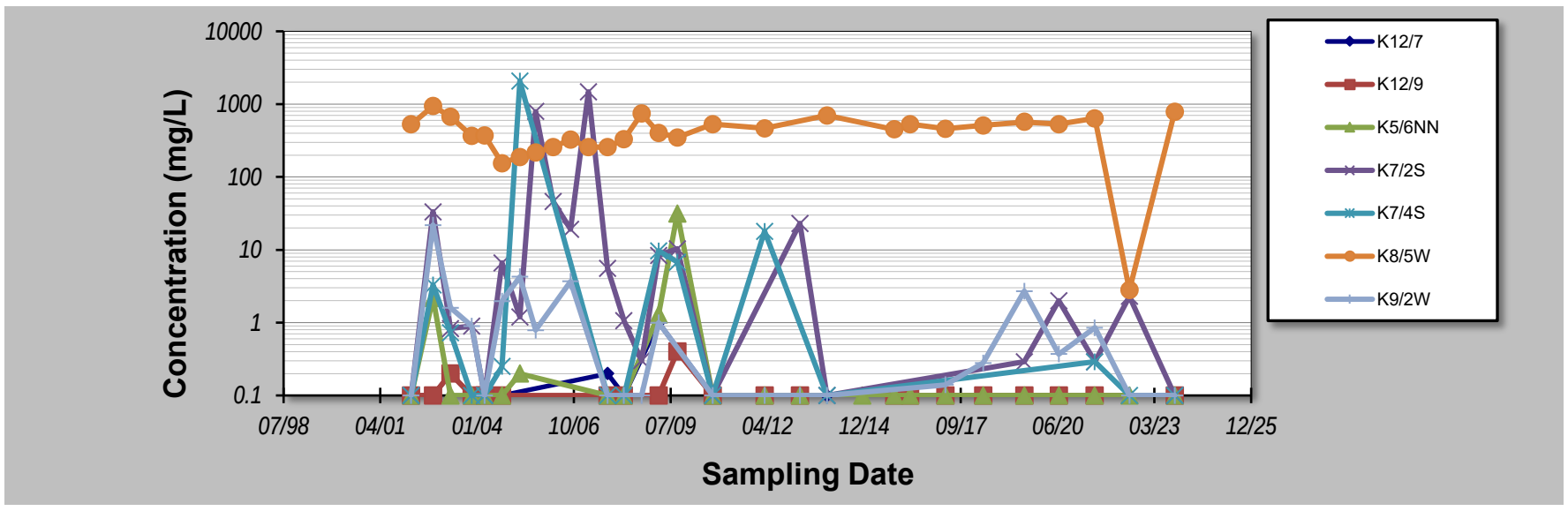
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Total PAHs**
Concentration Units: **mg/L**

Sampling Point ID:	K12/7	K12/9	K5/6NN	K7/2S	K7/4S	K8/5W	K9/2W
Sampling Event	Sampling Date	TOTAL PAHS CONCENTRATION (mg/L)						
1	4-Mar-02	0.1	0.1	0.1	0.1	0.1	527	0.1
2	14-Oct-02	0.1	0.1	2.2	33.3	3.3	941.9	21.9
3	15-Apr-03	0.2	0.2	0.1	0.83	0.73	672	1.6
4	17-Nov-03	0.1	0.1	0.1	0.9	0.1	368.5	0.9
5	31-Mar-04	0.1	0.1	0.1	0.1	0.1	371	0.1
6	27-Sep-04	0.1	0.1	0.1	6.61	0.25	155.06	1.97
7	31-Mar-05	-	-	0.2	1.2	2072.7	188.02	4.25
8	12-Sep-05	-	-	-	791.7	-	217.93	0.79
9	9-Mar-06	-	-	-	46.09	-	257.5	-
10	6-Sep-06	-	-	-	19.21	-	326.8	3.69
11	9-Mar-07	-	-	-	1476.09	-	258.1	-
12	22-Sep-07	0.2	0.1	0.1	5.58	0.1	256.7	0.1
13	11-Mar-08	0.1	0.1	0.1	1.06	0.1	332.1	0.1
14	10-Sep-08	-	-	-	0.3	-	741.26	0.1
15	5-Mar-09	1	0.1	1.3	8.37	9.7	403.91	1
16	14-Sep-09	0	0.4	31.5	10.3	6.8	348.57	0
17	5-Mar-10							
18	14-Sep-10	0.1	0.1	0.1	0.1	0.1	533.33	0.1
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12	0.1	0.1	0.1		18	466	0.1
22	14-Sep-12							
23	5-Mar-13	0.1	0.1	0.1	23			0.1
24	9-Dec-13	0.1			0.1	0.1	699.5	0.1
25	22-Apr-14							
26	9-Dec-14			0.1				
27	2-Nov-15		0.1	0.1			450	
28	15-Apr-16	0.1	0.1	0.1			530	-
29	2-Nov-16							
30	13-Apr-17	0.1	0.1	0.1			460	0.14
31	2-Nov-17							
32	11-May-18	0.1	0.1	0.1			510	0.28
33	2-Nov-18							
34	11-Jul-19	0.1	0.1	0.1	0.29		570	2.7
35	1-Nov-19							
36	1-Jul-20	0.1	0.1	0.1	2		530	0.37
37	1-Nov-20							
38	7-Jul-21	0.1	0.1	0.1	0.29	0.29	640	0.85
39	01-Jul-22	0.1		0.1	2.3	0.1	2.8	0.1
40	11-Oct-23	0.1	0.1	0.1	0.1	0.1	790.00	0.1
Coefficient of Variation:	**1.34**	**0.57**	**4.13**	**3.30**	**4.04**	**0.47**	**2.63**
Mann-Kendall Statistic (S):	**-23**	**-17**	**-38**	**-35**	**-8**	**95**	**-51**
Confidence Factor:	**73.0%**	**68.4%**	**81.9%**	**79.8%**	**61.2%**	**96.9%**	**87.7%**
Concentration Trend:	No Trend	Stable	No Trend	No Trend	No Trend	Increasing	No Trend



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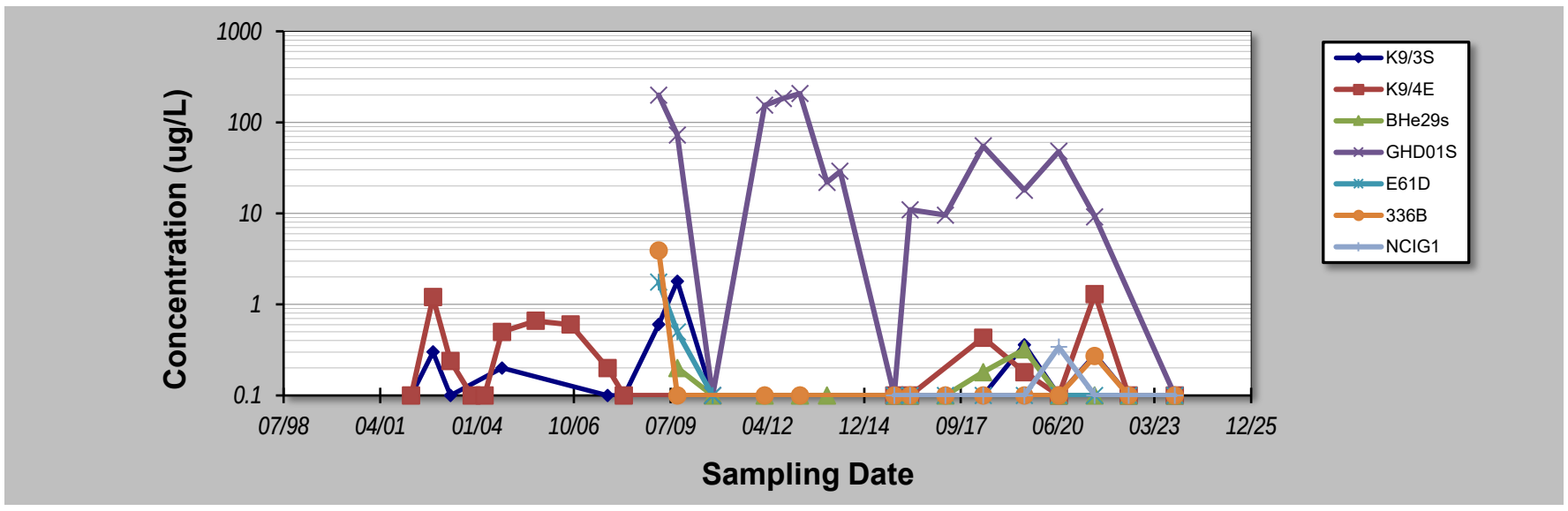
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Total PAHs**
Concentration Units: **ug/L**

Sampling Point ID:	K9/3S	K9/4E	BHe29s	GHD01S	E61D	336B	NCIG1
Sampling Event	Sampling Date	TOTAL PAHS CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1					
2	14-Oct-02	0.3	1.2					
3	15-Apr-03	0.1	0.24					
4	17-Nov-03		0.1					
5	31-Mar-04		0.1					
6	27-Sep-04	0.2	0.5					
7	31-Mar-05		-					
8	12-Sep-05	-	0.66					
9	9-Mar-06	-	-					
10	6-Sep-06	-	0.6					
11	9-Mar-07	-	-					
12	22-Sep-07	0.1	0.2					
13	11-Mar-08	0.1	0.1					
14	10-Sep-08	-	-					
15	5-Mar-09	0.6	-	-	198.92	1.76	3.9	
16	14-Sep-09	1.8		0.2	72.6	0.5	0.1	
17	5-Mar-10							
18	14-Sep-10	0.1		0.1	0.1	0.1		
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12			0.1	154		0.1	
22	14-Sep-12				183			
23	5-Mar-13	0.1		0.1	207		0.1	
24	9-Dec-13			0.1	22			
25	22-Apr-14				29			
26	2-Nov-15		0.1	0.1	0.1	0.1	0.1	0.1
27	15-Apr-16	0.1	0.1	0.1	11	0.1	0.1	0.1
28	2-Nov-16							
29	13-Apr-17	0.1	-	0.1	9.6	0.1	0.1	0.1
30	2-Nov-17							
31	11-May-18	0.1	0.43	0.18	55	0.1	0.1	0.1
32	2-Nov-18							
33	11-Jul-19	0.36	0.18	0.32	18	0.1	0.1	0.1
34	1-Nov-19							
35	1-Jul-20	0.1	0.1	0.1	48	0.1	0.1	0.34
36	1-Nov-20							
37	7-Jul-21	0.28	1.3	0.1	9.2	0.1	0.3	0.1
38	21-Jun-22	0.1	0.1	0.1		0.1	0.1	0.1
39	13-Oct-23	0.1	0.1	0.1	0.1	0.1	0.1	0.1
40								
Coefficient of Variation:		1.54	1.10	0.50	1.20	1.78	2.59	0.63
Mann-Kendall Statistic (S):		-11	-21	-4	-45	-21	-5	2
Confidence Factor:		64.6%	77.3%	56.4%	97.7%	91.3%	59.4%	54.0%
Concentration Trend:		No Trend	No Trend	Stable	Decreasing	Prob. Decreasing	No Trend	No Trend



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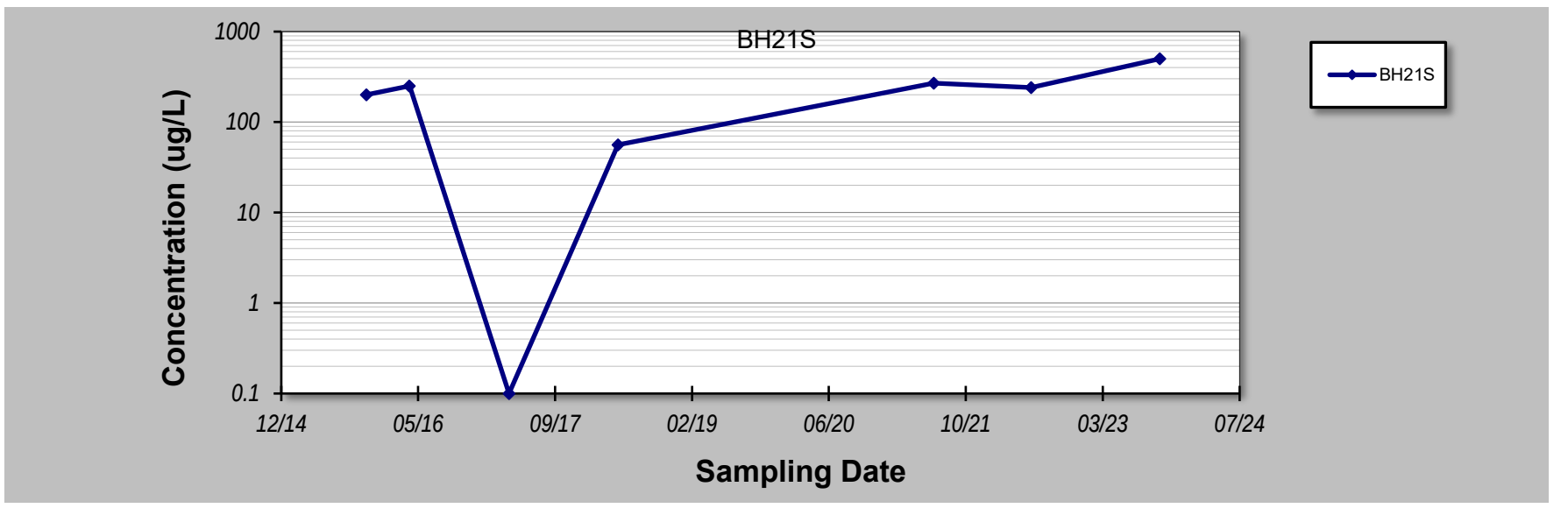
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Total PAHs**
Concentration Units: **ug/L**

Sampling Point ID: **BH21S**

Sampling Event	Sampling Date	TOTAL PAHS CONCENTRATION (ug/L)						
1	3-Nov-15	201						
2	8-Apr-16	250						
3	7-Apr-17	0.1						
4	10-May-18	56						
5	8-Jul-19							
6	23-Jun-20							
7	6-Jul-21	270						
8	27-Jun-22	240						
9	09-Oct-23	500						
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		1.07	0.00					
Mann-Kendall Statistic (S):		-6	0					
Confidence Factor:		66.8%						
Concentration Trend:		No Trend						



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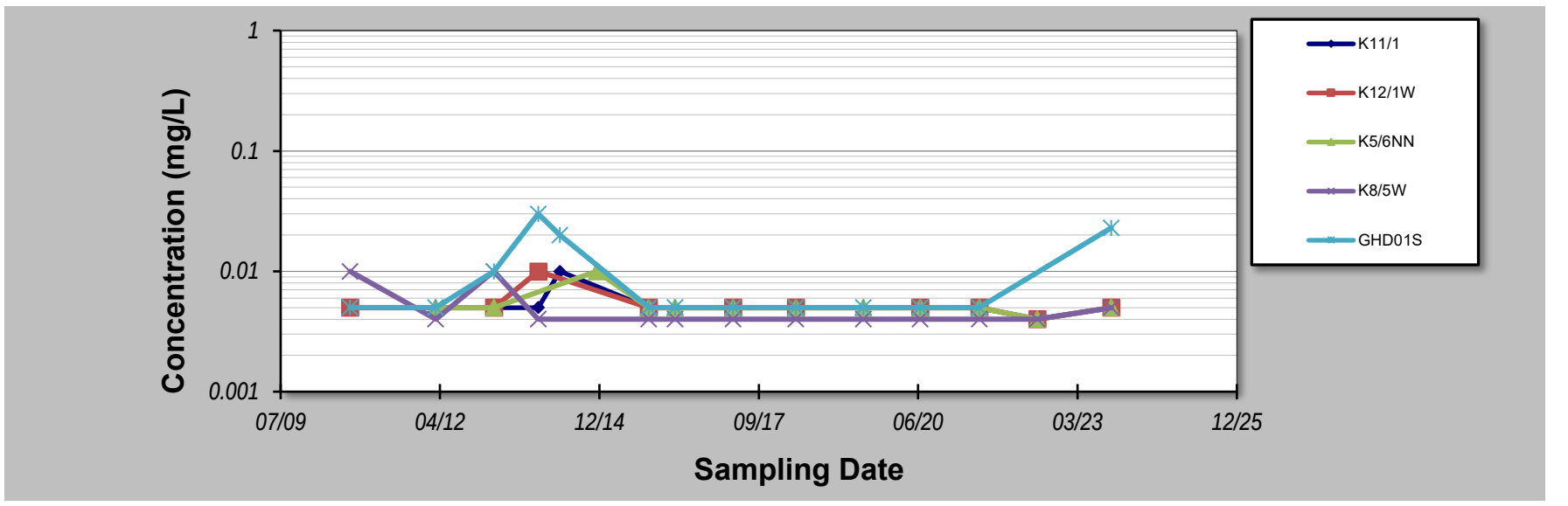
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Weak Acid Disociable Cyanide**
Concentration Units: **mg/L**

Sampling Point ID:	K11/1	K12/1W	K5/6NN	K8/5W	GHD01S		
Sampling Event	Sampling Date	WEAK ACID DISOCIABLE CYANIDE CONCENTRATION (mg/L)						
1	14-Sep-10	0.005	0.005		0.01	0.005		
2	5-Mar-11							
3	14-Sep-11							
4	5-Mar-12			0.005	0.004	0.005		
5	14-Sep-12							
6	5-Mar-13		0.005	0.005	0.01	0.01		
7	9-Dec-13	0.005	0.01		0.004	0.03		
8	22-Apr-14	0.01				0.02		
9	9-Dec-14			0.01				
10	5-Mar-15							
11	2-Nov-15	0.005	0.005	0.005	0.004	0.005		
12	15-Apr-16	0.005		0.005	0.004	0.005		
13	2-Nov-16							
14	13-Apr-17	0.005	0.005	0.005	0.004	0.005		
15	2-Nov-17							
16	11-May-18	0.005	0.005	0.005	0.004	0.005		
17	2-Nov-18							
18	11-Jul-19	0.005		0.005	0.004	0.005		
19	1-Nov-19							
20	1-Jul-20	0.005	0.005	0.005	0.004	0.005		
21	1-Nov-20							
22	7-Jul-21	0.005	0.005	0.005	0.004	0.005		
23	06-Jul-22	0.004	0.004	0.004	0.004			
24	13-Oct-23	0.005	0.005	0.005	0.005	0.02		
25								
Coefficient of Variation:		0.28	0.30	0.28	0.45	0.88		
Mann-Kendall Statistic (S):		-15	-11	-15	-10	-4		
Confidence Factor:		82.8%	81.0%	82.8%	70.5%	57.1%		
Concentration Trend:		Stable	Stable	Stable	Stable	Stable		



Notes:

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3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

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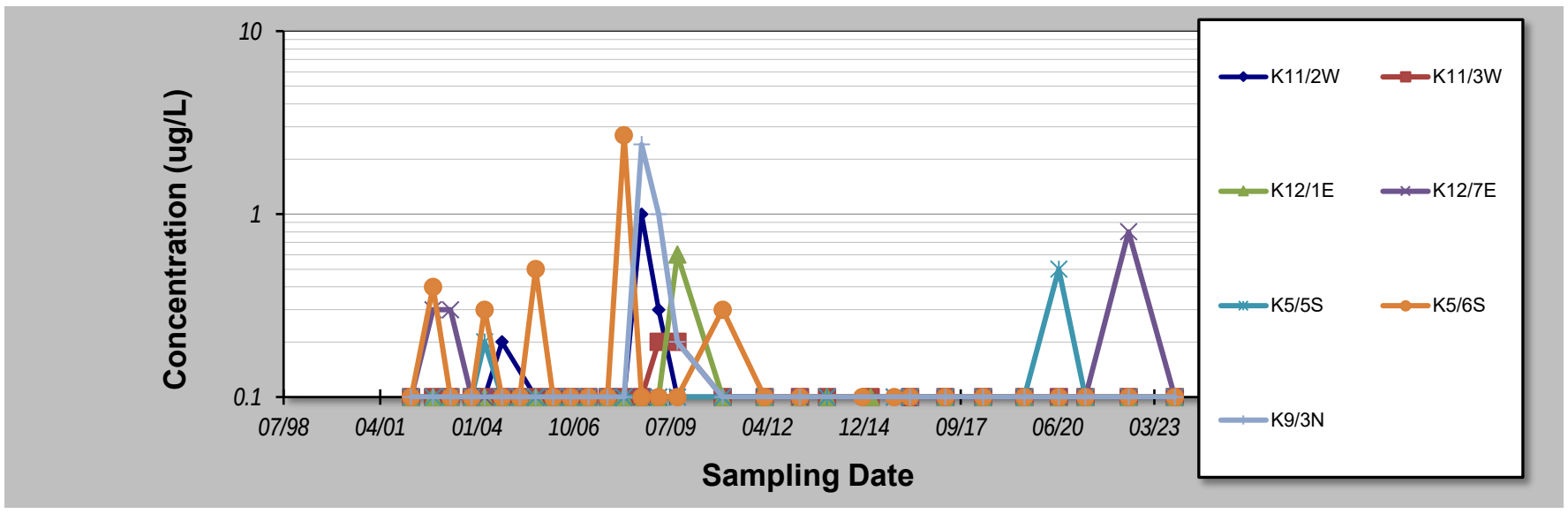
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Acenaphthene**
Concentration Units: **ug/L**

Sampling Point ID:	K11/2W	K11/3W	K12/1E	K12/7E	K5/5S	K5/6S	K9/3N
Sampling Event	Sampling Date	ACENAPHTHENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.10	0.1	0.1	0.1	0.1	0.1
2	14-Oct-02	0.1	0.10	0.1	0.3	0.1	0.4	0.1
3	15-Apr-03	0.1	0.10	0.1	0.3	0.1	0.1	0.1
4	17-Nov-03	0.1	0.10	0.1	0.1	0.1	0.1	0.1
5	31-Mar-04	0.1	0.10	0.1	0.1	0.2	0.3	0.1
6	27-Sep-04	0.2	0.10	0.1	0.1	0.1	0.1	0.1
7	31-Mar-05		0.10	0.1	0.1	0.1	0.1	0.1
8	12-Sep-05	0.1	0.10	0.1	0.1	0.1	0.5	0.1
9	9-Mar-06	0.1	0.10	0.1	0.1	0.1	0.1	0.1
10	6-Sep-06	0.1	0.10	0.1	0.1	0.1	0.1	0.1
11	9-Mar-07	0.1	0.10	0.1	0.1	0.1	0.1	0.1
12	22-Sep-07	0.1	0.10	0.1	0.1	0.1	0.1	0.1
13	11-Mar-08	0.1	0.10	0.1	0.1	0.1	2.7	0.1
14	10-Sep-08	1	0.10	0.1	0.1	4	0.1	2.4
15	5-Mar-09	0.3	0.2	0.1	0.1	0.1	0.1	1
16	14-Sep-09	0.1	0.2	0.6	0.1	0.1	0.1	0.2
17	5-Mar-10							
18	24-Dec-10	0.1	0.10	0.1	0.1	0.1	0.3	0.1
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12	0.1	0.10	0.1	0.1	0.1	0.1	
22	14-Sep-12							
23	5-Mar-13	0.1	0.10	0.1	0.1		0.1	0.1
24	9-Dec-13	0.1	0.10	0.1	0.1	0.1		
25	9-Dec-14						0.1	
26	5-Mar-15		0.10	0.1				
27	2-Nov-15	0.1			0.1	0.1	0.1	
28	15-Apr-16	0.1	0.10		0.1	0.1	0.1	0.1
29	2-Nov-16							
30	13-Apr-17		0.10	0.1	0.1	0.1	0.1	0.1
31	2-Nov-17							
32	11-May-18	0.1	0.10	0.1	0.1	0.1	0.1	0.1
33	2-Nov-18							
34	11-Jul-19	0.1	0.10	0.1	0.1	0.1	0.1	0.1
35	1-Nov-19							
36	1-Jul-20	0.1	0.10	0.1	0.1	0.5	0.1	0.1
37	1-Nov-20							
38	1-Apr-21	0.1	0.10	0.1	0.1	0.1	0.1	0.1
39	21-Jun-22	0.1	0.1	0.1	0.8	0.1	0.1	0.1
40	12-Oct-23		0.1	0.1	0.1	0.1	0.1	0.1
Coefficient of Variation:		1.23	0.24	0.80	1.00	0.66	2.14	2.10
Mann-Kendall Statistic (S):		-14	2	3	-22	2	-59	6
Confidence Factor:		61.2%	50.7%	51.6%	65.2%	50.8%	86.0%	54.4%
Concentration Trend:		No Trend	No Trend	No Trend	Stable	No Trend	No Trend	No Trend



Notes:

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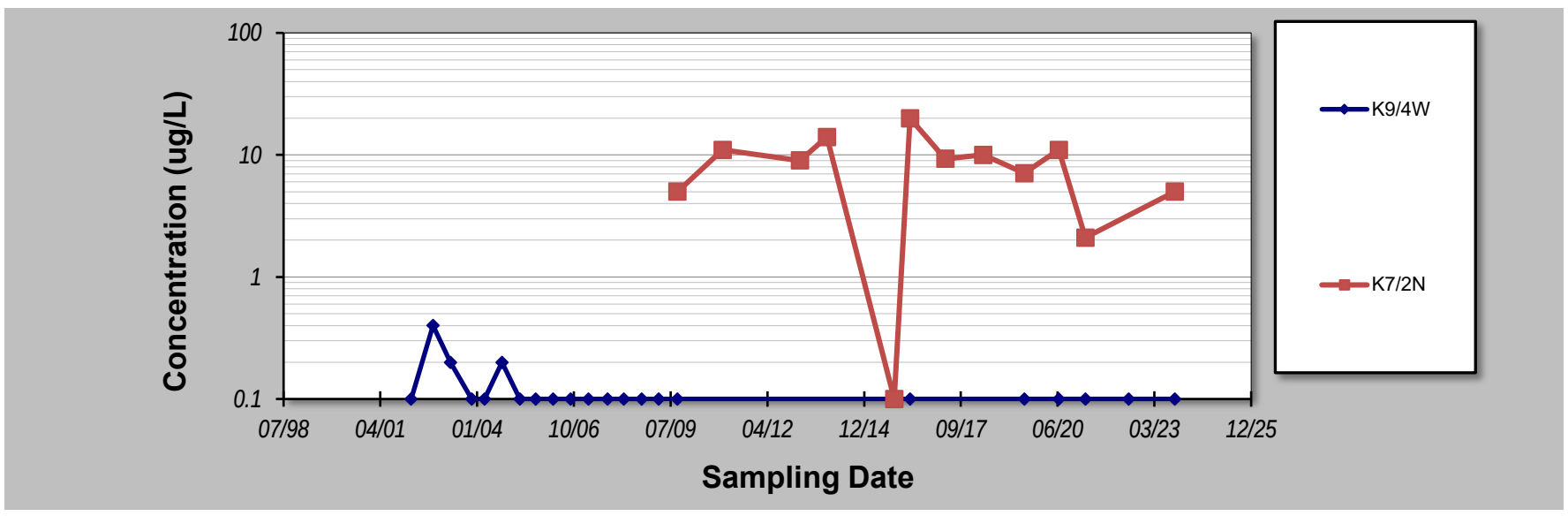
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Acenaphthene**
Concentration Units: **ug/L**

Sampling Point ID:	K9/4W	K7/2N					
Sampling Event	Sampling Date	ACENAPHTHENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1						
2	14-Oct-02	0.4						
3	15-Apr-03	0.2						
4	17-Nov-03	0.1						
5	31-Mar-04	0.1						
6	27-Sep-04	0.2						
7	31-Mar-05	0.1						
8	12-Sep-05	0.1						
9	9-Mar-06	0.1						
10	6-Sep-06	0.1						
11	9-Mar-07	0.1						
12	22-Sep-07	0.1						
13	11-Mar-08	0.1						
14	10-Sep-08	0.1						
15	5-Mar-09	0.1						
16	14-Sep-09	0.1	5					
17	5-Mar-10							
18	24-Dec-10		11					
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12							
22	14-Sep-12							
23	5-Mar-13		9					
24	9-Dec-13		14					
25	22-Apr-14							
26	2-Nov-15	0.1	0.1					
27	15-Apr-16	0.1	20					
28	2-Nov-16							
29	13-Apr-17		9.3					
30	2-Nov-17							
31	11-May-18		10					
32	2-Nov-18							
33	11-Jul-19	0.1	7.1					
34	1-Nov-19							
35	1-Jul-20	0.1	11					
36	1-Nov-20							
37	1-Apr-21	0.1	2.1					
38	24-Jun-22	0.1						
39	10-Oct-23	0.1	5.00					
40								
Coefficient of Variation:		**0.55**	**0.62**					
Mann-Kendall Statistic (S):		**-52**	**-8**					
Confidence Factor:		**91.0%**	**68.1%**					
Concentration Trend:		Prob. Decreasing	Stable					



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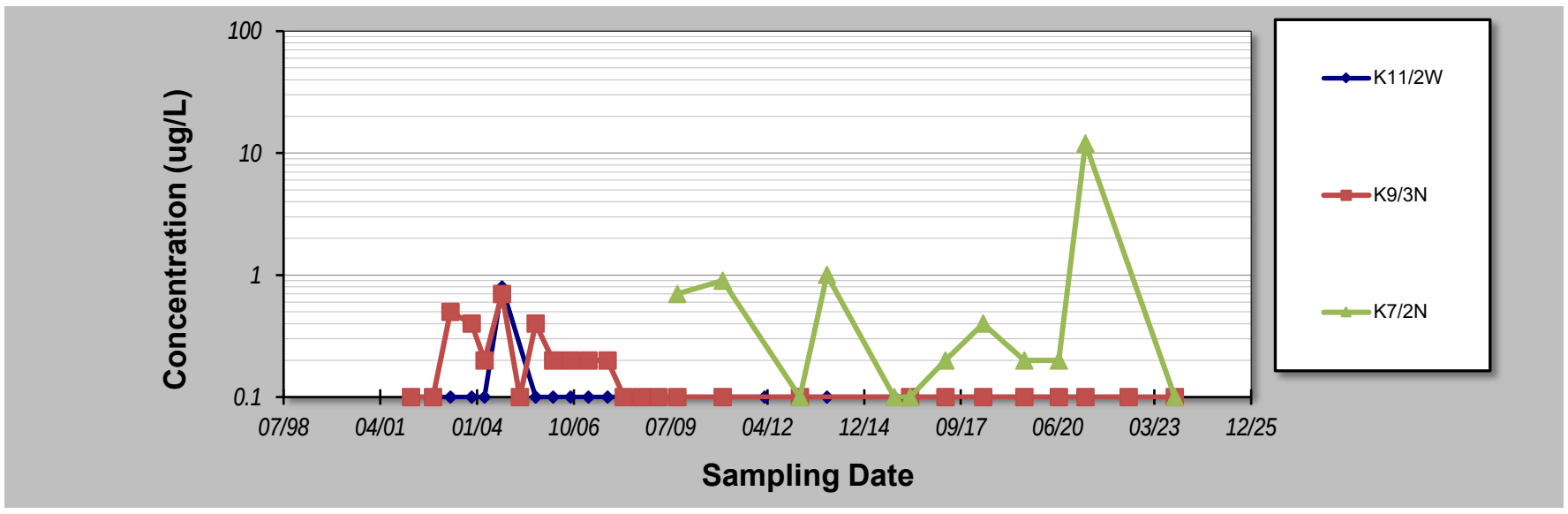
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Acenaphthylene**
Concentration Units: **ug/L**

Sampling Point ID:	K11/2W	K9/3N	K7/2N				
Sampling Event	Sampling Date	ACENAPHTHYLENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1					
2	14-Oct-02	0.1	0.1					
3	15-Apr-03	0.1	0.5					
4	17-Nov-03	0.1	0.4					
5	31-Mar-04	0.1	0.2					
6	27-Sep-04	0.8	0.7					
7	31-Mar-05		0.1					
8	12-Sep-05	0.1	0.4					
9	9-Mar-06	0.1	0.2					
10	6-Sep-06	0.1	0.2					
11	9-Mar-07	0.1	0.2					
12	22-Sep-07	0.1	0.2					
13	11-Mar-08	0.1	0.1					
14	10-Sep-08	0.1	0.1					
15	5-Mar-09	0.1	0.1					
16	14-Sep-09	0.1	0.1	0.7				
17	5-Mar-10							
18	24-Dec-10	0.1	0.1	0.9				
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12	0.1						
22	14-Sep-12							
23	5-Mar-13	0.1	0.1	0.1				
24	9-Dec-13	0.1		1				
25	22-Apr-14							
26	9-Dec-14							
27	5-Mar-15							
28	2-Nov-15	0.1		0.1				
29	15-Apr-16	0.1	0.1	0.1				
30	2-Nov-16							
31	13-Apr-17		0.1	0.2				
32	2-Nov-17							
33	11-May-18	0.1	0.1	0.4				
34	11-Jul-19	0.1	0.1	0.2				
35	1-Nov-19							
36	1-Jul-20	0.1	0.1	0.2				
37	1-Nov-20							
38	1-Apr-21	0.1	0.1	12.00				
39	21-Jun-22	0.1	0.1					
40	12-Oct-23		0.1	0.10				
Coefficient of Variation:		**1.08**	**0.84**	**2.53**				
Mann-Kendall Statistic (S):		**-15**	**-124**	**-3**				
Confidence Factor:		**62.0%**	**99.7%**	**55.4%**				
Concentration Trend:		No Trend	Decreasing	No Trend				



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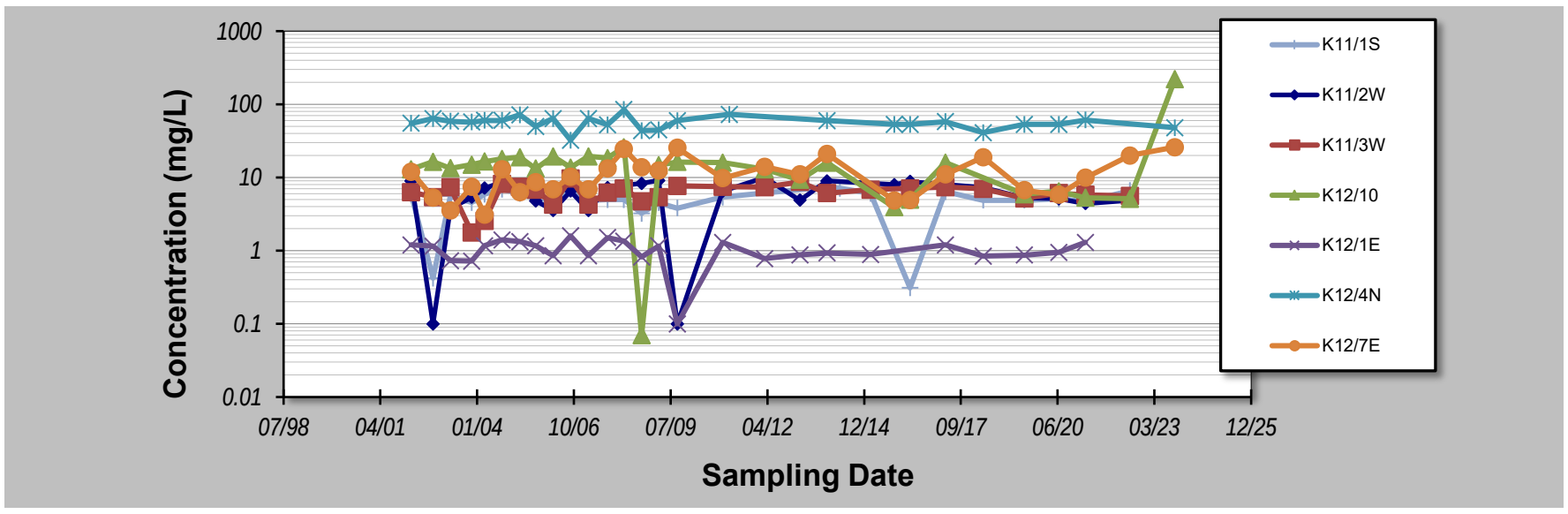
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Ammonia**
Concentration Units: **mg/L**

Sampling Point ID:	K11/1S	K11/2W	K11/3W	K12/10	K12/1E	K12/4N	K12/7E
Sampling Event	Sampling Date	AMMONIA CONCENTRATION (mg/L)						
1	4-Mar-02	5.9	9	6.3	13	1.2	55	12
2	14-Oct-02	0.42	0.1	5.38	16.4	1.15	64	5.32
3	15-Apr-03	5.62	3.81	7.34	13.4	0.73	58.8	3.55
4	17-Nov-03	4.56	5.37	1.77	15	0.72	57.3	7.44
5	31-Mar-04	5.89	7.15	2.54	16.5	1.17	60.2	3.1
6	27-Sep-04	6.93	8.66	8.19	18	1.4	60.3	13
7	31-Mar-05	6.02	7.22	7.5	19	1.33	72	6.28
8	12-Sep-05	5.22	4.81	6.8	13.2	1.17	49.9	8.67
9	9-Mar-06	4.86	3.55	4.25	19.4	0.853	63.9	6.88
10	6-Sep-06	7.18	6.52	9.71	13.7	1.59	32.4	10.2
11	9-Mar-07	4.86	3.55	4.25	19.40	0.853	63.9	6.88
12	22-Sep-07	5.00	7.26	6.22	18.40	1.51	52.3	13.30
13	11-Mar-08	5.01	7.77	7.11	26.00	1.35	84.50	24.4
14	10-Sep-08	3.25	8.29	4.72	0.07	0.82	43.90	13.8
15	5-Mar-09	4.52	9.12	5.38	14.8	1.16	44.6	12.4
16	14-Sep-09	3.82	0.1	7.67	16.3	0.1	59.7	25.4
17	5-Mar-10							
18	24-Dec-10	5.4	6.5	7.5	16	1.3		9.8
19	5-Mar-11						73	
20	14-Sep-11							
21	5-Mar-12		10	7.4	13	0.78		14
22	14-Sep-12							
23	5-Mar-13		4.9	8.7	9.3	0.88		11
24	9-Dec-13	7.4	9	6.1	16	0.93	60	21
25	22-Apr-14	7.1						
26	5-Mar-15	6.08		6.81		0.89		
27	2-Nov-15		7.97		3.92		53	4.85
28	15-Apr-16	0.31	8.8	7.1	5		53	4.9
29	2-Nov-16							
30	13-Apr-17	6.4		7.4	16	1.2	58	11
31	2-Nov-17							
32	11-May-18	4.9	7.3	7		0.84	41	19
33	2-Nov-18							
34	11-Jul-19	4.9	5.3	5.2	5.9	0.87	53	6.7
35	1-Nov-19							
36	1-Jul-20	5.1	5.1	6.1	6.5	0.95	53	5.8
37	1-Nov-20							
38	1-Apr-21	4.7	4.4	5.8	5.3	1.3	61	9.9
39	06-Jul-22	6.6	4.9	5.6	5.1			20
40	13-Oct-23	3.8		5.9	220.00	1.1	48.00	26.00
Coefficient of Variation:		**0.33**	**0.42**	**0.28**	**1.93**	**0.30**	**0.19**	**0.57**
Mann-Kendall Statistic (S):		**28**	**19**	**39**	**-85**	**7**	**-54**	**102**
Confidence Factor:		**71.2%**	**64.5%**	**77.2%**	**95.1%**	**55.2%**	**87.8%**	**97.1%**
Concentration Trend:		No Trend	No Trend	No Trend	Decreasing	No Trend	Stable	Increasing



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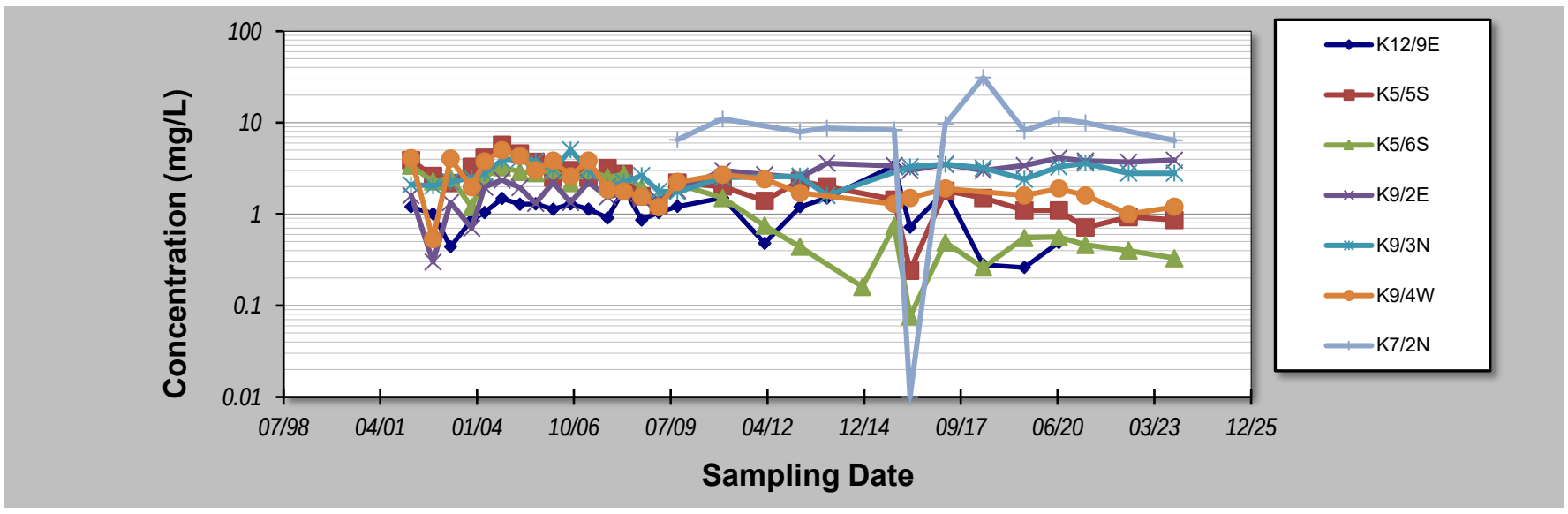
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Ammonia**
Concentration Units: **mg/L**

Sampling Point ID:	K12/9E	K5/5S	K5/6S	K9/2E	K9/3N	K9/4W	K7/2N
Sampling Event	Sampling Date	AMMONIA CONCENTRATION (mg/L)						
1	4-Mar-02	1.2	3.9	3.4	1.6	2.1	4.1	
2	14-Oct-02	1.01	2.6	2.27	0.3	2.03	0.53	
3	15-Apr-03	0.44	2.19	2.51	1.34	2.26	4.04	
4	17-Nov-03	0.86	3.28	1.19	0.7	2.48	1.97	
5	31-Mar-04	1.04	4.14	2.53	1.97	2.8	3.76	
6	27-Sep-04	1.48	5.73	3.25	2.36	3.89	4.97	
7	31-Mar-05	1.28	4.6	2.9	1.95	4.06	4.32	
8	12-Sep-05	1.29	3.71	2.82	1.31	3.79	3.01	
9	9-Mar-06	1.13	2.5	3.02	2.21	3.07	3.85	
10	6-Sep-06	1.29	3.01	2.19	1.34	5.03	2.58	
11	9-Mar-07	1.13	2.50	3.02	2.21	3.07	3.85	
12	22-Sep-07	0.91	3.19	2.52	1.55	2.02	1.85	
13	11-Mar-08	1.88	2.74	2.72	1.68	2.22	1.77	
14	10-Sep-08	0.86	1.57	1.94	1.47	2.65	1.54	
15	5-Mar-09	1.04	1.25	1.39	1.42	1.77	1.19	
16	14-Sep-09	1.21	2.2	2.12	1.82	1.75	2.25	6.52
17	5-Mar-10							
18	24-Dec-10	1.5	2	1.5	3	2.5	2.7	11
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12	0.48	1.4	0.75	2.7		2.4	
22	14-Sep-12							
23	5-Mar-13	1.2	2.3	0.44	2.5	2.6	1.7	7.9
24	9-Dec-13	1.5	2		3.6	1.6		8.7
25	22-Apr-14							
26	9-Dec-14			0.16				
27	2-Nov-15	3.38	1.44	0.74	3.38		1.29	8.32
28	15-Apr-16	0.72	0.24	0.076	3	3.3	1.5	0.01
29	2-Nov-16							
30	13-Apr-17	1.8	1.8	0.49	3.5	3.5	1.9	9.7
31	2-Nov-17							
32	11-May-18	0.28	1.5	0.26	3	3.2		31
33	2-Nov-18							
34	11-Jul-19	0.26	1.1	0.55	3.4	2.4	1.6	8.2
35	1-Nov-19							
36	1-Jul-20	0.49	1.1	0.56	4.1	3.3	1.9	11
37	1-Nov-20							
38	1-Apr-21		0.71	0.46	3.80	3.60	1.60	10.00
39	22-Jun-22		0.93	0.40	3.70	2.80	1.00	
40	09-Oct-23		0.86	0.33	3.90	2.80	1.20	6.40
Coefficient of Variation:		**0.55**	**0.56**	**0.70**	**0.43**	**0.28**	**0.50**	**0.73**
Mann-Kendall Statistic (S):		**-11**	**-271**	**-255**	**267**	**28**	**-166**	**7**
Confidence Factor:		**58.6%**	**>99.9%**	**>99.9%**	**>99.9%**	**71.2%**	**>99.9%**	**65.6%**
Concentration Trend:		Stable	Decreasing	Decreasing	Increasing	No Trend	Decreasing	No Trend



Notes:

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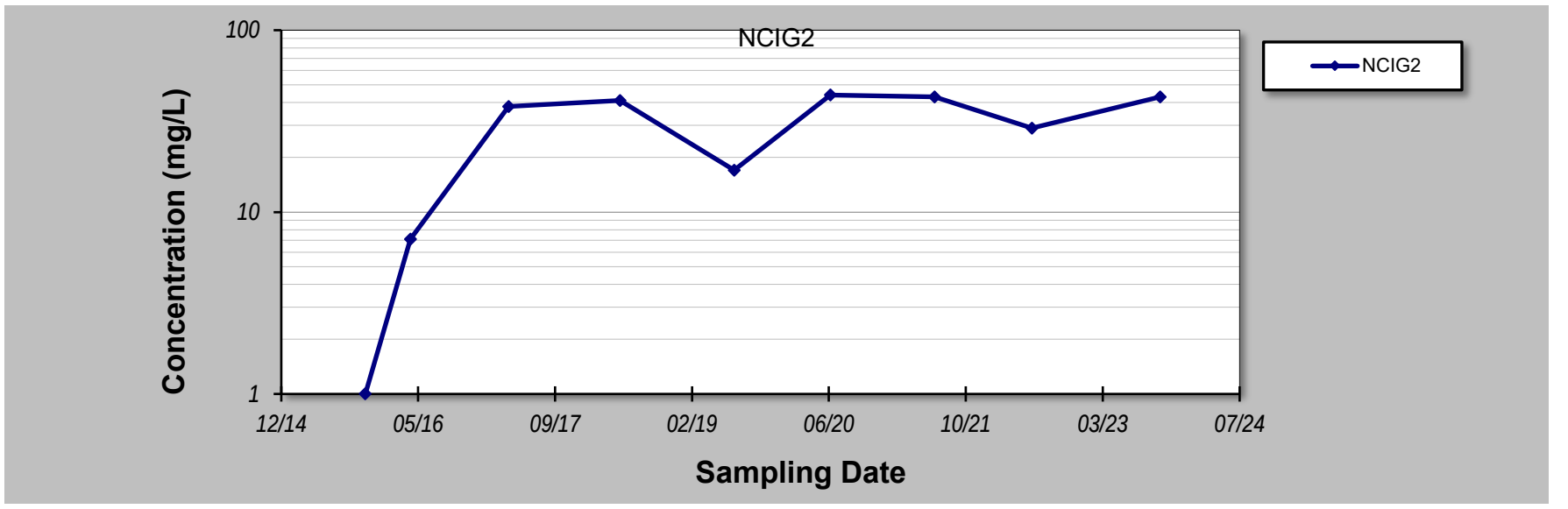
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Ammonia**
Concentration Units: **mg/L**

Sampling Point ID: **NCIG2**

Sampling Event	Sampling Date	AMMONIA CONCENTRATION (mg/L)
1	30-Oct-15	1
2	12-Apr-16	7.1
3	5-Apr-17	38
4	17-May-18	41
5	8-Jul-19	17
6	23-Jun-20	44
7	9-Jul-21	43
8	29-Jun-22	29
9	11-Oct-23	43.00
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
Coefficient of Variation:		0.57
Mann-Kendall Statistic (S):		19
Confidence Factor:		97.0%
Concentration Trend:		Increasing



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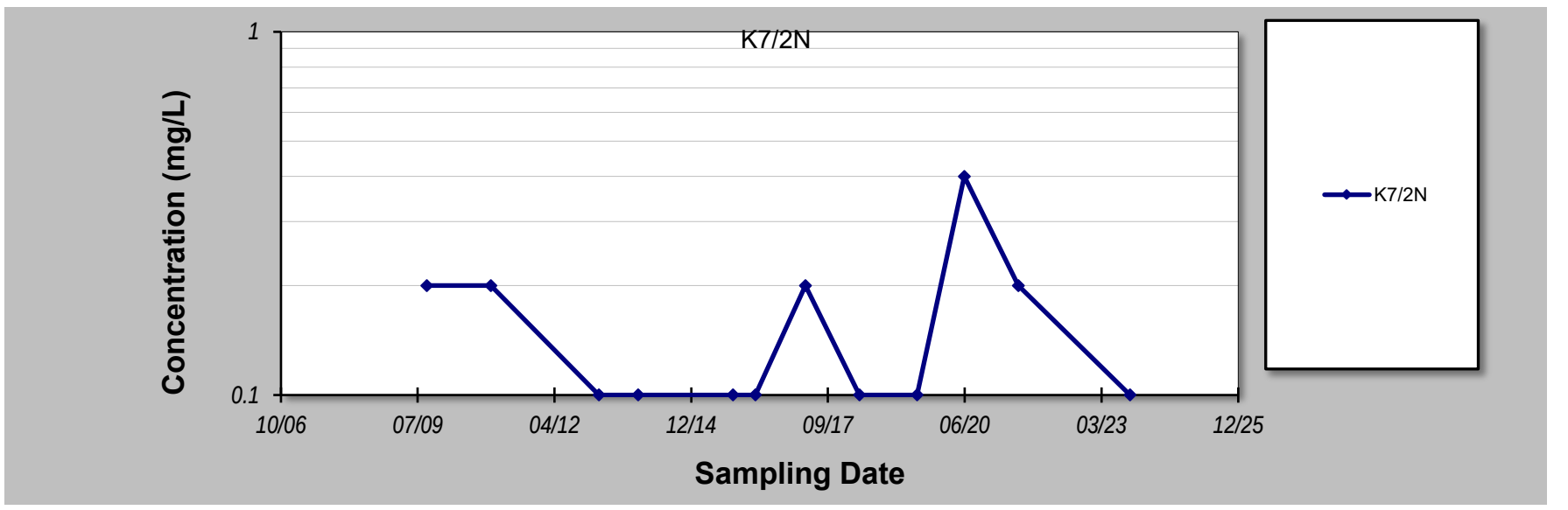
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Anthracene**
Concentration Units: **mg/L**

Sampling Point ID: **K7/2N**

Sampling Event	Sampling Date	ANTHRACENE CONCENTRATION (mg/L)
1	11-Sep-09	0.2
2	1-Mar-10	
3	23-Dec-10	0.2
4	5-Mar-11	
5	14-Sep-11	
6	5-Mar-12	
7	14-Sep-12	
8	21-Feb-13	0.1
9	5-Dec-13	0.1
10	22-Apr-14	
11	29-Oct-15	0.1
12	8-Apr-16	0.1
13	2-Nov-16	
14	10-Apr-17	0.2
15	2-Nov-17	
16	9-May-18	0.1
17	2-Nov-18	
18	5-Jul-19	0.1
19	1-Nov-19	
20	15-Jun-20	0.4
21	1-Nov-20	
22	14-Jul-21	0.2
23	10-Oct-23	0.1
24		
25		
Coefficient of Variation:		0.57
Mann-Kendall Statistic (S):		-1
Confidence Factor:		50.0%
Concentration Trend:		Stable



Notes:

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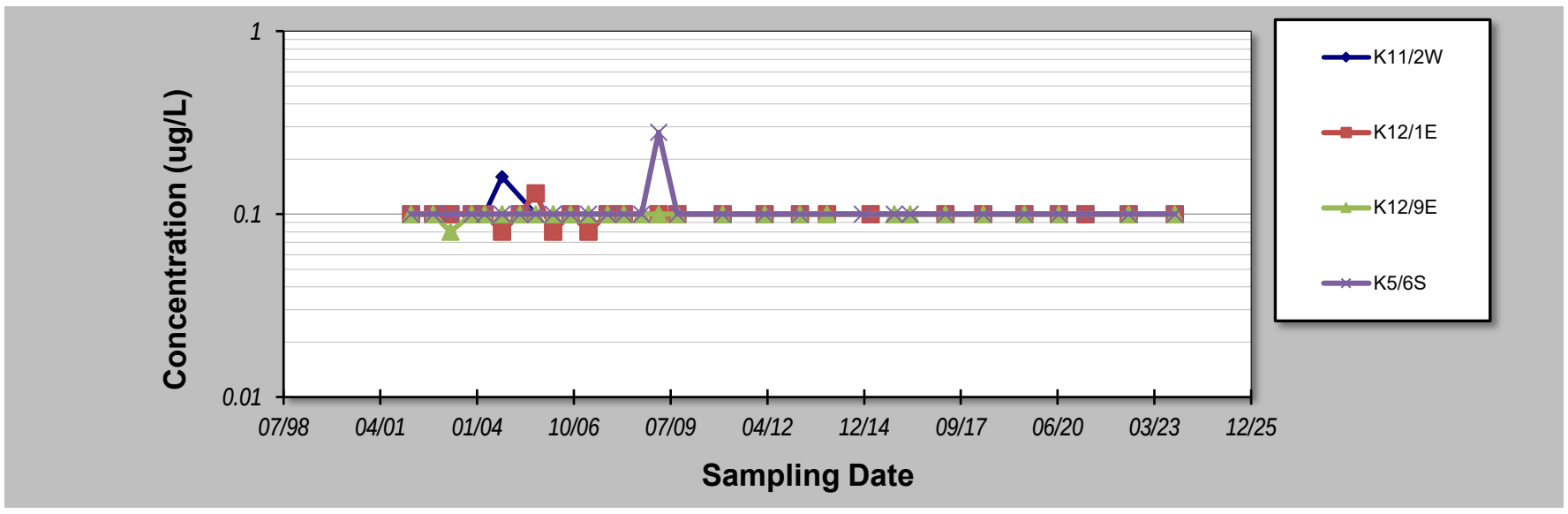
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Benzo(a)pyrene**
Concentration Units: **ug/L**

Sampling Point ID:	K11/2W	K12/1E	K12/9E	K5/6S			
Sampling Event	Sampling Date	BENZO(A)PYRENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1	0.1	0.1			
2	14-Oct-02	0.1	0.1	0.1	0.1			
3	15-Apr-03	0.1	0.1	0.08	0.1			
4	17-Nov-03	0.1	0.1	0.1	0.1			
5	31-Mar-04	0.1	0.1	0.1	0.1			
6	27-Sep-04	0.16	0.08	0.1	0.1			
7	31-Mar-05		0.1	0.1	0.1			
8	12-Sep-05	0.1	0.13	0.1	0.1			
9	9-Mar-06	0.1	0.08	0.1	0.1			
10	6-Sep-06	0.1	0.1	0.1	0.1			
11	9-Mar-07	0.1	0.08	0.1	0.1			
12	22-Sep-07	0.1	0.1	0.1	0.1			
13	11-Mar-08	0.1	0.1	0.1	0.1			
14	10-Sep-08	0.1	0.07	0.1	0.1			
15	5-Mar-09	0.1	0.1	0.1	0.28			
16	14-Sep-09	0.1	0.1	0.1	0.1			
17	5-Mar-10							
18	24-Dec-10	0.1	0.1	0.1	0.1			
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12	0.1	0.1	0.1	0.1			
22	14-Sep-12							
23	5-Mar-13	0.1	0.1	0.1	0.1			
24	9-Dec-13	0.1	0.1	0.1				
25	9-Dec-14				0.1			
26	5-Mar-15		0.1					
27	2-Nov-15	0.1		0.1	0.1			
28	15-Apr-16	0.1		0.1	0.1			
29	2-Nov-16							
30	13-Apr-17		0.1	0.1	0.1			
31	2-Nov-17							
32	11-May-18	0.1	0.1	0.1	0.1			
33	2-Nov-18							
34	11-Jul-19	0.1	0.1	0.1	0.1			
35	1-Nov-19							
36	1-Jul-20	0.1	0.1	0.1	0.1			
37	1-Nov-20							
38	1-Apr-21	0.1	0.1		0.1			
39	21-Jun-22	0.1	0.1	0.1	0.1			
40	12-Oct-23		0.1	0.1	0.1			
Coefficient of Variation:		**0.12**	**0.09**	**0.04**	**0.31**			
Mann-Kendall Statistic (S):		**-15**	**20**	**23**	**0**			
Confidence Factor:		**62.0%**	**65.3%**	**66.7%**	**49.3%**			
Concentration Trend:		Stable	No Trend	No Trend	Stable			



Notes:

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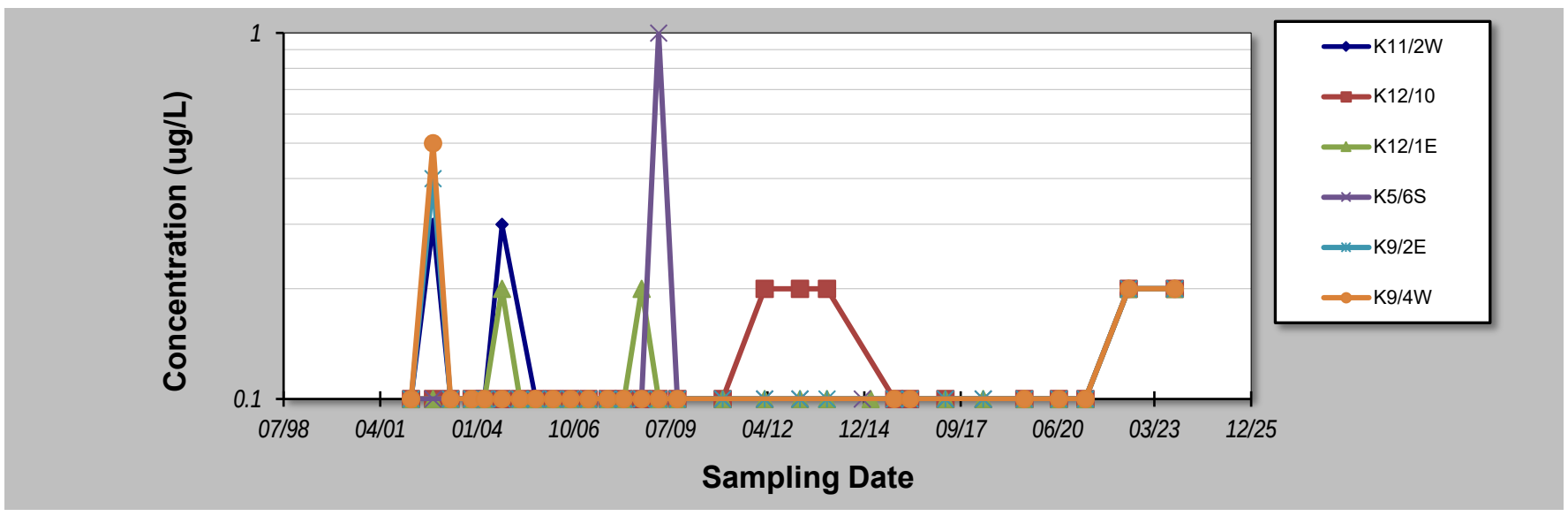
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Benzo(b)&(k)fluoranthene**
Concentration Units: **ug/L**

Sampling Point ID:	K11/2W	K12/10	K12/1E	K5/6S	K9/2E	K9/4W	
Sampling Event	Sampling Date	BENZO(B)&(K)FLUORANTHENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.10	0.1	0.1	0.1	0.1	
2	14-Oct-02	0.3	0.10	0.1	0.1	0.4	0.5	
3	15-Apr-03	0.1	0.10	0.1	0.1	0.1	0.1	
4	17-Nov-03	0.1	0.10	0.1	0.1	0.1	0.1	
5	31-Mar-04	0.1	0.10	0.1	0.1	0.1	0.1	
6	27-Sep-04	0.3	0.10	0.2	0.1	0.1	0.1	
7	31-Mar-05		0.10	0.1	0.1	0.1	0.1	
8	12-Sep-05	0.1	0.10	0.1	0.1	0.1	0.1	
9	9-Mar-06	0.1	0.10	0.1	0.1	0.1	0.1	
10	6-Sep-06	0.1	0.10	0.1	0.1	0.1	0.1	
11	9-Mar-07	0.1	0.10	0.1	0.1	0.1	0.1	
12	22-Sep-07	0.1	0.10	0.1	0.1	0.1	0.1	
13	11-Mar-08	0.1	0.10	0.1	0.1	0.1	0.1	
14	10-Sep-08	0.1	0.10	0.2	0.1	0.1	0.1	
15	5-Mar-09	0.1	0.10	0.1	1.0	0.1	0.1	
16	14-Sep-09	0.1	0.10	0.1	0.1	0.1	0.1	
17	5-Mar-10							
18	24-Dec-10	0.1	0.10	0.1	0.1	0.1		
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12	0.1	0.2	0.1	0.1	0.1		
22	14-Sep-12							
23	5-Mar-13	0.1	0.2	0.1	0.1	0.1		
24	9-Dec-13	0.1	0.2	0.1		0.1		
25	9-Dec-14				0.1			
26	5-Mar-15			0.1				
27	2-Nov-15	0.1	0.10		0.1	0.1	0.1	
28	15-Apr-16	0.1	0.10		0.1	0.1	0.1	
29	2-Nov-16							
30	13-Apr-17		0.10	0.1	0.1	0.1		
31	2-Nov-17							
32	11-May-18	0.1		0.1	0.1	0.1		
33	2-Nov-18							
34	11-Jul-19	0.1	0.10	0.1	0.1	0.1	0.1	
35	1-Nov-19							
36	1-Jul-20	0.1	0.10	0.1	0.1	0.1	0.1	
37	1-Nov-20							
38	1-Apr-21	0.1	0.10	0.1	0.1	0.1	0.1	
39	21-Jun-22	0.2	0.2	0.2	0.2	0.2	0.2	
40	12-Oct-23		0.2	0.2	0.2	0.2	0.2	
Coefficient of Variation:		0.48	0.33	0.31	1.22	0.51	0.69	
Mann-Kendall Statistic (S):		-15	79	34	52	26	20	
Confidence Factor:		62.0%	93.8%	74.1%	82.9%	67.9%	69.0%	
Concentration Trend:		Stable	Prob. Increasing	No Trend	No Trend	No Trend	No Trend	



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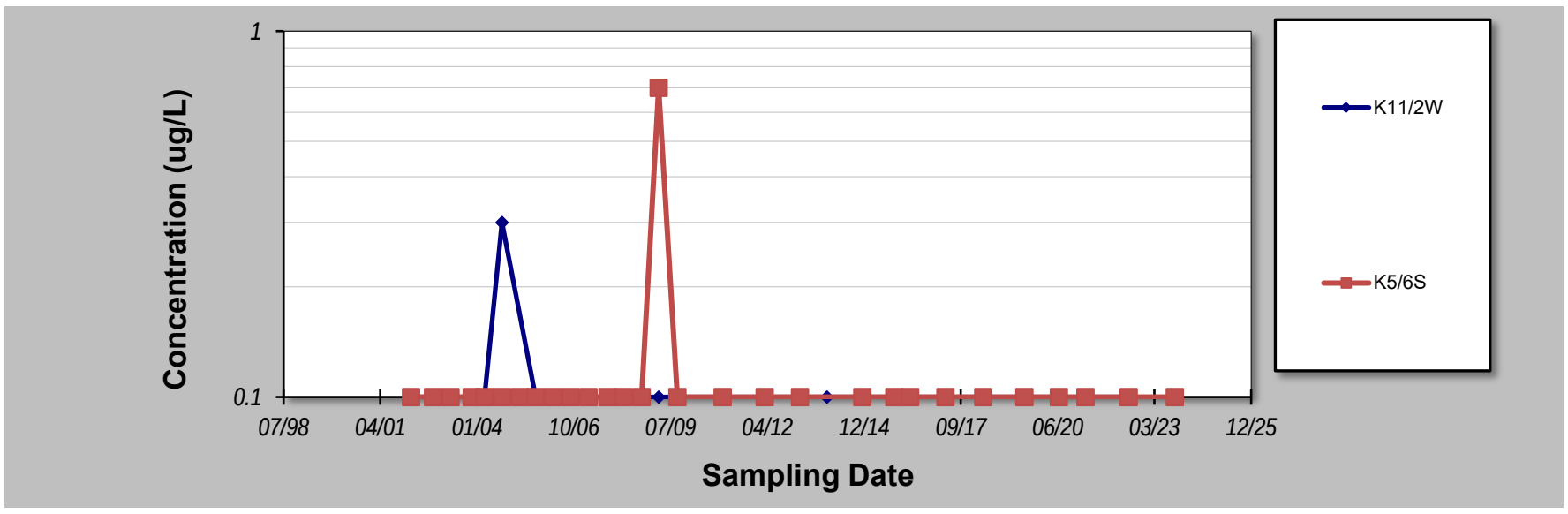
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Chrysene**
Concentration Units: **ug/L**

Sampling Point ID:	K11/2W	K5/6S					
Sampling Event	Sampling Date	CHRYSENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1					
2	14-Oct-02	0.1	0.1					
3	15-Apr-03	0.1	0.1					
4	17-Nov-03	0.1	0.1					
5	31-Mar-04	0.1	0.1					
6	27-Sep-04	0.3	0.1					
7	31-Mar-05		0.1					
8	12-Sep-05	0.1	0.1					
9	9-Mar-06	0.1	0.1					
10	6-Sep-06	0.1	0.1					
11	9-Mar-07	0.1	0.1					
12	22-Sep-07	0.1	0.1					
13	11-Mar-08	0.1	0.1					
14	10-Sep-08	0.1	0.1					
15	5-Mar-09	0.1	0.7					
16	14-Sep-09	0.1	0.1					
17	5-Mar-10							
18	24-Dec-10	0.1	0.1					
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12	0.1	0.1					
22	14-Sep-12							
23	5-Mar-13	0.1	0.1					
24	9-Dec-13	0.1						
25	9-Dec-14		0.1					
26	5-Mar-15							
27	2-Nov-15	0.1	0.1					
28	15-Apr-16	0.1	0.1					
29	2-Nov-16							
30	13-Apr-17		0.1					
31	2-Nov-17							
32	11-May-18	0.1	0.1					
33	2-Nov-18							
34	11-Jul-19	0.1	0.1					
35	1-Nov-19							
36	1-Jul-20	0.1	0.1					
37	1-Nov-20							
38	1-Apr-21	0.1	0.1					
39	21-Jun-22	0.1	0.1					
40	12-Oct-23		0.1					
Coefficient of Variation:		**0.36**	**0.92**					
Mann-Kendall Statistic (S):		**-15**	**0**					
Confidence Factor:		**62.0%**	**49.3%**					
Concentration Trend:		Stable	Stable					



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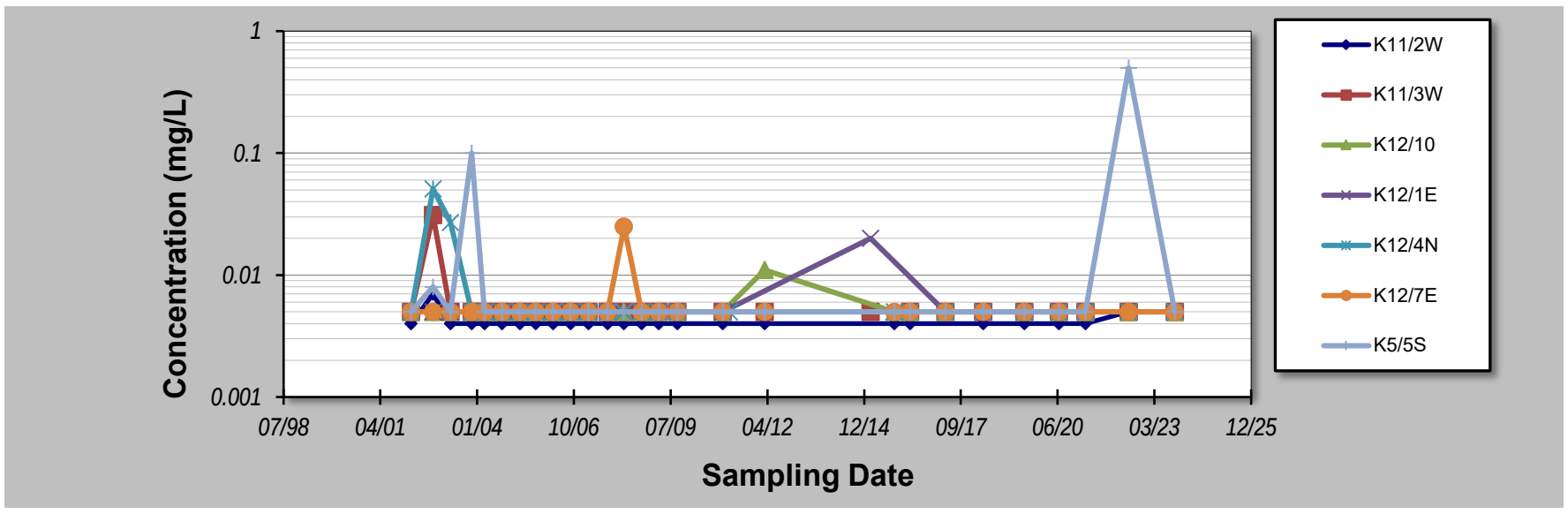
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Chromium VI**
Concentration Units: **mg/L**

Sampling Point ID:	K11/2W	K11/3W	K12/10	K12/1E	K12/4N	K12/7E	K5/5S
Sampling Event	Sampling Date	CHROMIUM VI CONCENTRATION (mg/L)						
1	4-Mar-02	0.004	0.005	0.005	0.005	0.005	0.005	0.005
2	14-Oct-02	0.007	0.031	0.005	0.005	0.051	0.005	0.008
3	15-Apr-03	0.004	0.005	0.005	0.005	0.027	0.005	0.005
4	17-Nov-03	0.004	0.005	0.005	0.005	0.005	0.005	0.1
5	31-Mar-04	0.004	0.005	0.005	0.005	0.005	0.005	0.005
6	27-Sep-04	0.004	0.005	0.005	0.005	0.005	0.005	0.005
7	31-Mar-05	0.004	0.005	0.005	0.005	0.005	0.005	0.005
8	12-Sep-05	0.004	0.005	0.005	0.005	0.005	0.005	0.005
9	9-Mar-06	0.004	0.005	0.005	0.005	0.005	0.005	0.005
10	6-Sep-06	0.004	0.005	0.005	0.005	0.005	0.005	0.005
11	9-Mar-07	0.004	0.005	0.005	0.005	0.005	0.005	0.005
12	22-Sep-07	0.004	0.005	0.005	0.005	0.005	0.005	0.005
13	11-Mar-08	0.004	0.005	0.005	0.005	0.005	0.025	0.005
14	10-Sep-08	0.004	0.005	0.005	0.005	0.005	0.005	0.005
15	5-Mar-09	0.004	0.005	0.005	0.005	0.005	0.005	0.005
16	14-Sep-09	0.004	0.005	0.005	0.005	0.005	0.005	0.005
17	5-Mar-10							
18	24-Dec-10	0.004	0.005	0.005	0.005		0.005	0.005
19	5-Mar-11					0.005		
20	14-Sep-11							
21	5-Mar-12	0.004	0.005	0.011			0.005	0.005
22	14-Sep-12							
23	5-Mar-13							
24	5-Mar-15		0.005		0.02			
25	2-Nov-15	0.004		0.005		0.005	0.005	0.005
26	15-Apr-16	0.004	0.005	0.005		0.005	0.005	0.005
27	2-Nov-16							
28	13-Apr-17		0.005	0.005	0.005	0.005	0.005	0.005
29	2-Nov-17							
30	11-May-18	0.004	0.005		0.005	0.005	0.005	0.005
31	2-Nov-18							
32	11-Jul-19	0.004	0.005	0.005	0.005	0.005	0.005	0.005
33	1-Nov-19							
34	1-Jul-20	0.004	0.005	0.005	0.005	0.005	0.005	0.005
35	1-Nov-20							
36	1-Apr-21	0.004	0.005	0.005	0.005	0.005	0.005	0.005
37	21-Jun-22	0.005	0.005	0.005	0.005	0.005	0.005	0.5
38	12-Oct-23	0.005	0.005	0.005	0.005	0.005	0.005	0.005
39								
40								
Coefficient of Variation:		0.15	0.84	0.22	0.54	1.29	0.67	3.57
Mann-Kendall Statistic (S):		23	-24	9	10	-45	-2	-17
Confidence Factor:		68.4%	68.3%	56.9%	58.2%	83.2%	50.8%	62.9%
Concentration Trend:		No Trend	Stable	No Trend	No Trend	No Trend	Stable	No Trend



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

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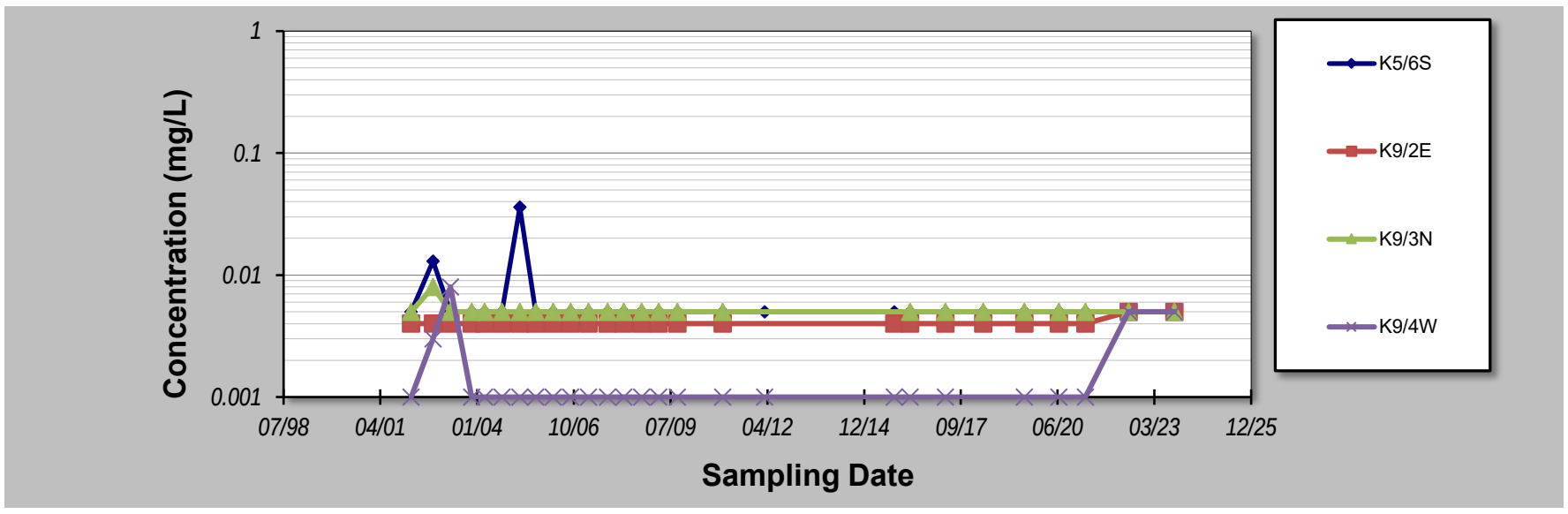
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Chromium VI**
Concentration Units: **mg/L**

Sampling Point ID:	K5/6S	K9/2E	K9/3N	K9/4W			
Sampling Event	Sampling Date	CHROMIUM VI CONCENTRATION (mg/L)						
1	4-Mar-02	0.005	0.004	0.005	0.001			
2	14-Oct-02	0.013	0.004	0.008	0.003			
3	15-Apr-03	0.005	0.004	0.005	0.008			
4	17-Nov-03	0.005	0.004	0.005	0.001			
5	31-Mar-04	0.005	0.004	0.005	0.001			
6	27-Sep-04	0.005	0.004	0.005	0.001			
7	31-Mar-05	0.036	0.004	0.005	0.001			
8	12-Sep-05	0.005	0.004	0.005	0.001			
9	9-Mar-06	0.005	0.004	0.005	0.001			
10	6-Sep-06	0.005	0.004	0.005	0.001			
11	9-Mar-07	0.005	0.004	0.005	0.001			
12	22-Sep-07	0.005	0.004	0.005	0.001			
13	11-Mar-08	0.005	0.004	0.005	0.001			
14	10-Sep-08	0.005	0.004	0.005	0.001			
15	5-Mar-09	0.005	0.004	0.005	0.001			
16	14-Sep-09	0.005	0.004	0.005	0.001			
17	5-Mar-10							
18	24-Dec-10	0.005	0.004	0.005	0.001			
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12	0.005			0.001			
22	14-Sep-12							
23	5-Mar-13							
24	9-Dec-13							
25	22-Apr-14							
26	2-Nov-15	0.005	0.004		0.001			
27	15-Apr-16	0.005	0.004	0.005	0.001			
28	2-Nov-16							
29	13-Apr-17	0.005	0.004	0.005	0.001			
30	2-Nov-17							
31	11-May-18	0.005	0.004	0.005				
32	2-Nov-18							
33	11-Jul-19	0.005	0.004	0.005	0.001			
34	1-Nov-19							
35	1-Jul-20	0.005	0.004	0.005	0.001			
36	1-Nov-20							
37	1-Apr-21	0.005	0.004	0.005	0.001			
38	22-Jun-22	0.005	0.005	0.005	0.005			
39	09-Oct-23	0.005	0.005	0.005	0.005			
40								
Coefficient of Variation:		**0.95**	**0.07**	**0.12**	**1.04**			
Mann-Kendall Statistic (S):		**-37**	**48**	**-22**	**5**			
Confidence Factor:		**77.2%**	**84.8%**	**68.6%**	**53.5%**			
Concentration Trend:		Stable	No Trend	Stable	No Trend			



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

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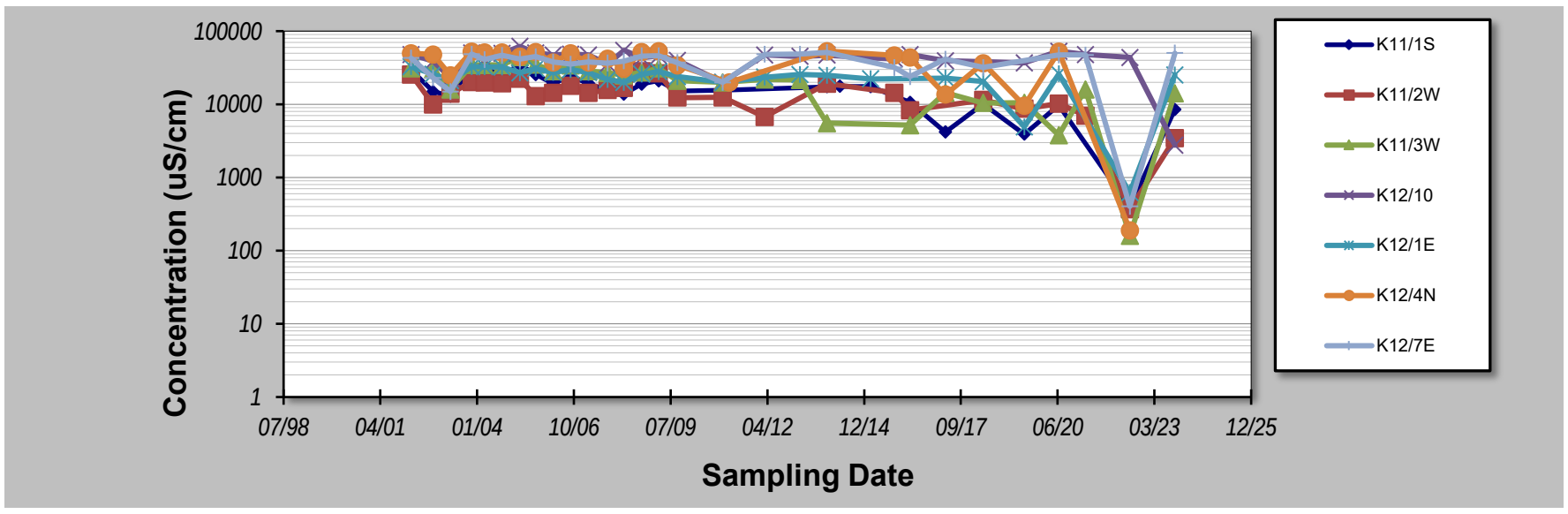
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **EC**
Concentration Units: **uS/cm**

Sampling Point ID:	K11/1S	K11/2W	K11/3W	K12/10	K12/1E	K12/4N	K12/7E
Sampling Event	Sampling Date	EC CONCENTRATION (uS/cm)						
1	4-Mar-02	29600	25600	31200	47900	32500	49700	42800
2	14-Oct-02	15000	10000	30000	39000	26000	48000	23000
3	15-Apr-03	13000	14000	16000	23000	21000	25000	15000
4	17-Nov-03	32000	20180	34500	50500	32700	52300	48700
5	31-Mar-04	30900	19930	34600	40800	32500	51200	40900
6	27-Sep-04	25100	19500	34400	49400	32300	51300	46800
7	31-Mar-05	34900	22300	44100	61900	27000	44800	41300
8	12-Sep-05	25600	12960	35100	50300	30900	52000	44700
9	9-Mar-06	19260	14360	28300	47300	27100	37400	37700
10	6-Sep-06	24400	17820	34200	48400	29900	50000	35600
11	9-Mar-07	19260	14360	28300	47300	27100	37400	37700
12	22-Sep-07	15620	15680	26900	35400	21900	42200	36700
13	11-Mar-08	13810	16870	25010	54400	19890	30800	39100
14	10-Sep-08	18840	28500	27400	43100	25700	51800	45700
15	5-Mar-09	20980	26500	31000	46000	28100	53000	45900
16	14-Sep-09	15170	12350	21100	39900	23900	34200	37100
17	5-Mar-10							
18	24-Dec-10	15600	12500	20000	20000	20000		20000
19	5-Mar-11						20000	
20	5-Mar-12		6710	21900	47200	23460		48200
21	14-Sep-12							
22	5-Mar-13			21500	45200	25500		48400
23	9-Dec-13	17400	19100	5550	46900	25000	53400	51200
24	22-Apr-14	17600						
25	9-Dec-14							
26	5-Mar-15	17500				22290		
27	2-Nov-15		14400		41700		46820	31890
28	15-Apr-16	10619	8280	5200	47941		43332	23900
29	2-Nov-16							
30	13-Apr-17	4179		14435	39344	22846	13548	41500
31	2-Nov-17							
32	11-May-18	10130	11450	10438		20560	36440	31850
33	2-Nov-18							
34	11-Jul-19	3920	8708	10532	37013	4900	9560	
35	1-Nov-19							
36	1-Jul-20	9672	10195	3793	53069	26048	52494	47154
37	1-Nov-20							
38	1-Apr-21		7033	16027	47822			47154
39	06-Jul-22	392.2	368.5	159.8	43539	622	190.2	402.5
40	13-Oct-23	8,501	3,427	14,207	2,761	25,342		50,039
Coefficient of Variation:		**0.50**	**0.47**	**0.51**	**0.27**	**0.30**	**0.38**	**0.32**
Mann-Kendall Statistic (S):		**-208**	**-162**	**-241**	**-67**	**-167**	**-73**	**28**
Confidence Factor:		**>99.9%**	**>99.9%**	**>99.9%**	**90.3%**	**>99.9%**	**95.4%**	**70.2%**
Concentration Trend:		Decreasing	Decreasing	Decreasing	Prob. Decreasing	Decreasing	Decreasing	No Trend



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
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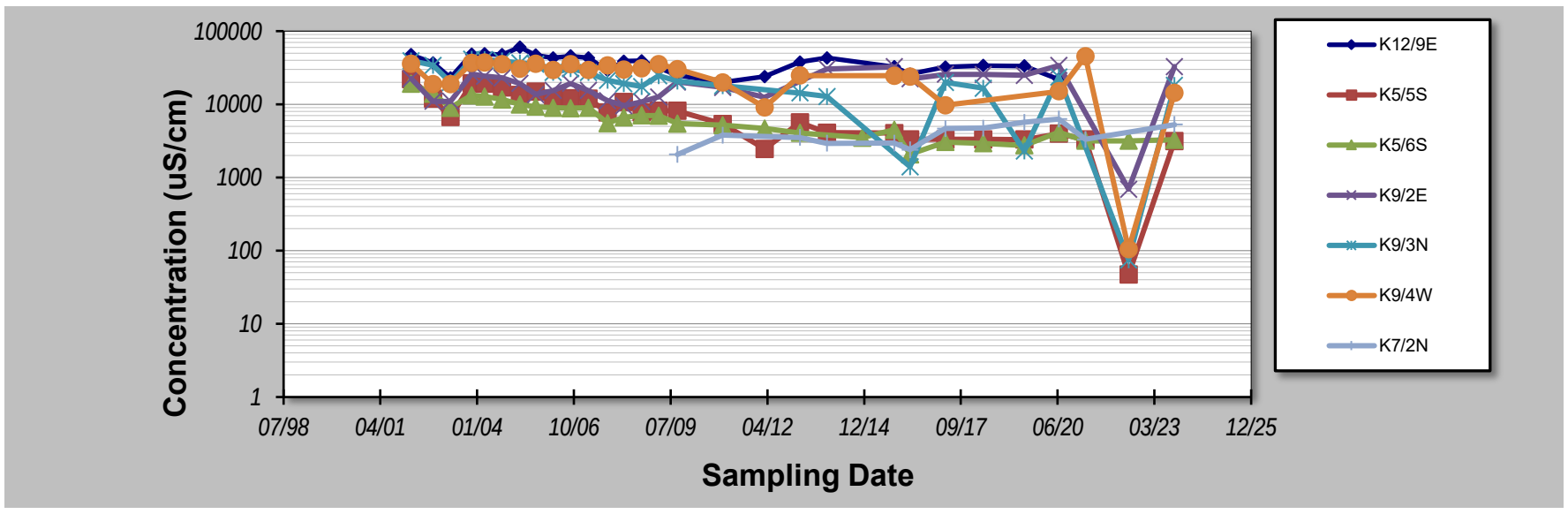
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **EC**
Concentration Units: **uS/cm**

Sampling Point ID:	K12/9E	K5/5S	K5/6S	K9/2E	K9/3N	K9/4W	K7/2N
Sampling Event	Sampling Date	EC CONCENTRATION (uS/cm)						
1	4-Mar-02	47500	22200	19200	22400	39300	35700	
2	14-Oct-02	37000	12000	14000	11000	34000	19000	
3	15-Apr-03	23000	6700	9000	11000	20000	19000	
4	17-Nov-03	48400	19400	13270	25900	41200	36800	
5	31-Mar-04	49300	19020	12830	24200	40800	37500	
6	27-Sep-04	47500	16900	11700	23100	39100	35600	
7	31-Mar-05	60600	13400	9980	19300	36800	30500	
8	12-Sep-05	46900	14920	9280	13620	35200	35900	
9	9-Mar-06	43200	11920	8970	15450	27100	29400	
10	6-Sep-06	45800	12030	8900	19280	30800	35200	
11	9-Mar-07	43200	11920	8970	15450	27100	29400	
12	22-Sep-07	28900	7730	5530	11200	21200	33800	
13	11-Mar-08	38700	10800	6630	9550	19140	29800	
14	10-Sep-08	39300	7710	7040	10840	17530	31100	
15	5-Mar-09	31500	8160	7000	12640	24500	35400	
16	14-Sep-09	25100	8140	5440	20130	20700	30200	2060
17	5-Mar-10							
18	24-Dec-10	20000	5400	5200	17000	18000	20000	3800
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12	24000	2460	4680	12450		9070	
22	14-Sep-12							
23	5-Mar-13	38000	5640	4070		14300	24700	3520
24	9-Dec-13	43100	4110		30500	12800		2940
25	9-Dec-14			3490				
26	5-Mar-15							
27	2-Nov-15	32500	4028	4473	32500		24500	2960
28	15-Apr-16	25934	3330	2080	22328	1400	23951	2390
29	2-Nov-16							
30	13-Apr-17	32444	3321	3057	25681	19948	9711	4673
31	2-Nov-17							
32	11-May-18	33800	3320	2930	25630	16540		4720
33	2-Nov-18							
34	11-Jul-19	33444	3300	2750	24904	2296		5659
35	1-Nov-19							
36	1-Jul-20	22031	3958	4138	33874	23713	15066	6285
37	1-Nov-20							
38	1-Apr-21		3319	3170			45066	3320
39	22-Jun-22		47	3170	692.4	75.2	104.8	
40	09-Oct-23		3,168	3,285	32,741	18,056	14,410	5,281
Coefficient of Variation:	**0.28**	**0.68**	**0.59**	**0.43**	**0.51**	**0.40**	**0.34**
Mann-Kendall Statistic (S):	**-143**	**-319**	**-332**	**71**	**-214**	**-131**	**32**
Confidence Factor:	**99.9%**	**>99.9%**	**>99.9%**	**92.7%**	**>99.9%**	**99.8%**	**98.4%**
Concentration Trend:	Decreasing	Decreasing	Decreasing	Prob. Increasing	Decreasing	Decreasing	Increasing



Notes:

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3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

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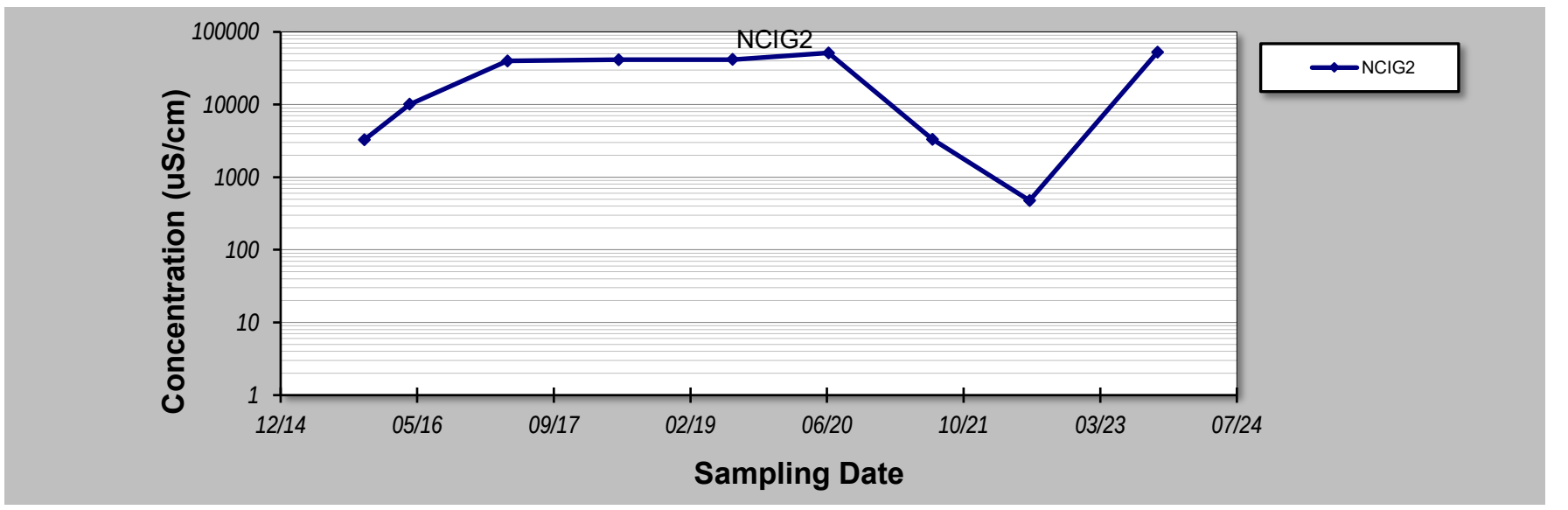
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **EC**
Concentration Units: **uS/cm**

Sampling Point ID: **NCIG2**

Sampling Event	Sampling Date	EC CONCENTRATION (uS/cm)
1	30-Oct-15	3280
2	12-Apr-16	10088
3	5-Apr-17	39874
4	17-May-18	41410
5	8-Jul-19	41730
6	23-Jun-20	51580
7	9-Jul-21	3314
8	29-Jun-22	477.3
9	11-Oct-23	52,941
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
Coefficient of Variation:		0.82
Mann-Kendall Statistic (S):		12
Confidence Factor:		87.0%
Concentration Trend:		No Trend



Notes:

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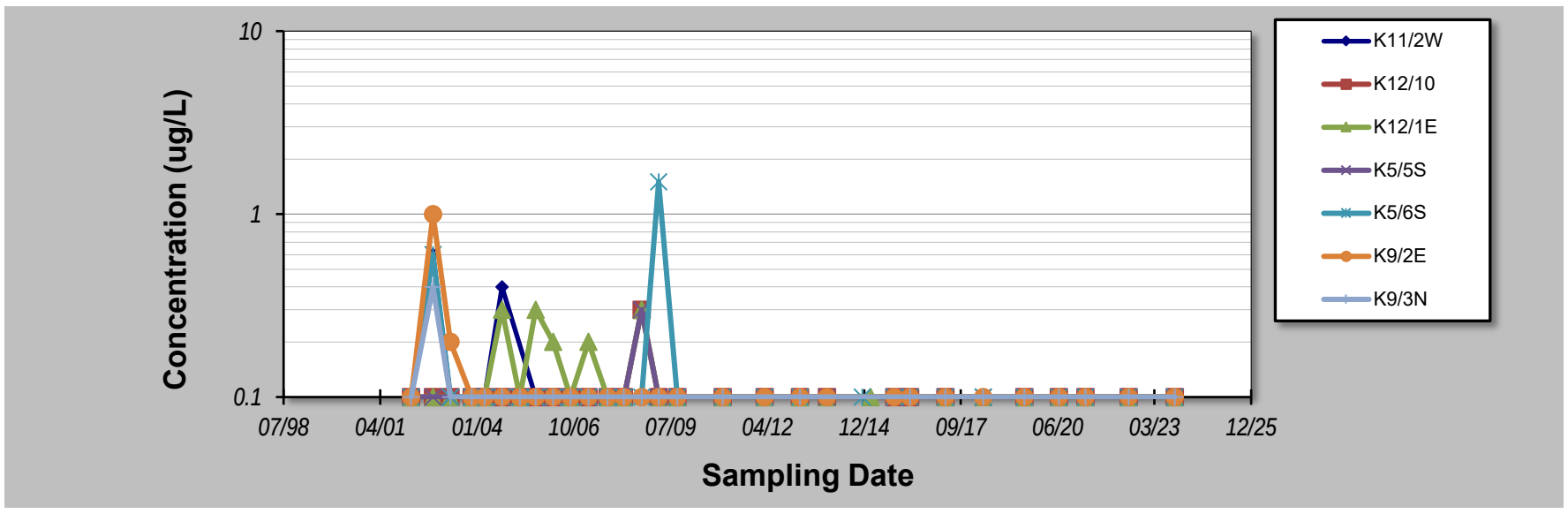
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Fluoranthene**
Concentration Units: **ug/L**

Sampling Point ID:	K11/2W	K12/10	K12/1E	K5/5S	K5/6S	K9/2E	K9/3N
Sampling Event	Sampling Date	FLUORANTHENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.10	0.1	0.1	0.1	0.1	0.1
2	14-Oct-02	0.6	0.10	0.1	0.1	0.6	1	0.4
3	15-Apr-03	0.1	0.10	0.1	0.1	0.1	0.2	0.1
4	17-Nov-03	0.1	0.10	0.1	0.1	0.1	0.1	0.1
5	31-Mar-04	0.1	0.10	0.1	0.1	0.1	0.1	0.1
6	27-Sep-04	0.4	0.10	0.3	0.1	0.1	0.1	0.1
7	31-Mar-05		0.10	0.1	0.1	0.1	0.1	0.1
8	12-Sep-05	0.1	0.10	0.3	0.1	0.1	0.1	0.1
9	9-Mar-06	0.1	0.10	0.2	0.1	0.1	0.1	0.1
10	6-Sep-06	0.1	0.10	0.1	0.1	0.1	0.1	0.1
11	9-Mar-07	0.1	0.10	0.2	0.1	0.1	0.1	0.1
12	22-Sep-07	0.1	0.10	0.1	0.1	0.1	0.1	0.1
13	11-Mar-08	0.1	0.10	0.1	0.1	0.1	0.1	0.1
14	10-Sep-08	0.1	0.3	0.3	0.3	0.1	0.1	0.1
15	5-Mar-09	0.1	0.10	0.1	0.1	1.5	0.1	0.1
16	14-Sep-09	0.1	0.10	0.1	0.1	0.1	0.1	0.1
17	5-Mar-10							
18	24-Dec-10	0.1	0.10	0.1	0.1	0.1	0.1	0.1
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12	0.1	0.10	0.1	0.1	0.1	0.1	
22	14-Sep-12							
23	5-Mar-13	0.1	0.10	0.1		0.1	0.1	0.1
24	9-Dec-13	0.1	0.10	0.1	0.1		0.1	
25	9-Dec-14					0.1		
26	5-Mar-15			0.1				
27	2-Nov-15	0.1	0.10		0.1	0.1	0.1	
28	15-Apr-16	0.1	0.10		0.1	0.1	0.1	0.1
29	2-Nov-16							
30	13-Apr-17		0.10	0.1	0.1	0.1	0.1	0.1
31	2-Nov-17							
32	11-May-18	0.1		0.1	0.1	0.1	0.1	0.1
33	2-Nov-18							
34	11-Jul-19	0.1	0.10	0.1	0.1	0.1	0.1	0.1
35	1-Nov-19							
36	1-Jul-20	0.1	0.10	0.1	0.1	0.1	0.1	0.1
37	1-Nov-20							
38	1-Apr-21	0.1	0.10	0.1	0.1	0.1	0.1	0.1
39	21-Jun-22	0.1	0.1	0.1	0.1	0.1	0.1	0.1
40	12-Oct-23		0.1	0.1	0.1	0.1	0.1	0.1
Coefficient of Variation:		0.86	0.35	0.51	0.35	1.65	1.25	0.53
Mann-Kendall Statistic (S):		-39	-1	-51	-1	-25	-51	-23
Confidence Factor:		79.7%	50.0%	83.7%	50.0%	67.3%	82.4%	68.4%
Concentration Trend:		Stable	Stable	Stable	Stable	No Trend	No Trend	Stable



Notes:

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3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

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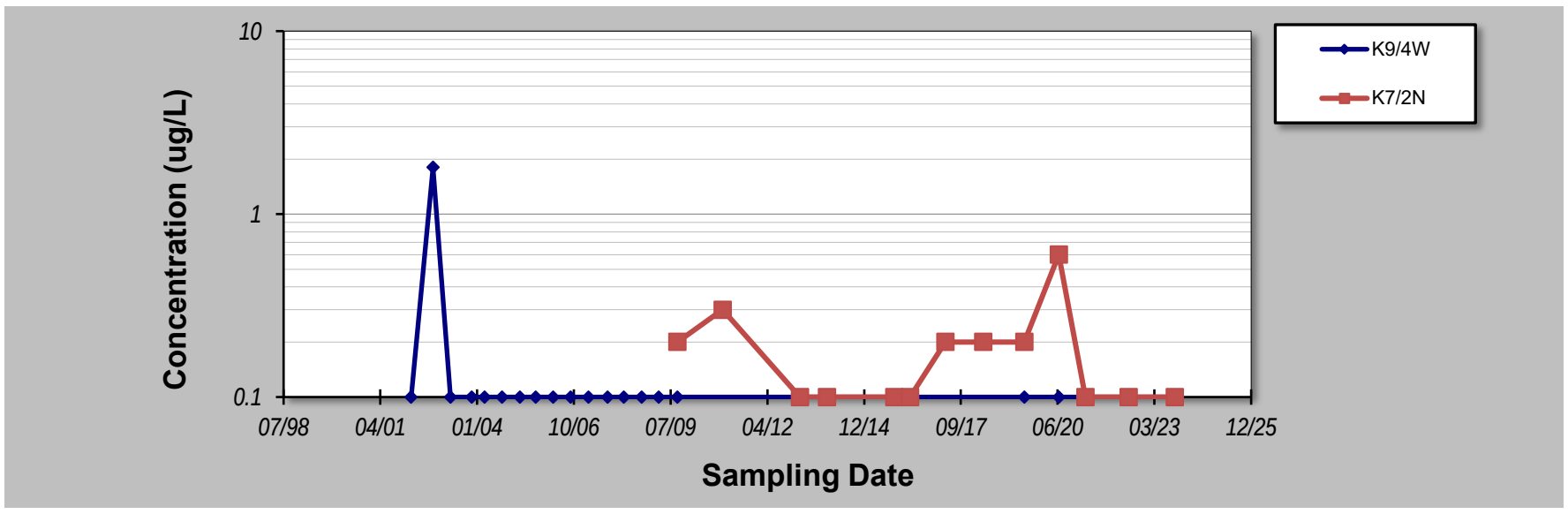
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Fluoranthene**
Concentration Units: **ug/L**

Sampling Point ID:	K9/4W	K7/2N					
Sampling Event	Sampling Date	FLUORANTHENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1						
2	14-Oct-02	1.8						
3	15-Apr-03	0.1						
4	17-Nov-03	0.1						
5	31-Mar-04	0.1						
6	27-Sep-04	0.1						
7	31-Mar-05	0.1						
8	12-Sep-05	0.1						
9	9-Mar-06	0.1						
10	6-Sep-06	0.1						
11	9-Mar-07	0.1						
12	22-Sep-07	0.1						
13	11-Mar-08	0.1						
14	10-Sep-08	0.1						
15	5-Mar-09	0.1						
16	14-Sep-09	0.1	0.2					
17	5-Mar-10							
18	24-Dec-10		0.3					
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12							
22	14-Sep-12							
23	5-Mar-13		0.1					
24	9-Dec-13		0.1					
25	22-Apr-14							
26	2-Nov-15	0.1	0.1					
27	15-Apr-16	0.1	0.1					
28	2-Nov-16							
29	13-Apr-17	-	0.2					
30	2-Nov-17							
31	11-May-18		0.2					
32	2-Nov-18							
33	11-Jul-19	0.1	0.2					
34	1-Nov-19							
35	1-Jul-20	0.1	0.6					
36	1-Nov-20							
37	1-Apr-21	0.1	0.1					
38	24-Jun-22	0.1	0.1					
39	10-Oct-23	0.1	0.1					
40								
Coefficient of Variation:		2.04	0.76					
Mann-Kendall Statistic (S):		-20	-7					
Confidence Factor:		69.0%	64.0%					
Concentration Trend:		No Trend	Stable					



Notes:

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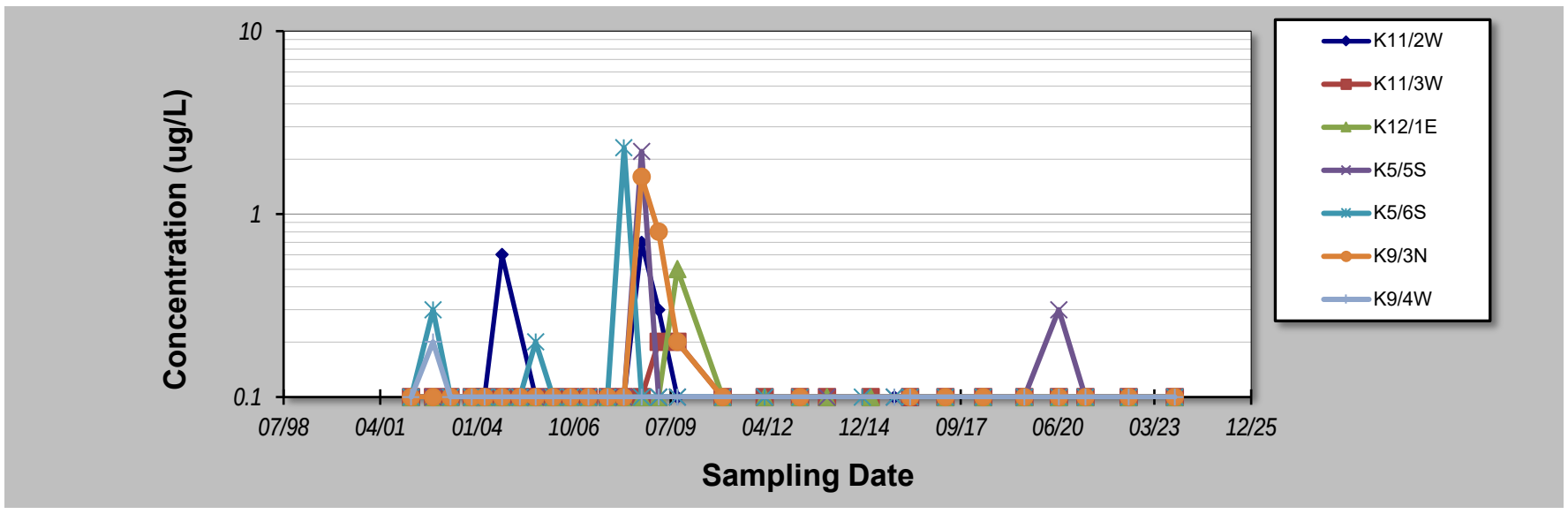
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Fluorene**
Concentration Units: **ug/L**

Sampling Point ID:	K11/2W	K11/3W	K12/1E	K5/5S	K5/6S	K9/3N	K9/4W
Sampling Event	Sampling Date	FLUORENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.10	0.1	0.1	0.1	0.1	0.1
2	14-Oct-02	0.1	0.10	0.1	0.1	0.3	0.1	0.2
3	15-Apr-03	0.1	0.10	0.1	0.1	0.1	0.1	0.1
4	17-Nov-03	0.1	0.10	0.1	0.1	0.1	0.1	0.1
5	31-Mar-04	0.1	0.10	0.1	0.1	0.1	0.1	0.1
6	27-Sep-04	0.6	0.10	0.1	0.1	0.1	0.1	0.1
7	31-Mar-05		0.10	0.1	0.1	0.1	0.1	0.1
8	12-Sep-05	0.1	0.10	0.1	0.1	0.2	0.1	0.1
9	9-Mar-06	0.1	0.10	0.1	0.1	0.1	0.1	0.1
10	6-Sep-06	0.1	0.10	0.1	0.1	0.1	0.1	0.1
11	9-Mar-07	0.1	0.10	0.1	0.1	0.1	0.1	0.1
12	22-Sep-07	0.1	0.10	0.1	0.1	0.1	0.1	0.1
13	11-Mar-08	0.1	0.10	0.1	0.1	2.3	0.1	0.1
14	10-Sep-08	0.7	0.10	0.1	2.2	0.1	1.6	0.1
15	5-Mar-09	0.3	0.2	0.1	0.1	0.1	0.8	0.1
16	14-Sep-09	0.1	0.2	0.5	0.1	0.1	0.2	0.1
17	5-Mar-10							
18	24-Dec-10	0.1	0.10	0.1	0.1	0.1	0.1	
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12	0.1	0.10	0.1	0.1	0.1		
22	14-Sep-12							
23	5-Mar-13	0.1	0.10	0.1		0.1	0.1	
24	9-Dec-13	0.1	0.10	0.1	0.1			
25	22-Apr-14							
26	9-Dec-14					0.1		
27	5-Mar-15		0.10	0.1				
28	2-Nov-15	0.1			0.1	0.1		0.1
29	15-Apr-16	0.1	0.10		0.1	0.1	0.1	0.1
30	13-Apr-17		0.10	0.1	0.1	0.1	0.1	-
31	2-Nov-17							
32	11-May-18	0.1	0.10	0.1	0.1	0.1	0.1	
33	2-Nov-18							
34	11-Jul-19	0.1	0.10	0.1	0.1	0.1	0.1	0.1
35	1-Nov-19							
36	1-Jul-20	0.1	0.10	0.1	0.3	0.1	0.1	0.1
37	1-Nov-20							
38	1-Apr-21	0.1	0.10	0.1	0.1	0.1	0.1	0.1
39	21-Jun-22	0.1	0.1	0.1	0.1	0.1	0.1	0.1
40	12-Oct-23		0.1	0.1	0.1	0.1	0.1	0.1
Coefficient of Variation:	1.02	0.24	0.66	2.18	2.19	1.69	0.20
Mann-Kendall Statistic (S):	-16	2	3	19	-43	6	-20
Confidence Factor:	62.9%	50.7%	51.6%	63.8%	78.3%	54.4%	69.0%
Concentration Trend:	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	Stable



Notes:

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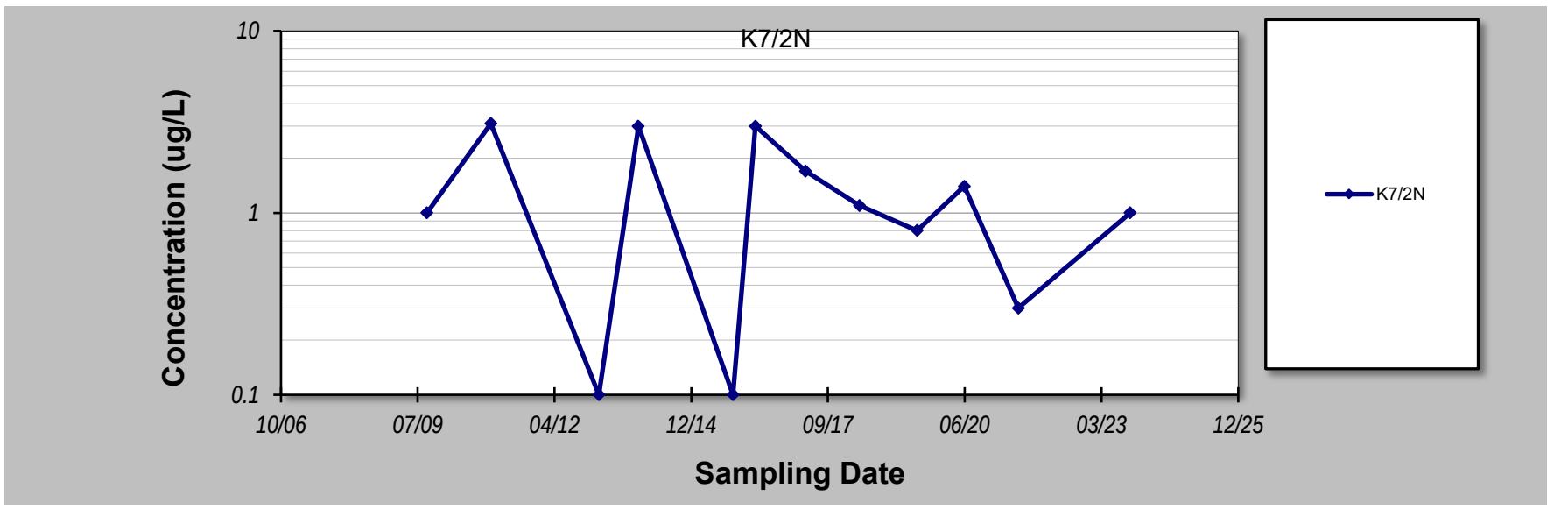
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21/11/20213**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Fluorene**
Concentration Units: **ug/L**

Sampling Point ID: **K7/2N**

Sampling Event	Sampling Date	FLUORENE CONCENTRATION (ug/L)
1	11-Sep-09	1
2	1-Mar-10	
3	23-Dec-10	3.1
4	5-Mar-11	
5	14-Sep-11	
6	5-Mar-12	
7	14-Sep-12	
8	21-Feb-13	0.1
9	5-Dec-13	3
10	22-Apr-14	
11	9-Dec-14	
12	5-Mar-15	
13	29-Oct-15	0.1
14	8-Apr-16	3
15	10-Apr-17	1.7
16	2-Nov-17	
17	9-May-18	1.1
18	2-Nov-18	
19	5-Jul-19	0.8
20	1-Nov-19	
21	15-Jun-20	1.4
22	1-Nov-20	
23	14-Jul-21	0.3
24	10-Oct-23	1.00
25		
Coefficient of Variation:		**0.80**
Mann-Kendall Statistic (S):		**-13**
Confidence Factor:		**79.0%**
Concentration Trend:		Stable



Notes:

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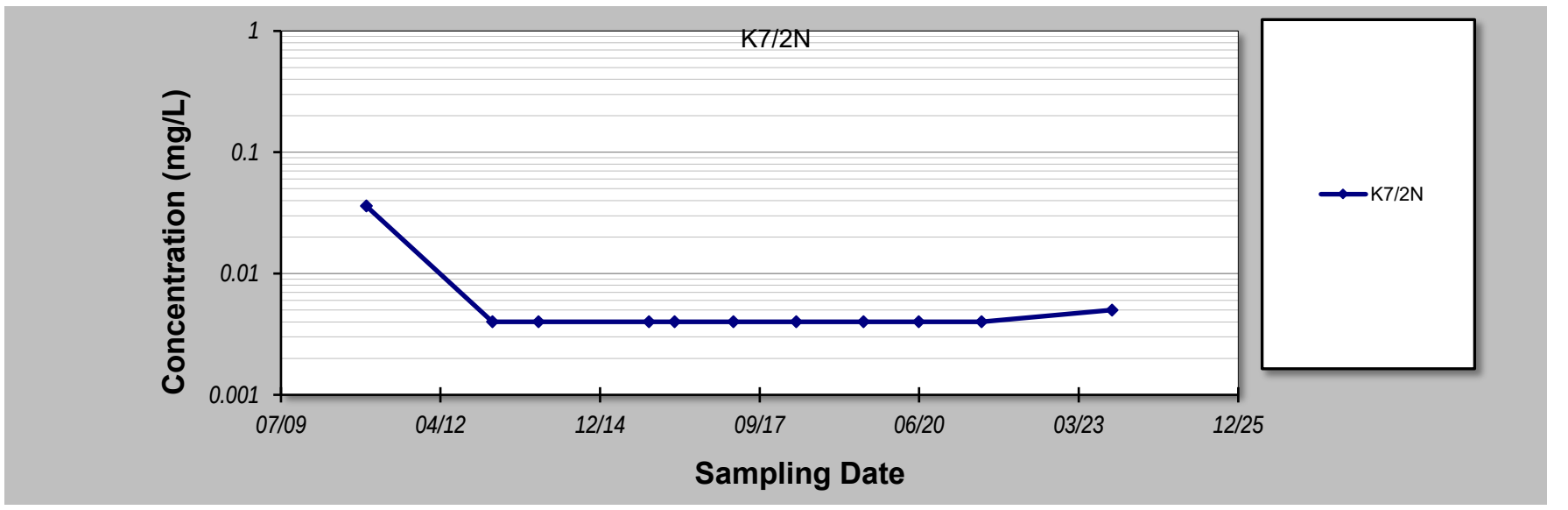
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Free Cyanide**
Concentration Units: **mg/L**

Sampling Point ID: **K7/2N**

Sampling Event	Sampling Date	FREE CYANIDE CONCENTRATION (mg/L)
1	23-Dec-10	0.036
2	5-Mar-11	
3	14-Sep-11	
4	5-Mar-12	
5	14-Sep-12	
6	21-Feb-13	0.004
7	5-Dec-13	0.004
8	22-Apr-14	
9	9-Dec-14	
10	5-Mar-15	
11	29-Oct-15	0.004
12	8-Apr-16	0.004
13	2-Nov-16	
14	10-Apr-17	0.004
15	2-Nov-17	
16	9-May-18	0.004
17	2-Nov-18	
18	5-Jul-19	0.004
19	1-Nov-19	
20	15-Jun-20	0.004
21	1-Nov-20	
22	14-Jul-21	0.004
23	10-Oct-23	0.005
24		
25		
Coefficient of Variation:		1.37
Mann-Kendall Statistic (S):		-1
Confidence Factor:		50.0%
Concentration Trend:		No Trend



Notes:

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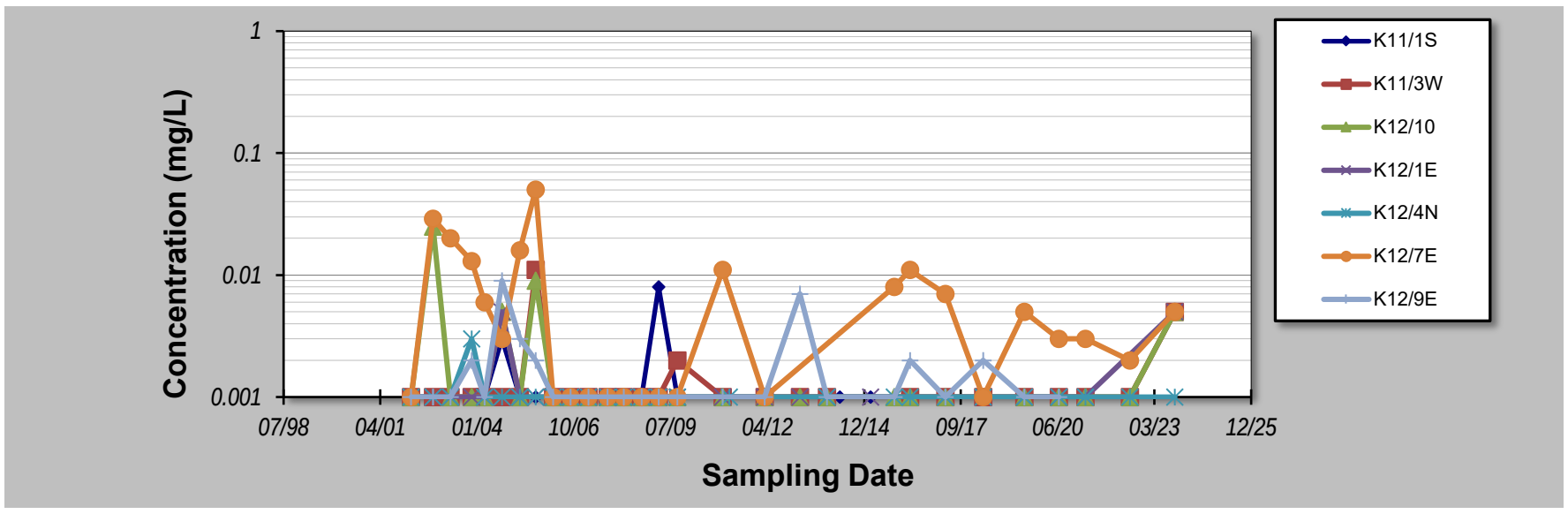
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Molybdenum**
Concentration Units: **mg/L**

Sampling Point ID:	K11/1S	K11/3W	K12/10	K12/1E	K12/4N	K12/7E	K12/9E
Sampling Event	Sampling Date	MOLYBDENUM CONCENTRATION (mg/L)						
1	4-Mar-02	0.001	0.001	0.001	0.001	0.001	0.001	0.001
2	14-Oct-02	0.001	0.001	0.025	0.001	0.001	0.029	0.001
3	15-Apr-03	0.001	0.001	0.001	0.001	0.001	0.02	0.001
4	17-Nov-03	0.001	0.001	0.001	0.001	0.003	0.013	0.002
5	31-Mar-04	0.001	0.001	0.001	0.001	0.001	0.006	0.001
6	27-Sep-04	0.003	0.001	0.005	0.005	0.001	0.003	0.009
7	31-Mar-05	0.001	0.001	0.001	0.001	0.001	0.016	0.003
8	12-Sep-05	0.001	0.011	0.009	0.001	0.001	0.05	0.002
9	9-Mar-06	0.001	0.001	0.001	0.001	0.001	0.001	0.001
10	6-Sep-06	0.001	0.001	0.001	0.001	0.001	0.001	0.001
11	9-Mar-07	0.001	0.001	0.001	0.001	0.001	0.001	0.001
12	22-Sep-07	0.001	0.001	0.001	0.001	0.001	0.001	0.001
13	11-Mar-08	0.001	0.001	0.001	0.001	0.001	0.001	0.001
14	10-Sep-08	0.001	0.001	0.001	0.001	0.001	0.001	0.001
15	5-Mar-09	0.008	0.001	0.001	0.001	0.001	0.001	0.001
16	14-Sep-09	0.001	0.002	0.001	0.001	0.001	0.001	0.001
17	5-Mar-10							
18	24-Dec-10	0.001	0.001	0.001	0.001		0.011	0.001
19	5-Mar-11					0.001		
20	14-Sep-11							
21	5-Mar-12		0.001	0.001	0.001		0.001	0.001
22	14-Sep-12							
23	5-Mar-13		0.001	0.001	0.001			0.007
24	9-Dec-13	0.001	0.001	0.001	0.001	0.001		0.001
25	22-Apr-14	0.001						
26	5-Mar-15	0.001	-		0.001			
27	2-Nov-15			0.001		0.001	0.008	0.001
28	15-Apr-16	0.001	0.001	0.001		0.001	0.011	0.002
29	2-Nov-16							
30	13-Apr-17	0.001	0.001	0.001	0.001	0.001	0.007	0.001
31	2-Nov-17							
32	11-May-18	0.001	0.001		0.001	0.001	0.001	0.002
33	2-Nov-18							
34	11-Jul-19	0.001	0.001	0.001	0.001	0.001	0.005	0.001
35	1-Nov-19							
36	1-Jul-20	0.001	0.001	0.001	0.001	0.001	0.003	0.001
37	1-Nov-20							
38	1-Apr-21	0.001	0.001	0.001	0.001	0.001	0.003	
39	06-Jul-22	0.001	0.001	0.001		0.001	0.002	
40	13-Oct-23	0.005	0.005	0.005	0.005	0.001	0.005	
Coefficient of Variation:		1.04	1.31	1.96	0.82	0.36	1.46	1.09
Mann-Kendall Statistic (S):		12	16	-31	10	-20	-43	-14
Confidence Factor:		58.5%	61.5%	72.2%	57.4%	65.3%	80.8%	61.2%
Concentration Trend:		No Trend	No Trend	No Trend	No Trend	Stable	No Trend	No Trend



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

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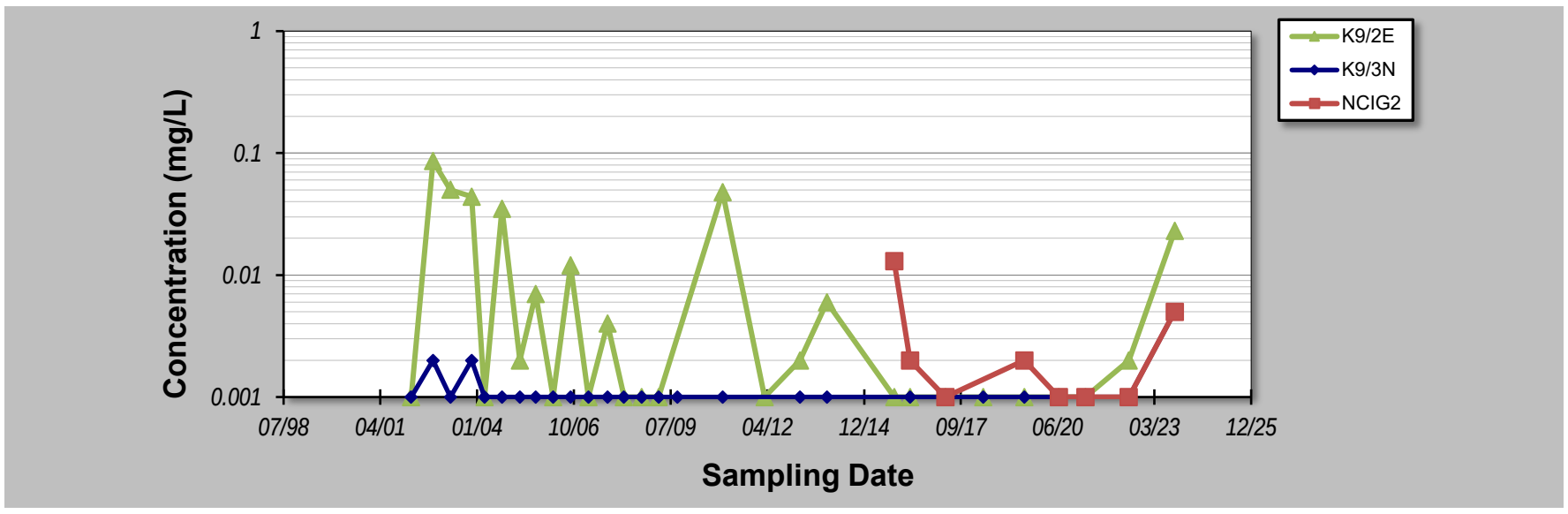
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Molybdenum**
Concentration Units: **mg/L**

Sampling Point ID:	K9/2E	K9/3N	NCIG2				
Sampling Event	Sampling Date	MOLYBDENUM CONCENTRATION (mg/L)						
1	4-Mar-02	0.001	0.001					
2	14-Oct-02	0.086	0.002					
3	15-Apr-03	0.05	0.001					
4	17-Nov-03	0.044	0.002					
5	31-Mar-04	0.001	0.001					
6	27-Sep-04	0.035	0.001					
7	31-Mar-05	0.002	0.001					
8	12-Sep-05	0.007	0.001					
9	9-Mar-06	0.001	0.001					
10	6-Sep-06	0.012	0.001					
11	9-Mar-07	0.001	0.001					
12	22-Sep-07	0.004	0.001					
13	11-Mar-08	0.001	0.001					
14	10-Sep-08	0.001	0.001					
15	5-Mar-09	0.001	0.001					
16	14-Sep-09	0.004	0.001					
17	5-Mar-10							
18	24-Dec-10	0.048	0.001					
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12	0.001						
22	14-Sep-12							
23	5-Mar-13	0.002	0.001					
24	9-Dec-13	0.006	0.001					
25	2-Nov-15	0.001		0.013				
26	15-Apr-16	0.001	0.001	0.002				
27	2-Nov-16							
28	13-Apr-17	0.001	0.001	0.001				
29	2-Nov-17							
30	11-May-18	0.001	0.001					
31	2-Nov-18							
32	11-Jul-19	0.001	0.001	0.002				
33	1-Nov-19							
34	1-Jul-20	0.001	0.001	0.001				
35	1-Nov-20							
36	1-Apr-21	0.001	0.001	0.001				
37	24-Jun-22	0.002	0.001	0.001				
38	10-Oct-23	0.02	0.005	0.005				
39								
40								
Coefficient of Variation:		1.77	0.66	1.28				
Mann-Kendall Statistic (S):		-90	-16	-7				
Confidence Factor:		96.1%	62.2%	76.4%				
Concentration Trend:		Decreasing	Stable	No Trend				



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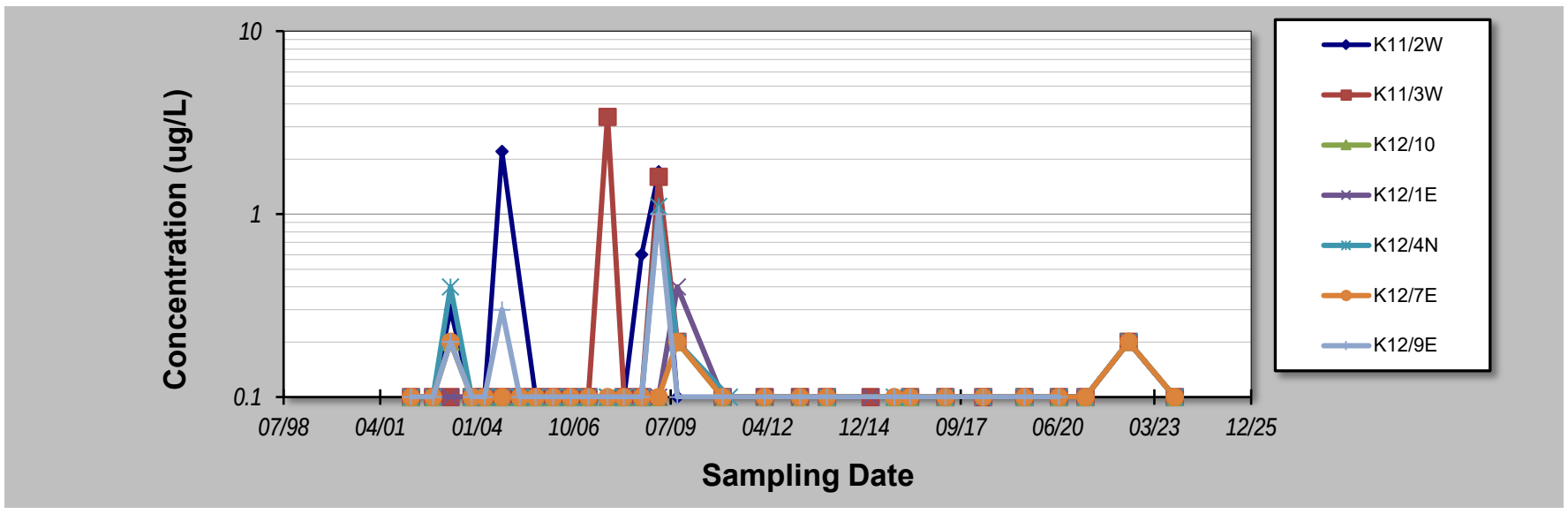
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Naphthalene**
Concentration Units: **ug/L**

Sampling Point ID:	K11/2W	K11/3W	K12/10	K12/1E	K12/4N	K12/7E	K12/9E
Sampling Event	Sampling Date	NAPHTHALENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.10	0.10	0.1	0.1	0.1	0.1
2	14-Oct-02	0.1	0.10	0.10	0.1	0.1	0.1	0.1
3	15-Apr-03	0.3	0.10	0.2	0.1	0.4	0.2	0.2
4	17-Nov-03	0.1	0.10	0.10	0.1	0.1	0.1	0.1
5	31-Mar-04	0.1	0.10	0.10	0.1	0.1	0.1	0.1
6	27-Sep-04	2.2	0.10	0.10	0.1	0.1	0.1	0.3
7	31-Mar-05		0.10	0.10	0.1	0.1	0.1	0.1
8	12-Sep-05	0.1	0.10	0.10	0.1	0.1	0.1	0.1
9	9-Mar-06	0.1	0.10	0.10	0.1	0.1	0.1	0.1
10	6-Sep-06	0.1	0.10	0.10	0.1	0.1	0.1	0.1
11	9-Mar-07	0.1	0.10	0.10	0.1	0.1	0.1	0.1
12	22-Sep-07	0.1	3.4	0.10	0.1	0.1	0.1	0.1
13	11-Mar-08	0.1	0.10	0.10	0.1	0.1	0.1	0.1
14	10-Sep-08	0.6	0.1	0.10	0.1	0.1	0.1	0.1
15	5-Mar-09	1.7	1.6	0.10	0.1	1.1	0.1	1
16	14-Sep-09	0.1	0.2	0.2	0.4	0.2	0.2	0.1
17	5-Mar-10							
18	24-Dec-10	0.1	0.10	0.10	0.1		0.1	0.1
19	5-Mar-11					0.1		
20	14-Sep-11							
21	5-Mar-12	0.1	0.10	0.10	0.1		0.1	0.1
22	14-Sep-12							
23	5-Mar-13	0.1	0.10	0.10	0.1		0.1	0.1
24	9-Dec-13	0.1	0.10	0.10	0.1	0.1	0.1	0.1
25	5-Mar-15		0.10		0.1			
26	2-Nov-15	0.1		0.10		0.1	0.1	0.1
27	15-Apr-16	0.1	0.10	0.10		0.1	0.1	0.1
28	2-Nov-16							
29	13-Apr-17		0.10	0.10	0.1	0.1	0.1	0.1
30	2-Nov-17							
31	11-May-18	0.1	0.10		0.1	0.1	0.1	0.1
32	2-Nov-18							
33	11-Jul-19	0.1	0.10	0.10	0.1	0.1	0.1	0.1
34	1-Nov-19							
35	1-Jul-20	0.1	0.10	0.10	0.1	0.1	0.1	0.1
36	1-Nov-20							
37	1-Apr-21	0.1	0.10	0.10	0.1	0.1	0.1	
38	21-Jun-22	0.2	0.2	0.2	0.2	0.2	0.2	
39	12-Oct-23		0.1	0.1	0.1	0.1	0.1	
40								
Coefficient of Variation:		1.87	2.43	0.28	0.52	1.28	0.28	1.23
Mann-Kendall Statistic (S):		-13	17	5	27	5	4	-30
Confidence Factor:		60.3%	61.7%	53.1%	69.5%	53.3%	52.2%	73.7%
Concentration Trend:		No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend



Notes:

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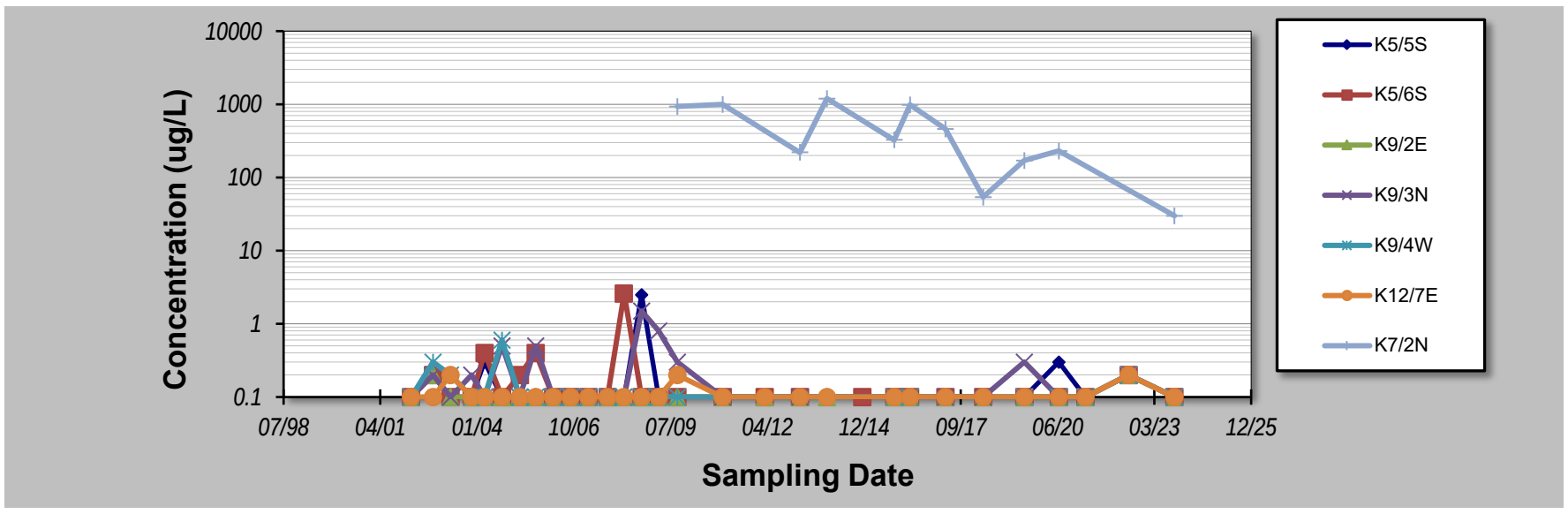
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Naphthalene**
Concentration Units: **ug/L**

Sampling Point ID:	K5/5S	K5/6S	K9/2E	K9/3N	K9/4W	K12/7E	K7/2N
Sampling Event	Sampling Date	NAPHTHALENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1	0.1	0.1	0.1	0.1	
2	14-Oct-02	0.1	0.2	0.2	0.2	0.3	0.1	
3	15-Apr-03	0.1	0.1	0.1	0.1	0.2	0.2	
4	17-Nov-03	0.1	0.1	0.1	0.2	0.1	0.1	
5	31-Mar-04	0.3	0.4	0.1	0.1	0.1	0.1	
6	27-Sep-04	0.1	0.1	0.1	0.5	0.6	0.1	
7	31-Mar-05	0.1	0.2	0.1	0.1	0.1	0.1	
8	12-Sep-05	0.1	0.4	0.1	0.5	0.1	0.1	
9	9-Mar-06	0.1	0.1	0.1	0.1	0.1	0.1	
10	6-Sep-06	0.1	0.1	0.1	0.1	0.1	0.1	
11	9-Mar-07	0.1	0.1	0.1	0.1	0.1	0.1	
12	22-Sep-07	0.1	0.1	0.1	0.1	0.1	0.1	
13	11-Mar-08	0.1	2.6	0.1	0.1	0.1	0.1	
14	10-Sep-08	2.5	0.1	0.1	1.5	0.1	0.1	
15	5-Mar-09	0.1	0.1	0.1	0.8	0.1	0.1	
16	14-Sep-09	0.1	0.1	0.1	0.3	0.1	0.2	938
17	24-Dec-10	0.1	0.1	0.1	0.1		0.1	1000
18	5-Mar-11							
19	14-Sep-11							
20	5-Mar-12	0.1	0.1	0.1			0.1	
21	14-Sep-12							
22	5-Mar-13		0.1	0.1	0.1		0.1	220
23	9-Dec-13	0.1		0.1			0.1	1200
24	22-Apr-14							
25	9-Dec-14		0.1					
26	5-Mar-15							
27	2-Nov-15	0.1	0.1	0.1		0.1	0.1	326
28	15-Apr-16	0.1	0.1	0.1	0.1	0.1	0.1	980
29	2-Nov-16							
30	13-Apr-17	0.1	0.1	0.1	0.1	-	0.1	460
31	2-Nov-17							
32	11-May-18	0.1	0.1	0.1	0.1		0.1	54
33	2-Nov-18							
34	11-Jul-19	0.1	0.1	0.1	0.3	0.1	0.1	170
35	1-Nov-19							
36	1-Jul-20	0.3	0.1	0.1	0.1	0.1	0.1	230
37	1-Nov-20							
38	1-Apr-21	0.1	0.1	0.1	0.1	0.1	0.1	
39	22-Jun-22	0.2	0.2	0.2	0.2	0.2	0.2	
40	09-Oct-23	0.1	0.1	0.1	0.1	0.1	0.1	30
Coefficient of Variation:		2.23	2.14	0.24	1.29	0.80	0.28	0.85
Mann-Kendall Statistic (S):		23	-51	0	-18	-31	4	-27
Confidence Factor:		66.7%	82.4%	49.3%	64.5%	78.4%	52.2%	98.0%
Concentration Trend:		No Trend	No Trend	Stable	No Trend	Stable	No Trend	Decreasing



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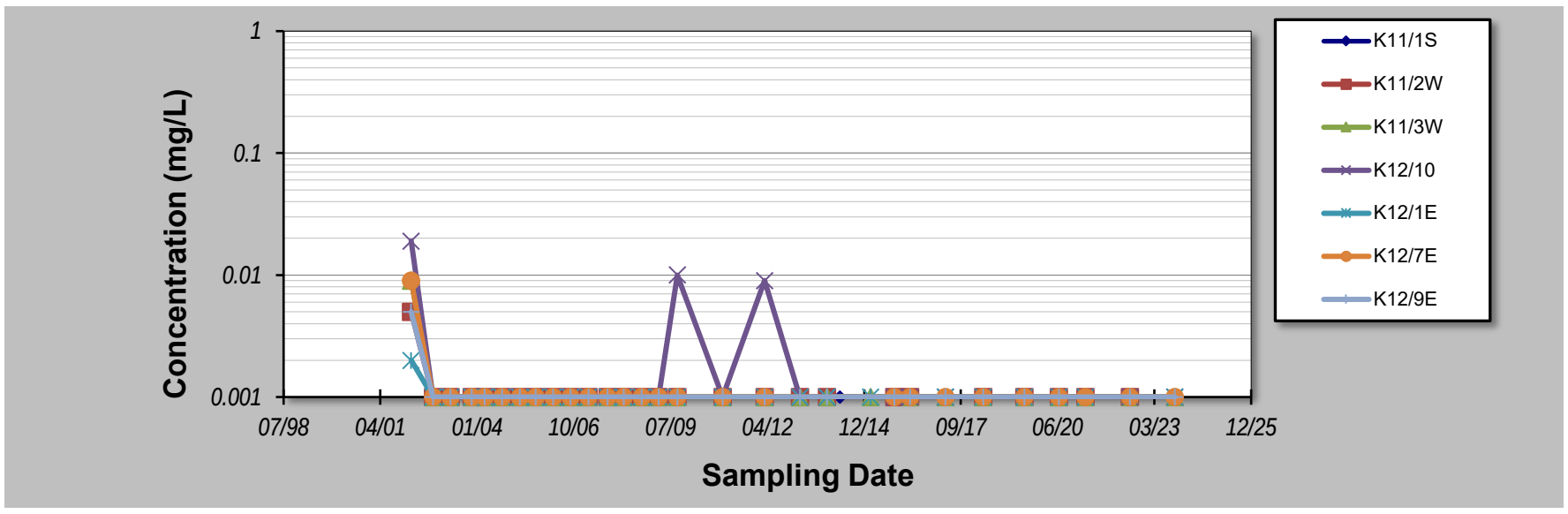
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Lead**
Concentration Units: **mg/L**

Sampling Point ID:	K11/1S	K11/2W	K11/3W	K12/10	K12/1E	K12/7E	K12/9E
Sampling Event	Sampling Date	LEAD CONCENTRATION (mg/L)						
1	4-Mar-02	0.009	0.005	0.009	0.019	0.002	0.009	0.005
2	14-Oct-02	0.001	0.001	0.001	0.001	0.001	0.001	0.001
3	15-Apr-03	0.001	0.001	0.001	0.001	0.001	0.001	0.001
4	17-Nov-03	0.001	0.001	0.001	0.001	0.001	0.001	0.001
5	31-Mar-04	0.001	0.001	0.001	0.001	0.001	0.001	0.001
6	27-Sep-04	0.001	0.001	0.001	0.001	0.001	0.001	0.001
7	31-Mar-05	0.001	0.001	0.001	0.001	0.001	0.001	0.001
8	12-Sep-05	0.001	0.001	0.001	0.001	0.001	0.001	0.001
9	9-Mar-06	0.001	0.001	0.001	0.001	0.001	0.001	0.001
10	6-Sep-06	0.001	0.001	0.001	0.001	0.001	0.001	0.001
11	9-Mar-07	0.001	0.001	0.001	0.001	0.001	0.001	0.001
12	22-Sep-07	0.001	0.001	0.001	0.001	0.001	0.001	0.001
13	11-Mar-08	0.001	0.001	0.001	0.001	0.001	0.001	0.001
14	10-Sep-08	0.001	0.001	0.001	0.001	0.001	0.001	0.001
15	5-Mar-09	0.001	0.001	0.001	0.001	0.001	0.001	0.001
16	14-Sep-09	0.001	0.001	0.001	0.01	0.001	0.001	0.001
17	5-Mar-10							
18	24-Dec-10	0.001	0.001	0.001	0.001	0.001	0.001	0.001
19	5-Mar-12		0.001	0.001	0.009	0.001	0.001	0.001
20	14-Sep-12							
21	5-Mar-13		0.001	0.001	0.001	0.001		0.001
22	9-Dec-13	0.001	0.001	0.001	0.001	0.001		0.001
23	22-Apr-14	0.001						
24	9-Dec-14							
25	5-Mar-15	0.001		0.001		0.001		
26	2-Nov-15		0.001		0.001		0.001	0.001
27	15-Apr-16	0.001	0.001	0.001	0.001		0.001	0.001
28	2-Nov-16							
29	13-Apr-17	0.001		0.001	0.001	0.001	0.001	0.001
30	11-May-18	0.001	0.001	0.001		0.001	0.001	0.001
31	2-Nov-18							
32	11-Jul-19	0.001	0.001	0.001	0.001	0.001	0.001	0.001
33	1-Nov-19							
34	1-Jul-20	0.001	0.001	0.001	0.001	0.001	0.001	0.001
35	1-Nov-20							
36	1-Apr-21	0.001	0.001	0.001	0.001	0.001	0.001	
37	06-Jul-22	0.001	0.001	0.001	0.001		0.001	0.001
38	13-Oct-23	0.001		0.001	0.001	0.001	0.001	0.001
39								
40								
Coefficient of Variation:		1.18	0.67	1.16	1.76	0.19	1.19	0.66
Mann-Kendall Statistic (S):		-27	-26	-28	-20	-26	-26	-27
Confidence Factor:		69.5%	69.7%	69.2%	64.5%	69.7%	69.7%	69.5%
Concentration Trend:		No Trend	Stable	No Trend	No Trend	Stable	No Trend	Stable



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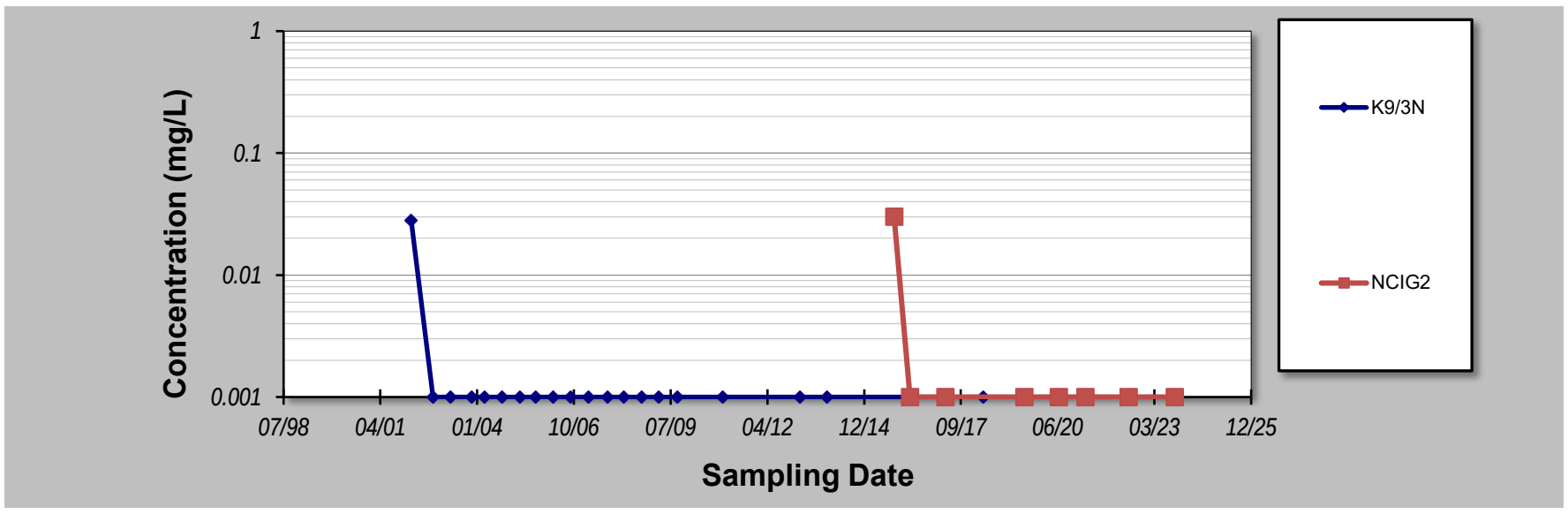
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Lead**
Concentration Units: **mg/L**

Sampling Point ID:	K9/3N	NCIG2					

Sampling Event	Sampling Date	LEAD CONCENTRATION (mg/L)						
1	4-Mar-02	0.028						
2	14-Oct-02	0.001						
3	15-Apr-03	0.001						
4	17-Nov-03	0.001						
5	31-Mar-04	0.001						
6	27-Sep-04	0.001						
7	31-Mar-05	0.001						
8	12-Sep-05	0.001						
9	9-Mar-06	0.001						
10	6-Sep-06	0.001						
11	9-Mar-07	0.001						
12	22-Sep-07	0.001						
13	11-Mar-08	0.001						
14	10-Sep-08	0.001						
15	5-Mar-09	0.001						
16	14-Sep-09	0.001						
17	5-Mar-10							
18	24-Dec-10	0.001						
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12							
22	14-Sep-12							
23	5-Mar-13	0.001						
24	9-Dec-13	0.001						
25	2-Nov-15		0.03					
26	15-Apr-16	0.001	0.001					
27	2-Nov-16							
28	13-Apr-17	0.001	0.001					
29	2-Nov-17							
30	11-May-18	0.001						
31	2-Nov-18							
32	11-Jul-19	0.001	0.001					
33	1-Nov-19							
34	1-Jul-20	0.001	0.001					
35	1-Nov-20							
36	1-Apr-21	0.001	0.001					
37	21-Jun-22	0.001	0.001					
38	12-Oct-23	0.001	0.001					
39								
40								
Coefficient of Variation:		2.60	2.22					
Mann-Kendall Statistic (S):		-26	-7					
Confidence Factor:		69.7%	76.4%					
Concentration Trend:		No Trend	No Trend					



Notes:

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3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

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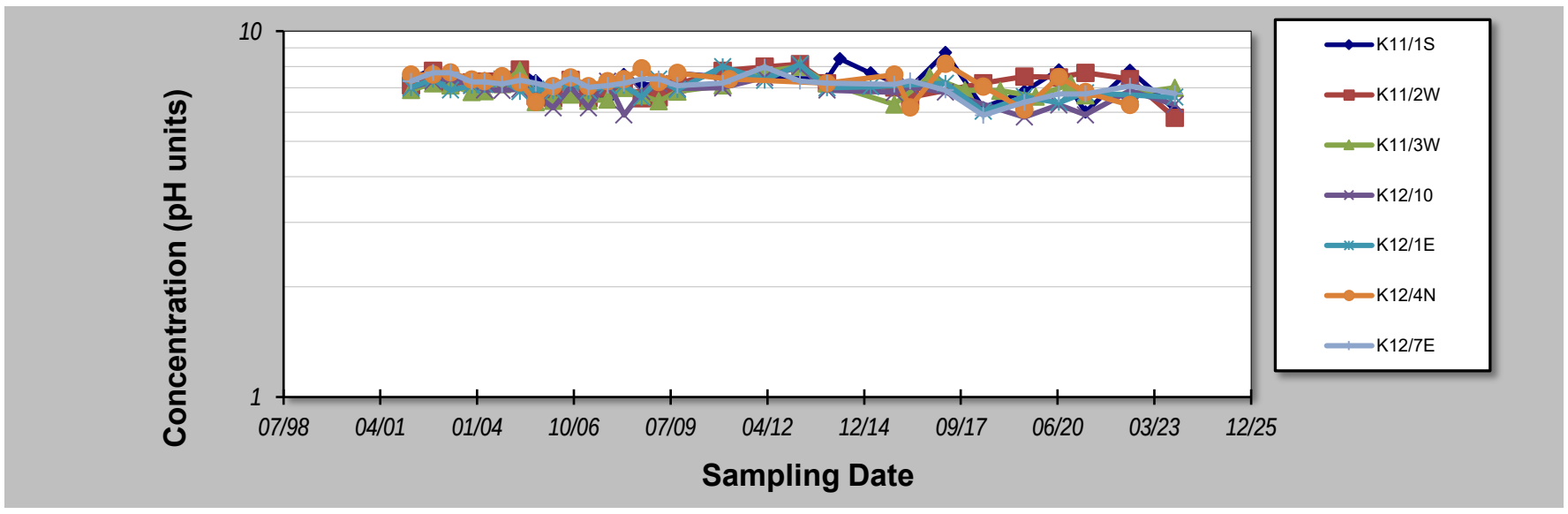
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **pH**
Concentration Units: **pH units**

Sampling Point ID:	K11/1S	K11/2W	K11/3W	K12/10	K12/1E	K12/4N	K12/7E
Sampling Event	Sampling Date	PH CONCENTRATION (pH units)						
1	4-Mar-02	7.4	7.1	6.9	7.0	7.0	7.6	7.3
2	14-Oct-02	7.9	7.8	7.2	7.3	7.4	7.6	7.7
3	15-Apr-03	7.5	7.2	7.1	7.4	6.9	7.7	7.7
4	17-Nov-03	7.2	7.2	6.8	7.1	7.1	7.4	7.3
5	31-Mar-04	7.4	7.3	6.9	6.9	7.1	7.3	7.3
6	27-Sep-04	7.5	7.3	7.2	6.9	7.4	7.5	7.2
7	31-Mar-05	7.9	7.9	7.8	6.9	6.8	7.2	7.3
8	12-Sep-05	7.31	6.64	6.41	6.71	6.94	6.40	7.2
9	9-Mar-06	6.97	6.56	6.46	6.17	6.88	7.07	7.03
10	6-Sep-06	7.53	7.36	6.72	7.05	7.24	7.48	7.43
11	9-Mar-07	6.97	6.56	6.46	6.17	6.88	7.07	7.03
12	22-Sep-07	6.50	7.00	6.50	7.30	7.10	7.30	7.10
13	11-Mar-08	7.60	7.10	7.0	5.90	7.10	7.40	7.20
14	10-Sep-08	7.15	6.56	6.7	6.83	6.59	7.91	7.39
15	5-Mar-09	7.1	6.6	6.4	7.2	7.4	7.3	7.4
16	14-Sep-09	7.7	7.2	6.8	7.0	6.9	7.7	7.1
17	5-Mar-10							
18	24-Dec-10	7.5	7.8	7.1	7	8.0		7.2
19	5-Mar-11						7.4	
20	5-Mar-12		7.99	7.76	7.47	7.3		7.98
21	14-Sep-12							
22	5-Mar-13		8.12	8	8	8.1		7.3
23	9-Dec-13	7.4	7.2	7.2	6.9	7.0	7.2	7.2
24	22-Apr-14	8.4						
25	9-Dec-14							
26	5-Mar-15	7.68				7.05		
27	2-Nov-15		7.01	6.31	6.8		7.6	7.16
28	15-Apr-16	7.01	6.6		7.05		6.19	7.32
29	2-Nov-16			7.51				
30	13-Apr-17	8.73			6.81	7.21	8.14	6.9
31	2-Nov-17			6.89				
32	11-May-18	6.18	7.2			6.04	7.06	5.89
33	2-Nov-18			6.87				
34	11-Jul-19	6.85	7.51		5.82	6.62	6.11	6.39
35	1-Nov-19			6.63				
36	1-Jul-20	7.84	7.47		6.29	6.38	7.5	6.74
37	1-Nov-20			7.18				
38	1-Apr-21	6.01	7.69	6.67	5.91	6.79	6.81	6.74
39	06-Jul-22	7.82	7.39	6.74	6.87		6.28	7.08
40	13-Oct-23	6.1	5.8	7	6.3	6.6		6.75
Coefficient of Variation:		0.09	0.07	0.06	0.08	0.06	0.07	0.06
Mann-Kendall Statistic (S):		-39	20	-7	-98	-69	-83	-170
Confidence Factor:		77.2%	64.5%	54.7%	97.3%	92.1%	96.5%	99.9%
Concentration Trend:		Stable	No Trend	Stable	Decreasing	Prob. Decreasing	Decreasing	Decreasing



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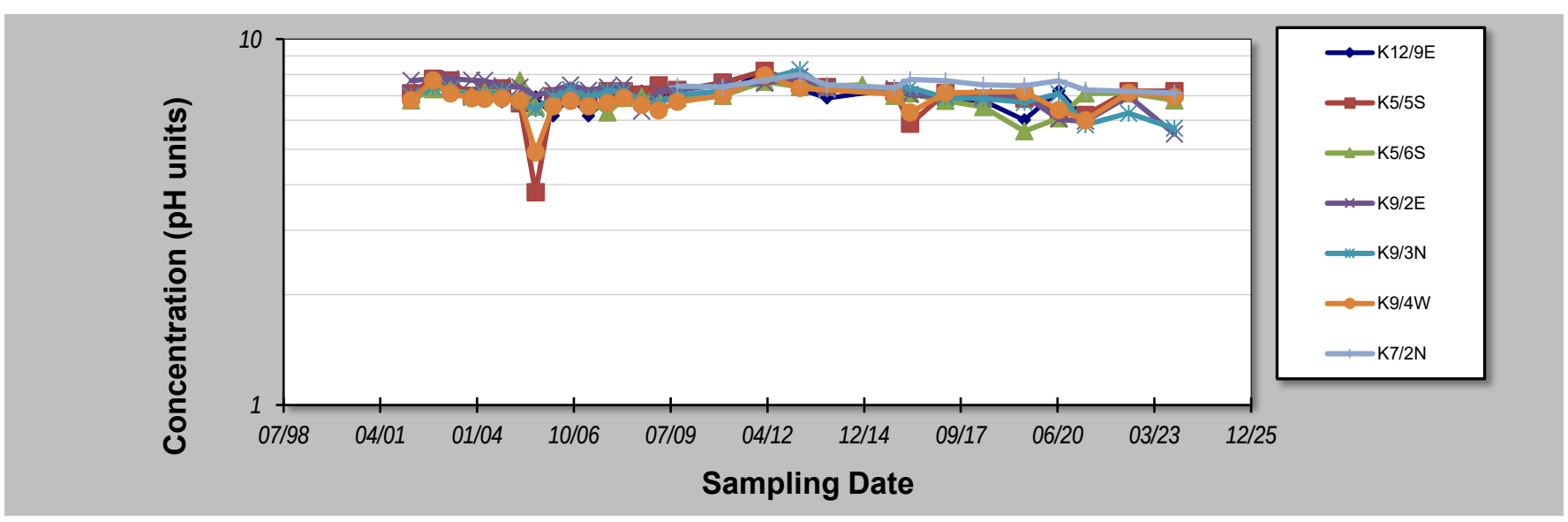
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **pH**
Concentration Units: **pH units**

Sampling Point ID:	K12/9E	K5/5S	K5/6S	K9/2E	K9/3N	K9/4W	K7/2N
Sampling Event	Sampling Date	PH CONCENTRATION (pH units)						
1	4-Mar-02	6.9	7.1	6.8	7.7	7.0	6.8	
2	14-Oct-02	7.3	7.8	7.3	7.8	7.4	7.7	
3	15-Apr-03	7.5	7.7	7.3	7.8	7.3	7.1	
4	17-Nov-03	7.0	7.0	7.0	7.7	6.9	6.9	
5	31-Mar-04	7.0	7.3	7.2	7.7	7.1	6.9	
6	27-Sep-04	6.7	7.3	7.2	7.5	7.2	6.9	
7	31-Mar-05	7.0	6.7	7.7	7.4	6.7	6.8	
8	12-Sep-05	6.94	3.81	6.53	7.01	6.44	4.90	
9	9-Mar-06	6.18	6.98	6.82	7.24	6.92	6.56	
10	6-Sep-06	7.02	7.08	7.11	7.50	7.27	6.78	
11	9-Mar-07	6.18	6.98	6.82	7.24	6.92	6.56	
12	22-Sep-07	6.90	7.20	6.30	7.40	7.20	6.70	
13	11-Mar-08	7.10	7.20	6.90	7.50	7.20	6.90	
14	10-Sep-08	7.21	7.06	6.95	6.35	6.79	6.61	
15	5-Mar-09	7.0	7.5	6.8	7.2	6.7	6.4	
16	14-Sep-09	7.0	7.3	6.9	7.3	7.1	6.7	7.4
17	5-Mar-10							
18	24-Dec-10	7.1	7.6	7	7.5	7.2	7.0	7.4
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12	8.19	8.2	7.65	7.57		8.0	
22	14-Sep-12							
23	5-Mar-13	7.3	7.6	7.4	7.9	8.25	7.4	8
24	9-Dec-13	6.9	7.4		7.3	7.3		7.5
25	22-Apr-14							
26	9-Dec-14			7.5				
27	2-Nov-15	7.31	7.2	7	7.31		7.07	7.37
28	15-Apr-16	7.08	5.87	7.1	7.05	7.38	6.3	7.75
29	2-Nov-16							
30	13-Apr-17	6.79	7.12	6.79	6.96	6.92	7.14	7.7
31	2-Nov-17							
32	11-May-18	6.79	6.87	6.52	6.96	6.88		7.49
33	2-Nov-18							
34	11-Jul-19	6.01	6.87	5.6	7.02	6.71	7.19	7.45
35	1-Nov-19							
36	1-Jul-20	7.22	6.28	6.08	6.04	7.09	6.4	7.7
37	1-Nov-20							
38	1-Apr-21	6.01	6.2	7.11	5.96	5.83	6	7.26
39	22-Jun-22		7.2	7.11	6.98	6.27	7.13	
40	09-Oct-23		7.2	6.8	5.5	5.7	6.95	7.12
Coefficient of Variation:		0.07	0.11	0.06	0.08	0.07	0.08	0.03
Mann-Kendall Statistic (S):		-14	-54	-64	-218	-83	0	-17
Confidence Factor:		60.6%	83.8%	88.0%	>99.9%	95.6%	49.2%	86.0%
Concentration Trend:		Stable	Stable	Stable	Decreasing	Decreasing	Stable	Stable



Notes:

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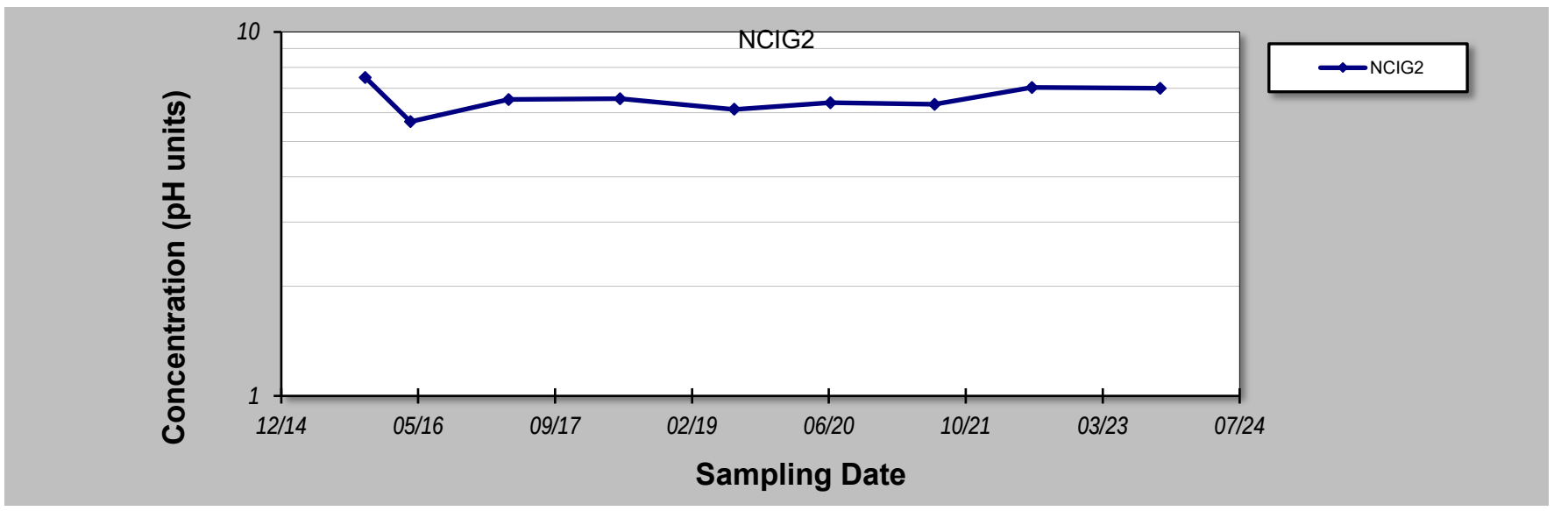
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **pH**
Concentration Units: **pH units**

Sampling Point ID: **NCIG2**

Sampling Event	Sampling Date	PH CONCENTRATION (pH units)
1	30-Oct-15	7.5
2	12-Apr-16	5.67
3	5-Apr-17	6.52
4	17-May-18	6.55
5	8-Jul-19	6.13
6	23-Jun-20	6.39
7	9-Jul-21	6.33
8	29-Jun-22	7.04
9	11-Oct-23	7
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
Coefficient of Variation:		0.08
Mann-Kendall Statistic (S):		4
Confidence Factor:		61.9%
Concentration Trend:		No Trend



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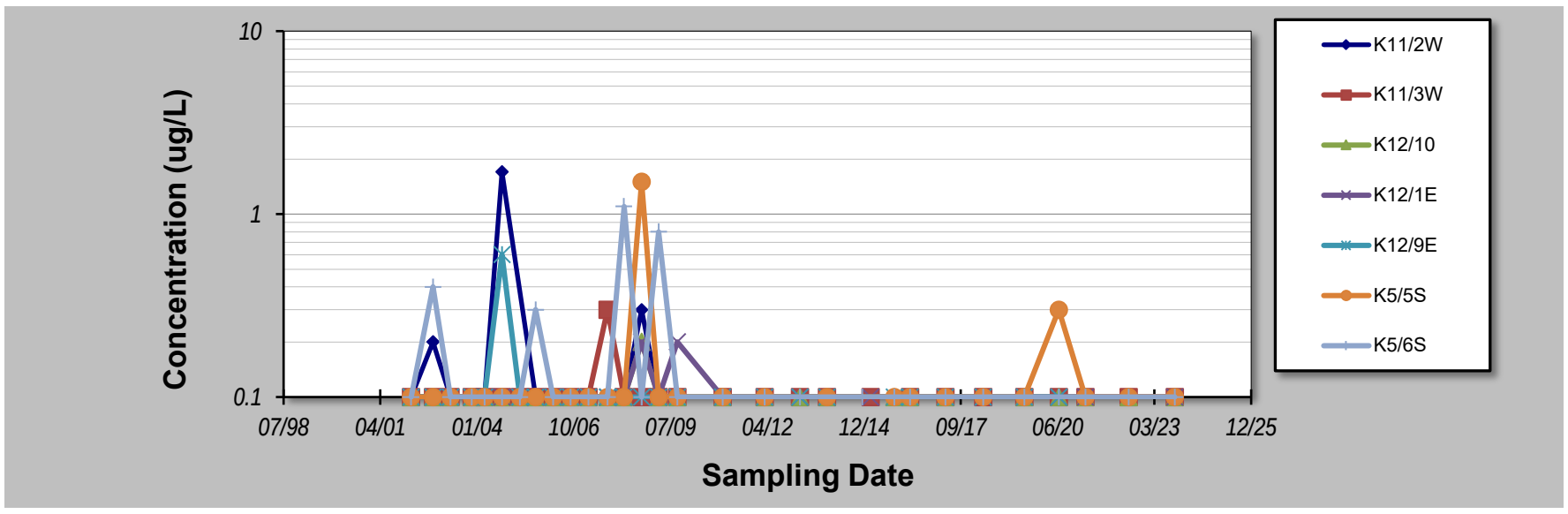
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Phenanthrene**
Concentration Units: **ug/L**

Sampling Point ID:	K11/2W	K11/3W	K12/10	K12/1E	K12/9E	K5/5S	K5/6S
Sampling Event	Sampling Date	PHENANTHRENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.10	0.10	0.1	0.1	0.1	0.1
2	14-Oct-02	0.2	0.10	0.10	0.1	0.1	0.1	0.4
3	15-Apr-03	0.1	0.10	0.10	0.1	0.1	0.1	0.1
4	17-Nov-03	0.1	0.10	0.10	0.1	0.1	0.1	0.1
5	31-Mar-04	0.1	0.10	0.10	0.1	0.1	0.1	0.1
6	27-Sep-04	1.7	0.10	0.10	0.1	0.6	0.1	0.1
7	31-Mar-05		0.10	0.10	0.1	0.1	0.1	0.1
8	12-Sep-05	0.1	0.10	0.10	0.1	0.1	0.1	0.3
9	9-Mar-06	0.1	0.10	0.10	0.1	0.1	0.1	0.1
10	6-Sep-06	0.1	0.10	0.10	0.1	0.1	0.1	0.1
11	9-Mar-07	0.1	0.10	0.10	0.1	0.1	0.1	0.1
12	22-Sep-07	0.1	0.3	0.10	0.1	0.1	0.1	0.1
13	11-Mar-08	0.1	0.10	0.10	0.1	0.1	0.1	1.1
14	10-Sep-08	0.3	0.10	0.2	0.2	0.1	1.5	0.1
15	5-Mar-09	0.1	0.1	0.10	0.1	0.1	0.1	0.8
16	14-Sep-09	0.1	0.10	0.10	0.2	0.1	0.1	0.1
17	24-Dec-10	0.1	0.10	0.10	0.1	0.1	0.1	0.1
18	5-Mar-11							
19	14-Sep-11							
20	5-Mar-12	0.1	0.10	0.10	0.1	0.1	0.1	0.1
21	14-Sep-12							
22	5-Mar-13	0.1	0.10	0.10	0.1	0.1		0.1
23	9-Dec-13	0.1	0.10	0.10	0.1	0.1	0.1	
24	22-Apr-14							
25	9-Dec-14							0.1
26	5-Mar-15		0.10		0.1			
27	2-Nov-15	0.1		0.10		0.1	0.1	0.1
28	15-Apr-16	0.1	0.10	0.10		0.1	0.1	0.1
29	2-Nov-16							
30	13-Apr-17		0.10	0.10	0.1	0.1	0.1	0.1
31	2-Nov-17							
32	11-May-18	0.1	0.10		0.1	0.1	0.1	0.1
33	2-Nov-18							
34	11-Jul-19	0.1	0.10	0.10	0.1	0.1	0.1	0.1
35	1-Nov-19							
36	1-Jul-20	0.1	0.10	0.10	0.1	0.1	0.3	0.1
37	1-Nov-20							
38	1-Apr-21	0.1	0.10	0.10	0.1		0.1	0.1
39	21-Jun-22	0.1	0.1	0.1			0.1	0.1
40	12-Oct-23		0.1	0.1	0.1		0.1	0.1
Coefficient of Variation:		1.82	0.35	0.18	0.25	0.82	1.69	1.30
Mann-Kendall Statistic (S):		-38	-6	-1	4	-15	19	-42
Confidence Factor:		79.1%	53.7%	50.0%	52.5%	62.0%	63.8%	77.7%
Concentration Trend:		No Trend	Stable	Stable	No Trend	Stable	No Trend	No Trend



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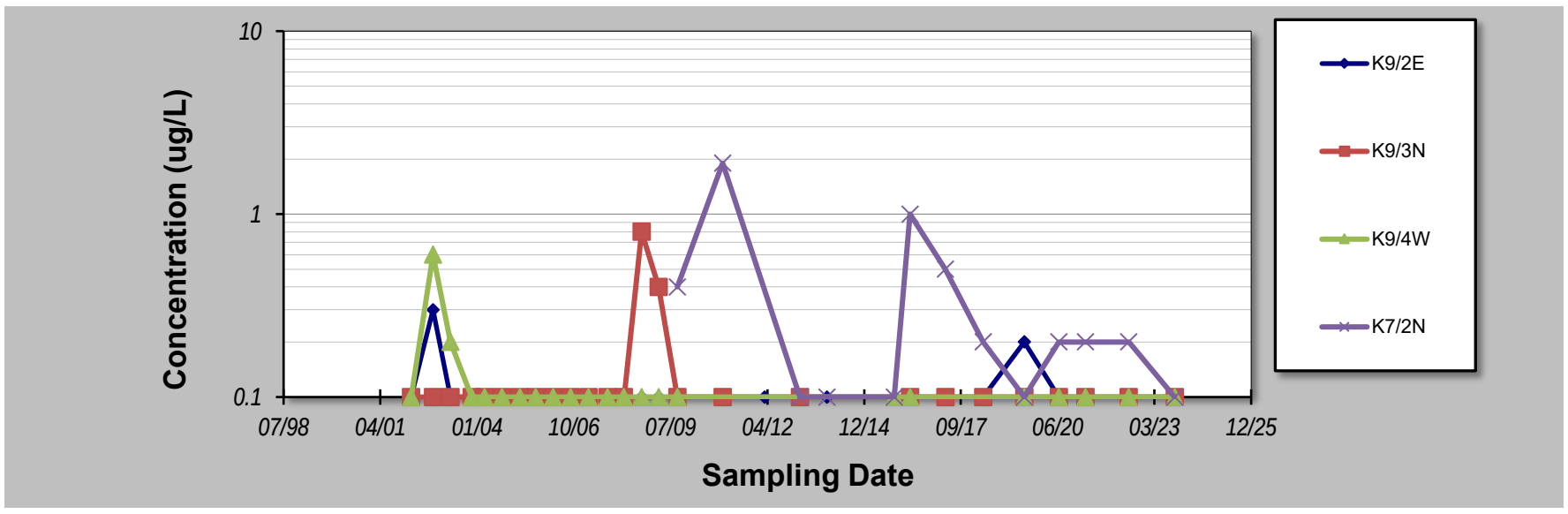
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Phenanthrene**
Concentration Units: **ug/L**

Sampling Point ID:	K9/2E	K9/3N	K9/4W	K7/2N			
Sampling Event	Sampling Date	PHENANTHRENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1	0.1				
2	14-Oct-02	0.3	0.1	0.6				
3	15-Apr-03	0.1	0.1	0.2				
4	17-Nov-03	0.1	0.1	0.1				
5	31-Mar-04	0.1	0.1	0.1				
6	27-Sep-04	0.1	0.1	0.1				
7	31-Mar-05	0.1	0.1	0.1				
8	12-Sep-05	0.1	0.1	0.1				
9	9-Mar-06	0.1	0.1	0.1				
10	6-Sep-06	0.1	0.1	0.1				
11	9-Mar-07	0.1	0.1	0.1				
12	22-Sep-07	0.1	0.1	0.1				
13	11-Mar-08	0.1	0.1	0.1				
14	10-Sep-08	0.1	0.8	0.1				
15	5-Mar-09	0.1	0.4	0.1				
16	14-Sep-09	0.1	0.1	0.1	0.4			
17	5-Mar-10							
18	24-Dec-10	0.1	0.1		1.9			
19	5-Mar-12	0.1						
20	14-Sep-12							
21	5-Mar-13	0.1	0.1		0.1			
22	9-Dec-13	0.1			0.1			
23	22-Apr-14							
24	9-Dec-14							
25	5-Mar-15							
26	2-Nov-15	0.1		0.1	0.1			
27	15-Apr-16	0.1	0.1	0.1	1			
28	2-Nov-16							
29	13-Apr-17	0.1	0.1	-	0.5			
30	2-Nov-17							
31	11-May-18	0.1	0.1		0.2			
32	2-Nov-18							
33	11-Jul-19	0.2	0.1	0.1	0.1			
34	1-Nov-19							
35	1-Jul-20	0.1	0.1	0.1	0.2			
36	1-Nov-20							
37	1-Apr-21	0.1	0.1	0.1	0.2			
38	24-Jun-22	0.1	0.1	0.1	0.2			
39	10-Oct-23	0.1	0.1	0.1	0.1			
40								
Coefficient of Variation:		**0.37**	**1.06**	**0.84**	**1.32**			
Mann-Kendall Statistic (S):		**-7**	**3**	**-39**	**-14**			
Confidence Factor:		**54.5%**	**51.7%**	**84.0%**	**78.2%**			
Concentration Trend:		Stable	No Trend	Stable	No Trend			



Notes:

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3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

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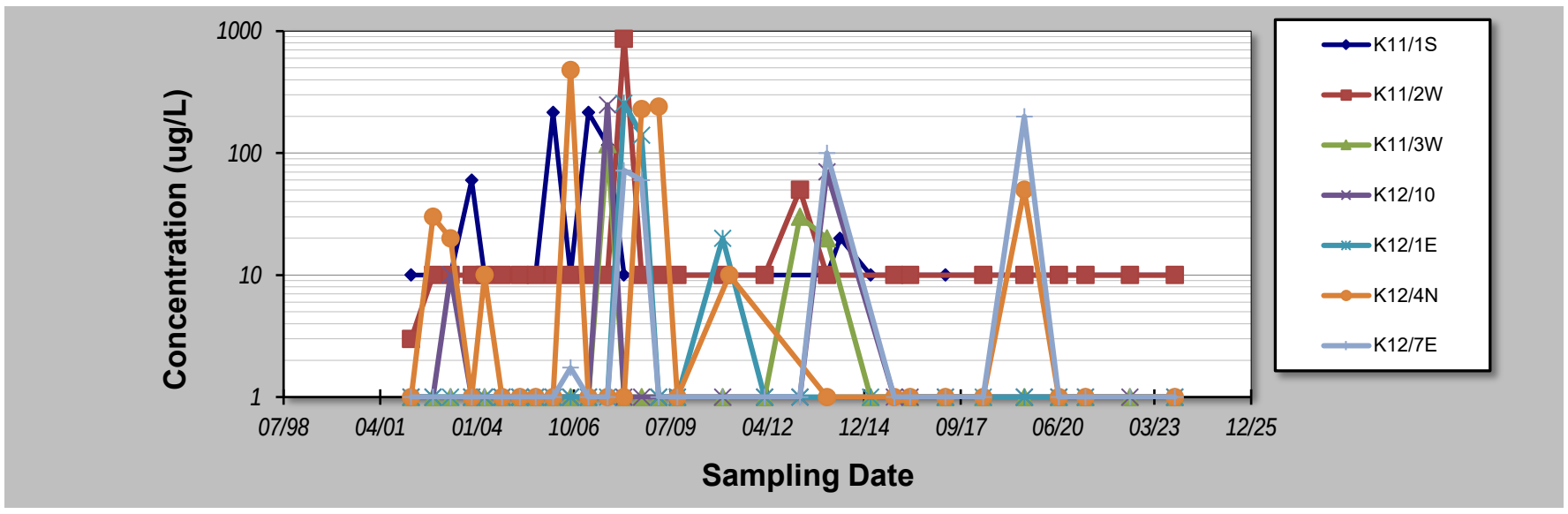
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Phenols**
Concentration Units: **ug/L**

Sampling Point ID:	K11/1S	K11/2W	K11/3W	K12/10	K12/1E	K12/4N	K12/7E
Sampling Event	Sampling Date	PHENOLS CONCENTRATION (ug/L)						
1	4-Mar-02	10	3	1	1	1	1	1
2	14-Oct-02	10	10	1	1	1	30	1
3	15-Apr-03	10	10	1	10	1	20	1
4	17-Nov-03	60	10	1	1	1	1	1
5	31-Mar-04	10	10	1	1	1	10	1
6	27-Sep-04	10	10	1	1	1	1	1
7	31-Mar-05	10	10	1	1	1	1	1
8	12-Sep-05	10	10	1	1	1	1	1
9	9-Mar-06	215	10	1	1	1	1	1
10	6-Sep-06	10	10	1	1	1	482	1.74
11	9-Mar-07	215	10	1	1	1	1	1
12	22-Sep-07	116	10	119	249	1	1	1
13	11-Mar-08	10	864	1	1	257	1	72
14	10-Sep-08	10	10	1	1	140	230	60
15	5-Mar-09	10	10	1	1	1	240	1
16	14-Sep-09	10	10	1	1	1	1	1
17	5-Mar-10							
18	24-Dec-10	10	10	1	1	20		1
19	5-Mar-11						10	
20	14-Sep-11							
21	5-Mar-12		10	1	1	1		1
22	14-Sep-12							
23	5-Mar-13		50	30	1	1		1
24	9-Dec-13	10	10	20	70		1	100
25	22-Apr-14	20						
26	9-Dec-14							
27	5-Mar-15	10		1		1		
28	2-Nov-15		10		1		1	1
29	15-Apr-16	10	10	1	1		1	1
30	13-Apr-17	10		1	1	1	1	1
31	2-Nov-17							
32	11-May-18	10	10	1		1	1	1
33	2-Nov-18							
34	11-Jul-19	10	10	1	1	1	50	200
35	1-Nov-19							
36	1-Jul-20	10	10	1	1	1	1	1
37	1-Nov-20							
38	1-Apr-21	10	10	1	1	1	1	1
39	06-Jul-22	10	10	1	1			1
40	13-Oct-23	10	10	1	1	1	1	1
Coefficient of Variation:		1.85	3.87	3.35	3.81	3.31	2.62	2.72
Mann-Kendall Statistic (S):		-38	30	9	-16	4	-37	22
Confidence Factor:		76.6%	71.5%	55.9%	61.5%	52.6%	78.4%	65.2%
Concentration Trend:		No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend



Notes:

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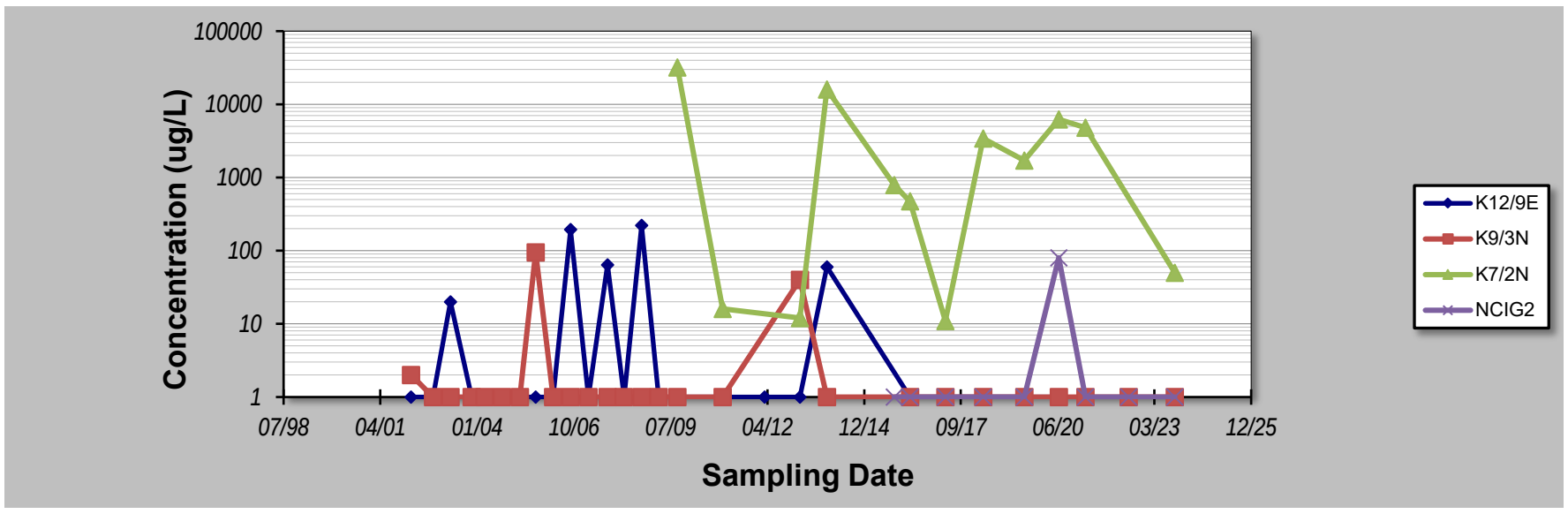
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Phenols**
Concentration Units: **ug/L**

Sampling Point ID:	K12/9E	K9/3N	K7/2N	NCIG2			
Sampling Event	Sampling Date	PHENOLS CONCENTRATION (ug/L)						
1	4-Mar-02	1	2					
2	14-Oct-02	1	1					
3	15-Apr-03	20	1					
4	17-Nov-03	1	1					
5	31-Mar-04	1	1					
6	27-Sep-04	1	1					
7	31-Mar-05	1	1					
8	12-Sep-05	1	95					
9	9-Mar-06	1	1					
10	6-Sep-06	193	1					
11	9-Mar-07	1	1					
12	22-Sep-07	64	1					
13	11-Mar-08	1	1					
14	10-Sep-08	221	1					
15	5-Mar-09	1	1					
16	14-Sep-09	1	1	31900				
17	5-Mar-10							
18	24-Dec-10	1	1	16				
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12	1						
22	14-Sep-12							
23	5-Mar-13	1	40	12				
24	9-Dec-13	60	1	16000				
25	2-Nov-15	-		790	1			
26	15-Apr-16	1	1	470	1			
27	2-Nov-16							
28	13-Apr-17	1	1	11	1			
29	2-Nov-17							
30	11-May-18	1	1	3400	1			
31	2-Nov-18							
32	11-Jul-19	1	1	1700	1			
33	1-Nov-19							
34	1-Jul-20	1	1	6200	80			
35	1-Nov-20							
36	1-Apr-21		1	4800	1			
37	21-Jun-22		1		1			
38	12-Oct-23		1	50	1			
39								
40								
Coefficient of Variation:		2.51	3.24	1.75	2.69			
Mann-Kendall Statistic (S):		-10	-29	0	2			
Confidence Factor:		58.2%	71.9%	47.3%	54.0%			
Concentration Trend:		No Trend	No Trend	No Trend	No Trend			



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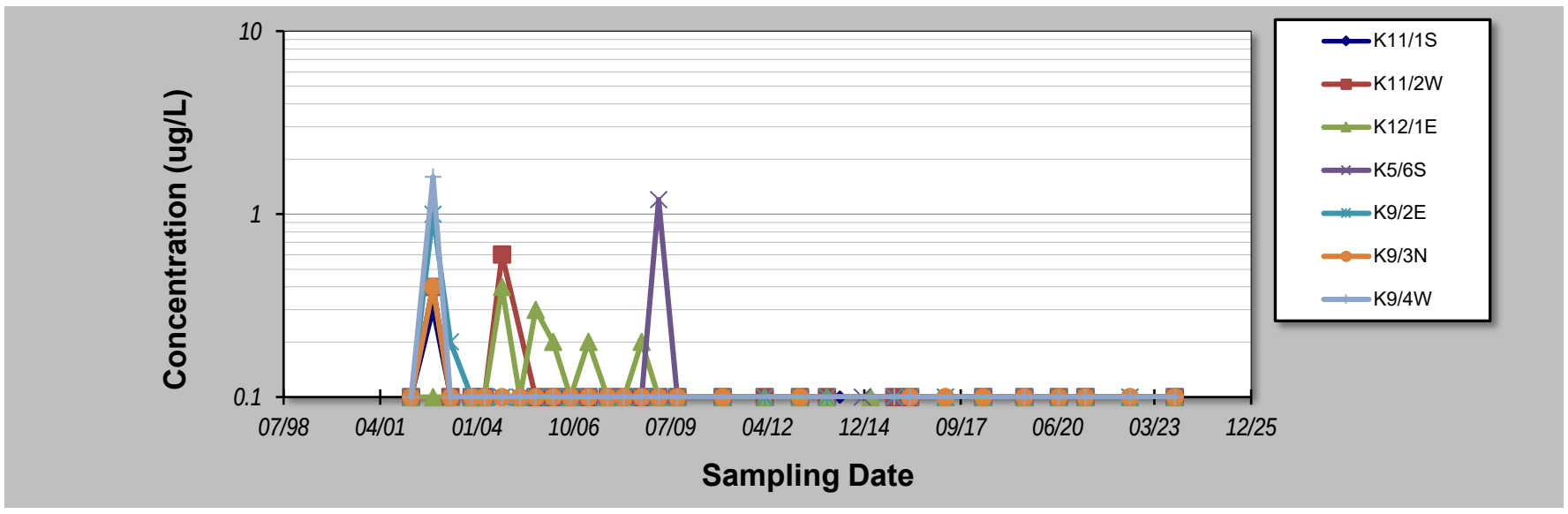
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Pyrene**
Concentration Units: **ug/L**

Sampling Point ID:	K11/1S	K11/2W	K12/1E	K5/6S	K9/2E	K9/3N	K9/4W
Sampling Event	Sampling Date	PYRENE CONCENTRATION (ug/L)						
1	4-Mar-02	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2	14-Oct-02	0.3	0.4	0.1	0.4	1	0.4	1.6
3	15-Apr-03	0.1	0.1	0.1	0.1	0.2	0.1	0.1
4	17-Nov-03	0.1	0.1	0.1	0.1	0.1	0.1	0.1
5	31-Mar-04	0.1	0.1	0.1	0.1	0.1	0.1	0.1
6	27-Sep-04	0.1	0.6	0.4	0.1	0.1	0.1	0.1
7	31-Mar-05	0.1		0.1	0.1	0.1	0.1	0.1
8	12-Sep-05	0.1	0.1	0.3	0.1	0.1	0.1	0.1
9	9-Mar-06	0.1	0.1	0.2	0.1	0.1	0.1	0.1
10	6-Sep-06	0.1	0.1	0.1	0.1	0.1	0.1	0.1
11	9-Mar-07	0.1	0.1	0.2	0.1	0.1	0.1	0.1
12	22-Sep-07	0.1	0.1	0.1	0.1	0.1	0.1	0.1
13	11-Mar-08	0.1	0.1	0.1	0.1	0.1	0.1	0.1
14	10-Sep-08	0.1	0.1	0.2	0.1	0.1	0.1	0.1
15	5-Mar-09	0.1	0.1	0.1	1.2	0.1	0.1	0.1
16	14-Sep-09	0.1	0.1	0.1	0.1	0.1	0.1	0.1
17	5-Mar-10							
18	24-Dec-10	0.1	0.1	0.1	0.1	0.1	0.1	
19	5-Mar-12		0.1	0.1	0.1	0.1		
20	14-Sep-12							
21	5-Mar-13		0.1	0.1	0.1	0.1	0.1	
22	9-Dec-13	0.1	0.1	0.1		0.1		
23	22-Apr-14	0.1						
24	9-Dec-14				0.1			
25	5-Mar-15	0.1		0.1				
26	2-Nov-15		0.1		0.1	0.1		0.1
27	15-Apr-16	0.1	0.1		0.1	0.1	0.1	0.1
28	2-Nov-16							
29	13-Apr-17	0.1		0.1	0.1	0.1	0.1	-
30	2-Nov-17							
31	11-May-18	0.1	0.1	0.1	0.1	0.1	0.1	
32	2-Nov-18							
33	11-Jul-19	0.1	0.1	0.1	0.1	0.1	0.1	0.1
34	1-Nov-19							
35	1-Jul-20	0.1	0.1	0.1	0.1	0.1	0.1	0.1
36	1-Nov-20							
37	1-Apr-21	0.1	0.1	0.1	0.1	0.1	0.1	0.1
38	06-Jul-22	0.1		0.1	0.1	0.1	0.1	0.1
39	13-Oct-23	0.1	0.1	0.1	0.1	0.1	0.1	0.1
40								
Coefficient of Variation:		0.35	0.86	0.55	1.41	1.25	0.53	1.89
Mann-Kendall Statistic (S):		-25	-37	-56	-25	-51	-23	-20
Confidence Factor:		68.1%	78.4%	86.0%	67.3%	82.4%	68.4%	69.0%
Concentration Trend:		Stable	Stable	Stable	No Trend	No Trend	Stable	No Trend



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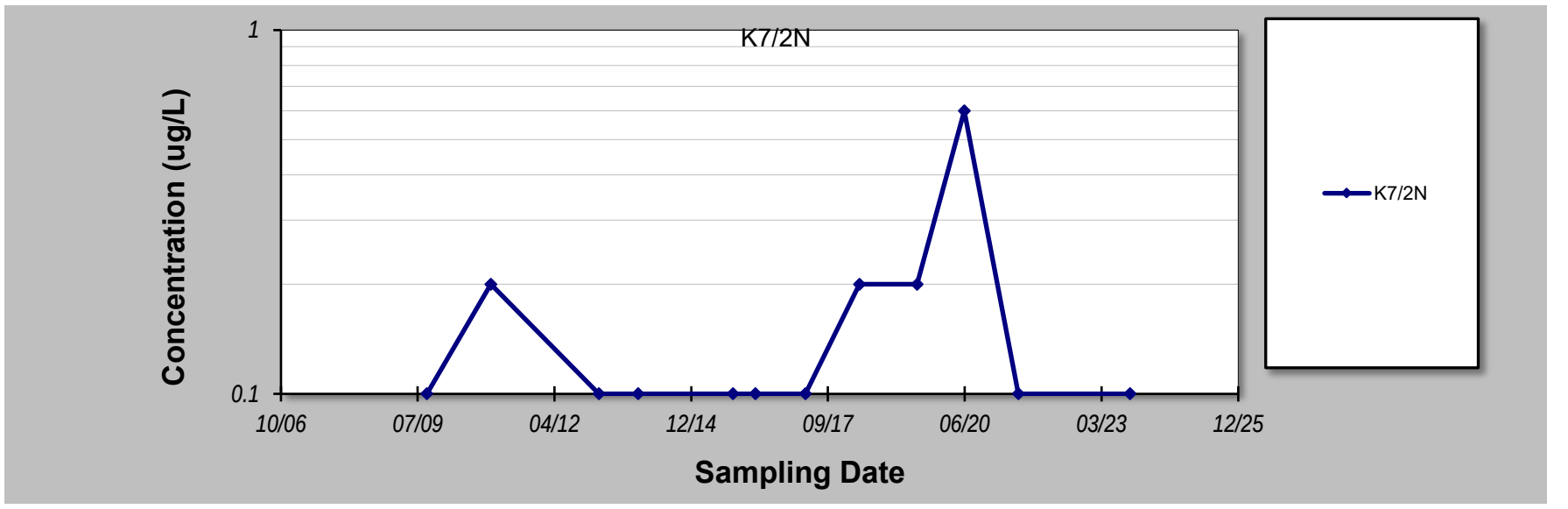
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Pyrene**
Concentration Units: **ug/L**

Sampling Point ID: **K7/2N**

Sampling Event	Sampling Date	PYRENE CONCENTRATION (ug/L)
1	11-Sep-09	0.1
2	1-Mar-10	
3	23-Dec-10	0.2
4	5-Mar-11	
5	14-Sep-11	
6	5-Mar-12	
7	14-Sep-12	
8	21-Feb-13	0.1
9	5-Dec-13	0.1
10	22-Apr-14	
11	9-Dec-14	
12	5-Mar-15	
13	29-Oct-15	0.1
14	8-Apr-16	0.1
15	2-Nov-16	
16	10-Apr-17	0.1
17	9-May-18	0.2
18	2-Nov-18	
19	5-Jul-19	0.2
20	1-Nov-19	
21	15-Jun-20	0.6
22	1-Nov-20	
23	14-Jul-21	0.1
24	10-Oct-23	0.1
25		
Coefficient of Variation:		**0.86**
Mann-Kendall Statistic (S):		**9**
Confidence Factor:		**70.4%**
Concentration Trend:		No Trend



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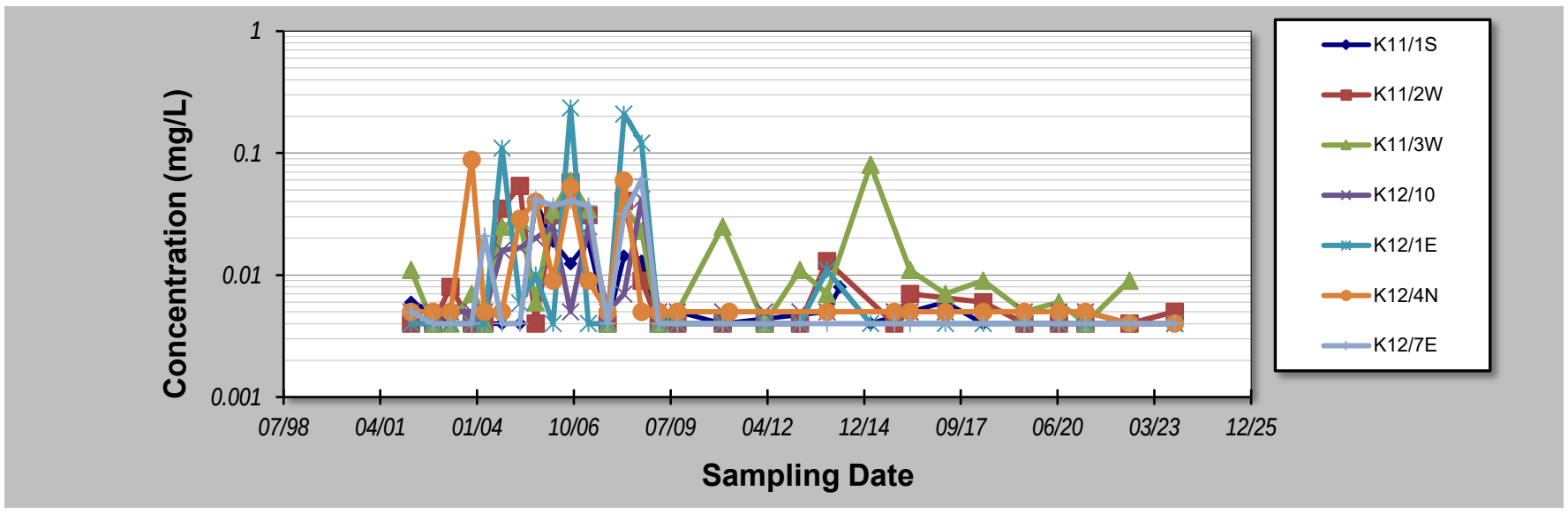
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Total Cyanide**
Concentration Units: **mg/L**

Sampling Point ID:	K11/1S	K11/2W	K11/3W	K12/10	K12/1E	K12/4N	K12/7E
Sampling Event	Sampling Date	TOTAL CYANIDE CONCENTRATION (mg/L)						
1	4-Mar-02	0.006	0.004	0.011	0.005	0.004	0.005	0.005
2	14-Oct-02	0.005	0.004	0.004	0.005	0.004	0.005	0.004
3	15-Apr-03	0.004	0.008	0.004	0.005	0.004	0.005	0.004
4	17-Nov-03	0.004	0.004	0.007	0.005	0.004	0.088	0.004
5	31-Mar-04	0.004	0.004	0.004	0.005	0.004	0.005	0.021
6	27-Sep-04	0.004	0.035	0.025	0.016	0.11	0.005	0.004
7	31-Mar-05	0.004	0.0538	0.0285	0.0167	0.0059	0.0289	0.004
8	12-Sep-05	0.04	0.004	0.006	0.02	0.01	0.04	0.042
9	9-Mar-06	0.019	0.031	0.034	0.025	0.004	0.009	0.037
10	6-Sep-06	0.0124	0.0573	0.0593	0.005	0.235	0.0524	0.0404
11	9-Mar-07	0.019	0.031	0.034	0.025	0.004	0.009	0.037
12	22-Sep-07	0.004	0.004	0.004	0.005	0.004	0.005	0.004
13	11-Mar-08	0.0143	0.0404	0.0364	0.007	0.209	0.0596	0.0316
14	10-Sep-08	0.013	0.009	0.023	0.042	0.121	0.005	0.061
15	5-Mar-09	0.004	0.004	0.004	0.005	0.004	0.005	0.004
16	14-Sep-09	0.005	0.004	0.005	0.005	0.004	0.005	0.004
17	5-Mar-10							
18	24-Dec-10	0.004	0.004	0.025	0.005	0.004		0.004
19	5-Mar-11						0.005	
20	14-Sep-11							
21	5-Mar-12		0.004	0.004	0.005	0.004		0.004
22	14-Sep-12							
23	5-Mar-13		0.004	0.011	0.005	0.004		0.004
24	9-Dec-13	0.005	0.013	0.007	0.005	0.011	0.005	0.004
25	22-Apr-14	0.008						
26	5-Mar-15	0.004		0.08		0.004		
27	2-Nov-15		0.004		0.005		0.005	0.004
28	15-Apr-16	0.005	0.007	0.011	0.005		0.005	0.004
29	2-Nov-16							
30	13-Apr-17	0.006		0.007	0.005	0.004	0.005	0.004
31	2-Nov-17							
32	11-May-18	0.004	0.006	0.009		0.004	0.005	0.004
33	2-Nov-18							
34	11-Jul-19	0.004	0.004	0.005	0.005	0.004	0.005	0.004
35	1-Nov-19							
36	1-Jul-20	0.004	0.004	0.006	0.005	0.004	0.005	0.004
37	1-Nov-20							
38	1-Apr-21	0.004	0.004	0.004	0.005	0.004	0.005	0.004
39	29-Jun-22	0.004	0.004	0.009	0.004		0.004	0.004
40	11-Oct-23	0.005	0.005	0.009	0.004	0.004	0.004	0.004
Coefficient of Variation:		0.99	1.25	1.11	0.98	2.18	1.48	1.30
Mann-Kendall Statistic (S):		-55	-49	18	-69	-37	-110	-87
Confidence Factor:		85.6%	82.7%	63.0%	92.1%	77.2%	98.9%	94.6%
Concentration Trend:		Stable	No Trend	No Trend	Prob. Decreasing	No Trend	Decreasing	Prob. Decreasing



Notes:

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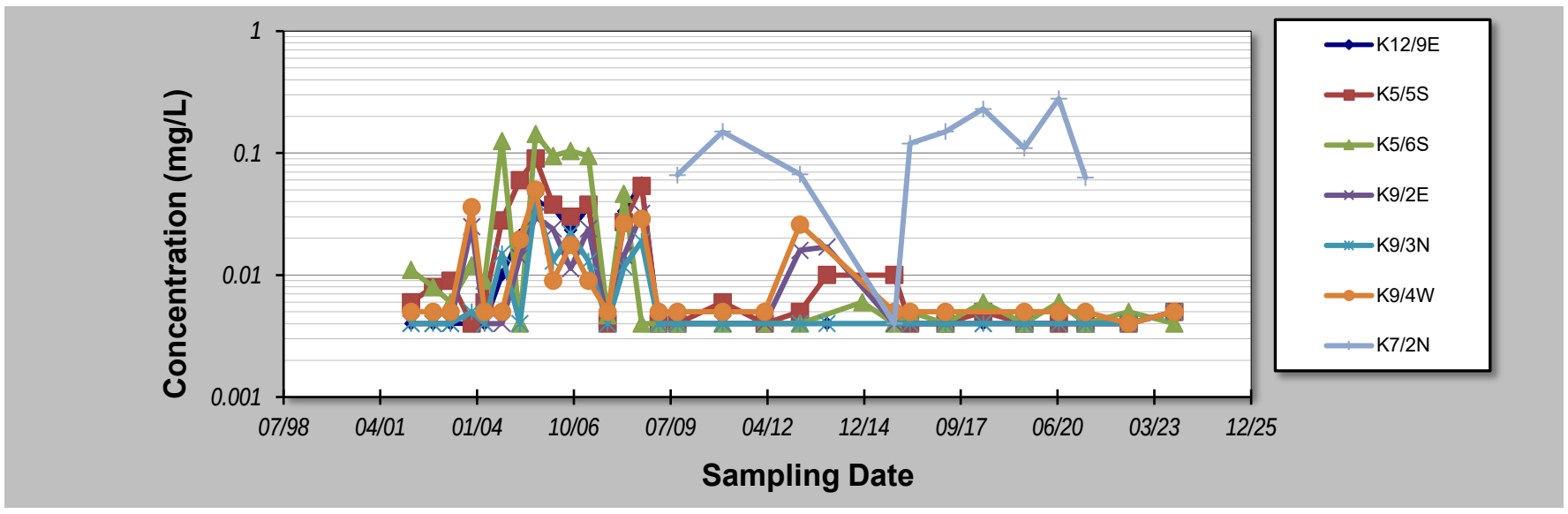
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Total Cyanide**
Concentration Units: **mg/L**

Sampling Point ID:	K12/9E	K5/5S	K5/6S	K9/2E	K9/3N	K9/4W	K7/2N
Sampling Event	Sampling Date	TOTAL CYANIDE CONCENTRATION (mg/L)						
1	4-Mar-02	0.004	0.006	0.011	0.004	0.004	0.005	
2	14-Oct-02	0.004	0.008	0.008	0.004	0.004	0.005	
3	15-Apr-03	0.004	0.009	0.006	0.004	0.004	0.005	
4	17-Nov-03	0.004	0.004	0.012	0.025	0.005	0.036	
5	31-Mar-04	0.004	0.006	0.009	0.004	0.004	0.005	
6	27-Sep-04	0.01	0.028	0.126	0.004	0.015	0.005	
7	31-Mar-05	0.0212	0.06	0.004	0.014	0.004	0.0196	
8	12-Sep-05	0.04	0.09	0.144	0.03	0.04	0.05	
9	9-Mar-06	0.036	0.0377	0.0946	0.0239	0.013	0.009	
10	6-Sep-06	0.0235	0.0301	0.104	0.0113	0.022	0.0177	
11	9-Mar-07	0.036	0.0377	0.0946	0.0239	0.013	0.009	
12	22-Sep-07	0.004	0.004	0.0047	0.0041	0.004	0.005	
13	11-Mar-08	0.0333	0.0272	0.0462	0.0145	0.0117	0.0266	
14	10-Sep-08	0.057	0.054	0.004	0.032	0.019	0.029	
15	5-Mar-09	0.004	0.004	0.004	0.004	0.004	0.005	
16	14-Sep-09	0.004	0.004	0.004	0.004	0.004	0.005	0.066
17	5-Mar-10							
18	24-Dec-10	0.004	0.006	0.004	0.004	0.004	0.005	0.15
19	5-Mar-12	0.004	0.004	0.004	0.004		0.005	
20	14-Sep-12							
21	5-Mar-13	0.004	0.005	0.004	0.016	0.004	0.026	0.067
22	9-Dec-13	0.004	0.01		0.017	0.004		0..088
23	22-Apr-14							
24	9-Dec-14			0.006				
25	5-Mar-15							
26								
27	2-Nov-15	0.004	0.01	0.004	0.004		0.005	0.004
28	15-Apr-16	0.004	0.004	0.005	0.004	0.004	0.005	0.12
29	2-Nov-16							
30	13-Apr-17	0.004	0.004	0.004	0.004	0.004	0.005	0.15
31	2-Nov-17							
32	11-May-18	0.004	0.005	0.006	0.004	0.004		0.23
33	2-Nov-18							
34	11-Jul-19	0.004	0.004	0.004	0.004	0.004	0.005	0.11
35	1-Nov-19							
36	1-Jul-20	0.004	0.004	0.006	0.004	0.004	0.005	0.28
37	1-Nov-20							
38	1-Apr-21		0.004	0.004	0.004	0.004	0.005	0.063
39	22-Jun-22		0.004	0.005	0.004	0.004	0.004	
40	09-Oct-23		0.005	0.004	0.005	0.005	0.005	0.085
Coefficient of Variation:		1.20	1.29	1.66	0.92	1.03	1.04	0.67
Mann-Kendall Statistic (S):		-47	-129	-140	-61	-54	-80	20
Confidence Factor:		84.3%	99.3%	99.6%	86.8%	86.4%	95.0%	95.5%
Concentration Trend:		No Trend	Decreasing	Decreasing	Stable	No Trend	Prob. Decreasing	Increasing



Notes:

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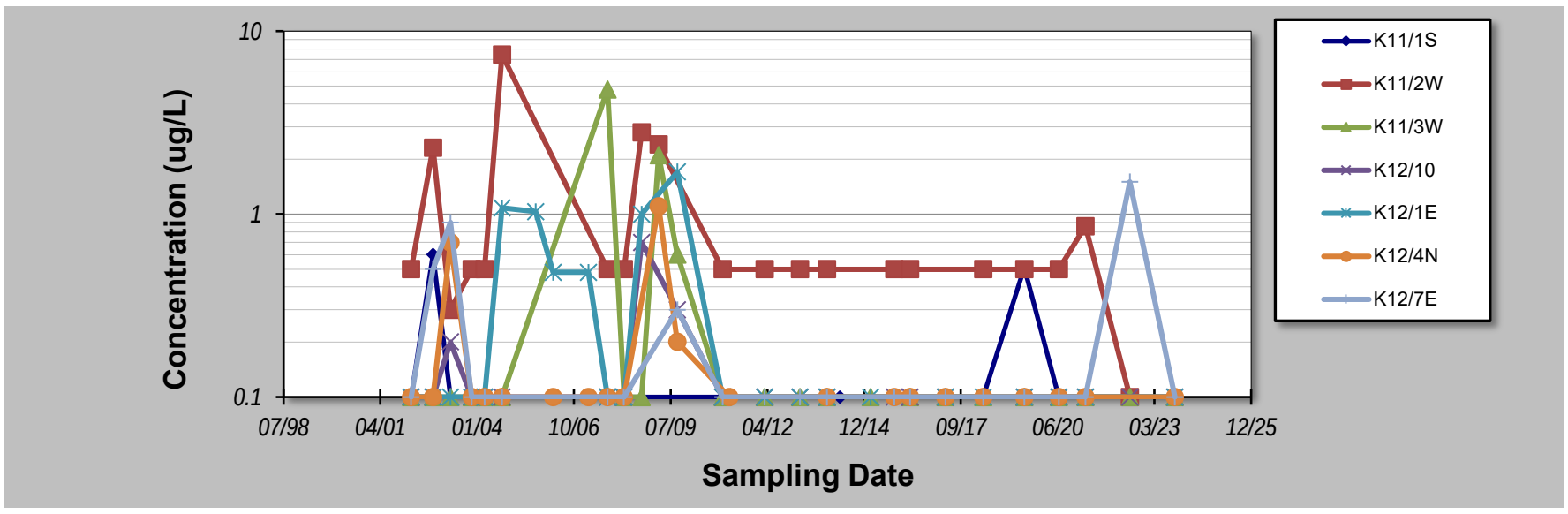
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Total PAHs**
Concentration Units: **ug/L**

Sampling Point ID:	K11/1S	K11/2W	K11/3W	K12/10	K12/1E	K12/4N	K12/7E
Sampling Event	Sampling Date	TOTAL PAHS CONCENTRATION (ug/L)						
1	4-Mar-02	0.10	0.50	0.10	0.10	0.10	0.10	0.10
2	14-Oct-02	0.6	2.3	0.10	0.10	0.1	0.1	0.5
3	15-Apr-03	0.10	0.3	0.10	0.2	0.1	0.7	0.9
4	17-Nov-03	0.10	0.50	0.10	0.10	0.10	0.10	0.1
5	31-Mar-04	0.10	0.50	0.10	0.10	0.10	0.10	0.1
6	27-Sep-04	0.10	7.46	0.10	0.10	1.08	0.10	0.1
7	31-Mar-05	-	-	-	-	-	-	-
8	12-Sep-05	-	-	-	-	1.03	-	-
9	9-Mar-06	-	-	-	-	0.48	0.1	-
10	6-Sep-06	-	-	-	-	-	-	-
11	9-Mar-07	-	-	-	-	0.48	0.1	-
12	22-Sep-07	0.10	0.50	4.8	0.1	0.10	0.10	0.1
13	11-Mar-08	0.10	0.50	0.10	0.10	0.10	0.10	0.1
14	10-Sep-08	-	2.8	0.1	0.7	1	-	-
15	5-Mar-09	-	2.4	2.1	-	-	1.1	-
16	14-Sep-09	0.0	0.0	0.6	0.3	1.7	0.2	0.3
17	5-Mar-10							
18	24-Dec-10	0.10	0.50	0.10	0.10	0.10		0.1
19	5-Mar-11						0.10	
20	14-Sep-11							
21	5-Mar-12		0.50	0.10	0.10	0.10		0.1
22	14-Sep-12							
23	5-Mar-13		0.50	0.10	0.10	0.10		0.1
24	9-Dec-13	0.10	0.50	0.10	0.10	0.10	0.10	0.1
25	22-Apr-14	0.10						
26	5-Mar-15	0.10		0.10		0.10		
27	2-Nov-15		0.50		0.10		0.1	0.1
28	15-Apr-16	0.10	0.50	0.10	0.10		0.1	0.1
29	2-Nov-16							
30	13-Apr-17	0.10		0.10	0.10	0.10	0.1	0.1
31	2-Nov-17							
32	11-May-18	0.10	0.50	0.10		0.10	0.1	0.1
33	2-Nov-18							
34	11-Jul-19	0.51	0.50	0.10	0.10	0.10	0.1	0.1
35	1-Nov-19							
36	1-Jul-20	0.10	0.50	0.10	0.10	0.10	0.1	0.1
37	1-Nov-20							
38	1-Apr-21	0.10	0.86	0.10	0.10	0.10	0.1	0.1
39	06-Jul-22	0.10	0.10	0.10	0.10			1.50
40	13-Oct-23	0.10		0.10	0.10	0.10	0.10	0.10
Coefficient of Variation:		1.02	1.52	2.56	0.95	1.38	1.37	1.50
Mann-Kendall Statistic (S):		-3	-22	-22	-24	-40	-18	-20
Confidence Factor:		52.4%	72.1%	69.7%	73.9%	83.1%	68.2%	70.2%
Concentration Trend:		No Trend	No Trend	No Trend	Stable	No Trend	No Trend	No Trend



Notes:

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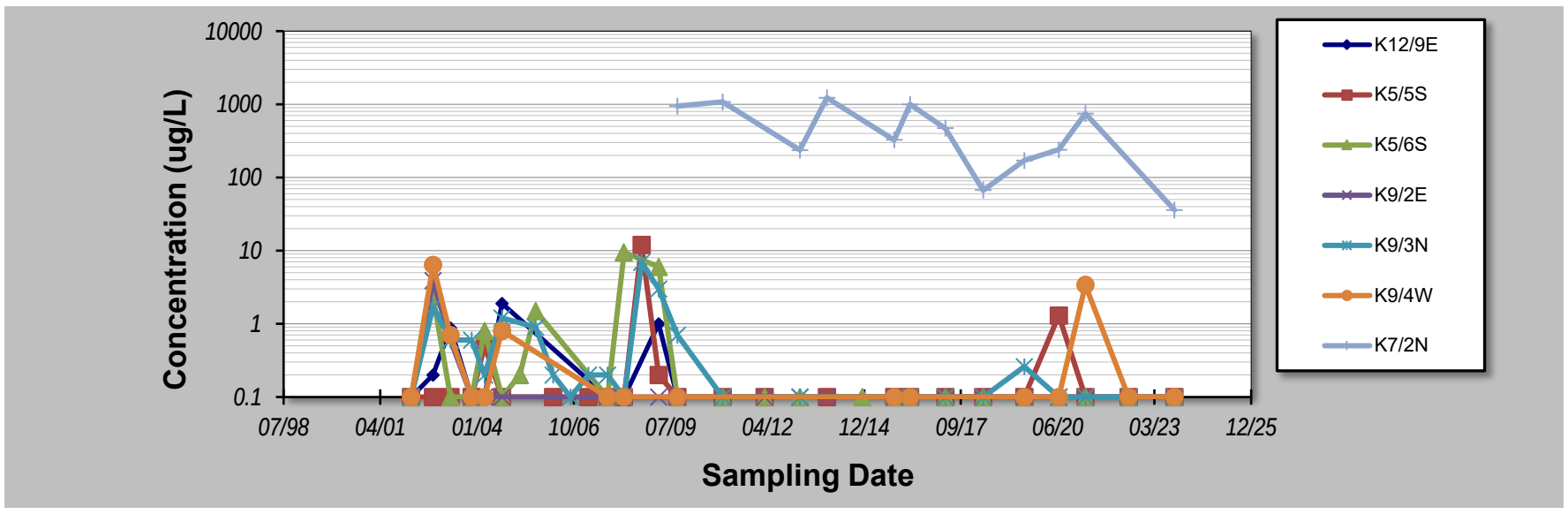
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Total PAHs**
Concentration Units: **ug/L**

Sampling Point ID:	K12/9E	K5/5S	K5/6S	K9/2E	K9/3N	K9/4W	K7/2N
Sampling Event	Sampling Date	TOTAL PAHS CONCENTRATION (ug/L)						
1	4-Mar-02	0.10	0.10	0.10	0.10	0.10	0.10	
2	14-Oct-02	0.2	0.1	2.4	3.9	1.7	6.4	
3	15-Apr-03	0.88	0.1	0.1	0.6	0.6	0.7	
4	17-Nov-03	0.1	0.1	0.1	0.1	0.6	0.1	
5	31-Mar-04	0.1	0.5	0.8	0.1	0.2	0.1	
6	27-Sep-04	1.9	0.1	0.1	0.1	1.2	0.8	
7	31-Mar-05			0.2		-		
8	12-Sep-05			1.5		0.9		
9	9-Mar-06		0.1			0.2		
10	6-Sep-06					0.1		
11	9-Mar-07		0.1			0.2		
12	22-Sep-07	0.1	0.1	0.1	0.1	0.2	0.1	
13	11-Mar-08	0.1	0.1	9.5	0.1	0.1	0.1	
14	10-Sep-08		11.9			6.9		
15	5-Mar-09	1	0.2	5.98	0.1	3		
16	14-Sep-09	0.1	0.1	0.1	0.1	0.7	0.1	945.6
17	5-Mar-10							
18	24-Dec-10	0.1	0.1	0.1	0.1	0.1		1074.27
19	5-Mar-11							
20	14-Sep-11							
21	5-Mar-12	0.1	0.1	0.1	0.1			
22	14-Sep-12							
23	5-Mar-13	0.1		0.1	0.1	0.1		236
24	9-Dec-13	0.1	0.1		0.1			1230
25	22-Apr-14							
26	9-Dec-14			0.1				
27	2-Nov-15	0.1	0.1	0.1	0.1		0.1	326
28	15-Apr-16	0.1	0.1	0.1	0.1	0.1	0.1	1000
29	2-Nov-16							
30	13-Apr-17	0.1	0.1	0.1	0.1	0.1		470
31	2-Nov-17							
32	11-May-18	0.1	0.1	0.1	0.1	0.1		67
33	2-Nov-18							
34	11-Jul-19	0.1	0.1	0.1	0.1	0.26	0.1	170
35	1-Nov-19							
36	1-Jul-20	0.1	1.3	0.1	0.1	0.1	0.1	240
37	1-Nov-20							
38	1-Apr-21	0.10	0.1	0.1	0.1	0.1	3.4	750
39	22-Jun-22		0.1	0.1	0.1	0.1	0.1	
40	09-Oct-23		0.1	0.1	0.1	0.1	0.1	36.00
Coefficient of Variation:		**1.67**	**3.69**	**2.46**	**2.77**	**2.03**	**2.19**	**0.79**
Mann-Kendall Statistic (S):		**-44**	**-4**	**-65**	**-39**	**-103**	**-18**	**-26**
Confidence Factor:		**90.2%**	**52.8%**	**93.2%**	**84.0%**	**99.2%**	**77.5%**	**95.7%**
Concentration Trend:		Prob. Decreasing	No Trend	Prob. Decreasing	No Trend	Decreasing	No Trend	Decreasing



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
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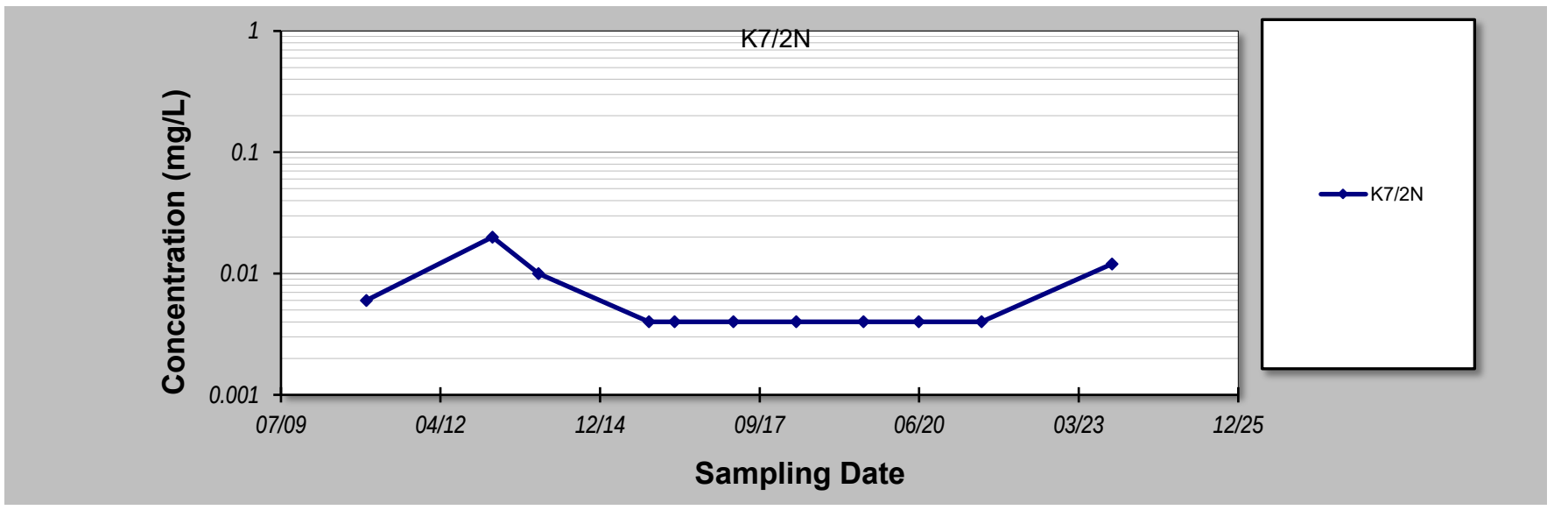
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **21-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **WAD Cyanide**
Concentration Units: **mg/L**

Sampling Point ID: **K7/2N**

Sampling Event	Sampling Date	WAD CYANIDE CONCENTRATION (mg/L)
1	23-Dec-10	0.006
2	5-Mar-11	
3	14-Sep-11	
4	5-Mar-12	
5	14-Sep-12	
6	21-Feb-13	0.02
7	5-Dec-13	0.01
8	22-Apr-14	
9	9-Dec-14	
10	5-Mar-15	
11	29-Oct-15	0.004
12	8-Apr-16	0.004
13	2-Nov-16	
14	10-Apr-17	0.004
15	2-Nov-17	
16	9-May-18	0.004
17	2-Nov-18	
18	5-Jul-19	0.004
19	1-Nov-19	
20	15-Jun-20	0.004
21	1-Nov-20	
22	14-Jul-21	0.004
23	10-Oct-23	0.01
24		
25		
Coefficient of Variation:		0.75
Mann-Kendall Statistic (S):		-12
Confidence Factor:		79.9%
Concentration Trend:		Stable



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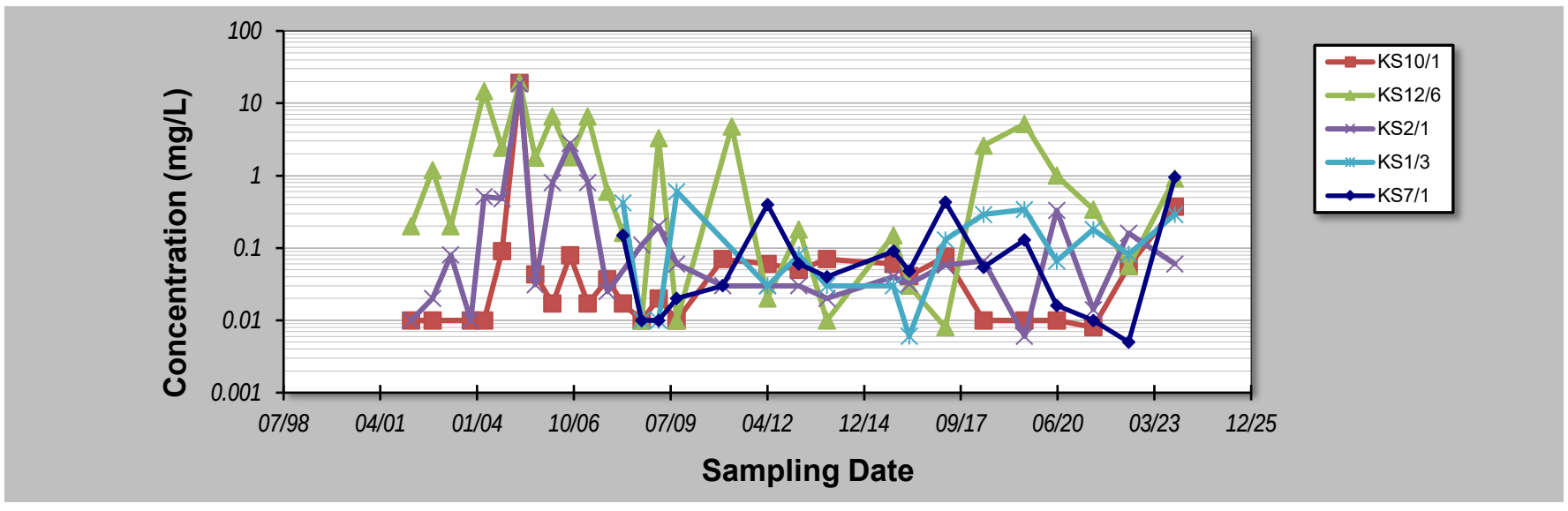
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Ammonia**
Concentration Units: **mg/L**

Sampling Point ID:	KS10/1	KS12/6	KS2/1	KS1/3	KS7/1		
Sampling Event	Sampling Date	AMMONIA CONCENTRATION (mg/L)						
1	04-Mar-02	0.01	0.2	0.01				
2	10-Oct-02	0.01	1.19	0.02				
3	16-Apr-03		0.2	0.08				
4	10-Nov-03	0.01		0.01				
5	25-Mar-04	0.01	14.6	0.51				
6	27-Sep-04	0.09	2.42	0.48				
7	29-Mar-05	19.1	19.3	18.6				
8	07-Sep-05	0.043	1.77	0.031				
9	03-Mar-06	0.017	6.56	0.8				
10	01-Sep-06	0.079	1.8	2.76				
11	03-Mar-07	0.017	6.56	0.8				
12	21-Sep-07	0.037	0.598	0.025				
13	29-Feb-08	0.017	0.162		0.42	0.15		
14	11-Sep-08	0.01	0.01	0.11	0.01	0.01		
15	03-Mar-09	0.02	3.29	0.2	0.01	0.01		
16	07-Sep-09	0.01	0.01	0.06	0.6	0.02		
17	01-Apr-10							
18	24-Dec-10	0.07		0.03		0.03		
19	01-Apr-11		4.8					
20	01-Sep-11							
21	03-Apr-12	0.06	0.02	0.03	0.03	0.4		
22	01-Sep-12							
23	21-Feb-13	0.05	0.18	0.03	0.08	0.06		
24	06-Dec-13	0.07	0.01	0.02	0.03	0.04		
25	26-Oct-15	0.06	0.15	0.04	0.03	0.09		
26	05-Apr-16	0.041	0.03	0.032	0.006	0.048		
27	01-Sep-16							
28	13-Apr-17	0.076	0.008	0.058	0.13	0.43		
29	01-Sep-17							
30	16-May-18	0.01	2.6	0.066	0.29	0.054		
31	01-Sep-18							
32	12-Jul-19	0.01	5.2	0.006	0.34	0.13		
33	01-Sep-19							
34	09-Jun-20	0.01	1	0.33	0.066	0.016		
35	01-Sep-20							
36	21-Jun-21	0.008	0.34	0.014	0.18	0.01		
37	20-Jun-22	0.056	0.056	0.16	0.082	0.005		
38	12-Oct-23	0.37	0.92	0.06	0.29	0.95		
39								
40								
Coefficient of Variation:		**4.95**	**1.72**	**3.87**	**1.09**	**1.69**		
Mann-Kendall Statistic (S):		**25**	**-85**	**-27**	**25**	**11**		
Confidence Factor:		**68.1%**	**95.1%**	**69.5%**	**85.7%**	**65.7%**		
Concentration Trend:		No Trend	Decreasing	No Trend	No Trend	No Trend		



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3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

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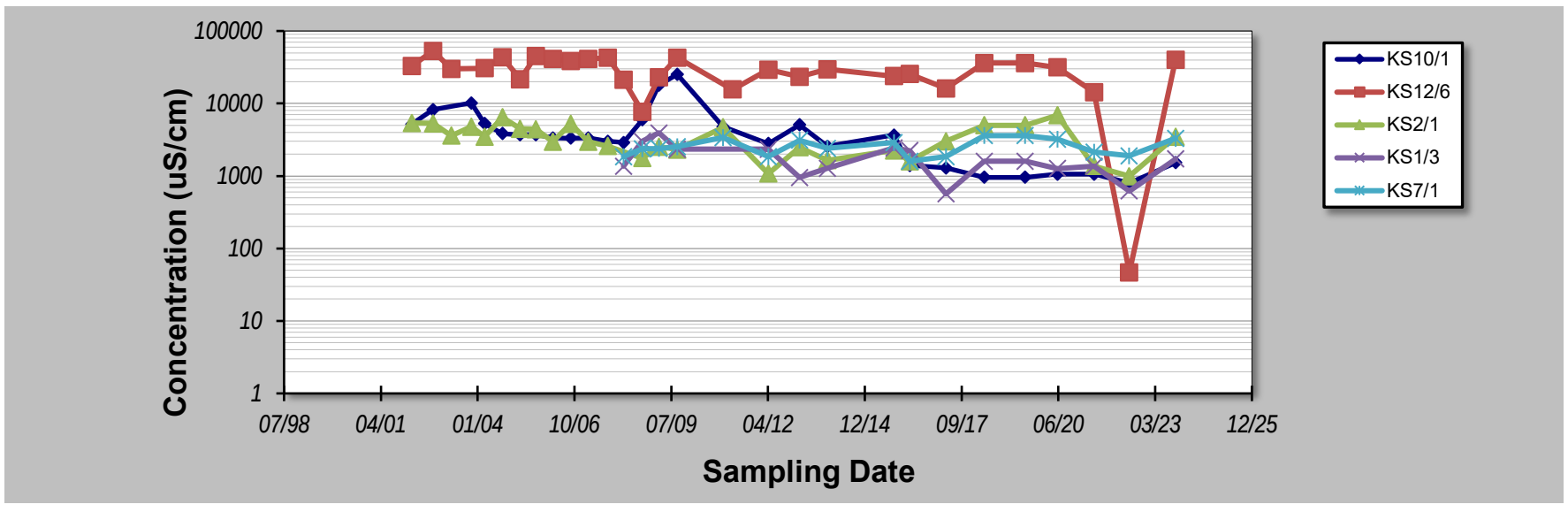
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **EC**
Concentration Units: **uS/cm**

Sampling Point ID:	KS10/1	KS12/6	KS2/1	KS1/3	KS7/1		
Sampling Event	Sampling Date	EC CONCENTRATION (uS/cm)						
1	04-Mar-02	5200	33000	5400				
2	10-Oct-02	8200	53000	5300				
3	16-Apr-03		30000	3600				
4	10-Nov-03	10130		4790				
5	25-Mar-04	5280	30600	3490				
6	27-Sep-04	3850	43200	6440				
7	29-Mar-05	3690	21600	4460				
8	07-Sep-05	3720	45200	4420				
9	03-Mar-06	3350	41000	2960				
10	01-Sep-06	3330	38400	5250				
11	03-Mar-07	3350	41000	2960				
12	21-Sep-07	3000	42900	2582				
13	29-Feb-08	2890	21150		1368	1850		
14	11-Sep-08	5950	7700	1765	3000	2380		
15	03-Mar-09	17930	22870	2540	3940	2390		
16	07-Sep-09	25200	42900	2319	2334	2530		
17	01-Apr-10							
18	24-Dec-10	4800		4700		3400		
19	01-Apr-11		15600					
20	01-Sep-11							
21	03-Apr-12	2800	29300	1080	2340	1850		
22	01-Sep-12							
23	21-Feb-13	5070	23400	2490	950	3110		
24	06-Dec-13	2560	29700	1650	1280	2400		
25	26-Oct-15	3670	23883	2260	2430	2890		
26	05-Apr-16	1400	25500	1600	2235	1600		
27	01-Sep-16							
28	13-Apr-17	1297	16114	3002	565	1845		
29	01-Sep-17							
30	16-May-18	960	36000	5000	1600	3601		
31	01-Sep-18							
32	12-Jul-19	960	36000	5000	1600	3601		
33	01-Sep-19							
34	09-Jun-20	1064	31480	6890	1269	3228		
35	01-Sep-20							
36	21-Jun-21	1064	14335	1369	1368	2130		
37	20-Jun-22	801	46.7	994	621	1894		
38	12-Oct-23	1524	40013	3468	1720	3301		
39								
40								
Coefficient of Variation:		**1.12**	**0.41**	**0.47**	**0.50**	**0.26**		
Mann-Kendall Statistic (S):		**-217**	**-99**	**-132**	**-40**	**24**		
Confidence Factor:		**>99.9%**	**97.4%**	**99.6%**	**96.1%**	**82.6%**		
Concentration Trend:		Decreasing	Decreasing	Decreasing	Decreasing	No Trend		



Notes:

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3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

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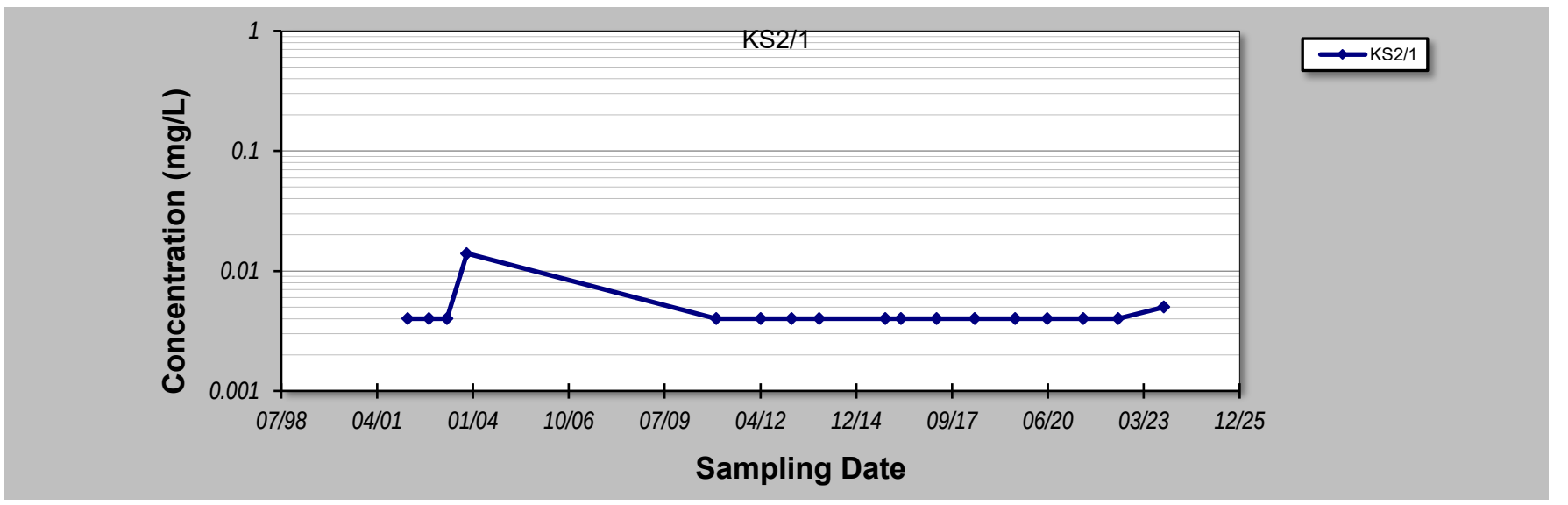
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Free cyanide**
Concentration Units: **mg/L**

Sampling Point ID: **KS2/1**

Sampling Event	Sampling Date	FREE CYANIDE CONCENTRATION (mg/L)
1	04-Mar-02	0.004
2	10-Oct-02	0.004
3	16-Apr-03	0.004
4	10-Nov-03	0.014
5	25-Mar-04	
6	24-Dec-10	0.004
7	01-Apr-11	
8	01-Sep-11	
9	03-Apr-12	0.004
10	01-Sep-12	
11	21-Feb-13	0.004
12	06-Dec-13	0.004
13	01-Apr-14	
14	01-Sep-14	
15	01-Apr-15	
16	26-Oct-15	0.004
17	05-Apr-16	0.004
18	01-Sep-16	
19	13-Apr-17	0.004
20	01-Sep-17	
21	16-May-18	0.004
22	01-Sep-18	
23	12-Jul-19	0.004
24	01-Sep-19	
25	09-Jun-20	0.004
26	01-Sep-20	
27	21-Jun-21	0.004
28	20-Jun-22	0.004
29	09-Oct-23	0.005
30		
Coefficient of Variation:		**0.52**
Mann-Kendall Statistic (S):		**5**
Confidence Factor:		**56.4%**
Concentration Trend:		No Trend



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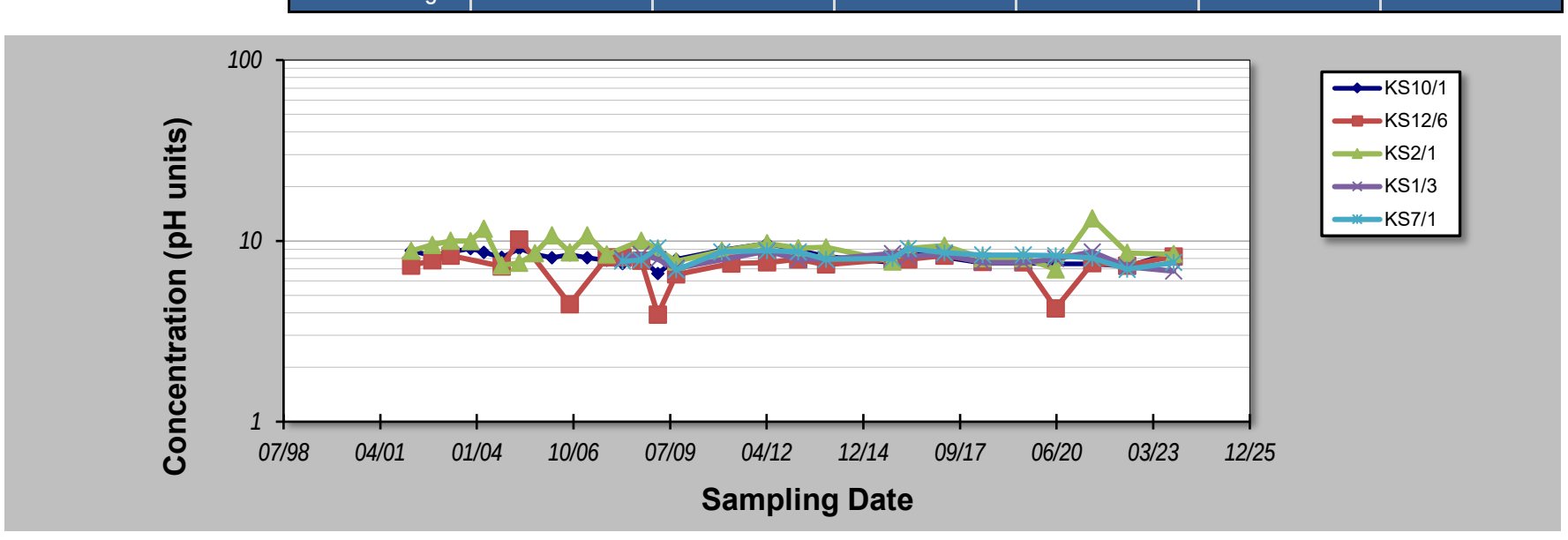
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **pH**
Concentration Units: **pH units**

Sampling Point ID:	KS10/1	KS12/6	KS2/1	KS1/3	KS7/1		
Sampling Event	Sampling Date	PH CONCENTRATION (pH units)						
1	04-Mar-02	8.8	7.3	8.8				
2	10-Oct-02	8.3	7.8	9.5				
3	16-Apr-03		8.3	10.0				
4	10-Nov-03	9.1		10.0				
5	25-Mar-04	8.6		11.7				
6	27-Sep-04	8.1	7.2	7.3				
7	29-Mar-05	9.1	10.2	7.6				
8	07-Sep-05	8.4		8.5				
9	03-Mar-06	8.1		10.8				
10	01-Sep-06	8.4	4.5	8.7				
11	03-Mar-07	8.1		10.8				
12	21-Sep-07	7.8	8.1	8.4				
13	29-Feb-08	7.5	8.1		8.0	7.7		
14	11-Sep-08	8.0	7.8	10.0	8.4	7.8		
15	03-Mar-09	6.6	3.9	9.0	7.9	9.2		
16	07-Sep-09	7.9	6.5	7.7	7.1	6.9		
17	01-Apr-10							
18	24-Dec-10	8.9		8.8		8.7		
19	01-Apr-11		7.5					
20	01-Sep-11							
21	03-Apr-12	9.68	7.6	9.7	8.8	8.8		
22	01-Sep-12							
23	21-Feb-13	8.9	7.9	9.1	7.9	8.7		
24	06-Dec-13	8.2	7.4	9.2	7.9	7.9		
25	26-Oct-15	7.6	7.9	7.7	8.5	8.0		
26	05-Apr-16	8.91	7.9	9.1	8.2	9.1		
27	01-Sep-16							
28	13-Apr-17	8.12	8.3	9.4	8.5	8.6		
29	01-Sep-17							
30	16-May-18	7.54	7.65	8.04	7.59	8.35		
31	01-Sep-18							
32	12-Jul-19	7.54	7.62	8.04	7.59	8.35		
33	01-Sep-19							
34	09-Jun-20	7.48	4.24	6.97	7.96	8.3		
35	01-Sep-20							
36	21-Jun-21	7.48	7.51	13.3	8.68	8.03		
37	20-Jun-22	7.23	7.31	8.57	7.2	6.96		
38	12-Oct-23	8.6	8.2	8.44	6.8	7.6		
39								
40								
Coefficient of Variation:		**0.08**	**0.19**	**0.15**	**0.07**	**0.08**		
Mann-Kendall Statistic (S):		**-132**	**-9**	**-56**	**-23**	**-22**		
Confidence Factor:		**99.6%**	**57.8%**	**86.0%**	**83.6%**	**80.4%**		
Concentration Trend:		Decreasing	Stable	Stable	Stable	Stable		



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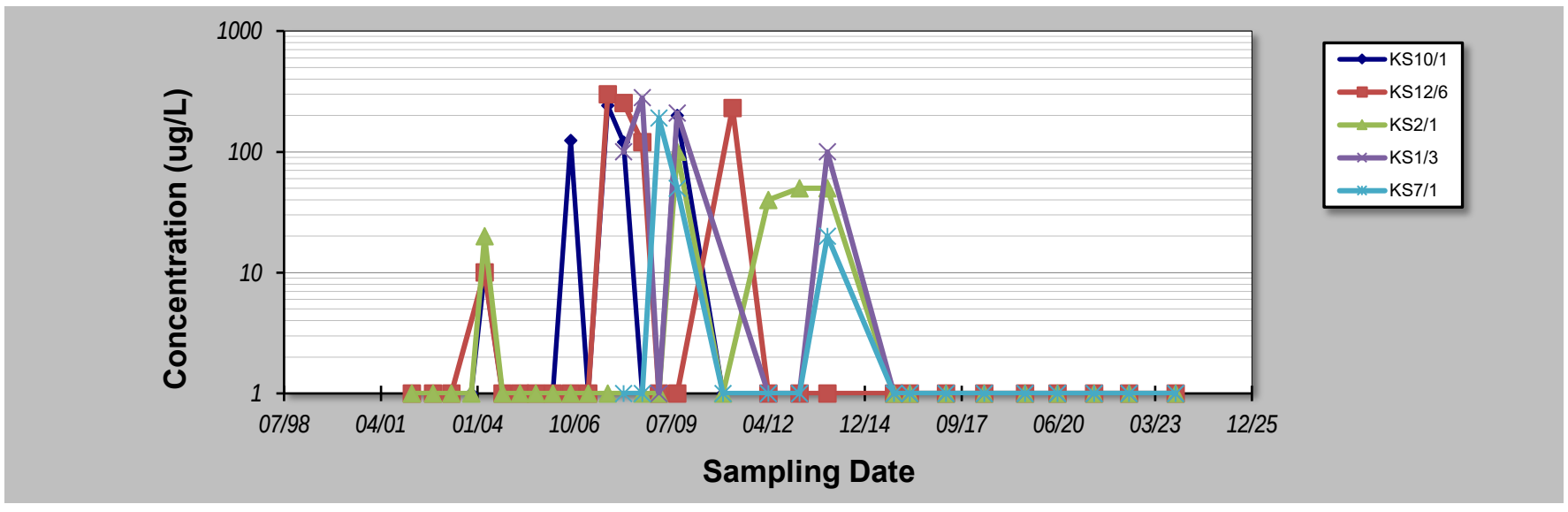
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Phenols**
Concentration Units: **ug/L**

Sampling Point ID:	KS10/1	KS12/6	KS2/1	KS1/3	KS7/1		
Sampling Event	Sampling Date	PHENOLS CONCENTRATION (ug/L)						
1	04-Mar-02	1	1	1				
2	10-Oct-02	1	1	1				
3	16-Apr-03		1	1				
4	10-Nov-03	1		1				
5	25-Mar-04	10	10	20				
6	27-Sep-04	1	1	1				
7	29-Mar-05	1	1	1				
8	07-Sep-05	1	1	1				
9	03-Mar-06	1	1	1				
10	01-Sep-06	124	1	1				
11	03-Mar-07	1	1	1				
12	21-Sep-07	241	299	1				
13	29-Feb-08	120.000	254		100	1		
14	11-Sep-08	1	120	1	280	1		
15	03-Mar-09	1	1	1	1	190		
16	07-Sep-09	200	1	100	210	50		
17	01-Apr-10							
18	24-Dec-10	1		1		1		
19	01-Apr-11		230					
20	01-Sep-11							
21	03-Apr-12	1	1	40	1	1		
22	01-Sep-12							
23	21-Feb-13	1	1	50	1	1		
24	06-Dec-13	1	1	50	100	20		
25	26-Oct-15	1	1	1	1	1		
26	05-Apr-16	1	1	1	1	1		
27	01-Sep-16							
28	13-Apr-17	1	1	1	1	1		
29	01-Sep-17							
30	16-May-18	1	1	1	1	1		
31	01-Sep-18							
32	12-Jul-19	1	1	1	1	1		
33	01-Sep-19							
34	09-Jun-20	1	1	1	1	1		
35	01-Sep-20							
36	21-Jun-21	1	1	1	1	1		
37	20-Jun-22	1	1	1	1	1		
38	12-Oct-23	1	1	1	1	1		
39								
40								
Coefficient of Variation:		2.48	2.51	2.27	1.97	2.89		
Mann-Kendall Statistic (S):		-39	-33	6	-41	-27		
Confidence Factor:		77.2%	73.5%	53.9%	96.5%	85.6%		
Concentration Trend:		No Trend	No Trend	No Trend	Decreasing	No Trend		



Notes:

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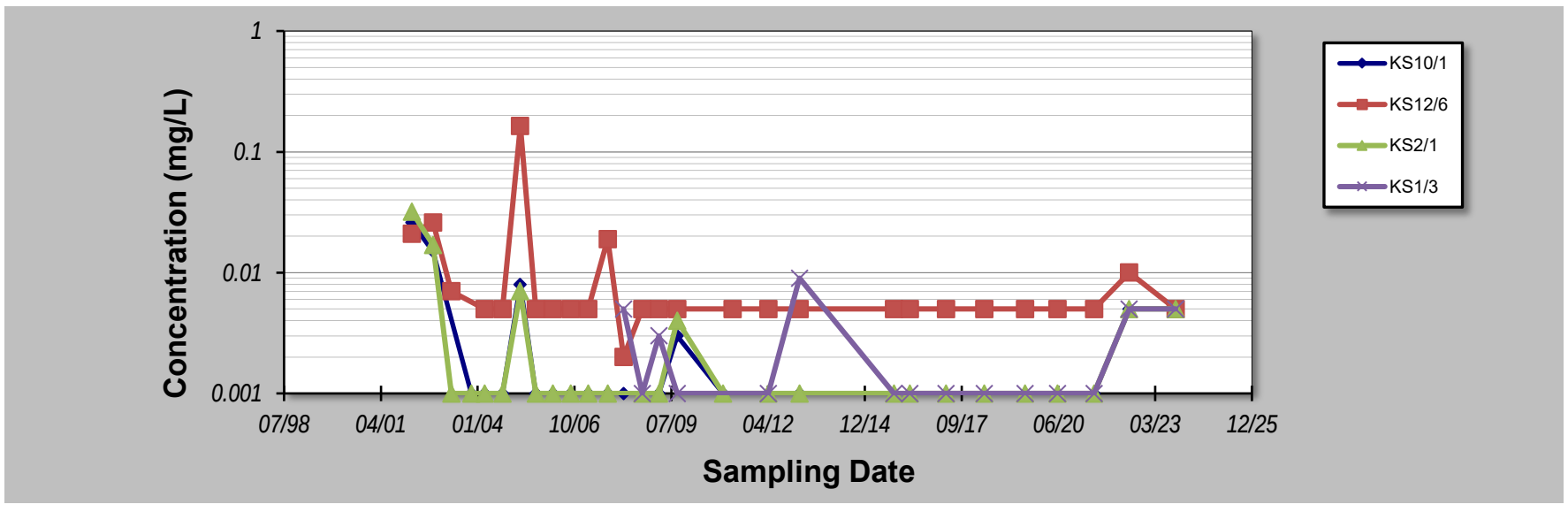
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Total Cr**
Concentration Units: **mg/L**

Sampling Point ID:	KS10/1	KS12/6	KS2/1	KS1/3			
Sampling Event	Sampling Date	TOTAL CR CONCENTRATION (mg/L)						
1	04-Mar-02	0.026	0.021	0.032				
2	10-Oct-02	0.015	0.026	0.017				
3	16-Apr-03		0.007	0.001				
4	10-Nov-03	0.001		0.001				
5	25-Mar-04	0.001	0.005	0.001				
6	27-Sep-04	0.001	0.005	0.001				
7	29-Mar-05	0.008	0.164	0.007				
8	07-Sep-05	0.001	0.005	0.001				
9	03-Mar-06	0.001	0.005	0.001				
10	01-Sep-06	0.001	0.005	0.001				
11	03-Mar-07	0.001	0.005	0.001				
12	21-Sep-07	0.001	0.019	0.001				
13	29-Feb-08	0.001	0.002		0.005			
14	11-Sep-08	0.001	0.005	0.001	0.001			
15	03-Mar-09	0.001	0.005	0.001	0.003			
16	07-Sep-09	0.003	0.005	0.004	0.001			
17	01-Apr-10							
18	24-Dec-10	0.001		0.001				
19	01-Apr-11		0.005					
20	01-Sep-11							
21	03-Apr-12	0.001	0.005	0.001	0.001			
22	01-Sep-12							
23	21-Feb-13	0.001	0.005	0.001	0.009			
24	26-Oct-15	0.001	0.005	0.001	0.001			
25	05-Apr-16	0.001	0.005	0.001	0.001			
26	01-Sep-16							
27	13-Apr-17	0.001	0.005	0.001	0.001			
28	01-Sep-17							
29	16-May-18	0.001	0.005	0.001	0.001			
30	01-Sep-18							
31	12-Jul-19	0.001	0.005	0.001	0.001			
32	01-Sep-19							
33	09-Jun-20	0.001	0.005	0.001	0.001			
34	01-Sep-20							
35	21-Jun-21	0.001	0.005	0.001	0.001			
36	20-Jun-22	0.005	0.01	0.005	0.005			
37	12-Oct-23	0.005	0.005	0.005	0.005			
38								
39								
40								
Coefficient of Variation:		1.79	2.38	1.97	0.99			
Mann-Kendall Statistic (S):		-24	-65	-22	-1			
Confidence Factor:		68.3%	90.8%	66.8%	50.0%			
Concentration Trend:		No Trend	Prob. Decreasing	No Trend	Stable			



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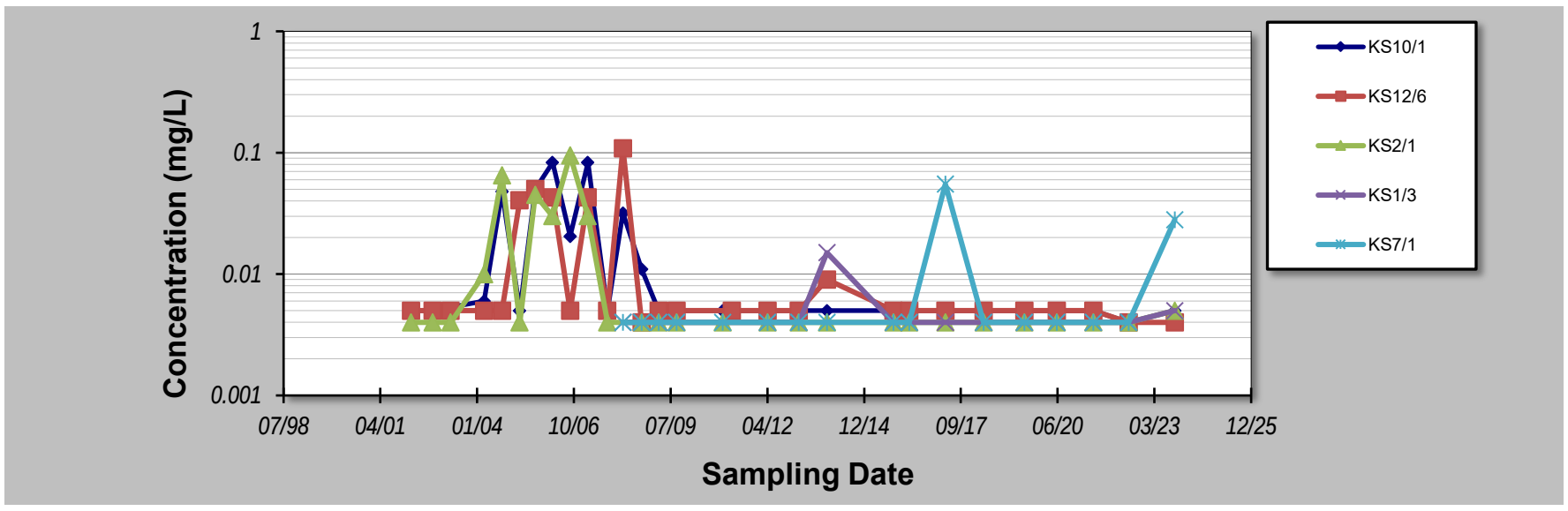
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Total Cyanide**
Concentration Units: **mg/L**

Sampling Point ID:	KS10/1	KS12/6	KS2/1	KS1/3	KS7/1		
Sampling Event	Sampling Date	TOTAL CYANIDE CONCENTRATION (mg/L)						
1	04-Mar-02	0.005	0.005	0.004				
2	10-Oct-02	0.005	0.005	0.004				
3	16-Apr-03		0.005	0.004				
4	10-Nov-03							
5	25-Mar-04	0.006	0.005	0.01				
6	27-Sep-04	0.048	0.005	0.065				
7	29-Mar-05	0.005	0.0407	0.004				
8	07-Sep-05	0.05	0.05	0.045				
9	03-Mar-06	0.083	0.043	0.03				
10	01-Sep-06	0.0205	0.005	0.0953				
11	03-Mar-07	0.083	0.043	0.03				
12	21-Sep-07	0.005	0.005	0.004				
13	29-Feb-08	0.0318	0.109		0.004	0.004		
14	11-Sep-08	0.011	0.004	0.004	0.004	0.004		
15	03-Mar-09	0.005	0.005	0.004	0.004	0.004		
16	07-Sep-09	0.005	0.005	0.004	0.004	0.004		
17	01-Apr-10							
18	24-Dec-10	0.005		0.004		0.004		
19	01-Apr-11		0.005					
20	01-Sep-11							
21	03-Apr-12	0.005	0.005	0.004	0.004	0.004		
22	01-Sep-12							
23	21-Feb-13	0.005	0.005	0.004	0.004	0.004		
24	06-Dec-13	0.005	0.009	0.004	0.015	0.004		
25	26-Oct-15	0.005	0.005	0.004	0.004	0.004		
26	05-Apr-16	0.005	0.005	0.004	0.004	0.004		
27	01-Sep-16							
28	13-Apr-17	0.005	0.005	0.004	0.004	0.055		
29	01-Sep-17							
30	16-May-18	0.005	0.005	0.004	0.004	0.004		
31	01-Sep-18							
32	12-Jul-19	0.005	0.005	0.004	0.004	0.004		
33	01-Sep-19							
34	09-Jun-20	0.005	0.005	0.004	0.004	0.004		
35	01-Sep-20							
36	21-Jun-21	0.005	0.005	0.004	0.004	0.004		
37	20-Jun-22	0.004	0.004	0.004	0.004	0.004		
38	12-Oct-23	0.005	0.004	0.005	0.005	0.03		
39								
40								
Coefficient of Variation:		1.46	1.62	1.66	0.58	1.59		
Mann-Kendall Statistic (S):		-119	-83	-60	11	19		
Confidence Factor:		99.4%	94.7%	88.9%	67.1%	76.8%		
Concentration Trend:		Decreasing	Prob. Decreasing	No Trend	No Trend	No Trend		



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

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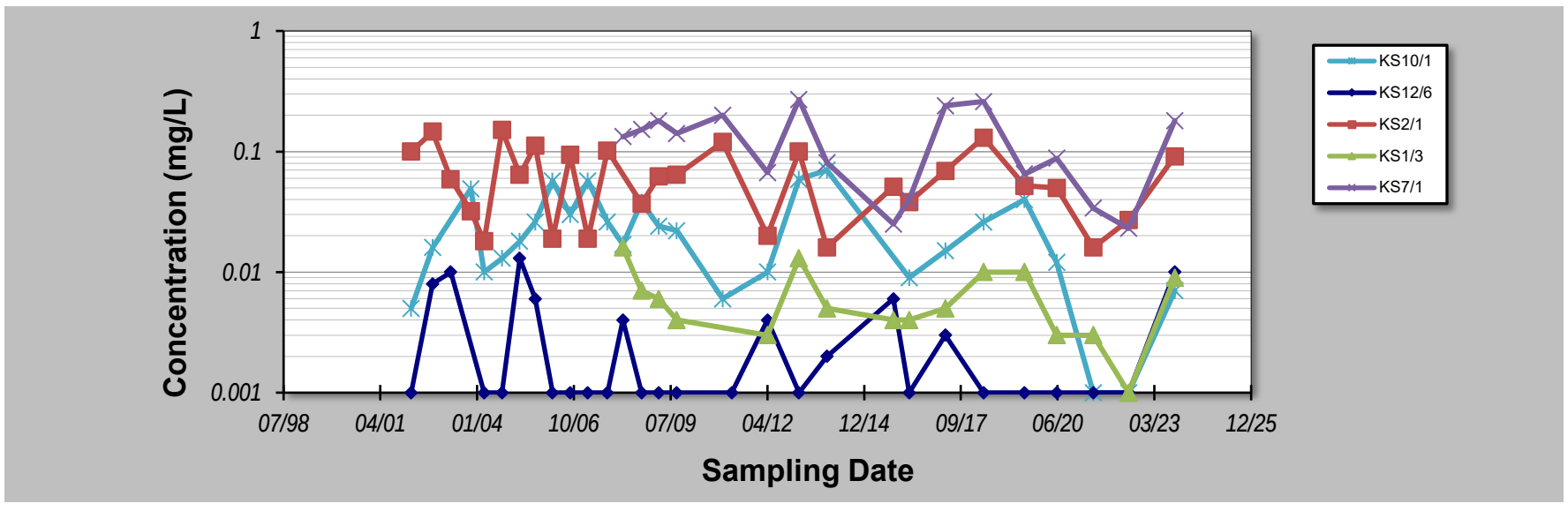
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **22-Nov-23**
Facility Name: **KIWEF**
Conducted By: **Laisly Brito**

Job ID: **12568155**
Constituent: **Total Mo**
Concentration Units: **mg/L**

Sampling Point ID:	KS10/1	KS12/6	KS2/1	KS1/3	KS7/1		
Sampling Event	Sampling Date	TOTAL MO CONCENTRATION (mg/L)						
1	04-Mar-02	0.005	0.001	0.1				
2	10-Oct-02	0.016	0.008	0.146				
3	16-Apr-03		0.01	0.059				
4	10-Nov-03	0.049		0.032				
5	25-Mar-04	0.01	0.001	0.018				
6	27-Sep-04	0.013	0.001	0.151				
7	29-Mar-05	0.018	0.013	0.064				
8	07-Sep-05	0.026	0.006	0.112				
9	03-Mar-06	0.057	0.001	0.019				
10	01-Sep-06	0.03	0.001	0.094				
11	03-Mar-07	0.057	0.001	0.019				
12	21-Sep-07	0.026	0.001	0.102				
13	29-Feb-08	0.017	0.004		0.016	0.133		
14	11-Sep-08	0.038	0.001	0.037	0.007	0.152		
15	03-Mar-09	0.024	0.001	0.062	0.006	0.18		
16	07-Sep-09	0.022	0.001	0.064	0.004	0.141		
17	01-Apr-10							
18	24-Dec-10	0.006		0.12		0.2		
19	01-Apr-11		0.001					
20	01-Sep-11							
21	03-Apr-12	0.01	0.004	0.02	0.003	0.067		
22	01-Sep-12							
23	21-Feb-13	0.059	0.001	0.1	0.013	0.27		
24	06-Dec-13	0.07	0.002	0.016	0.005	0.081		
25	26-Oct-15		0.006	0.051	0.004	0.025		
26	05-Apr-16	0.009	0.001	0.038	0.004	0.04		
27	01-Sep-16							
28	13-Apr-17	0.015	0.003	0.069	0.005	0.24		
29	01-Sep-17							
30	16-May-18	0.026	0.001	0.13	0.01	0.26		
31	01-Sep-18							
32	12-Jul-19	0.04	0.001	0.052	0.01	0.065		
33	01-Sep-19							
34	09-Jun-20	0.012	0.001	0.05	0.003	0.088		
35	01-Sep-20							
36	21-Jun-21	0.001	0.001	0.016	0.003	0.034		
37	20-Jun-22	0.001	0.001	0.027	0.001	0.023		
38	12-Oct-23	0.007	0.01	0.091	0.009	0.18		
39								
40								
Coefficient of Variation:		0.79	1.14	0.63	0.64	0.65		
Mann-Kendall Statistic (S):		-45	-32	-52	-34	-27		
Confidence Factor:		81.9%	72.8%	84.2%	93.0%	85.6%		
Concentration Trend:		Stable	No Trend	Stable	Prob. Decreasing	Stable		



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

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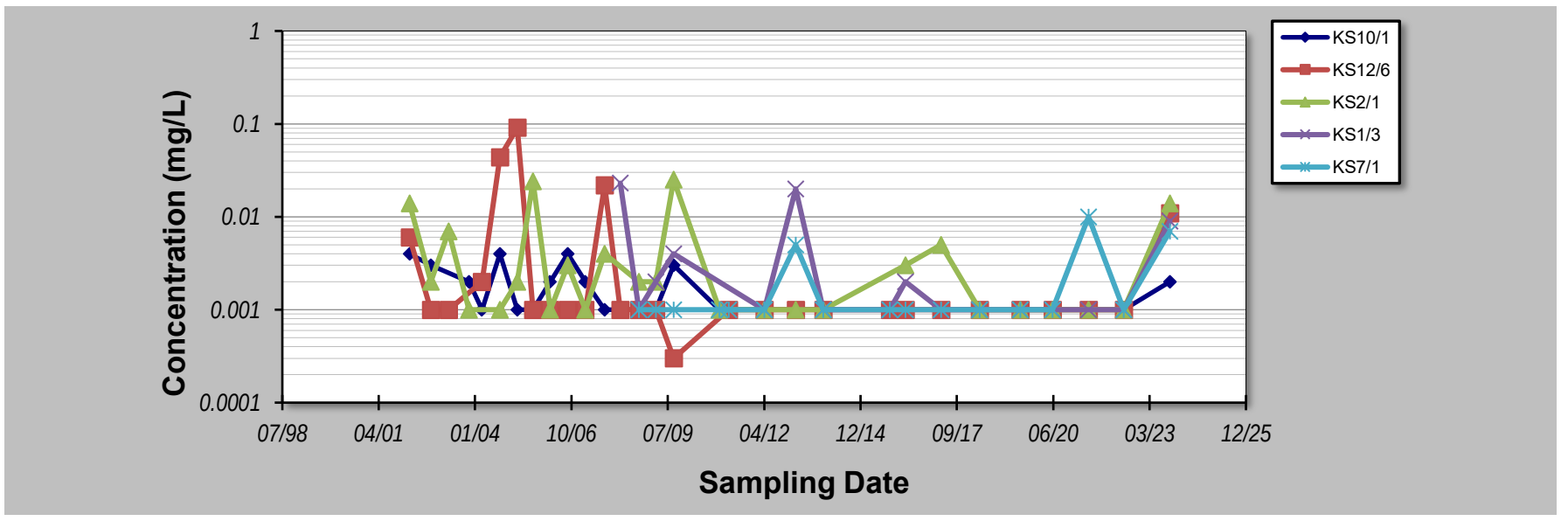
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: z
Facility Name: KIWEF
Conducted By: Laisly Brito

Job ID: 12568155
Constituent: Total Pb
Concentration Units: mg/L

Sampling Point ID:	KS10/1	KS12/6	KS2/1	KS1/3	KS7/1		
Sampling Event	Sampling Date	TOTAL PB CONCENTRATION (mg/L)						
1	04-Mar-02	0.004	0.006	0.014				
2	10-Oct-02	0.003	0.001	0.002				
3	16-Apr-03		0.001	0.007				
4	10-Nov-03	0.002		0.001				
5	25-Mar-04	0.001	0.002	<0.001				
6	27-Sep-04	0.004	0.044	0.001				
7	29-Mar-05	0.001	0.091	0.002				
8	07-Sep-05	0.001	0.001	0.024				
9	03-Mar-06	0.002	0.001	0.001				
10	01-Sep-06	0.004	0.001	0.003				
11	03-Mar-07	0.002	0.001	0.001				
12	21-Sep-07	0.001	0.022	0.004				
13	29-Feb-08	0.001	0.001		0.023			
14	11-Sep-08	0.001	0.001	0.002	0.001	0.001		
15	03-Mar-09	0.001	0.001	0.002	0.002	0.001		
16	07-Sep-09	0.003	0.0003	0.025	0.004	0.001		
17	01-Apr-10							
18	24-Dec-10	0.001		0.001		0.001		
19	01-Apr-11		0.001			0.001		
20	01-Sep-11							
21	03-Apr-12	0.001	0.001	0.001	0.001	0.001		
22	01-Sep-12							
23	21-Feb-13	0.001	0.001	0.001	0.02	0.005		
24	06-Dec-13	0.001	0.001	0.001	0.001	0.001		
25	26-Oct-15		0.001		0.001	0.001		
26	05-Apr-16	0.001	0.001	0.003	0.002	0.001		
27	01-Sep-16							
28	13-Apr-17	0.001	0.001	0.005	0.001	0.001		
29	01-Sep-17							
30	16-May-18	0.001	0.001	0.001	0.001	0.001		
31	01-Sep-18							
32	12-Jul-19	0.001	0.001	0.001	0.001	0.001		
33	01-Sep-19							
34	09-Jun-20	0.001	0.001	0.001	0.001	0.001		
35	01-Sep-20							
36	21-Jun-21	0.001	0.001	0.001	0.001	0.01		
37	20-Jun-22	0.001	0.001	0.001	0.001	0.001		
38	12-Oct-23	0.002	0.011	0.014	0.009	0.007		
39								
40								
Coefficient of Variation:		0.64	2.66	1.49	1.60	1.25		
Mann-Kendall Statistic (S):		-102	-58	-57	-26	25		
Confidence Factor:		98.3%	86.9%	89.0%	86.7%	83.6%		
Concentration Trend:		Decreasing	No Trend	No Trend	No Trend	No Trend		



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
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3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

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Appendix F – KIWEF Area 2 Cap Maintenance Summary (Ecological Australia, 2022)

Suites 28 & 29, Level 7
19 Bolton Street
Newcastle NSW 2300
t: (02) 4064 8421

31 October 2022

Our ref: 20New18055

Jonathon Bourne
Daracon Group
PO Box 401 Beresfield NSW
2322

Dear Jonathon,

18055 Kooragang Island Area 2 Closure Works – Pre-clearance summary report 19th and 20th of October 2022

Daracon undertook vegetation clearing works at Kooragang Island Area 2 requiring of the removal and mulching of *Acacia saligna* (Golden Wreath Wattle) trees located in several locations around the Kooragang Islands Area 2 Closure Works area (see Figure 1 below). Ecologists were present to undertake Green and Golden Bell Frog (GGBF) pre-clearance surveys on each day prior to the commencement of clearing works and then for the duration of the works (Table 1).

Table 1: Summary of GGBF located on the 19th and 20th of October

Ecologist	19/10	20/10	
Brea Heidke	0		
Melanie Thurtell	0	0	
Julian Carson		0	
		Number of GGBF relocated	0

No GGBF were encountered in the works area on either day and no frogs of any type were seen. One *Chelodina longicollis* (Eastern Long-necked Turtle) was found on the 20th of October and relocated to a suitable water body immediately adjacent to but outside the works area. On the 19th of October *Acanthiza lineata* (Striated Thornbills) were seen in the works area, but no nests were seen and the birds relocated themselves outside of the area of works.

Figure 1. Location of vegetation clearing works for the 19th and 20th of October, 2022

Please contact me if you have any questions regarding this report.

Regards,

Frank Lemckert
Principal Ecologist

Appendix G – KIWEF Area 2 Biannual Cap Inspections – Quarter 4 2022 (HCCDC, 2022)

KIWEF Cap Inspection Report

Kooragang Island Waste Emplacement Facility, Area 2 (K3, K5 and K7)

EF18/46502_08.2

Revision 1

19 December 2022

Document history and status

Revision	Date	Description	By	Checked	Approved
0	19 December 2022	Final	G. Moylan	M. Bardsley	M. Bardsley

NSW GOVERNMENT | Hunter & Central Coast Development Corporation

Hunter & Central Coast Development Corporation

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1. Introduction

1.1 Background

Hunter & Central Coast Development Corporation (HCCDC) is the NSW State Government agent tasked with the remediation of the Kooragang Island Waste Emplacement Facility (KIWEF). The KWIEF is a 179 hectare site located on the western portion of Kooragang Island, approximately 7km north of Newcastle's City Centre. The closure of the KIWEF was approved by the NSW EPA, in accordance with the conditions of a Notice of Surrender of License issued in 2010.

1.2 Purpose

This cap inspection report has been prepared to satisfy the conditions 4j and 4k of the Notice of Surrender of License (Notice 1111840, as varied under notices N1510956 and N1520063) for KIWEF Area 2 – K3, K5 and K7 (refer to Figure 1); and requires the following:

4j) At the completion of the final cap, the licensee shall undertake inspections of the cap, on a six (6) monthly basis, to detect and remediate areas where the cap has eroded, degraded or slumped.

4k) The licensee shall provide the EPA with a written statement of the results of the inspection required by condition 4(j) on an annual basis. The statement must describe the condition of the cap and any actions taken to remediate the cap as a result of the inspection. The first statement must be provided to the EPA by 30 September 2013 with subsequent reports provided 12 monthly following the provision of the first report.

1.3 Subject Site

Area 2 – K3, K5 and K7 as defined under the Surrender Notice occupies an area of approximately 31 hectares. The Closure Works for Area 2 were completed by Daracon Pty Ltd (Daracon) in June 2020, with the maintenance period extending through until September 2020. The first capping inspection report was prepared by Daracon at the completion of the maintenance period in October 2020. Subsequent biannual inspections and reports were prepared by HCCDC.

1.4 Methodology

HCCDC personnel undertook the following tasks in the preparation of this Area 2 Cap Inspection Report:

- Review of previous cap inspection reports;
- Completion of a site inspection of Area 2;
- Compilation of photo survey of Area 2;
- Preparation of a report detailing the following:
    - the status of previously identified issues;
    - newly identified issues;
    - recommended rectification measures; and
    - the locations of the rectification issues identified.

Figure 1: KIWEF Closure Works Area's.

2. Previous Inspections

The preliminary cap inspection report for Area 2 was prepared by Daracon in October 2020, subsequent inspections were completed by HCCDC in June 2021, December 2021 and July 2022. The latest inspection identified the following issues that required rectification works.

ID	Area	Issue	Work Undertaken
A2-01	Low Area & Pond 5	Areas of sparse vegetation	Continued observation
A2-04	Site Wide	Shrub Growth on Cap	Issue identified
A2-08	Basin SB01 SB02 & SB03	Weed growth around basin edge	Issue Identified

A summary of the current status of each rectification issue is provided in Section 4.

3. Condition Inspection

3.1 Inspection Details

Date of Inspection: 6 December 2022
Area of Inspection: KIWEF, Area 2, K3, K5 and K7
Inspection ID: Round 5
Inspected by: Grant Moylan (HCCDC)

3.2 Photo Survey

A map showing the indicative location and direction of each photo is included in Figure 2.

ID	Photo	Comment	Rectification
1		Cell 7 Good vegetation coverage. Shrub growth present along the drainage line. In accordance with GGBF movement corridors, drainage lines can allow for shrub growth (2m either side).	
2		Cell 7 Good vegetation coverage. Shrub growth present along the drainage line/ transition slope. In accordance with GGBF movement corridors, can allow for shrub growth (2m either side). Shrubs removed from area between drainage and transition slope. Issue closed (Ref: A2-04) following removal of shrub growth from cap.	
3		Cell 7 drainage drop structure Good vegetation coverage. Drainage line appears stable. Some shrub growths on the embankment are to remain to stabilise and reduce erosion of banks and provide GGBF movement corridors.	

ID	Photo	Comment	Rectification
4		Eastern Cap (Pond 5) Previously identified areas with sparse vegetation coverage[1] (Issue Ref: A2-01) on Pond 5 has continued to improve. Inspection shows greater than 50% coverage. Issue (Ref: A2-01) has now been closed following achievement of vegetation coverage targets.	
5		Eastern Cap (Pond 5) Previously identified areas with sparse vegetation coverage (Issue Ref: A2-01) on Pond 5 has continued to improve. Inspection shows greater than 50% coverage. Issue (Ref: A2-01) has now been closed following achievement of vegetation coverage targets.	
6		Eastern Cap (Pond 5) Southern Cap Good vegetation coverage. Shrub growth has now been removed from capped during maintenance works. Issue (Ref: A2-04) has been closed following removal of shrub growth from cap.	
7		Eastern Cap (Pond 5) Good vegetation coverage. Shrub growth has now been removed from capped during maintenance works. Issue (Ref: A2-04) has been closed following removal of shrub growth from cap.	

[1] Sparse coverage is defined within the Area 2 Closure Works, Preliminary Documentation Package (Appendix 8 – Revegetation Management Plan) as areas of greater than 10m^2 with less than 50% coverage.

ID	Photo	Comment	Rectification
8		Eastern Cap (Cell 3) Good vegetation coverage. Shrub growth has now been removed from capped during maintenance works. Issue (Ref: A2-04) has been closed following removal of shrub growth from cap.	
9		Eastern Embankment No signs of erosion/slippage at southern drainage outlet and further vegetation establishment observed.	
10		Southern Cap Good vegetation coverage. Shrub growth has now been removed from capped during maintenance works. Issue (Ref: A2-04) has been closed following removal of shrub growth from cap.	
11		Southern Cap Previously identified areas with sparse vegetation coverage (Issue Ref: A2-01) on south boundary has continued to improve. Inspection shows greater than 50% coverage. Issue (Ref: A2-01) has now been closed following achievement of vegetation coverage targets.	

ID	Photo	Comment	Rectification
12		K3 West Good vegetation coverage. Shrub growth has now been removed from capped during maintenance works. Issue (Ref: A2-04) has been closed following removal of shrub growth from cap.	
13		K3 West Good vegetation coverage. Shrub growth has now been removed from capped during maintenance works. Issue (Ref: A2-04) has been closed following removal of shrub growth from cap.	
14		BOS Cap drainage chute Drainage chute transition from capped area to Deep Pond observed to have good vegetation coverage and no signs of erosion or rills.	
15		Sediment Basin SB02 SB02 appears to be holding water indicating liner is in good condition. Maintenance team removed seed heads from weeds (Pampas Grass) on banks of pond, herbicide not used due to proximity to water. Issue (Ref: A2-08) now closed following removal of seed pods from weed species.	

ID	Photo	Comment	Rectification
16		Sediment Basin SB01 SB01 appears to be holding water indicating liner is in good condition. Maintenance team removed seed heads from weeds (Pampas Grass) on banks of pond, herbicide not used due to proximity to water. Issue (Ref: A2-08) now closed following removal of seed pods from weed species.	
17		SB01 spillway The SB01 spillway appears to be in good working condition. No evidence of erosion or scouring present after recent exceptionally high and persistent rainfall.	
18		BOS Cap Good vegetation coverage. Shrub growth has now been removed from capped during maintenance works. Issue (Ref: A2-04) has been closed following removal of shrub growth from cap.	
19		Sediment Basin SB03 SB03 appears to be holding water indicating liner is in good condition. Maintenance team removed seed heads from weeds (Pampas Grass) on banks of pond, herbicide not used due to proximity to water. Issue (Ref: A2-08) now closed following removal of seed pods from weed species.	

ID	Photo	Comment	Rectification
20		Sediment Basin SB03 Inlet The SB03 inlet appears to be in good working condition. No evidence of erosion or scouring present.	

3.3 General Comments

All the basins appear to be holding water, indicating the liner is in good condition. Following rectification works undertaken by Daracon between August and October 2022 emergent shrub growth has been removed (except for areas classified as GGBF movement corridors) and areas of previously sparse vegetation coverage have shown continued improvement and are no longer classified as sparse under the Area 2 Preliminary Documentation Package trigger levels. Weed species have been observed on banks of ponds in Area 2, the current maintenance activities were unable to spray the weeds due to proximity to the wetlands, works therefore manually removed the seed heads to reduce potential spread of the weeds.

Figure 2: Area 2 Photo Survey – Indicative Location and Directions.

4. Status of Rectification Works

ID	Area	Issue	Work Undertaken	Current Inspection	Work Required	Current Status
A2-01	Low Area & Pond 5	Areas of sparse vegetation	Topsoil spread on cap & reseeded	Continued vegetation coverage, now achieves coverage targets.	None.	Closed – Dec 2022.
A2-02	Eastern Embankment	Guttering has not been installed to Southern drainage outlet.	Observations after significant rainfall demonstrated guttering not required	No signs of road deterioration.	None.	Closed – July 2022
A2-03	Cell 2 and Cell 3	Small areas of ponding observed	Placement of additional topsoil to allow free draining	No signs of ponding observed.	None.	Closed – Dec 2021.
A2-04	Site Wide	Shrub Growth on Cap	Mechanical removal of shrubs	Shrubs removed from cap (GGBF movement corridors still maintained).	None.	Closed – Dec 2022.
A2-05	Basin SB01 SB02 & SB03	Limited vegetation on sides	Topsoil spread on basin embankments & reseeded	Good vegetation coverage around basin embankments	None.	Closed – Dec 2021.
A2-06	Basin SB03 Inlet	Erosion observed at the inlet	Erosion repaired, additional rock installed	No further erosion observed, vegetation establishing in drain.	None.	Closed – Dec 2021.
A2-07	Monitoring Well (Cell 3)	Top of monitoring well has been damaged and monument is missing	Monument installed	Monument installed.	None.	Closed – Dec 2021.
A2-08	Basin SB01 SB02 & SB03	Weed growth around basin edge	Seed heads of weed species removed.	Seed heads removed from weed species.	None.	Closed – Dec 2022.

KIWEF Cap Inspection Report

Kooragang Island Waste Emplacement Facility, Area 2 Wedge (Lot 7)

EF18/46502_08.3

Revision 0

19 December 2022

Document history and status

Revision	Date	Description	By	Checked	Approved
0	19 December 2022	Final	G. Moylan	M. Bardsley	M. Bardsley

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1. Introduction

1.1 Background

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1.2 Purpose

This cap inspection report has been prepared to satisfy the conditions 4j and 4k of the Notice of Surrender of License (Notice 1111840, as varied under notices N1510956 and N1520063) for KIWEF Area 2, Wedge (refer to Figure 1); and requires the following:

4j) At the completion of the final cap, the licensee shall undertake inspections of the cap, on a six (6) monthly basis, to detect and remediate areas where the cap has eroded, degraded or slumped.

4k) The licensee shall provide the EPA with a written statement of the results of the inspection required by condition 4(j) on an annual basis. The statement must describe the condition of the cap and any actions taken to remediate the cap as a result of the inspection. The first statement must be provided to the EPA by 30 September 2013 with subsequent reports provided 12 monthly following the provision of the first report.

1.3 Subject Site

Area 2 – K3, K5 and K7 as defined under the Surrender Notice occupies an area of approximately 31 hectares. The Wedge Area comprises an area of approximately 3 hectares of the total Area 2 area. The Closure Works for Area 2, Wedge were completed by Daracon Pty Ltd (Daracon) in June 2020, with the maintenance period extending through until September 2020. The first capping inspection report was prepared by Daracon at the completion of the maintenance period in October 2020. Subsequent biannual inspections and reports were prepared by HCCDC.

1.4 Methodology

HCCDC personnel undertook the following tasks in the preparation of this Area 2, Wedge Cap Inspection Report:

- Review of previous cap inspection reports;
- Completion of a site inspection of Area 2, Wedge;
- Compilation of photo survey of Area 2, Wedge;
- Preparation of a report detailing the following:
    - the status of previously identified issues;
    - newly identified issues;
    - recommended rectification measures; and
    - the locations of the rectification issues identified.

Figure 1: KIWEF Closure Works Area's.

2. Previous Inspections

The preliminary cap inspection report for Area 2 was prepared by Daracon in October 2020, subsequent inspections were completed by HCCDC in July 2021, December 2021 and July 2022. The latest inspection identified the following issues that required rectification works.

ID	Area	Issue	Work Undertaken
Nil – All issues resolved			

A summary of the current status of each rectification issue is provided in Section 4.

3. Condition Inspection

3.1 Inspection Details

Date of Inspection: 12 October 2022
Area of Inspection: KIWEF, Area 2, Wedge
Inspection ID: Round 5
Inspected by: Grant Moylan (HCCDC)

3.2 Photo Survey

A map showing the indicative location and direction of each photo is included in Figure 2.

ID	Photo	Comment	Rectification
1		Sediment Basin (SB04) The basin outlet for SB04 appears to be stable, no signs of erosion, slipping or slumping.	
2		Wedge Capped Area Good vegetation growth across capped area, no signs of sparse vegetation. Some shrub growth observed growing a new issue (Ref: A2W-04) was raised for removal of shrub growth. A maintenance team were attending the inspection and completed the shrub removal. Issue A2W-04 is now closed.	
3		Sediment Basin (SB04) Basin appears to be holding water during rainfall, indicating liner is still in good condition. Vegetation coverage on banks of basin is improved. Weeds also not as dominant	

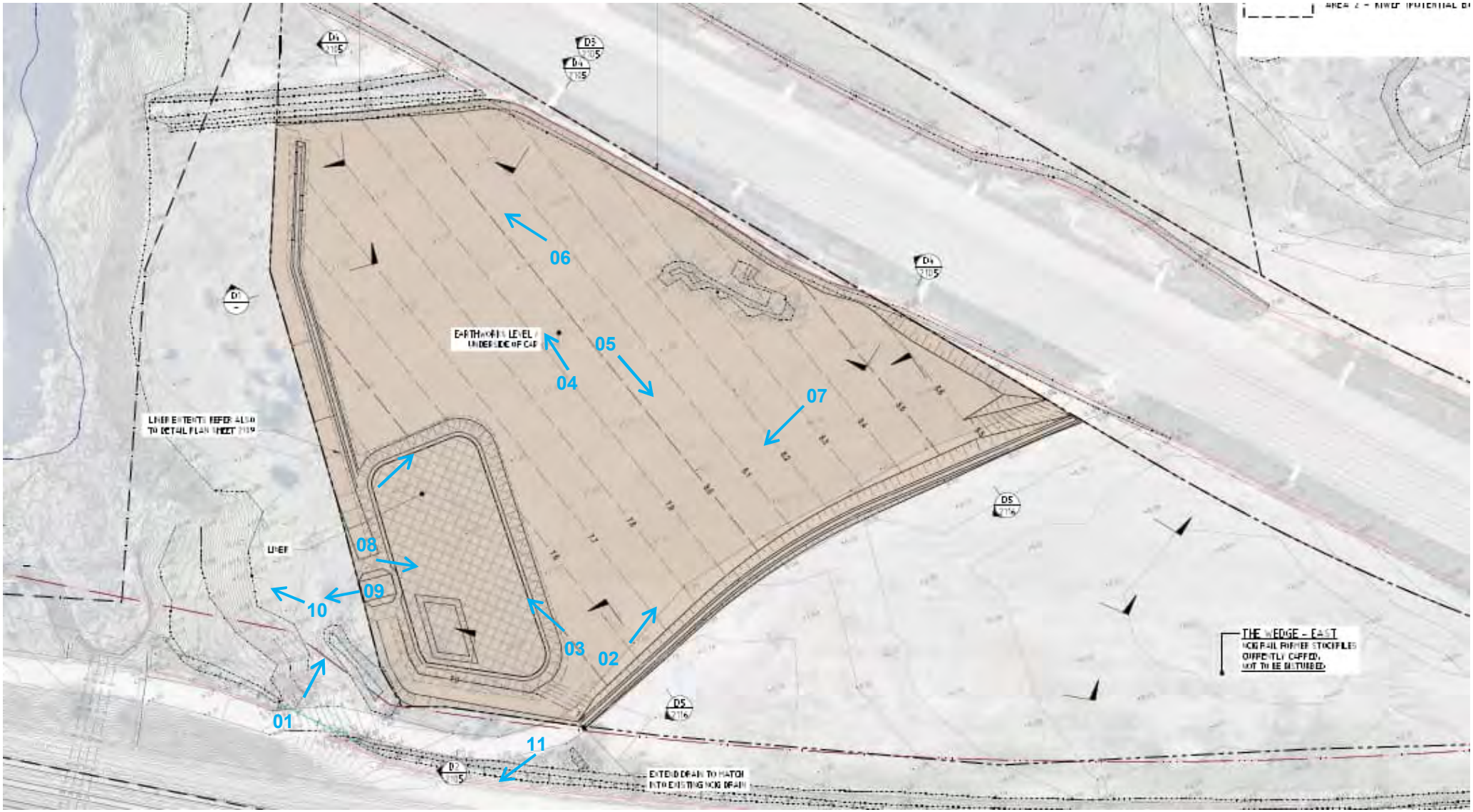
ID	Photo	Comment	Rectification
4		Wedge Capped Area Good vegetation growth across capped area, no signs of sparse vegetation. Some shrub growth observed growing a new issue (Ref: A2W-04) was raised for removal of shrub growth. A maintenance team were attending the inspection and completed the shrub removal. Issue A2W-04 is now closed.	
5		Wedge Capped Area Maintenance team removing shrub growth from the capped area of the Wedge. Issue A2W-04 is now closed.	
6		Wedge Capped Area The maintenance team completed the removal of shrub growth from the capped area of the Wedge. Issue A2W-04 is now closed.	
7		Wedge Capped Area The maintenance team completed the removal of shrub growth from the capped area of the Wedge. Issue A2W-04 is now closed.	

ID	Photo	Comment	Rectification
8		Sediment Basin (SB04) Basin appears to be holding water, indicating liner is still in good condition. Vegetation coverage on banks of basin is improved. Weeds also not as dominant	
9		Sediment Basin (SB04) The basin outlet for SB04 appears to be stable, no signs of erosion, slipping or slumping.	
10		Sediment Basin (SB04) The basin outlet for SB04 appears to be stable, no signs of erosion, slipping or slumping.	
11		Eastern Drain The connection of the Eastern Drain with the NCIG drainage line appears to have stabilised and well vegetated.	

3.3 General Comments

The basin appears to be holding water, indicating the liner is in good condition. Vegetation growth on the banks of the basins has greatly improved and weed load has reduced. Capped area shows good vegetation growth across the cap; some shrubs were establishing, however HCCDC had arranged for a maintenance crew to attend the cap inspection and were able to remove the shrubs immediately. The outlet appears in good condition, no signs of erosion or slumping.

Figure 2: Area 2, Wedge Photo Survey – Indicative Location and Directions.



4. Status of Rectification Works

ID	Area	Issue	Work Undertaken	Current Inspection	Work Required	Current Status
A2W-01	Wedge	Areas of sparse vegetation	Continued observation	Further growth on capped area	None.	Closed – Dec 2021.
A2W-02	Basin SB04	Weed growth (Castor Oil) on banks	Continued observation	Improved growth of grasses and reduced castor oil density	None.	Closed – Dec 2021.
A2W-03	Eastern Drain	Drain connection to NCIG appears to be eroding side walls	Continued observation	Drain has been heavily vegetated and appears stabilised	None.	Closed – Dec 2021.
A2W-04	Wedge	Shrub Growth observed on cap	Maintenance Crew cut and removed shrubs	Shrub Growth removed	None	Closed – Oct 2022.

Appendix H – KIWEF Area 2 Biannual Cap Inspections – Quarter 2 2023 (HCCDC, 2023)

KIWEF Cap Inspection Report

Kooragang Island Waste Emplacement Facility, Area 2 (K3, K5 and K7)

EF18/46502_08.2

Revision 1

19 December 2022

Document history and status

Revision	Date	Description	By	Checked	Approved
0	19 December 2022	Final	G. Moylan	M. Bardsley	M. Bardsley

NSW GOVERNMENT | Hunter & Central Coast Development Corporation

Hunter & Central Coast Development Corporation

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1. Introduction

1.1 Background

Hunter & Central Coast Development Corporation (HCCDC) is the NSW State Government agent tasked with the remediation of the Kooragang Island Waste Emplacement Facility (KIWEF). The KWIEF is a 179 hectare site located on the western portion of Kooragang Island, approximately 7km north of Newcastle's City Centre. The closure of the KIWEF was approved by the NSW EPA, in accordance with the conditions of a Notice of Surrender of License issued in 2010.

1.2 Purpose

This cap inspection report has been prepared to satisfy the conditions 4j and 4k of the Notice of Surrender of License (Notice 1111840, as varied under notices N1510956 and N1520063) for KIWEF Area 2 – K3, K5 and K7 (refer to Figure 1); and requires the following:

4j) At the completion of the final cap, the licensee shall undertake inspections of the cap, on a six (6) monthly basis, to detect and remediate areas where the cap has eroded, degraded or slumped.

4k) The licensee shall provide the EPA with a written statement of the results of the inspection required by condition 4(j) on an annual basis. The statement must describe the condition of the cap and any actions taken to remediate the cap as a result of the inspection. The first statement must be provided to the EPA by 30 September 2013 with subsequent reports provided 12 monthly following the provision of the first report.

1.3 Subject Site

Area 2 – K3, K5 and K7 as defined under the Surrender Notice occupies an area of approximately 31 hectares. The Closure Works for Area 2 were completed by Daracon Pty Ltd (Daracon) in June 2020, with the maintenance period extending through until September 2020. The first capping inspection report was prepared by Daracon at the completion of the maintenance period in October 2020. Subsequent biannual inspections and reports were prepared by HCCDC.

1.4 Methodology

HCCDC personnel undertook the following tasks in the preparation of this Area 2 Cap Inspection Report:

- Review of previous cap inspection reports;
- Completion of a site inspection of Area 2;
- Compilation of photo survey of Area 2;
- Preparation of a report detailing the following:
    - the status of previously identified issues;
    - newly identified issues;
    - recommended rectification measures; and
    - the locations of the rectification issues identified.

Figure 1: KIWEF Closure Works Area's.

2. Previous Inspections

The preliminary cap inspection report for Area 2 was prepared by Daracon in October 2020, subsequent inspections were completed by HCCDC in June 2021, December 2021 and July 2022. The latest inspection identified the following issues that required rectification works.

ID	Area	Issue	Work Undertaken
A2-01	Low Area & Pond 5	Areas of sparse vegetation	Continued observation
A2-04	Site Wide	Shrub Growth on Cap	Issue identified
A2-08	Basin SB01 SB02 & SB03	Weed growth around basin edge	Issue Identified

A summary of the current status of each rectification issue is provided in Section 4.

3. Condition Inspection

3.1 Inspection Details

Date of Inspection: 6 December 2022
Area of Inspection: KIWEF, Area 2, K3, K5 and K7
Inspection ID: Round 5
Inspected by: Grant Moylan (HCCDC)

3.2 Photo Survey

A map showing the indicative location and direction of each photo is included in Figure 2.

ID	Photo	Comment	Rectification
1		Cell 7 Good vegetation coverage. Shrub growth present along the drainage line. In accordance with GGBF movement corridors, drainage lines can allow for shrub growth (2m either side).	
2		Cell 7 Good vegetation coverage. Shrub growth present along the drainage line/ transition slope. In accordance with GGBF movement corridors, can allow for shrub growth (2m either side). Shrubs removed from area between drainage and transition slope. Issue closed (Ref: A2-04) following removal of shrub growth from cap.	
3		Cell 7 drainage drop structure Good vegetation coverage. Drainage line appears stable. Some shrub growths on the embankment are to remain to stabilise and reduce erosion of banks and provide GGBF movement corridors.	

ID	Photo	Comment	Rectification
4		Eastern Cap (Pond 5) Previously identified areas with sparse vegetation coverage[1] (Issue Ref: A2-01) on Pond 5 has continued to improve. Inspection shows greater than 50% coverage. Issue (Ref: A2-01) has now been closed following achievement of vegetation coverage targets.	
5		Eastern Cap (Pond 5) Previously identified areas with sparse vegetation coverage (Issue Ref: A2-01) on Pond 5 has continued to improve. Inspection shows greater than 50% coverage. Issue (Ref: A2-01) has now been closed following achievement of vegetation coverage targets.	
6		Eastern Cap (Pond 5) Southern Cap Good vegetation coverage. Shrub growth has now been removed from capped during maintenance works. Issue (Ref: A2-04) has been closed following removal of shrub growth from cap.	
7		Eastern Cap (Pond 5) Good vegetation coverage. Shrub growth has now been removed from capped during maintenance works. Issue (Ref: A2-04) has been closed following removal of shrub growth from cap.	

[1] Sparse coverage is defined within the Area 2 Closure Works, Preliminary Documentation Package (Appendix 8 – Revegetation Management Plan) as areas of greater than 10m^2 with less than 50% coverage.

ID	Photo	Comment	Rectification
8		Eastern Cap (Cell 3) Good vegetation coverage. Shrub growth has now been removed from capped during maintenance works. Issue (Ref: A2-04) has been closed following removal of shrub growth from cap.	
9		Eastern Embankment No signs of erosion/slippage at southern drainage outlet and further vegetation establishment observed.	
10		Southern Cap Good vegetation coverage. Shrub growth has now been removed from capped during maintenance works. Issue (Ref: A2-04) has been closed following removal of shrub growth from cap.	
11		Southern Cap Previously identified areas with sparse vegetation coverage (Issue Ref: A2-01) on south boundary has continued to improve. Inspection shows greater than 50% coverage. Issue (Ref: A2-01) has now been closed following achievement of vegetation coverage targets.	

ID	Photo	Comment	Rectification
12		K3 West Good vegetation coverage. Shrub growth has now been removed from capped during maintenance works. Issue (Ref: A2-04) has been closed following removal of shrub growth from cap.	
13		K3 West Good vegetation coverage. Shrub growth has now been removed from capped during maintenance works. Issue (Ref: A2-04) has been closed following removal of shrub growth from cap.	
14		BOS Cap drainage chute Drainage chute transition from capped area to Deep Pond observed to have good vegetation coverage and no signs of erosion or rills.	
15		Sediment Basin SB02 SB02 appears to be holding water indicating liner is in good condition. Maintenance team removed seed heads from weeds (Pampas Grass) on banks of pond, herbicide not used due to proximity to water. Issue (Ref: A2-08) now closed following removal of seed pods from weed species.	

ID	Photo	Comment	Rectification
16		Sediment Basin SB01 SB01 appears to be holding water indicating liner is in good condition. Maintenance team removed seed heads from weeds (Pampas Grass) on banks of pond, herbicide not used due to proximity to water. Issue (Ref: A2-08) now closed following removal of seed pods from weed species.	
17		SB01 spillway The SB01 spillway appears to be in good working condition. No evidence of erosion or scouring present after recent exceptionally high and persistent rainfall.	
18		BOS Cap Good vegetation coverage. Shrub growth has now been removed from capped during maintenance works. Issue (Ref: A2-04) has been closed following removal of shrub growth from cap.	
19		Sediment Basin SB03 SB03 appears to be holding water indicating liner is in good condition. Maintenance team removed seed heads from weeds (Pampas Grass) on banks of pond, herbicide not used due to proximity to water. Issue (Ref: A2-08) now closed following removal of seed pods from weed species.	

ID	Photo	Comment	Rectification
20		Sediment Basin SB03 Inlet The SB03 inlet appears to be in good working condition. No evidence of erosion or scouring present.	

3.3 General Comments

All the basins appear to be holding water, indicating the liner is in good condition. Following rectification works undertaken by Daracon between August and October 2022 emergent shrub growth has been removed (except for areas classified as GGBF movement corridors) and areas of previously sparse vegetation coverage have shown continued improvement and are no longer classified as sparse under the Area 2 Preliminary Documentation Package trigger levels. Weed species have been observed on banks of ponds in Area 2, the current maintenance activities were unable to spray the weeds due to proximity to the wetlands, works therefore manually removed the seed heads to reduce potential spread of the weeds.

Figure 2: Area 2 Photo Survey – Indicative Location and Directions.

4. Status of Rectification Works

ID	Area	Issue	Work Undertaken	Current Inspection	Work Required	Current Status
A2-01	Low Area & Pond 5	Areas of sparse vegetation	Topsoil spread on cap & reseeded	Continued vegetation coverage, now achieves coverage targets.	None.	Closed – Dec 2022.
A2-02	Eastern Embankment	Guttering has not been installed to Southern drainage outlet.	Observations after significant rainfall demonstrated guttering not required	No signs of road deterioration.	None.	Closed – July 2022
A2-03	Cell 2 and Cell 3	Small areas of ponding observed	Placement of additional topsoil to allow free draining	No signs of ponding observed.	None.	Closed – Dec 2021.
A2-04	Site Wide	Shrub Growth on Cap	Mechanical removal of shrubs	Shrubs removed from cap (GGBF movement corridors still maintained).	None.	Closed – Dec 2022.
A2-05	Basin SB01 SB02 & SB03	Limited vegetation on sides	Topsoil spread on basin embankments & reseeded	Good vegetation coverage around basin embankments	None.	Closed – Dec 2021.
A2-06	Basin SB03 Inlet	Erosion observed at the inlet	Erosion repaired, additional rock installed	No further erosion observed, vegetation establishing in drain.	None.	Closed – Dec 2021.
A2-07	Monitoring Well (Cell 3)	Top of monitoring well has been damaged and monument is missing	Monument installed	Monument installed.	None.	Closed – Dec 2021.
A2-08	Basin SB01 SB02 & SB03	Weed growth around basin edge	Seed heads of weed species removed.	Seed heads removed from weed species.	None.	Closed – Dec 2022.

KIWEF Cap Inspection Report

Kooragang Island Waste Emplacement Facility, Area 2 Wedge (Lot 7)

EF18/46502_08.3

Revision 0

19 December 2022

Document history and status

Revision	Date	Description	By	Checked	Approved
0	19 December 2022	Final	G. Moylan	M. Bardsley	M. Bardsley

NSW GOVERNMENT | Hunter & Central Coast Development Corporation

Hunter & Central Coast Development Corporation

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1. Introduction

1.1 Background

Hunter & Central Coast Development Corporation (HCCDC) is the NSW State Government agent tasked with the remediation of the Kooragang Island Waste Emplacement Facility (KIWEF). The KWIEF is a 179 hectare site located on the western portion of Kooragang Island, approximately 7km north of Newcastle's City Centre. The closure of the KIWEF was approved by the NSW EPA, in accordance with the conditions of a Notice of Surrender of License issued in 2010.

1.2 Purpose

This cap inspection report has been prepared to satisfy the conditions 4j and 4k of the Notice of Surrender of License (Notice 1111840, as varied under notices N1510956 and N1520063) for KIWEF Area 2, Wedge (refer to Figure 1); and requires the following:

4j) At the completion of the final cap, the licensee shall undertake inspections of the cap, on a six (6) monthly basis, to detect and remediate areas where the cap has eroded, degraded or slumped.

4k) The licensee shall provide the EPA with a written statement of the results of the inspection required by condition 4(j) on an annual basis. The statement must describe the condition of the cap and any actions taken to remediate the cap as a result of the inspection. The first statement must be provided to the EPA by 30 September 2013 with subsequent reports provided 12 monthly following the provision of the first report.

1.3 Subject Site

Area 2 – K3, K5 and K7 as defined under the Surrender Notice occupies an area of approximately 31 hectares. The Wedge Area comprises an area of approximately 3 hectares of the total Area 2 area. The Closure Works for Area 2, Wedge were completed by Daracon Pty Ltd (Daracon) in June 2020, with the maintenance period extending through until September 2020. The first capping inspection report was prepared by Daracon at the completion of the maintenance period in October 2020. Subsequent biannual inspections and reports were prepared by HCCDC.

1.4 Methodology

HCCDC personnel undertook the following tasks in the preparation of this Area 2, Wedge Cap Inspection Report:

- Review of previous cap inspection reports;
- Completion of a site inspection of Area 2, Wedge;
- Compilation of photo survey of Area 2, Wedge;
- Preparation of a report detailing the following:
    - the status of previously identified issues;
    - newly identified issues;
    - recommended rectification measures; and
    - the locations of the rectification issues identified.

Figure 1: KIWEF Closure Works Area's.

2. Previous Inspections

The preliminary cap inspection report for Area 2 was prepared by Daracon in October 2020, subsequent inspections were completed by HCCDC in July 2021, December 2021 and July 2022. The latest inspection identified the following issues that required rectification works.

ID	Area	Issue	Work Undertaken
Nil – All issues resolved			

A summary of the current status of each rectification issue is provided in Section 4.

3. Condition Inspection

3.1 Inspection Details

Date of Inspection: 12 October 2022
Area of Inspection: KIWEF, Area 2, Wedge
Inspection ID: Round 5
Inspected by: Grant Moylan (HCCDC)

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A map showing the indicative location and direction of each photo is included in Figure 2.

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1		Sediment Basin (SB04) The basin outlet for SB04 appears to be stable, no signs of erosion, slipping or slumping.	
2		Wedge Capped Area Good vegetation growth across capped area, no signs of sparse vegetation. Some shrub growth observed growing a new issue (Ref: A2W-04) was raised for removal of shrub growth. A maintenance team were attending the inspection and completed the shrub removal. Issue A2W-04 is now closed.	
3		Sediment Basin (SB04) Basin appears to be holding water during rainfall, indicating liner is still in good condition. Vegetation coverage on banks of basin is improved. Weeds also not as dominant	

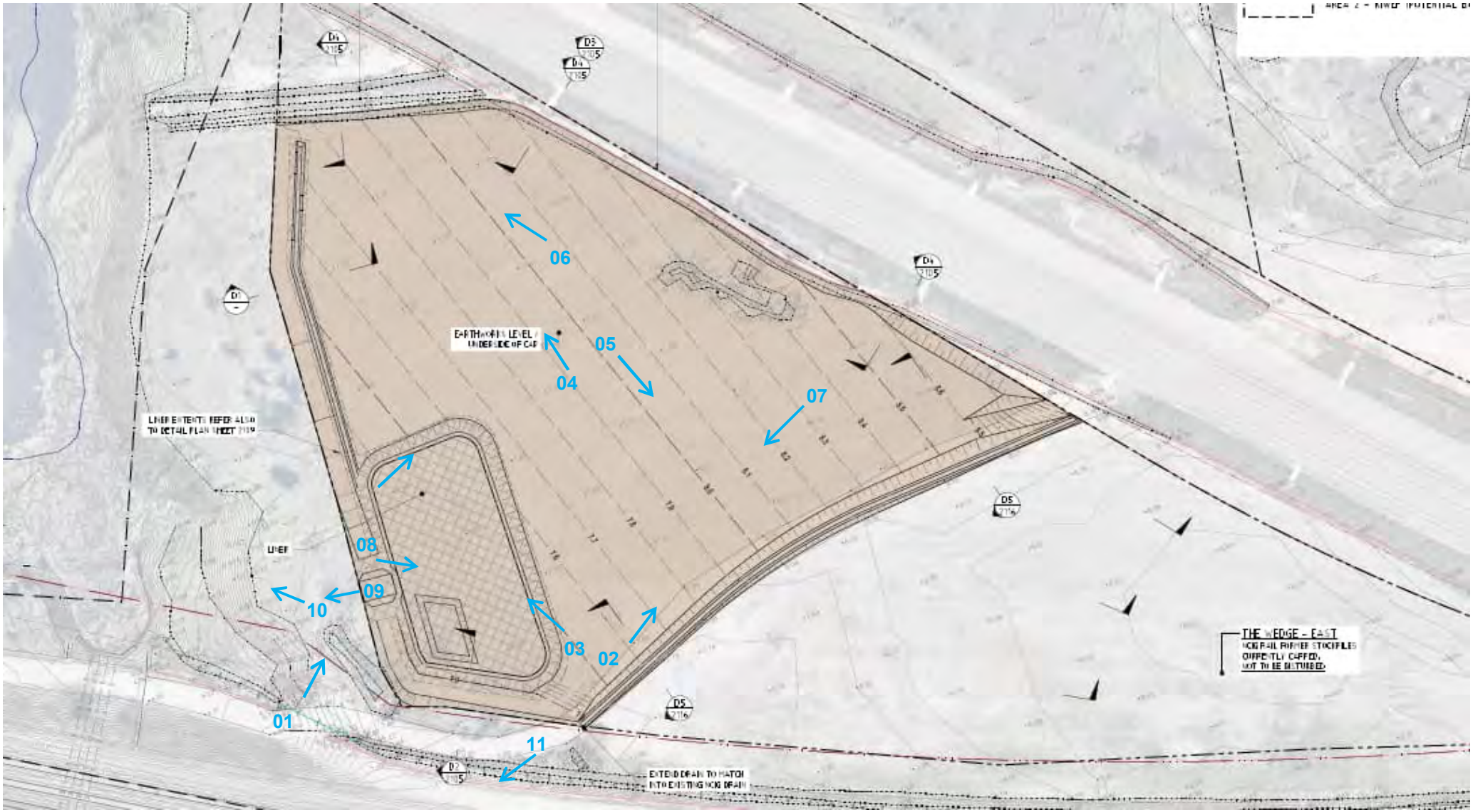
ID	Photo	Comment	Rectification
4		Wedge Capped Area Good vegetation growth across capped area, no signs of sparse vegetation. Some shrub growth observed growing a new issue (Ref: A2W-04) was raised for removal of shrub growth. A maintenance team were attending the inspection and completed the shrub removal. Issue A2W-04 is now closed.	
5		Wedge Capped Area Maintenance team removing shrub growth from the capped area of the Wedge. Issue A2W-04 is now closed.	
6		Wedge Capped Area The maintenance team completed the removal of shrub growth from the capped area of the Wedge. Issue A2W-04 is now closed.	
7		Wedge Capped Area The maintenance team completed the removal of shrub growth from the capped area of the Wedge. Issue A2W-04 is now closed.	

ID	Photo	Comment	Rectification
8		Sediment Basin (SB04) Basin appears to be holding water, indicating liner is still in good condition. Vegetation coverage on banks of basin is improved. Weeds also not as dominant	
9		Sediment Basin (SB04) The basin outlet for SB04 appears to be stable, no signs of erosion, slipping or slumping.	
10		Sediment Basin (SB04) The basin outlet for SB04 appears to be stable, no signs of erosion, slipping or slumping.	
11		Eastern Drain The connection of the Eastern Drain with the NCIG drainage line appears to have stabilised and well vegetated.	

3.3 General Comments

The basin appears to be holding water, indicating the liner is in good condition. Vegetation growth on the banks of the basins has greatly improved and weed load has reduced. Capped area shows good vegetation growth across the cap; some shrubs were establishing, however HCCDC had arranged for a maintenance crew to attend the cap inspection and were able to remove the shrubs immediately. The outlet appears in good condition, no signs of erosion or slumping.

Figure 2: Area 2, Wedge Photo Survey – Indicative Location and Directions.



4. Status of Rectification Works

ID	Area	Issue	Work Undertaken	Current Inspection	Work Required	Current Status
A2W-01	Wedge	Areas of sparse vegetation	Continued observation	Further growth on capped area	None.	Closed – Dec 2021.
A2W-02	Basin SB04	Weed growth (Castor Oil) on banks	Continued observation	Improved growth of grasses and reduced castor oil density	None.	Closed – Dec 2021.
A2W-03	Eastern Drain	Drain connection to NCIG appears to be eroding side walls	Continued observation	Drain has been heavily vegetated and appears stabilised	None.	Closed – Dec 2021.
A2W-04	Wedge	Shrub Growth observed on cap	Maintenance Crew cut and removed shrubs	Shrub Growth removed	None	Closed – Oct 2022.

Appendix I – KIWEF Area 2 Closure Works, Project Works Period – Independent Audit Report (EMM Consulting, 2023)

KIWEF Area 2 Closure Works

Independent Audit of EPBC Act Approval 2016/7670

Prepared for Hunter and Central Coastal Development Corporation

February 2023

KIWEF Area 2 Closure Works

Independent Audit of EPBC Act Approval 2016/7670

Hunter and Central Coastal Development Corporation

E220406 RP#1

February 2023

Version	Date	Prepared by	Approved by	Comments
First Draft	13 December 2022	Nena Lane Kirwan	David Bone	Internal draft
Draft	25 February 2023	Nathan Garvey, Brett McLennan	David Bone	HCCDC review
Final Draft	28 February 2023	David Bone	Brett McLennan	HCCDC sign-off

Approved by

David Bone
Sector Lead – Construction
National Technical Leader – Construction Environmental Management
28 February 2023

Level 3 175 Scott Street
Newcastle NSW 2300

This report has been prepared in accordance with the brief provided by Hunter and Central Coastal Development Corporation and, in its preparation, EMM has relied upon the information collected at the times and under the conditions specified in this report. All findings, conclusions or recommendations contained in this report are based on those aforementioned circumstances. The contents of this report are private and confidential. This report is only for Hunter and Central Coastal Development Corporation's use in accordance with its agreement with EMM and is not to be relied on by or made available to any other party without EMM's prior written consent. Except as permitted by the Copyright Act 1968 (Cth) and only to the extent incapable of exclusion, any other use (including use or reproduction of this report for resale or other commercial purposes) is prohibited without EMM's prior written consent. Except where expressly agreed to by EMM in writing, and to the extent permitted by law, EMM will have no liability (and assumes no duty of care) to any person in relation to this document, other than to Hunter and Central Coastal Development Corporation (and subject to the terms of EMM's agreement with Hunter and Central Coastal Development Corporation).

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Audit details

Project name

Kooragang Island Waste Emplacement Facility - Area 2 Closure Works, off Cormorant Road, Kooragang Island, Newcastle, NSW (EPBC 2016/7670) – herein referred to as the Area 2 Works.

Project approval holder

Crown in right of the State of NSW, acting through NSW Treasury.

Details of the approval to which the audit relates

To undertake closure works and the rehabilitation of Area 2 (K3 and KS and a small section of K7). Area 2 forms part of the Kooragang Island Waste Emplacement Facility (KIWEF) near Newcastle, NSW. Area 2 is approximately 36 hectares (ha) in size.

Scope of the audit

The audit assesses compliance with conditions of EPBC Act approval 2016/7670, targeting the construction, operation, and closure phases of the Area 2 Works. There are 22 conditions within EPBC Act approval 2016/7670. However, the conditions that form a focus for this audit are:

- Part A – conditions specific to the action, conditions 1 – 8
- Part B – standard administrative conditions, conditions 9 – 19.

Conditions 20 and 21 (in Part B) are not applicable to the audit as they have yet to be triggered and Condition 22 (in Part C) provides definitions for terms used in the approval. The definitions in Condition 22 were referenced and used where required.

Dates and locations of the audit

The audit was undertaken from 19 August 2022 to 25 February 2023. A site inspection was conducted of the Area 2 Works on 12 October 2022. Interviews were undertaken on 1 November 2022.

Audit methods

Compliance was assessed by a number of key activities:

- review of documentation provided by HCCDC and publicly available records
- site inspection of the area the subject of the audit
- interviews with key stakeholders including project managers, independent auditors and contract personnel.

Evidence reviewed

The documents reviewed by the audit team included the following record types:

- maps and figures of the area the subject of the audit
- Green and Golden Bell Frog (GGBF) clearance Inspection reports
- monthly audit reports
- GGBF annual monitoring data and reports
- imported material assessments
- revegetation seed mixes data
- site inspection reports, daily, weekly, monthly and six monthly
- ground water and surface water monitoring results and reports
- certified erosion and sediment control (CPESC) reports
- site inspection reports and plans
- GGBF pond water quality monitoring results
- contractor ISO certification
- construction induction and pre-start meeting records
- construction integrated project management plan
- contractor monthly summary reports
- internal contamination notifications of unexpected finds
- safe work method statement (SWMS) registers
- email notifications of incidents and actions
- Incident notifications.

A site inspection and interviews were also conducted and are reported in the body of this report.

Executive summary

EMM Consulting Pty Ltd (EMM Consulting) has been engaged by the Hunter and Central Coast Development Corporation (HCCDC) to undertake an independent environmental audit (IEA) of an approval granted by the then Commonwealth Department of the Environment and Energy (DEE) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (EPBC Act approval 2016/7670) for the Kooragang Island Waste Emplacement Facility (KIWEF) Area 2 Closure Works (herein referred to as the Area 2 Works).

The Area 2 Works were undertaken by HCCDC, acting as the agent of the NSW Government for the Area 2 Works. HCCDC contracted civil construction firm Daracon Contractors Pty Ltd (Daracon) to perform the Area 2 Works, which were undertaken between August 2019 and 10 July 2020.

Conditions within EPBC Act approval 2016/7670 require the approval holder to ensure that an IEA is undertaken "following the completion of onsite construction works and prior to the completion of the project works period".

EMM Consulting's engagement was approved by the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) as delegate of the Commonwealth Minister for the Environment. The audit was conducted in accordance with the *Department of Environment and Energy 2019, Independent Audit and Audit Report Guidelines* (Audit Guidelines).

The audit scope was developed by the lead auditor, Mr David Bone, with the assistance of Mr Brett McLennan, and included a review of the EPBC Act approval 2016/7670 and all documentation relevant to the Area 2 Works.

The audit scope was approved by DCCEEW on 19 August 2022.

The audit's objective was to determine the project's compliance with the EPBC Act approval 2016/7670 and to assess the effectiveness of environmental management at the site of the Area 2 Works.

The audit involved a review of extensive information and documentation provided by HCCDC, a site inspection, and interviews.

Of the 22 conditions reviewed as part of the EPBC Act approval 2016/7670, all applicable conditions were found to be compliant, and three (3) were found to be not applicable. The not applicable conditions relate to two (2) conditions that have not yet been triggered and one (1) which provides the definitions for the approval. Three observations were also made in relation to the conditions.

Accordingly, the audit has found that there is full compliance (100%) with the relevant conditions of EPBC Act approval 2016/7670.

The observations identified in Section 3.5 relate to administrative recommendations, revegetation of stormwater infrastructure, and ongoing management of the site.

This audit provides assurance to stakeholders that the Area 2 Works have been completed in compliance with the required environmental standards and that the management of the site has been effective in, not only avoiding and mitigating impacts to the controlling provisions of EPBC Act 2016/7670 (predominantly the GGBF), but in creating additional effective breeding and foraging habitat outcomes for the GGBF.

The audit team would like to thank representatives from HCCDC and Daracon for providing access to the site, detailed knowledge of the works undertaken, and for the excellent record and data storage and recovery systems in use.

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1 Introduction

1.1 Background

In December 2015, the then Hunter Development Corporation (HDC), now Hunter and Central Coast Development Corporation (HCCDC), submitted a referral on behalf of the Port of Newcastle Lessor Pty Ltd under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) to undertake the Kooragang Island Waste Emplacement Facility (KIWEF) Area 2 Closure Works (herein referred to as the Area 2 Works) (EPBC Act referral 2016/7670).

KIWEF is located on the western portion of Kooragang Island, approximately 7 kilometers (km) north-west of the Newcastle city centre. The Area 2 Works involved the construction of an engineered cap over a 32 hectare (ha) portion of KIWEF, as shown on Figure 1.1. The site of the Area 2 Works is surrounded by Ramsar listed wetlands and provides habitat for the threatened Green and Golden Bell Frog (GGBF) and migratory wading birds that utilise the wetlands.

On 2 December 2016, the Area 2 Works were deemed by the Commonwealth Department of the Environment and Energy (DEE) to be a controlled action, therefore requiring assessment and approval under the EPBC Act before it can proceed. The controlling provisions related to:

- listed threatened species and communities (sections 18 and 18A)
- Ramsar wetland (section 16 and section 17B).

On 22 December 2016, DEE advised that the assessment approach was to be preliminary documentation.

In September 2018, the preliminary documentation was lodged with DEE for assessment.

In February 2019, the entity proposing to undertake the Area 2 Works (Port of Newcastle Lessor Pty Ltd) was transferred to 'the Crown in right of the State of NSW, acting through NSW Treasury' (the NSW Government).

On 22 March 2019, DEE issued approval (EPBC Act approval 2016/7670) for the Area 2 Works subject to 22 conditions.

The Area 2 Works were undertaken by HCCDC, acting as the agent of the NSW Government for the Area 2 Works. HCCDC contracted civil construction firm Daracon Contractors Pty Ltd (Daracon) to perform the Area 2 Works, which were undertaken between August 2019 and 10 July 2020. Since then, the site has been managed by HCCDC to conduct the required monitoring and maintenance including:

- establishment of vegetation
- removal of weeds or vegetative species that have the potential to damage the engineered cap
- monitoring of the GGBF.

Conditions 18 of EPBC Act approval 2016/7670 states that:

> The approval holder must ensure that independent audits of compliance with the conditions are conducted:
>
> a. Following the completion of onsite construction works and prior to the completion of the project works period…

Condition 19 of the approval states:

> For each independent audit, the approval holder must:
>
> a. provide the name and qualifications of the independent auditor and the draft audit criteria to the Department;
>
> b. only commence the independent audit once the audit criteria have been approved in writing by the Department; and
>
> c. submit an audit report to the Department within the timeframe specified in the approved audit criteria.

EMM Consulting Pty Ltd (EMM) was engaged by HCCDC on 18 May 2022 to undertake the independent environmental audit (IEA) of the Area 2 Works to satisfy the requirements of Condition 18 of EPBC Act approval 2016/7670.

EMM's nominated audit team and their qualifications, and the draft audit criteria, were submitted to the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW), formerly DEE, on 10 June 2022.

The audit team and audit scope were approved by DCCEEW on 19 August 2022. The letter stated that the audit report was to be submitted to DCCEEW by 28 January 2023. This date was subsequently changed to 28 February 2023 to allow time for EMM to consider additional monitoring data on the Green and Golden Bell Frog (GGBF) provided by the University of Newcastle (UoN) in January 2023.

1.2 Audit team

The audit was conducted by EMM Consulting, headed by the approved lead auditor, Mr David Bone. David has signed the independent audit declaration and was assisted by Mr Brett McLennan, Mr Nathan Garvey, and Ms Nena Lane-Kirwan. Support was provided by Ms Wendy Mason.

1.3 Audit objectives

The key objective of the audit is to determine the project's compliance with EPBC Act approval 2016/7670. It also determines compliance with the requirements of supporting documentation approved under the conditions, including, but not limited to, a *KIWEF Site Environmental Management Plan* (EMP) and the *GGBF Management Plan*.

Finally, the audit assesses the overall effectiveness of environmental management at the site of the Area 2 Works.

1.4 Audit scope

As stated above, the audit scope was approved by DCCEWW on 19 August 2022. The audit assesses the project's compliance with conditions as set out by EPBC Act approval 2016/7670, targeting the construction, operation, and closure phases of the Area 2 Works. There are 22 conditions within EPBC Act approval 2016/7670. However, the conditions that form a focus for this audit are:

- Part A – conditions specific to the action, conditions 1–8
- Part B – standard administrative conditions, conditions 9–19.

Conditions 20 and 21(in Part B) are not applicable to the audit as they have yet to be triggered and Condition 22 (in Part C) provides definitions for terms used in the approval. The definitions in Condition 22 were referenced and used where required.

The audit also included assessment of post approval and compliance documentation prepared to satisfy the conditions of approval, particularly the key management and mitigation measures made in the management plans reference in the conditions outlined above, including:

- *GGBF Management Plan*
- *Revegetation Management Plan*
- *Water Quality Management Plan*
- *KIWEF Site EMP* – also known as the *Kooragang Island Waste Emplacement Facility Area 2 Closure, Construction Environmental Management Framework*.

The audit reviewed the environmental performance of the project via assessment of:

- actual impacts compared to predicted impacts documented in the environmental impact assessment
- the physical extent of the project in comparison with the approved boundary
- incidents, non-compliances, and complaints that occurred or were made during the audit period
- the performance of the Area 2 Works having regard to agency policy and any particular environmental issues identified through consultation carried out during the development of the audit scope.

Figure 1.1 Area 2 Works site

Source – Daracon 2020 (Closure Works Footprint 20200722)

2 Audit methodology

2.1 Audit criteria

The audit was undertaken to address compliance with EPBC Act approval 2016/7670 and conducted in accordance with the *Department of Environment and Energy 2019, Independent Audit and Audit Report Guidelines* (Audit Guidelines).

The audit scope was developed by the lead auditor, David Bone, with the assistance of Brett McLennan, and included a review of the EPBC Act approval 2016/7670 and all documentation relevant to the Area 2 Works.

The audit scope was approved by DCCEEW on 19 August 2022.

2.2 Selection and endorsement of audit team

This is an IEA, meaning that the auditor(s) must be endorsed by the Commonwealth Minister for the Environment or delegate prior to conducting the audit in accordance with Condition 19. As such, the audit team's qualifications, and a statement on their independence from the site, were submitted and approval was obtained.

The audit team was approved by DCCEEW on 19 August 2022 as delegate of the Minister. The endorsement letter is contained in Appendix A.

2.3 Site inspection

On 12 October 2022, a site inspection was undertaken. The audit team was escorted by HCCDC representatives. Those involved in the site inspection comprised:

- David Bone (EMM Consulting)
- Brett McLennan (EMM Consulting)
- Nathan Garvey (EMM Consulting)
- Nena Lane-Kirwan (EMM Consulting)
- Grant Moylan (HCCDC).

Site inspection photos are provided in Appendix D.

2.4 Document review

A document library using the software SharePoint was set up to allow access to extensive documentation records for the Area 2 Works.

Following an initial review of documentation publicly available on DCCEEW and HCCDC's websites, a request for information (RFI) was prepared and additional information supplied by HCCDC.

Much of the information was provided prior to the site inspection to ensure as much information as possible could be reviewed before arriving on site, as well as to understand key elements of the Area 2 Works. Some additional information was provided after the site inspection.

All information requested by EMM as part of the RFI was made available by HCCDC.

2.5 Interviews

Interviews were held via videoconference on 1 November 2022. Interviews included the following participants:

- Grant Moylan (HCCDC) – site and videoconference
- Michael Bardsley (HCCDC) – videoconference
- Gary Woodham (Public Works Advisory) – videoconference
- Belinda Sinclair (Ramboll) – videoconference
- Brett McLennan (EMM Consulting) – videoconference
- David Bone (EMM Consulting) – videoconference.

A recording of the videoconference was made at the consent of all participants and was subsequently reviewed by Nathan Garvey and Nena Lane-Kirwan.

2.6 Compliance findings

The audit has been undertaken in consideration of the following compliance status descriptors, in accordance with the requirements as set out by section 6 of the Audit Guidelines:

- **Compliance (Y)** – the auditor has collected sufficient verifiable evidence to demonstrate that all elements of the requirement have been complied with within the scope of the audit.
- **Non-compliance (N)** – the auditor has determined that one or more specific elements of the conditions or requirements have not been complied with within the scope of the audit.
- **Not applicable (NA)** – A rating of 'not applicable' at the time of the audit is given when the condition or element of a condition falls outside the scope of the audit (e.g. if an activity has not yet commenced or a requirement has not been triggered).
- **Observation (O)** – An 'observation' may be made about issues relevant to the protection of a matter of national environmental significance when the issue is not strictly related to compliance or non-compliance with a condition or element of a condition.

3 Detailed audit findings

3.1 Documents audited

The following approval documents were reviewed to assess compliance against the conditions of EPBC Act approval 2016/7670 and the operational performance and effectiveness of environmental management measures implemented during the audit period:

- EPBC Act approval 2016/7670 – all conditions of approval
- *GGBF Management Plan,* required by Condition 2 of EPBC Act approval 2016/7670
- *Revegetation Management Plan,* required by Condition 5 of EPBC Act approval 2016/7670
- *Water Quality Management Plan,* required by Condition 6 of EPBC Act approval 2016/7670
- KIWEF Site EMP, also known as the *Kooragang Island Waste Emplacement Facility Area 2 Closure, Construction Environmental Management Framework*, required by Condition 8 of EPBC Act approval 2016/7670.

3.2 Previous areas of non-compliance

As this is the first IEA for this project, there were no previous areas of non-compliance to review.

3.3 Compliance summary

Of the 22 conditions reviewed as part of the EPBC Act approval 2016/7670, all applicable conditions were found to be compliant, and three (3) were found to be not applicable. The not applicable conditions relate to two (2) conditions that have not yet been triggered and one (1) which provides the definitions for the approval.

Three observations were also made in relation to the conditions, with detail provided in Section 3.5.

Accordingly, the audit has found that there is full compliance (100%) with the relevant conditions of EPBC Act approval 2016/7670.

The Audit compliance matrix is included in Appendix B.

The auditor's certification is provided in Appendix C.

3.4 Non-compliances

There were no non-compliances identified by the audit team.

3.5 Observations

Three (3) observations were identified by the audit team, as follows.

Observation 2016-7670 #1

Project footprint description in Condition 1 of EPBC Act approval 2016/7670

Condition 1 states that the action (Area 2 Works) must only be undertaken within the footprint. The footprint is defined in Condition 22 as the "areas enclosed by the red dashed line captioned 'Revised Referral Boundary' identified on Map 1 at Attachment A" of the approval.

Approval documentation contains a note under the 'Details' section in the action description that a variation under section 156B of the EPBC Act was accepted on 23 October 2018. This variation included a modification of the footprint. A correction notice for Map 1 in Attachment A of EPBC Act approval 2016/7670 was issued by DEE on 14 January. This correction notice states:

> Map 1, titled 'The Proposed Action Footprint', in Attachment A attached to the approval does not show the correct project boundary.
>
> The correct Map 1 which should be in Attachment A attached to the Approval decision, which shows the correct project boundary (designated as 'Revised Referral Boundary'), is attached to this correction notice.

For future reference, and to avoid confusion, it is recommended that the revised footprint be included in Attachment A of the publicly available approval decision.

Observation 2016-7670 #2

Revegetation Management Plan **required by Condition 5 of EPBC Act approval 2016/7670**

Revegetation of stormwater infrastructure has been found, by extensive monitoring undertaken as part of the approved *GGBF Management Plan*, to be favourable to the GGBF dispersal across the Area 2 Works.

Specific planting of species as seed mixes, or direct planting, was not undertaken in stormwater infrastructure, with the new drainage works allowed to re-colonise naturally after an initial hydroseeding of general grass cover used across the entire site. The latest UoN (2023) monitoring report and additional information provided to the audit team by Colin McHenry of UoN indicates that the GGBF population is readily moving around Kooragang Island along stormwater infrastructure as well as across rehabilitated areas of the Area 2 Works. The colonisation of constructed ponds created within the Area 2 Works identified that small trees (such as *Acacia*) and clumping ground plants (which can be native species such as *Lomandra* or introduced species such as pampas *Cortaderia*) provide suitable terrestrial habitat, both adjacent to wetlands and as habitat corridors connecting wetlands within a mosaic. In particular, GGBF have been detected on multiple occasions in *Acacia* some distance away from wetland habitats (Colin McHenry email 27/2/23). Recent monitoring in February 2023 has identified that significant GGBF chorusing has been noted from constructed ponds following recent rainfall. This indicates that the works have achieved one of the primary outcomes of the Area 2 Works, with GGBF dispersal evident and the naturally recolonised stormwater infrastructure currently not impeding movement of the GGBF.

No loss of habitat for the GGBF is evident from review of data provided and from site inspections and UoN monitoring. Conversely, overall, there has been a net increase in habitat through the creation of additional ponds and movement corridors for the species, with GGBF detected in these ponds.

Observation 2016-7670 #3

Revegetation Management Plan **required by Condition 5 of EPBC Act approval 2016/7670**

Portions of the site of the Area 2 Works were showing a dense regrowth of Acacia (*Acacia saligna*) following completion of revegetation works. There is some evidence of the GGBF using the "trees" with 3.5% of observations in 2019/20 season (UoN 2020, p.99) and 8% of observation in 2021/22 occurring within this microhabitat (UoN 2023, p. 20) (see Photograph 3.1). However, dense regrowth of trees adjacent to waterbodies, resulting in overshadowing of those waterbodies, is known to reduce the suitability of waterbodies as breeding habitat. This has not been observed in Area 2 to date.

Photograph 3.1 GGBFs utilising *Acacia saligna* tree (source UoN Colin McHenry)

Acacia was actively being removed by contractors to maintain the integrity of the capping layer during the site inspection, and HCCDC has advised (G. Moylan pers comms) that the vegetation removal program has now been completed under the supervision of ecologists.

It is recognised that some level of control is required in the future to prevent impacts to breeding habitat and will be included within post-closure management plans.

4 Conclusion

EMM Consulting has been engaged by HCCDC to undertake an IEA of EPBC Act approval 2016/7670. EMM Consulting's engagement was approved by DCCEEW as delegate of the Commonwealth Minister for the Environment. The audit was undertaken in accordance with the Audit Guidelines.

The audit scope was developed by the lead auditor, David Bone, with the assistance of Brett McLennan, and included a review of the EPBC Act approval 2016/7670 and all documentation relevant to the Area 2 Works.

The scope of the audit was approved by DCCEEW on 19 August 2022.

The audit's objective was to determine the project's compliance with the EPBC Act approval 2016/7670 and to assess the effectiveness of environmental management at the site of the Area 2 Works.

The audit involved a review of extensive information and documentation provided by HCCDC, a site inspection, and interviews.

Of the 22 conditions reviewed as part of the EPBC Act approval 2016/7670, all applicable conditions were found to be compliant, and three (3) were found to be not applicable. The not applicable conditions relate to two (2) conditions that have not yet been triggered and one (1) which provides the definitions for the approval.

Three observations were also made in relation to the conditions.

Accordingly, the audit has found that there is full compliance (100%) with the relevant conditions of EPBC Act approval 2016/7670.

The observations identified in Section 3.5 related to administrative recommendations, revegetation of stormwater infrastructure, and ongoing management of the site.

This audit provides assurance to stakeholders that the Area 2 Works have predominantly been completed in compliance with the required environmental standards and that the management of the site has been effective in, not only avoiding and mitigating impacts to the controlling provisions of EPBC Act 2016/7670 (predominantly the GGBF), but in creating additional effective breeding and foraging habitat for the GGBF.

The audit team would like to thank representatives from HCCDC and Daracon for providing access to the site, detailed knowledge of the works undertaken, and for the excellent record and data storage and recovery systems in use. The team would also like to thank the representatives from HCCDC, Public Works Advisory, and Ramboll for their availability and assistance during the interviews.

Appendix A

Auditor’s declaration of independence and audit team approval

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A.1 Auditor's declaration of independence

I, **David Bone of EMM Consulting Pty Ltd, Level 3, 175 Scott Street, Newcastle NSW 2300 (ABN: 28 141 736 558),** declare that to the best of my knowledge and belief, I and my organisation do not have any conflicting or competing interests with the Auditee, **Hunter and Central Coastal Development Corporation**, **on behalf of the Crown in right of the State of NSW, acting through NSW Treasury,** the Auditee's staff or representatives or other persons associated with the Auditee, including any personal, financial, business or employment relationship, except to the extent detailed below.

The project to be audited is **the closure and rehabilitation of Area 2 (K3 and K5 and a small section of K7), of the Kooragang Island Waste Emplacement Facility (KIWEF) near Newcastle, NSW (EPBC 2016/7670)**.

I shall notify the Department of the Environment within seven days of any change in these circumstances or any other change that may affect my independent status. I shall at all times observe any professional code of conduct and/or ethics applicable to undertaking audits (i.e. – as prescribed by the agency with which I hold accreditation/membership). I take full responsibility for any factual inaccuracy or mistake made in giving this declaration, particularly to the extent that others rely upon the truth of this declaration. I acknowledge that the Department of the Environment may request further information to verify my independence at any time.

Details of any personal, financial, business or employment relationship with the Auditee, the Auditee's staff, representatives or associated persons. (This is in the context of both the person making the declaration and the organisation that they are employed by – specify 'nil' if none):

David Bone has undertaken work on KIWEF, but not for HCCDC. This work included:

- **KIWEF Eastern Ponds Action Plan water quality monitoring, CENVP independent peer review 2018 – 2020, on behalf of Hazmat Services, and**
- **KIWEF Waste Emplacement Facility Ground and Surface Water Annual Monitoring CENVP independent peer review 2018 – 2020, on behalf of Hazmat Services.**

Details of audit qualifications and professional accreditations/memberships. (Include copies of current audit qualifications and current professional accreditations/memberships):

David Bone is a registered environmental practitioner with the EIANZ (CENVP #137) and has undertaken the Lead Environmental Auditor course at the University of NSW.

In making this declaration, I am aware that section 491 of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) makes it an offence in certain circumstances to knowingly provide false or misleading information or documents to specified persons who are known to be performing a duty or carrying out a function under the EPBC Act or the regulations. The offence is punishable on conviction by imprisonment for not more than 1 year, a fine not more than 60 penalty units, or both. An extract of section 491 of the EPBC Act is attached.

Signed:

Full name: David Bone

Organisation: EMM Consulting Pty Ltd

Date: __28__/__02__/__2023__

Footnote:

1. Where an organisation or a team of auditors is nominated to undertake the audit, each individual that is nominated is to complete a separate declaration.
2. The curriculum vitaes of all audit team members are to be submitted with the declaration outlining their relevant experience and qualifications.

Appendix B
Audit compliance matrix

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Audit Criteria and Methodology
EPBC 2016-7670 Kooragang Island Waste Emplacement Facility
Prepared for: Hunter and Central Coast Development Corporation

Date of Report: 27 February 2023
Report Prepared By: David Bone, Nathan Garvey, Brett McLennan, Nena Lane-Kirwan
Report Approved By: Mike Bardsley HCCDC **Date of Approval:** **22-Mar-19**

EPBC 2016-7670 Kooragang Island Waste Emplacement Facility Conditions of Approval

EPBC Act Approval Condition #	Criteria	Verification Method	Evidence	Documents Sighted	Determination	Compliance Finding
	PART A - Conditions specific to the action					
1	The action must only be undertaken within the footprint.	Site Inspection	No works outside of the footprint were sited during the site inspection.	Visual assessment during site inspection, including site tour. \\emmsvr1\EMM2\2022\E220406 - KIWEF Area 2 - Independent EPBC Audit\Background information\HCCDC_RFI response_EPBC 2016_7670\01. Project Footprint\Closure Works Footprint 20200722.pdf	Observation 2016-7670 #1 The approval documentation contains a note under the Details section in Action description that a variation under section 156B of the Act was accepted on 23 October 2018. This variation included a modification of the proposed action footprint. Attachment A of the referral does not include the revised boundary which is part of the approved management plan. For future reference and to avoid confusion it is suggested that the revised footprint be included in Attachment A of the publicly available approval decision.	Compliant
2	The person taking the action must implement the Green and Golden Bell Frog Management Plan to avoid and mitigate impacts on the Green and Golden Bell Frog (*Litoria aurea*) (GGBF) population.	Document Review	Documentary evidence clearly indicates that the GGBF Management Plan has been implemented to firstly avoid, and secondly mitigate impacts of the action on GGBFs. Known and potential GGBF habitat has been identified in the clearance inspection reports. Known aquatic habitat was outside of the works perimeter and the GGBF fence could therefore be installed at the extent of works boundary. Terrestrial habitat within the works area, had already been impacted by the initial grass fire and subsequent subterranean fire across large portions of Area 2. Fencing and GGBF protection measures were excluded during the emergency works to extinguish the subterranean fire duty to safety concerns. Following extinguishment, Daracon's first step was to install the GGBF fencing around the perimeter of extent of works, which acted as the delineation. Monthly inspections by the Independent Environmental Auditor (Ramboll) reviewed fences were installed around extent of works.	GGBF clearance reports are provided in Folder 2 GGBF Clearance Inspection Reports (taken from Area 2 Validation Report) Ramboll monthly reports in Folder 3 Ramboll Monthly Audit Reports folder. \\emmsvr1\EMM2\2022\E220406 - KIWEF Area 2 - Independent EPBC Audit\Background information\HCCDC_RFI response_EPBC 2016_7670\02. GGBF Clearance Inspection Reports \\emmsvr1\EMM2\2022\E220406 - KIWEF Area 2 - Independent EPBC Audit\Background information\HCCDC_RFI response_EPBC 2016_7670\03. Ramboll Monthly Audit Reports	The documents reviewed support the criteria.	Compliant
3	GGBF monitoring must be undertaken in accordance with the Green and Golden Bell Frog Management Plan within the KIWEF Site, including the temporary basins, aligned with NCIG Monitoring program.	Document Review	Annual monitoring has been undertaken in accordance with Condition 3. However, monitoring reporting of data on habitat condition and identification and monitoring of temporary basins is not clearly defined in the documents provided by HCCDC and sighted by the audit team. Notwithstanding this, data on habitat condition and monitoring results of temporary basins can be inferred from monitoring reports. The timing and extent of monitoring has exceeded the requirements of the condition with annual monitoring being undertaken from 2020 to present.	Condition 3 of the approval requires monitoring to be undertaken in accordance with the *Green and Golden Bell Frog Management Plan - Kooragang Island Waste Emplacement Facility Closure Works* (Golder Associates 2011). The management plan requires annual monitoring until 2020 then three-yearly until 2030. Annual monitoring has been ongoing since 2020 (see below) exceeding the requirements of the management plan. The results of annual monitoring undertaken by the University of Newcastle (UoN) are provided in Folder 5 - GGBF Annual Monitoring (\\emmsvr1\EMM2\2022\E220406 - KIWEF Area 2 - Independent EPBC Audit\Background information\HCCDC_RFI response_EPBC 2016_7670\05. GGBF Annual Monitoring). This includes monitoring for the 2019/20, 2020/21 and 2021/22 breeding seasons. No data was available for the 2022/23 breeding season. Data collected includes: - presence/absence of Green and Golden Bell Frog (and other frog species) at waterbodies across Kooragang Island, including KIWEF (from 2020/21) - GGBF distribution, population size and demographics - habitat utilisation - presence of Mosquito Fish (*Gambusia holbrooki*). It is worth noting that breeding ponds within the KIWEF (noted as K124-126 in UoN reports) were completed in late 2020 and surveyed from 2020/21.	While not clearly defined, data to support habitat condition monitoring is provided within monitoring report. This should be clearly defined and reported in future monitoring reports.	Compliant
4	GGBF monitoring must be analysed following each round of monitoring to identify any changes to the GGBF population, as compared to the baseline data described in the Green and Golden Bell Frog Management Plan. Should a decline in population be attributed to the action, response measures must be developed and implemented in accordance with the Green and Golden Bell Frog Management Plan.	Document Review	Monitoring data collected as a part of the annual monitoring indicates there has not been a decline in the Green and Golden Bell frog population against baseline data during the monitoring period.	Baseline monitoring reported in Golder Associates (2011) does not include population estimates for the GGBF, making detection of any changes in population impossible to detect. However, data collected by the University of Newcastle provides a useful comparison to detect population level changes. The results of annual monitoring undertaken by the University of Newcastle are provided in Folder 5 - GGBF Annual Monitoring (\\emmsvr1\EMM2\2022\E220406 - KIWEF Area 2 - Independent EPBC Audit\Background information\HCCDC_RFI response_EPBC 2016_7670\05. GGBF Annual Monitoring). This includes analysis of the GGBF population on Kooragang Island. The most recent draft annual report for 2022/23 indicates: - the Kooragang Island population of the GGBF grew from 2014/15 to 2016/17 - the population was relatively stable between 2016/17 and 2019/20 - there was a boom in the population in 2020/21 associated with a mass breeding event with juveniles making up a large portion of the population - in 2021/22 population numbers declined back to baseline levels *"consistent with the baseline population size before the 2020-21 'boom'"* (UoN 2023). GGBFs were detected in Area 2, in ponds created as a part of the closure works, during the 2020/21 (n=11 adults) and 2021/22 (n=49 adults) monitoring periods, (no data is currently available for the 2022/23 monitoring period). An adult GGBF was recorded in pond K124 during the site visit undertaken as a part of the audit.	The documents reviewed support the criteria.	Compliant

EPBC 2016-7670 Kooragang Island Waste Emplacement Facility Conditions of Approval

EPBC Act Approval Condition #	Criteria	Verification Method	Evidence	Documents Sighted	Determination	Compliance Finding
5	The person taking the action must revegetate the area marked in yellow and identified as 'Area 2 Closure works' on Map 2 at Attachment A to restore Green and Golden Bell Frog habitat in accordance with the Revegetation Management Plan.	Document Review	Revegetation works, particularly pond design, was undertaken in consultation with GGBF experts from the UoN, Ecologists from Jacobs and engineers from SMEC (M. Bardsley, pers. comm.). This work has built on extensive knowledge gained during revegetation works and habitat creation across Kooragang Island. Aquatic vegetation has been allowed to naturally establish in ponds based on advice from UoN. These environments are being colonised by the GGBF. Riparian corridors/table drains/open stormwater infrastructure appear to have been revegetated with the general seed mix used across the majority of the capping area, rather than aquatic species favoured by the GGBF. This is contrary to the revegetation management plan which requires “open stormwater infrastructure across the KIWEF site may be planted with species known to be favoured by GGBF” and “stormwater infrastructure, will be vegetated with species known to be favourable to GGBFs.” This requirement, to revegetate stormwater infrastructure with species favoured by the GGBF was also removed from the Kooragang Island Waste Emplacement Facility Area 2 Closure: Construction Environmental Management Framework (Jacobs 2019) where a revised Revegetation Management Plan is provided at Appendix E. This revised plan does not require revegetation of stormwater infrastructure with species favoured by the GGBF, with an updated requirement to "Allow terrestrial species to re-colonise Drainage culverts . . ." (p.37 of Appendix E).	The Revegetation Management Plan is provided in Appendix 8 of the EPBC Referral Preliminary Documentation Package: KIWEF Area 2 Closure Works (Ramboll 2018) accessed from https://www.hccdc.nsw.gov.au/sites/default/files/2019-05/06.%20KIWEF%20Area%202%20Closure%20Works%2C%20Preliminary%20Documentation%20PackageL_0.pdf	Observation 2016-7670 #2 Revegetation works have been undertaken in accordance with the Revegetation Management Plan is provided in Appendix 8 of the EPBC Referral Preliminary Documentation Package. Revegetation of stormwater infrastructure has been undertaken with species favourable to the Green and Golden Bell Frog. UoN (2023) indicates that the Green and Golden Bell Frog is moving around Kooragang Island, with colonisation of created ponds within Area 2. This would indicate that the species used to revegetate stormwater infrastructure is unlikely to have an impact on the movement of the species.	Compliant
		Interview	This was raised during the interviews and HCCDC responded that the revegetation works were informed by previous stages (e.g. K10 south, where mass breeding was observed). Other regeneration has occurred through self-seeding of some species, as per the revised Revegetation Management Plan. Portions of the site are now showing a dense regrowth of Acacia (*Acacia saligna*) following revegetation works. There is some evidence of the GGBF using "trees" with 3.5% of observations in 2019/20 season (UoN 2020, p.99) and 8% of observation in 2021/22 occurring within this microhabitat (UoN 2023, p. 20). However, dense regrowth and overshadowing trees is known to reduce the suitability of waterbodies as breeding habitat. It is likely that some control of Acacia will be required in the future to prevent this occurring. Some work to control Acacia has been undertaken (G. Moylan pers. comm.) and a post-closure management plan is being drafted. This will include ongoing management of weeds and vegetation across Area 2 with a focus on GGBF (M. Bardsley, pers. comm.).	Interviews Site Inspection	Observation 2016-7670 #3 During the site inspection undertaken as part of the audit, it was noted that there were dense areas of regrowth of Acacia. Some of this Acacia was being removed by contractors at the time, and HCCDC has advised (G. Moylan pers comms) that a removal program was put in place post the inspection. It is recognised that some level of control is required in the future to prevent impacts to breeding habitat and will be included within post-closure management plans.	
6	The person taking the action must undertake water quality monitoring for groundwater and surface water at the KIWEF Site in accordance with the Water Quality Management Plan.	Document Review	Water quality monitoring has been undertaken in accordance with the approved plans and requirements of the approval.	GW and SW monitoring reports, 2020 - 2022 GGBF pond Salinity monitoring, 2018-2022	The documents reviewed support the criteria	Compliant
7	At the completion of the project works, the approval holder must ensure: i) no increased distribution of Gambusia holbrooki due to the project works, within the area identified as 'Potential GGBF foraging or breeding habitat' as identified on Map 2 at Attachment A. and	Document Review	Data indicates there has not been an increase in the distribution of Mosquito Fish in ponds adjacent to the Referral Boundary, with a recorded reduction in distribution of the Mosquito Fish. Newly created ponds within Area 2 are free of Mosquito Fish.	Data on occupancy of waterbodies by Mosquito Fish is provided in the annual monitoring reports provided by UoN (\\emmsvr1\EMM2\2022\E220406 - KIWEF Area 2 - Independent EPBC Audit\Background information\HCCDC_RFI response_EPBC 2016_7670\05. GGBF Annual Monitoring) Mosquito Fish was known to occur in all in all 'Potential GGBF foraging or breeding habitat' identified on Map 2 at Attachment A of the approval in 2016 (see Item 15 in the 2021/22 annual monitoring report). During subsequent monitoring periods a number of ponds identified as 'Potential GGBF foraging or breeding habitat' on Map 2 at Attachment A have been recorded as Mosquito Fish being absent, including Pond 11 (K29) and the newly created ponds within Area 2 (K124-126).	The documents reviewed support the criteria	Compliant
	ii) no net loss of GGBF foraging or breeding habitat as an impact of the project works.	Site Inspection	No loss of habitat for the GGBF is evident. Conversely, overall, there has been a net increase in habitat through the creation of additional ponds for the species, with GGBF detected in these ponds.	Data on GGBF habitat is provided in the annual monitoring reports provided by UoN (\\emmsvr1\EMM2\2022\E220406 - KIWEF Area 2 - Independent EPBC Audit\Background information\HCCDC_RFI response_EPBC 2016_7670\05. GGBF Annual Monitoring). No evidence of loss of foraging or breeding habitat for the GGBF was observed during the site audit. Conversely, evidence of creation of habitat was observed during the site audit, with three ponds created (K124-126).	The site inspection identified actions which support the criteria.	Compliant
8	The approval holder must implement the KIWEF Site EMP.	Site Inspection	The approved KIWEF EMP has been implemented during the works.	KIWEF GGBF Management Plan.	The site inspection identified actions which support the criteria.	Compliant
	Part B - Standard administrative conditions					

EPBC 2016-7670 Kooragang Island Waste Emplacement Facility Conditions of Approval

EPBC Act Approval Condition #	Criteria	Verification Method	Evidence	Documents Sighted	Determination	Compliance Finding
	Notification of date of commencement of the proposed action	Document Review	Works commenced on the project on 21/8/19, following control of a major fire which started in mid January 2019. HCCDC notified DAWE of the commencement of the action under EPBC 2016/7670 via email on the 4/9/19. Within the email HCCDC also provided an update on Emergency Works underway related to the extinguishment of the subterranean fire (noting some of these works were ongoing). The email confirms that ground engaging works outside of the fire extinguishment zone started on 21/8/19.	Email of 4/9/19 M. Bardsley to K. Lowe. Ground Fire KIWEF Briefing Note DoEE.	The documents reviewed support the criteria.	Compliant
9	The approval holder must notify the Department in writing of the date of commencement of the action within 10 business days after the date of commencement of the action.	Document Review	Notification provided on 4/9/19.	Email of 4/9/19 M. Bardsley to K. Lowe.	The documents reviewed support the criteria.	Compliant
10	If the commencement of the action does not occur within 5 years from the date of this approval, then the approval holder must not commence the action without the prior written agreement of the Minister	Document Review	The action commenced on 21/8/19.	Email of 4/9/19 M. Bardsley to K. Lowe.	The documents reviewed support the criteria.	Compliant
	Compliance records					
11	The approval holder must maintain accurate and complete compliance records.	Document Review	Comprehensive records retained as required and available to the audit team on request. Documents support full compliance with requirements of these conditions.	Consultant (Eco Logical) reports on GGBF fencing and survey inspections February 2019 to February 2020. Monthly consultant (Ramboll) audit reports September 2019 to June 2020. Civil contractor (Daracon) weekly inspections August 2019 to May 2020. Incident register, Site Induction and records, Annual Compliance reports 2019 to 2022. Civil contractor (Daracon) monthly reports September 2019 to June 2020 . GGBF Pond water monitoring data 2018 - 2022. GGBF annual Monitoring (UoN) 2019 - 2022. Ground and Surface Water Monitoring (Hazmat) 2020 - 2022. Soil Conservation reports (Rubicon Enviro) October 2019 - April 2020. Water quality data reports (RCA) 2018 - 2022. Induction and pre-start records, Waste management receipts, incident register. Consultant (Eco Logical) pre-clearance report October 2022	The documents reviewed support the criteria.	Compliant
12	If the Department makes a request in writing, the approval holder must provide electronic copies of compliance records to the Department within the timeframe specified in the request.	Interview	No request of this nature from the Department has been made to the approval holder in relation to EPBC 2016/7670.		The interview responses satisfied the criteria for this condition. No requests recorded in documents reviewed.	Compliant
	Note: Compliance records may be subject to audit by the Department or an independent auditor in accordance with section 458 of the EPBC Act, and or used to verify compliance with the conditions. Summaries of the result of an audit may be published on the Department's website or through the general media.		Noted.			Not applicable.
	Preparation and publication of plans					
13	The approval holder must: a. publish all plans associated with the action on the approval holder's **website** within 30 **business days** of the date of approval of the action;	Document Review	The website contains the required documents in accordance with this condition.	https://www.hccdc.nsw.gov.au/publications#projects	The documents reviewed support the criteria.	Compliant
	b. exclude or redact **sensitive ecological data** from plans published on the **website** or provided to a member of the public, and	Document Review	Detailed sensitive ecological data has been excluded from the website with information limited to the documents already publicly available from other sources.	https://www.hccdc.nsw.gov.au/publications#projects	The documents reviewed support the criteria.	Compliant
	c. keep plans published on the **website** and the end date of this approval.	Document Review	The website information was up to date at the time of the audit.	https://www.hccdc.nsw.gov.au/publications#projects	The documents reviewed support the criteria.	Compliant
14	The approval holder must ensure that any monitoring data (including sensitive ecological data), surveys, maps, and other spatial and metadata required under a plan, is prepared in accordance with the Department's Guidelines for biological survey and mapped data (2018) and submitted electronically to the Department in accordance with the requirements of the plan.	Document Review	Data gathered for the project was prepared in accordance with these guidelines and statements to this effect are included in monitoring plans and reports.		The documents reviewed support the criteria.	Compliant
	Annual compliance reporting					
15	The approval holder must prepare a compliance report for each 12 month period following the date of the commencement of the proposed action, or as otherwise agreed to in writing by the Minister. The approval holder must: a) publish each compliance report on the website within 60 business days following the relevant 12 month period;	Document Review	Date of commencement of the action is 21/8/19, 60 business days following the annual period is 13/11/20, 15/11/21 and 15/11/22. The 2019/20 Annual Compliance Report (ACR) was uploaded to the HCCDC website on 11/11/20, DAWE were notified via email on 13/11/20.	Email correspondence of data records compliance.	The documents reviewed support the criteria.	Compliant
	b) notify the Department by email that a compliance report has been published on the website within five business days of the date of publication;	Document Review	Notifications provided for each report as required.	Email correspondence of compliance reports 19-20 and 20-21.	The documents reviewed support the criteria.	Compliant
	c) keep all compliance reports publicly available on the website until this approval expires;	Document Review	Reports available on the website at the time of the audit.	https://www.hccdc.nsw.gov.au/publications#projects	The documents reviewed support the criteria.	Compliant
	d) exclude or redact sensitive ecological data from compliance reports published on the website; and	Document Review	Detailed sensitive ecological data has been excluded from the website with information limited to the documents already publicly available from other sources.		The documents reviewed support the criteria.	Compliant
	e) where any sensitive ecological data has been excluded from the version published, submit the full compliance report to the Department within five business days of publication.	Document Review	Compliance reports submitted as required by this condition.	Email correspondence of compliance reports 19-20 and 20-21.	The documents reviewed support the criteria.	Compliant
	Note: The first compliance report may report a period less than 12 months so that it and subsequent compliance reports align with the similar requirement under state approval. Compliance reports may be published on the Department's website.		Noted.			Not Applicable
	Reporting non-compliance					
16	The approval holder must notify the Department in writing of any: incident; non-compliance with the conditions; or non-compliance with the commitments made in plans. The notification must be given as soon as practicable, and no later than two business days after becoming aware of the incident or non-compliance. The notification must specify: a) the condition which is or may be in breach; and	Document Review	During routine UoN nocturnal surveys for the Annual IWS on 7/4/20, ecologists identified a mass juvenile GGBF dispersion event that had breached the GGBF control measures (in particular the perimeter fencing) in place around the KIWEF and HCCDC considered there was a potential to harm the GGBF if no action was taken. Normal construction works in the area were stopped and only works in response to the dispersal event (capture/relocation/repairs) were allowed.	Environmental Incident KIWEF EPBC 2016/7670 [SEC=UNCLASSIFIED] - Detection of GGBF Within the Work Exclusion Area at The Peninsula Borrow Area, 7th April. EPBC 2016/7670 - Incident Report - Update June 2020. Juvenile GGBF Dispersal Event Rev 1.	The documents reviewed support the criteria.	Compliant
	b) a short description of the **incident** and/or non-compliance.		See 16a		The documents reviewed support the criteria.	Compliant

EPBC 2016-7670 Kooragang Island Waste Emplacement Facility Conditions of Approval

EPBC Act Approval Condition #	Criteria	Verification Method	Evidence	Documents Sighted	Determination	Compliance Finding
17	The approval holder must provide to the Department the details of any incident or noncompliance with the conditions or commitments made in plans as soon as practicable and no later than 10 business days after becoming aware of the incident or non-compliance, specifying: a) any corrective actions or investigation which the approval holder has already taken or	Document Review	HCCDC notified the Approval Holder (NSW Treasury) and DAWE of the incident the following day 8/4/20.	Environmental Incident KIWEF EPBC 2016/7670 [SEC=UNCLASSIFIED] - Detection of GGBF Within the Work Exclusion Area at The Peninsula Borrow Area, 7th April. EPBC 2016/7670 - Incident Report - Update June 2020. Juvenile GGBF Dispersal Event Rev 1.	The documents reviewed support the criteria.	Compliant
	b) the potential impacts of the **incident** or non-compliance; and	Document Review	Details required are contained in the documents reviewed.	Environmental Incident KIWEF EPBC 2016/7670 [SEC=UNCLASSIFIED] - Detection of GGBF Within the Work Exclusion Area at The Peninsula Borrow Area, 7th April. EPBC 2016/7670 - Incident Report - Update June 2020. Juvenile GGBF Dispersal Event Rev 1.	The documents reviewed support the criteria	Compliant
	c) the method and timing of any remedial action that will be undertaken by the approval holder.	Document Review	Updates on the actions taken were provided as required	Incident Report & updates (FW EPBC 20167670 - Incident Report - Update June 2020).	The documents reviewed support the criteria	Compliant
	Independent audit					
18	The approval holder must ensure that independent audits of compliance with the conditions are conducted: i) Following the completion of onsite construction works and prior to the **completion of the**	Document Review	This audit has been undertaken following completion of works as required.	This audit was commissioned and undertaken as required by the criteria of this condition.		Compliant
	ii) Within a 12month period from the completion of the action;	Document Review	This audit has been undertaken following completion of works as required.	This audit was commissioned and undertaken as required by the criteria of this condition.		Compliant
	iii) of as requested in writing by the Minister.		No requests received at the time of the audit.	This audit was commissioned and undertaken as required by the criteria of this condition		Compliant
19	For each **independent audit**, the approval holder must: a. provide the name and qualifications of the independent auditor and the draft audit criteria to the **Department**	Document Review	The audit team were approved by the department prior to the audit commencement.	Letter from HCCDC to the Department contained names and qualifications of audit team.	The documents reviewed support the criteria.	Compliant
	b. only commence the **independent audit** for once the audit criteria have been approved in	Document Review	The audit scope was approved by the department prior to the audit	ATTB 2016-7670 - approve independent auditot-criteria19AUG22.pdf.	The documents reviewed support the criteria.	Compliant
	c. submit an audit report to the **Department** within the timeframe specified in the approved		This report.			Compliant
20	The approval holder must publish the audit report on the website within 10 business days of receiving the Department's approval of the audit report and keep the audit report published on the website until the end date of this approval.		Noted.			Compliant
	Completion of the action					
22	Within 30 days after the completion of the action, the approval holder must notify the Department in writing and provide completion data.	Document Review	The action is not completed.			Not Applicable

EPBC 2016-7670 Kooragang Island Waste Emplacement Facility Compliance Table - Conditions of Approval

REF#	Requirement	Triggered for audit cycle	Evidence collected	Audit findings and recommendations	Compliance Status (Compliant/Non compliant/ Not triggered)
	CEMP				
	Conditions of approval				
3.2	All contractor personnel and sub-contractor will undergo environmental training before commencing works on site. Training will be undertaken in the following forms: Project induction; and Regular (daily) pre-start discussions on environmental topics	Triggered	Project Induction (Daracon KIWEF) Induction records Pre-start briefings	Induction training and pre-start records reviewed	Compliant
3.2.1	Prior to working on site, the Contractor will ensure that all staff and sub-contractors working on site are appropriately inducted. The Contractors induction must communicate the environmental performance expectations of this CEMF and the specific mitigation measures to achieve these expectations as documented in the Contractors CEMP. Induction content is expected to include: · Legal and regulatory requirements including duty of care and potential consequences of infringements; · Environmental responsibilities with detailed training on the implementation of hygiene protocols and the importance of GGBF; · Identification of sensitive areas including threatened species habitat, waterways, asbestos impacted waste and other hazardous waste; · Identification of boundaries for vegetation clearing, washing, refueling and maintenance areas for vehicles, plant and equipment; · Environmental management techniques for noise, air, surface and ground water, waste generation, contaminated land etc.; · Emergency plans and incident management including the use of spill kits; · Reporting processes for environmental harm or environmental incidents; · Roles and responsibilities in achieving conformance with environmental policies and requirements, including emergency preparedness and response requirements; and · Identification and management of non-conformances.	Triggered	Project Induction (Daracon KIWEF) Induction records	Section 3 and 5 of the induction include relevant information for environmental/emergency response and implementation of the CEMP.	Compliant
Section 4.1	This Construction Environmental Management Plan (CEMP) and sub plans have been prepared to comply with the Minister for Planning and Infrastructure's Conditions of Approval for the project. The CEMP has been developed and adopted in accordance with Daracon's Certified Environmental Management System under ISO14001:2015, Project specifications, and the Guideline for the Preparation of Environmental Management Plans (DIPNR, 2004). This CEMP meets the requirements of the CoA and outlines the following at a minimum:	Triggered	KIWEF Area 2 Closure Works, Construction Environmental Management Framework_Final KIWEF - Construction Environmental Management CEMP Sub-Plan - Rev 3	CEMP approved for use on the project and implemented	Compliant
	• Project details including activities to be undertaken; • Specific mitigation measures and controls that can be applied onsite to avoid or minimise negative environmental impacts; • Specific mechanisms for compliance with applicable polices, approvals, licenses, permits, consultation agreements and legislation; • Environmental management related roles and responsibilities of personnel; • States objectives and targets for issues important to the environmental performance of the Project; and • Outlines monitoring processes to check the adequacy of controls as they are implemented during construction.	Triggered	KIWEF Area 2 Closure Works, Construction Environmental Management Framework_Final KIWEF - Construction Environmental Management CEMP Sub-Plan - Rev 3	CEMP outlines all of the following requirements.	Compliant
Section 4.3.1	Provide evidence that an on-site risk workshop was held within 21 days of the contract date for the project	Triggered	Daracon Internal Audit of IPMP on 2 Oct 19. Record of the audit is included within the Daracon Monthly report for October 2019, (s 2.6 and 6.6).	The contractor undertook an internal audit of the implementation of the IPMP on 2/10/19.	Compliant

EPBC 2016-7670 Kooragang Island Waste Emplacement Facility Compliance Table - Conditions of Approval

REF#	Requirement	Triggered for audit cycle	Evidence collected	Audit findings and recommendations	Compliance Status (Compliant/Non compliant/ Not triggered)
Section 4.3.4	Provide work method statements for the following activities: •Site establishment •Clearing and grubbing •Topsoil strip and stockpile •General earthworks •Import and placement of capping material •Drainage works	Triggered	SWMS register provided	SWMS register contains the required documents	Compliant
Section 4.6	All staff working, including sub-contractors on this site are provided with the environmental training required to competently carry out their work.	Triggered	Induction register provided.	Details provided from May 2019 - December 2020	Compliant
Section 4.6	All site staff, contractors and sub-contractors are inducted before commencing work. Daracon site personnel will conduct an onsite induction prior to commencement A Training Register and Induction Register is kept on site.	Triggered	Induction register provided.	Details provided from May 2019 - December 2020	Compliant
Section 4.5	Daracon will ensure subcontractor compliance with duties including planning, implementing and monitoring environmental protection measures and for keeping environmental records by managing them in accordance with Daracon's IPMP and this CEMP. Daracon will retain the environmental protection for the duties for the following all subcontracted work. Daracon is responsible for the surveillance of all subcontractors environmental protection measures to monitor the effectiveness of these measures. The surveillance program includes formal bi-weekly activity surveillance and weekly environmental inspections. It also includes daily supervision and visual inspections.	Triggered	Monthly reports Weekly Reports Pre-Start meetings	Daracon monthly report - October 2019. Section 2.6 and 6.6 states an internal audit was conducted on 2 October 2019, noting the audit focused on the implementation of the Integrated Project Management Plan (IPMP).	Compliant
Section 4.8	Daracon will utilise its emergency response management plan to communicate environmental problems and incidents with site personnel, the client and relevant authorities and stake holders.	Triggered	Emergency Response Management Plan provided.	Implementation of plan identified in Induction, pre-starts and toolbox meeting records	Compliant
Section 4.8.1	A report will be prepared on each occasion the site is visited by EPA, and the Principal will be immediately notified. The Report will be provided to the Principal within 1 working day (24hrs) of the visit. If statutory notice is given to the EPA as required under the POEO Act, notification will be provided to the Secretary within 24hrs after the notification was given to the EPA.	Triggered	Noted	No reported inspections by EPA. Fire and rescue along with EPA were present at the site during the ground fire emergency. Reports were prepared for this activity.	Compliant
Section 4.9	Daracon will implement an emergency response management plan and all site personnel working on the project will be inducted into the requirements of the emergency response plan (IM-DDK-0323-005).	Triggered	Emergency Response Management Plan. Project Induction Induction records	The Daracon Emergency Response Plan is an Appendix of the Integrated Project Management Plan and includes details to respond to environmental emergencies. Requirements included in Induction	Compliant
Section 4.10	Environmental and ESC inspections are undertaken weekly on this project	Triggered	Daily/weekly environmental inspections provided - weekly reports include erosion and sediment control inspections. Monthly environmental reports provided. CPESC inspections reports provided for Area 2	Weekly Inspections were undertaken by Daracon to check the status of various environmental aspects, these weekly inspections also collated daily checks on targeted items (eg. amphibian hygiene stations). The Daracon inspections also included checks of ESC items. The Daracon monthly report would summarise these inspections and issues would also be raised during weekly meetings/inspections between Daracon and HCCDC. In addition, a CPESC conducted regular inspections to advise on the controls implemented and provide any recommendations. During the visit the CPESC would also prepare a Progressive Erosion & Sediment Control Plan (PESCP).	Compliant

EPBC 2016-7670 Kooragang Island Waste Emplacement Facility Compliance Table - Conditions of Approval

REF#	Requirement	Triggered for audit cycle	Evidence collected	Audit findings and recommendations	Compliance Status (Compliant/Non compliant/ Not triggered)
Section 4.10	Additional ESC inspections are done prior to adverse weather conditions and after more than 10mm of rain in a 24 hr period using IM-REP-0503-001.	Triggered	Regular CPESC inspections were conducted and copies provided. The reposts advise on controls implemented and provide any recommendations. Observations and recommendations are recorded in the reports. Water monitoring and rainfall data is provided in Coffey reports. Section 4.3.3 notes additional measures taken prior to predicted weather conditions.	Regular CPESC inspections were conducted to advise on the controls implemented and provide any recommendations. During the visit the CPESC would also prepare a Progressive Erosion & Sediment Control Plan (PESCP) to document observations and recommendations. Daracon's environmental consultant Coffey's undertook the Water Quality monitoring to demonstrate compliance with the CEMP. The results of the surface water monitoring following heavy rainfall are provided in the Coffey's Monthly Reports, which are submitted as a component of the Daracon Monthly Report.	Compliant
Section 4.11	All environmental non-conformances with project approvals, this CEMP or Daracon procedures is to be recorded as an incident, investigated and closed out in a timely manner. Close-out is required to include sign-off that corrective actions have been implemented or alternative solutions substituted. A summary of all non-conformances and associated corrective actions is to be provided to the client.	Triggered	Environmental Incident KIWEF EPBC 2016/7670 [SEC=UNCLASSIFIED] - Detection of GGBF Within the Work Exclusion Area at The Peninsula Borrow Area, 7th April; EPBC 2016/7670 - Incident Report - Update June 2020 Juvenile GGBF Dispersal Event Rev 1	During routine UoN nocturnal surveys for the Annual IWS on 7/4/20, ecologists identified a mass juvenile GGBF dispersion event that had breached the GGBF control measures (in particular the perimeter fencing) in place around the KIWEF and HCCDC considered there was a potential to harm the GGBF if no action was taken. Normal construction works in the area were stopped and only works in response to the dispersal event (capture/relocation/repairs) were allowed.	Compliant
Section 5.7.1	Plant and equipment brought on to site will be cleaned and free of deleterious material, mud and other material that may harbour weed seeds.	Triggered	Plant pre-start forms	Plant pre-start forms reviewed noting this requirement	Compliant

EPBC 2016-7670 Kooragang Island Waste Emplacement Facility Compliance Table - Conditions of Approval

REF#	Requirement	Triggered for audit cycle	Evidence collected	Audit findings and recommendations	Compliance Status (Compliant/Non compliant/ Not triggered)
Section 5.7.1	Any capping materials imported from outside the KIWEF facility will be sourced from an area that is assessed as having a low risk of containing Chytrid Fungus.	Triggered	S143 forms Assessment report of import material - 5196096_JH NIF Kangy Angy_K1 ENM Suitability_20022024_Combined	An example of imported material used during the Area 2 works is the K1 stockpile sourced from Kangy Angy, Fleet Maintenance Facility. The ENM waste classification assessment and referral to UoN amphibian specialists for review of chytrid risks within the material are provided. Another example the Cameron Park Mulch stockpile that was used as a topsoil layer. Representatives from HCCDC and UoN attended the site to assess potential for chytrid from importation and use of the material. UoN also provided a letter report documenting the low risk from use of the material. Other sources used were considered low risk, eg subgrade from M1 and Toukley road works, which the previous road subgrade materials were removed and imported to Area 2 (20+ years covered by hardstand = very low risk for chytrid). The Ramboll environmental auditor also conducted regular reviews of material sources and associated chytrid risk assessments as the materials were identified.	Compliant
	Topsoil to be used for surface layers will be sourced from within KIWEF to the extent possible and will otherwise be assessed as required.	Triggered	Cap inspection reports EF18_46502_08.2 Rev 0_KIWEF (2021_06) Area 2, Cap Inspection_V1	Cap inspection reports were reviewed and noted to contain an assessment of topsoil. Sources of material not noted in these reports	Compliant
Section 5.7.3	Establish any controls necessary to prevent works from occurring outside the referral boundary.	Triggered	Visual assessment fencing installation	Visual assessment during site inspection. No works outside of the footprint were sited during the site inspection.	Compliant
Section 5.7.3	Temporary frog exclusion fencing will surround the Closure Works site and ensure GGBF habitat protected from unauthorised access prior to works commencing in those works areas or their parts.	Triggered	Fencing was sighted during site visit Known and potential GGBF habitat has been identified in the clearance inspection reports. Ramboll monthly reports show the inspection of the fencing around the area of works.	GGBF clearance reports were reviewed known aquatic habitat was outside of the works perimeter and the GGBF fence could therefore be installed at the extent of works boundary. Terrestrial habitat within the works area, had already been impacted by the initial grass fire and subsequent subterranean fire across large portions of Area 2. Fencing and GGBF protection measures were excluded during the emergency works to extinguish the subterranean fire duty to safety concerns. Following extinguishment, Daracon's first step was to install the GGBF fencing around the perimeter of extent of works, which acted as the delineation. Monthly inspections by the Independent Environmental Auditor (Ramboll) reviewed fences were installed around extent of works	Compliant
Section 5.7.3	Establishment and use of chytrid hygiene procedures such that the Chytrid fungus is not brought to site or transferred between area's of the site,	Triggered	Daily environmental inspections of frog hygiene station is recorded in inspection checklist.	The monthly independent environmental audit report confirms frog hygiene stations were available and maintained throughout project.	Compliant

EPBC 2016-7670 Kooragang Island Waste Emplacement Facility Compliance Table - Conditions of Approval

REF#	Requirement	Triggered for audit cycle	Evidence collected	Audit findings and recommendations	Compliance Status (Compliant/Non compliant/ Not triggered)
Section 5.7.3	Appropriate levels of GGBF pre-clearance/disturbance surveys and relocation to ensure to the extent possible that direct disturbance area's are free of GGBF on the commencement of works in each area,	Triggered	Pre-clearance surveys	Pre-clearance surveys contain appropriate information as required	Compliant
Section 5.7.3	Conduct pre-clearance surveys by a qualified ecologist in week prior to works commencing in works areas or their parts.	Triggered	Pre-clearance surveys	Pre-clearance surveys were completed by ecological Australia	Compliant
Section 5.7.3	Utilise an onsite ecologist during construction to relocate any native fauna which may be displaced	Triggered	Ecological Australia were engaged.	Reports on clearing were provided by the project ecologist as required	Compliant
Section 5.7.3	Show that suitable risk assessment has been undertaken by an appropriately qualified and experienced ecologist on all imported capping and revegetation materials to demonstrate that it contains a low risk of containing Chytrid.	Triggered	S143 forms Assessment report of import material - 5196096_JH NIF Kangy Angy_K1 ENM Suitability_20022024_Combined	An example of imported material used during the Area 2 works is the K1 stockpile sourced from Kangy Angy, Fleet Maintenance Facility. The ENM waste classification assessment and referral to UoN amphibian specialists for review of chytrid risks within the material are provided.	Compliant
	Green and Golden Bell Frog Management Plan				
	Project Approval				
Section 1.4	This GGBF Management Plan has been developed in order to partly address the KIWEF site's Approval Surrender of License Number 6437, dated 8 December 2010, Condition 5.b), which requires the following: b) The license shall prepare and submit a Green and Golden Bell Frog Management Plan to the EPA for approval by 13 April 2011. The plan shall encompass the entire premises occupied by the licensee and include, but not limited to:	Triggered	KIWEF GGBF Management Plan	This plan was approved and implemented for the works	Compliant
	i) Management measure to be undertaken to minimise the spread of the amphibian Chytrid fungus including: i. the training of project personnel in site hygiene management; and ii. site hygiene procedures for project personal, mobile plant and equipment, in accordance with the NPWS Hygiene Protocol for the Control of Disease in Frogs 2001; and	Triggered	KIWEF GGBF Management Plan Weekly inspections Monthly Audit Reports	The plans includes these requirements and has been implemented and audited monthly by the EMR	Compliant
	ii) Measures to maintain, restore and enhance Green and Golden Bell Frog habitat, including movement corridors across the site.	Triggered	KIWEF GGBF Management Plan Weekly inspections Monthly Audit Reports	The plans includes these requirements and has been implemented and audited monthly by the EMR	Compliant
	Additionally obligations exist under the DSWEPC's *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) as to the protection of this nationally threatened species. These obligations are detailed in the PBC Act policy statement 3.19, as well as the significant impact criteria set out in the NSW *Threatened Species Conservation Act 1995* (TSC Act).	Triggered		Noted. These requirements are in the approved plans	Compliant

EPBC 2016-7670 Kooragang Island Waste Emplacement Facility Compliance Table - Conditions of Approval

REF#	Requirement	Triggered for audit cycle	Evidence collected	Audit findings and recommendations	Compliance Status (Compliant/Non compliant/ Not triggered)
Section 3.1	Provide evidence that prior to works commencing, known and potential GGBF habitat was clearly identified on the ground (with appropriate signage)	Triggered	GGBG habitat was in daily/weekly inspections. Refer to Daracon daily/weekly environmental inspections of frog and sediment fences. Pre-clearance surveys for GGBF were completed through out the works	Mapping and delineation of frog habitat areas was clearly identified. Site inspections noted signage in place as well as controls and fencing to restrict access where required.	Compliant
Section 3.1	Provide evidence that communications to personnel undertaking works included obligations to maintain and protect known and potential GGBF habitat	Triggered	Training package provided,	Daracon's ecologists (ELA) prepared a GGBF training package, summarising key information and documents in relation to GGBF. Daracon included this information within their onsite induction and posted signage within lunch rooms, site office. Training package provided, includes: environmental site induction identification photos Fact sheet Similar species identification Hygiene protocol	Compliant
Section 3.3	All HDC personnel, contractors and sub-contractors will undergo environmental induction and training before commencing work on-site. As it pertains to the Green and Golden Bell Frog, information addressed during this training will include (NCIG, 2007): - Green and Golden Bell Frog profile and identification; - Identification of Green and Golden Bell Frog habitat areas. Project personnel will be prohibited from entering Green and Golden Bell Frog habitat areas located outside defined works areas - Site hygiene management in accordance with the Hygiene Protocol (Section 3.4) - Procedures to be followed in the event Green and Golden Bell Fogs are found (Section 3.6)	Triggered	Training package provided, all elements included	A copy of the Contractors induction is provided. Section 3 and 5 of the induction include relevant information for environmental/emergency response and implementation of the CEMP.	Compliant
Section 3.4.1	To reduce the likelihood of spreading FCF, all HDC employees and contractors involved in activities in areas of known habitat for the Green and Golden Bell Frog (and other amphibian species) will be trained in site hygiene management in accordance with the hygiene protocol (Appendix X). This will be part of the environmental induction and training (Section 3.3).	Triggered	Training pack provided includes hygiene training	Inductions include training and details on the hygiene protocols for the site. Hygiene protocols implemented during site inspection phase of the audit.	Compliant
Section 3.4.2	Any mobile plant entering and leaving KIWEF site during the closure and capping activities will be routinely disinfected as a matter of routine, following the methods outlined in the Hygiene Protocol (Appendix A). Inspection and disinfection of mobile plant, and affected PPE, will be undertaken at a designated, concrete bunded disinfection area at the entrance of the KIWEF site. The location of this area, and the disinfection procedure will be incorporated into the site induction and training program (Section 3.3).	Triggered	Daily environmental inspections of frog hygiene stations are included in inspection. Ramboll independent environmental audits (monthly) confirmed frog hygiene stations were available and maintained throughout project.	Wheel Wash in use at the time of the inspection in the Eastern Ponds area. Site vehicles disinfected prior to entry during site inspection due to entering via an areas without a wheel wash.	Compliant

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REF#	Requirement	Triggered for audit cycle	Evidence collected	Audit findings and recommendations	Compliance Status (Compliant/Non compliant/ Not triggered)
Section 3.5	Pre-work surveys will include targeted active searches of potential Green and Golden Bell Frog habitat located within proposed disturbance areas. These surveys will be undertaken by a suitably qualified and licensed ecologist.	Triggered	Pre-clearance reports	Pre-clearance surveys were completed by Ecological Australia and provided (including nocturnal surveys)	Compliant
	Green and Golden Bell Frog Monitoring program The NCIG monitoring will be conducted annually until 2020 and then three-yearly till 2030. HDC propose to annually review the NCIG data to ensure it meets HDC's requirements. The overall objective of HDC's review of the Green and Golden Bell Frog monitoring program is to monitor the dynamics of the Green and Golden Bell Frog populations supported within known and potential habitat areas within the KIWEF site. The intention of the review program will be to ascertain if the landfill closure works have an effect on the population. Monitoring parameters that will be used for comparison will include, yet not to be limited to: a) GGBF presence/absence, distribution, habitat utilisation, behaviour and abnormalities b) observations of other frog species distribution, relative abundance and abnormalities c) habitat condition d) date e) time of day f) rainfall (mm) g) site location (GPS coordinated and map location) h) survey method utilised i) sampling effort j) habitats surveyed k) weather conditions (including temperature) l) number of observations m) photographs taken	Triggered	2019-20, 2020-21, 2021-2022 reports provided	Reports reviewed as part of the audit contained the required data from the monitoring program. Data on GGBF monitoring from 2019 - 2022 contains information on habitats in use and by default identifies suitable habitat areas .	Compliant
Section 5.1	The boundaries of all Green and Golden Bell Frog habitat will be clearly identified on the ground	Triggered	Site Inspection	Habitat areas clearly identified by signage	Compliant
Section 5.1	Appropriate erosion and sediment control structures will be installed at least 30m upslope of all such habitat areas. These erosion and sediment control structures will be regularly inspected and maintained, particularly after significant rainfall events.	Triggered	Site Inspection CPESC (Rubicon Enviro) Reports	Monthly inspection reports with actions prepared. Actions closed in following reports, PESCP's endorsed by CPESC	Compliant
Section 5.1	All plant entering and leaving the KIWEF site will be, as a matter of routine, disinfected via a wash bay. The location and procedures involved at this wash bay will form part of the site induction and training (see section 3.3). Records will be kept.	Triggered	Daily environmental inspections of frog hygiene stations are included in inspection. Ramboll independent environmental audits (monthly) confirmed frog hygiene stations were available and maintained throughout project.	Wheel Wash in use at the time of the inspection in the Eastern Ponds area. Site vehicles disinfected prior to entry during site inspection due to entering via an areas without a wheel wash.	Compliant
Section 5.1	Similarly, all HDC employees and contractors involved in activities in areas of known habitat for the Green and Gold Bell Frog (and other amphibian species) will be trained in site hygiene management in accordance with the hygiene protocol (Appendix A). This will be part of the Environmental induction and training (Section 3.3). Records will be kept.	Triggered	Training pack provided includes hygiene training	Induction records show training in this requirement. Implementation confirmed during site inspection	Compliant
Section 5.1	All PPE in contact with soil, particularly boots, of HDC employees and contractors entering and leave the site will be disinfected as a matter of routine, following the methods outlined in the Hygiene Protocol (Appendix A).	Triggered	Boots sprayed during site visit	Implementation confirmed during site inspection	Compliant

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Section 5.1	All disinfection processes will be monitored and controlled at the KIEWF site's entry and exit point. The location of these disinfection, will be communicated during the site induction and training (Section 3.3.)	Triggered	Included in training pack provided, Weekly inspections EMR monthly reports	Implementation confirmed during site inspection	Compliant
Section 5.1	All water required for dust suppression will be drawn from ponds established for the purpose. No water for dust suppression will be drawn from current ponds on the site. The establishment of dedicated dust suppression ponds will be undertaken to prevent the potential spread of Plague Minnow into ponds currently free of this species. The location and procedure for those dedicated dust suppression ponds will be communicated during the site induction and training (Section 3.3).	Triggered	Weekly Reports	Water source identified as 'standpipe' in reports. Location of standpipe noted to be offsite and not drawn from ponds or onsite water sources	Compliant
Section 5.1	Stormwater diversion measures, if required, will be put in place to maintain the current hydrological regime for the site	Triggered	Site Inspection CPESC (Rubicon Enviro) Reports	Monthly inspection reports with actions prepared. Actions closed in following reports, PESCP's endorsed by CPESC	Compliant
Section 5.1	If practicable, the capping and grading activities will be schedule to occur outside the core Green and Golden Bell Frog breeding period (that is, September to March), especially in areas adjacent to known and potential breeding habitat.	Triggered	Environmental Incident KIWEF EPBC 2016/7670 [SEC=UNCLASSIFIED] - Detection of GGBF Within the Work Exclusion Area at The Peninsula Borrow Area, 7th April; EPBC 2016/7670 - Incident Report - Update June 2020 Juvenile GGBF Dispersal Event Rev 1	In general works were undertaken in accordance with this requirement. One incident was recorded where works were undertaken outside these requirements. During routine UoN nocturnal surveys for the Annual IWS on 7/4/20, ecologists identified a mass juvenile GGBF dispersion event that had breached the GGBF control measures (in particular the perimeter fencing) in place around the KIWEF and HCCDC considered there was a potential to harm the GGBF if no action was taken. Normal construction works in the area were stopped and only works in response to the dispersal event (capture/relocation/repairs) were allowed.	Compliant
5.2	In an attempt to limit the potential for Green and Golden Bell Frigs to enter the disturbance footprint and if practicable, a frog-proof barrier will be erected around the disturbance footprint	Triggered	Ecological Australia GGBF reports are provided: \\emmsvr1\EMM2\2022\E220406 - KIWEF Area 2 - Independent EPBC Audit\Background information\HCCDC_RFI response_EPBC 2016_7670\02. GGBF Clearance Inspection Reports	Frog Fence in place as required at the time of the audit	Compliant
Monitoring program **Water quality management plan**					

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REF#	Requirement	Triggered for audit cycle	Evidence collected	Audit findings and recommendations	Compliance Status (Compliant/Non compliant/ Not triggered)
	The licensee shall undertake the groundwater monitoring program outlined in Table 1, 2 and 3 of the Surrender Notice. Monitoring locations are those groundwater bores identified in both the fill and natural aquifers as shown on the map attached to the Surrender Notice		2020, 2021 and 2022 GW and SW monitoring annual reports provided. Monitoring program outlined in Table 1-3 of the surrender notices has been undertaken for each year.	Compliant	Compliant

Table 1 – Deep Estuarine Wells being K5/5S, K5/6S, K7/2N, K9/2E, K9/3N, K9/4W, K11/1S, K11/2W, K11/3W, K12/1E, K12/3N, K12/4N, K12/7E, K12/9E and K12/10

Pollutant	Units of Measure	Frequency	Sampling Method
Ammonia	mg/L	Every 12 months	Grab sample
Phenols[1]	mg/L	Every 12 months	Grab sample
Cyanide (Total, WAD and free)	mg/L	Every 12 months	Grab sample
Chromium (hexavalent)	mg/L	Every 12 months	Grab sample
Molybdenum (dissolved)[2]	mg/L	Every 12 months	Grab sample
Lead (dissolved)[3]	mg/L	Every 12 months	Grab sample
Total PAHs	mg/L	Every 12 months	Grab sample
Conductivity	mg/L	Every 12 months	Grab sample
pH	pH	Every 12 months	Grab sample

Table 2 – Shallow Estuarine Wells being K3/1W, K5/6NN, K7/2S, K7/4S, K8/5W, K9/2W, K9/3S, K9/4E, K10/2NN, K11/1, K11/2E, K11/3E, K12/1W, K12/3W, K12/6, K12/7, K12/9, K12/10E, BHe29s, GHD02, E61D, 336B, 334B

Pollutant	Units of Measure	Frequency	Sampling Method
Ammonia	mg/L	Every 12 months	Grab sample
Phenols[4]	mg/L	Every 12 months	Grab sample
Cyanide (Total, WAD and free)	mg/L	Every 12 months	Grab sample
Chromium (hexavalent)	mg/L	Every 12 months	Grab sample
Molybdenum (dissolved)[5]	mg/L	Every 12 months	Grab sample
Lead (dissolved)[6]	mg/L	Every 12 months	Grab sample
Total PAHs	mg/L	Every 12 months	Grab sample
Conductivity	mg/L	Every 12 months	Grab sample
pH	pH	Every 12 months	Grab sample

Table 3 – Fill Wells being K5/4, K5/5N, K5/6N, K7/4N, K8/5E, K10/2, K10/2N, K7/1, GHD01, E61S, 336A, 344A

Pollutant	Units of Measure	Frequency	Sampling Method
Ammonia	mg/L	Every 12 months	Grab sample
Phenols[7]	mg/L	Every 12 months	Grab sample
Cyanide (Total[8], WAD and free)	mg/L	Every 12 months	Grab sample
Chromium (hexavalent)	mg/L	Every 12 months	Grab sample
Molybdenum (dissolved)[9]	mg/L	Every 12 months	Grab sample
Lead (dissolved)[10]	mg/L	Every 12 months	Grab sample
Total PAHs	mg/L	Every 12 months	Grab sample
Conductivity	mg/L	Every 12 months	Grab sample
pH	pH	Every 12 months	Grab sample

[4] Not required to be analysed at wells K7/4S, K8/3W, K9/2W, K9/4E, K10/2NN

[5] Not required to be analysed at wells K5/6NN, K7/2S, K9/4E

[6] Not required to be analysed at wells K5/6NN, K7/2S, K9/4E, K7/4S, K9/2W, K9/4E

[7] Not required to be analysed at wells K5/4, K5/5N, K7/4N, K8/5E, K10/2, K10/2N

[8] Not required to be analysed at wells K5/5N, K10/2, K10/2N

[9] Not required to be analysed at wells K5/4, K5/5N, K5/6N

[10] Not required to be analysed at wells K5/4, K5/5N, K5/6N, K7/4N

Compliant

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REF#	Requirement	Triggered for audit cycle	Evidence collected	Audit findings and recommendations	Compliance Status (Compliant/Non compliant/ Not triggered)
	Table 4– Surface Water Monitoring at Locations KS2/1, KS1/3, K10/1, KS7/1, KS12/6 Pollutant / Units of Measure / Frequency / Sampling Method Ammonia / mg/L / Every 12 months / Grab sample Phenols / mg/L / Every 12 months / Grab sample Cyanide (Total, WAD and free) / mg/L / Every 12 months / Grab sample Chromium (hexavalent) / mg/L / Every 12 months / Grab sample Molybdenum (dissolved) / mg/L / Every 12 months / Grab sample Lead (dissolved) / mg/L / Every 12 months / Grab sample Total PAHs / mg/L / Every 12 months / Grab sample Conductivity / mg/L / Every 12 months / Grab sample pH / pH / Every 12 months / Grab sample	Triggered			Compliant
	If any samples collected from monitoring locations listed in Condition 5c) and 5d) show an increase in pollutant concentration at the boundary of the lands to which the Surrender License applies, HDC must commence capping works within 2 months of receiving the data. Capping works are to commence regardless of the progress of the T4 project unless otherwise agreed in writing by the EPA. The key methods, locations, frequency, and duration of the monitoring program, investigation triggers, contingency measures and corrective actions are described in Section B1 of this Water Quality Management Plan.	Triggered		NA	Compliant
	That appropriate erosion and sediment control structures will be installed at least 30 metres upslope of known and potential GGBF habitat. These erosion and sediment control structures will be regularly inspected and maintained, particularly after significant rainfall events. This is also required under Section 5.1 of GGBF Management Plan.	Triggered	Site Inspection CPESC (Rubicon Enviro) Reports	Monthly inspection reports with actions prepared. Actions closed in following reports, PESCP's endorsed by CPESC	Compliant
	The establishment of erosion and sedimentation controls and construction of sedimentation basins as required.	Triggered	Site Inspection CPESC (Rubicon Enviro) Reports	Monthly inspection reports with actions prepared. Actions closed in following reports, PESCP's endorsed by CPESC	Compliant
	Progressive erosion and sediment control plans (ESCPs) will be developed and implemented prior to the commencement of topsoil stripping and earthworks.	Triggered	Site Inspection CPESC (Rubicon Enviro) Reports	Monthly inspection reports with actions prepared. Actions closed in following reports, PESCP's endorsed by CPESC	Compliant
	Toolbox talks will be conducted for employees and subcontractors on the requirements of the Erosion and Sediment Control Plan.	Triggered	Pre-start meeting examples	A selection of Pre-start meetings were reviewed and noted to contain this element	Compliant
	Erosion and Sediment Control Plan is to be maintained and up to date for the current site conditions.	Triggered	Site Inspection CPESC (Rubicon Enviro) Reports	Monthly inspection reports with actions prepared. Actions closed in following reports, PESCP's endorsed by CPESC	Compliant
	The installation of hydro-salinity monitoring devises has been undertaken and will be monitored throughout the duration of capping with any identified significant changes in pond hydro-salinity attributable to the proposed activity to be investigated and mitigation measures explored	Triggered	Records of continuous monitoring results provided	Monitoring results were reviewed during the audit in relation to this aspect	Compliant
	An adaptive response approach will be undertaken for GGBF habitat should salinity measure outside the range of comparison limits. Primarily when an impact to the population is observed a further detailed investigation will be undertaken aimed to fully understand reasons for the change.	Triggered	Records of continuous monitoring results provided EMR monthly reports	Monitoring results were reviewed during the audit in relation to this aspect. EMR monthly reports showed regular review of this information and actions taken where required.	Compliant
	Water monitoring at the KIWEF is undertaken consistently with the requirements of the Surrender Notice, which will be undertaken annually until the Surrender Notice is relinquished or as directed by the EPA. There are 50 monitoring wells and five surface water monitoring locations listed under the Surrender Notice	Triggered	2020, 2021 and 2022 Groundwater and surface annual water monitoring	plans and reports provided and the auditors note that monitoring has been completed as per requirements of the Surrender Notice	Compliant

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REF#	Requirement	Triggered for audit cycle	Evidence collected	Audit findings and recommendations	Compliance Status (Compliant/Non compliant/ Not triggered)
	The KIWEF Annual Water Monitoring Program will be undertaken annually until the Surrender Notice is relinquished or as directed by the EPA. The Continuous Monitoring of Pond Water Quality Parameters will continue for 2 years post-construction. The Post Construction monitoring and maintenance will continue (on a biannual basis) in accordance with the requirements of the Surrender Notice (or as superseded by new instruments directed by the EPA).	Triggered	2020, 2021 and 2022 Groundwater and surface annual water monitoring	plans and reports provided and the auditors note that monitoring has been completed as per requirements of the Surrender Notice	Compliant
	The results of the KIWEF Annual Water Monitoring program are compared against historical analytical results, national groundwater investigation levels (NEPM and ANZECC). Discussion of the actions and contingency measures under this program is included in Section B1 of this Water Quality Management Plan.	Triggered	2020, 2021 and 2022 Groundwater and surface annual water monitoring	plans and reports provided and the auditors note that monitoring has been completed as per requirements of the Surrender Notice	Compliant
	Data collected during the Continuous Monitoring of Pond Water Quality Parameters (temperature, water level and salinity concentration), are compared to established salinity threshold for chytrid protection. Discussion of the actions and contingency measures under this program is included in Section B2 of this Water Quality Management Plan.	Triggered	Records of continuous monitoring results provided EMR monthly reports	Monitoring results were reviewed during the audit in relation to this aspect. EMR monthly reports showed regular review of this information and actions taken where required. Threshold requirements are clearly identified in Table 1 of the reports	Compliant
	Biannual cap inspections will be undertaken following the construction maintenance period in accordance with the Surrender Notice (or as superseded by new instruments directed by the EPA), to ensure the cap surface remains stable. This will include inspection of any water quality features to determine whether they are functioning correctly, or if any rectification woks are necessary.	Triggered	EF18_46502_08.2 Rev 0_KIWEF (2021_12) Area 2, Cap Inspection_V1	Cap inspections undertaken on a 6 mthly basis, actions required are noted in the reports	Compliant
KIWEF Construction Environmental Management Framework					
3.1	The Contractor is required to have a corporate Environmental Management System certified under AS/NZS ISO 14001:2015.	Triggered	Daracon ISO14001	Certification in place as required	Compliant
3.2.1	Prior to working on site, the Contractor will ensure that all staff and sub-contractors working on site are appropriately inducted. The Contractors induction must communicate the environmental performance expectations of this CEMF and the specific mitigation measures to achieve these expectations as documented in the Contractors CEMP. Induction content is expected to include: · Legal and regulatory requirements including duty of care and potential consequences of infringements; · Environmental responsibilities with detailed training on the implementation of hygiene protocols and the importance of GGBF; · Identification of sensitive areas including threatened species habitat, waterways, asbestos impacted waste and other hazardous waste; · Identification of boundaries for vegetation clearing, washing, refueling and maintenance areas for vehicles, plant and equipment; · Environmental management techniques for noise, air, surface and ground water, waste generation, contaminated land etc.; · Emergency plans and incident management including the use of spill kits; · Reporting processes for environmental harm or environmental incidents; · Roles and responsibilities in achieving conformance with environmental policies and requirements, including emergency preparedness and response requirements; and · Identification and management of non-conformances.	Triggered	Induction and records	The induction contains these requirements	Compliant
3.2.2	Pre-start talks will help to ensure that timely and relevant information is communicated to the workforce and that feedback can be provided on issues of interest or concern. Pre-start talks should address weather forecasts with implications for daily site environmental management (dust or rainfall response requirements) as a minimum, and where necessary, should be used to provide refresher information on the environmental induction topics and associated environmental procedures.	Triggered	Pre start talks	Pre-start talks conducted daily. Talks reviewed and noted to cover a range of relevant environmental topics for this site	Compliant

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REF#	Requirement	Triggered for audit cycle	Evidence collected	Audit findings and recommendations	Compliance Status (Compliant/Non compliant/ Not triggered)
3.3	An emergency response plan would be prepared and implemented during the Project by the Contractor. The emergency response plan should document the contractor's approach to managing potential hazards and risks, incidents and emergencies	Triggered	Daracon Emergency Response Plan Integrated Project Mgt Plan. Daracon Site Supervisor (Dan Majer) Training Certificate and copies of Prestart talks	Plan prepared and implemented as required	Compliant
4.1	In preparing the Contractor's Construction Environmental Management Plan, the Contractor is required to undertake any additional risk assessment they deem necessary to manage environmental risks, such that the performance expectations of the CEMF are achieved when implementing their nominated construction methodology.	Triggered	Daracon Internal Audit of IPMP on 2 Oct 19. Record of the audit is included within the Daracon Monthly report for October 2019, (s 2.6 and 6.6).	CEMP in place and implemented as required. Audits conducted on project and EMR monthly reports cover implementation of plans	Compliant
4.3	The project Environmental Control Map is to be updated to include: · The worksite layout and boundary, including entry/exit points and internal roads and clearing limits; · Location of adjoining land-use and nearest noise sensitive receivers; · Location and type of sediment and erosion control measures, including size / capacity of detention basins and wheel wash facilities; · Location and type of fauna exclusion fences; · Location of site offices; · Location of spill containment and clean-up equipment; · Location of worksite waste management facilities; · Hours of work applicable to the worksite (including specific time windows for deliveries and any restrictions on high noise generating activities). · Location of environmentally sensitive areas (e.g. threatened species, critical habitat, known contaminated areas, etc.) · Vegetation and trees to be protected; · Location of stormwater drainage and watercourses leading to / from the worksite; and · Summary of specific environmental management requirements from licenses, approvals or permit conditions. The provisions of this plan apply in addition to any erosion and sediment control plans or other documentation that specify the location of environmental controls on site.	Triggered	Project Footprint Ramboll Monthly Audit Reports Daracon Daily/Weekly Enviro Inspections Area 2 CPESC Reports, refer to PESCP for endorsed plans showing changes to ESC measures implemented. Offsite Disposal dockets & certifications(taken from Validation Report)	Documents reviewed showed that a range of maps and diagrams were in use and site inspections noted these plans and diagrams to be readily available and relevant areas were clearly identified, cordoned off or fenced as required.	Compliant
4.4	The Environmental Schedules set out below represent the records likely to be required to be kept during the Project. · Weekly and post rainfall site inspection checklist; · Daily materials tracking forms; · Level 2 and Level 3 notification forms; · Notified materials tracking register; · Water quality monitoring results register; · Dewatering form; · Waste Register; · Induction record; · Internal Audit Register; · Non-Conformance Register; · Complaint Form; and · Complaint Register. The form and content of the Environmental Schedules is to be provided by the Contractor in accordance with their Environmental Management System.	Triggered	Level 2 notifications are available within Folder 16 Level 2 Notifications. Folder 15 Daracon Monthly Reports Folder 17 NCR's (Engineering)	Records of a selection of these items were reviewed by the audit team. Interviews with staff were also conducted to ensure that the requirements of the plans and records was understood.	Compliant

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REF#	Requirement	Triggered for audit cycle	Evidence collected	Audit findings and recommendations	Compliance Status (Compliant/Non compliant/ Not triggered)
5.1	As part of the overall environmental management of the site, during the landfill closure works, the Contractor is to conduct at least weekly inspections of all mitigation measures. The results of these inspections will be recorded on a weekly environmental inspection record. Should non-conformances be identified, the Contractor is required to undertake corrective action to address the issue	Triggered	Daracon Daily/Weekly Enviro Inspections Daracon Monthly Reports Area 2 CPESC Reports		Compliant
	The following construction monitoring is required: · Daily prestart checks on amphibian-disease hygiene station functioning and supplies, and weather forecast noting predicted wind and rain; · Real-time classification of materials to nominated thresholds in accordance with the Materials Management Plan decision matrix; · Post rainfall checks of sediment dam water level and water quality, and erosion and sediment control functioning; · Inspection covering sediment dam water levels and water quality, erosion and sediment control structures, frog fences, fuel and chemical storage, stockpile bunding and covers; · Sediment basin discharge or dewatering water quality sampling and analysis suitable to demonstrate pollution of water has/will not occur; · noise monitoring of any out of hours construction works in accordance with Interim Construction Noise Guidelines; · visual observations of visible dust levels to confirm no off site dust impacts; and · post capping defects and liabilities monitoring including revegetation success monitoring. Where recommended actions are suggested, priorities should be set against these actions for site implementation. The list of actions should be distributed to the responsible personnel. A close out system must be included. The defects and liabilities period is linked to a demonstration of performance against parameters to be negotiated with the HCCDC. These are likely to include revegetation success and surface water quality. In accordance with notice of determination condition 11 and 12, accurate and complete compliance records are required to be maintained and provided to the Department of Environment and Energy on request.	Triggered		Weekly inspections undertaken as required. Actions noted for closeout in these reports	Compliant
5.1.1	The closure works are required to comply with the general duty not to pollute waters under section 120 of the POEO Act. The contractor will be required to take adequate precautions to ensure either that discharge/or dewatering is not required, or otherwise undertake sampling and analysis to demonstrate that pollution of water has or will not occur associated with water releases from sediment basins. In the absence of an EPL, to avoid causing pollution and breaches of section 120, any water discharged from site must be of the same quality, or better, than the quality of the receiving waters (at the time of discharge) or able to be demonstrated to not have caused water pollution. A summary of water quality monitoring including sample results is required to be submitted to the HCCDC following any dewatering or discharge event demonstrating that the Contractor has complied with the above obligations.	Triggered	Area 2 CPESC Reports Daracon Monthly Reports, refer to Coffeys reporting, section on Water Monitoring (Note at the start of the project, there was a very dry period, rainfall did not start until Feb/March 2020).	Water monitoring is undertaken across the site as part of the EPL surrender notice. Annual reports are produced and contain information on the compliance with conditions of the EPL and POEO Act.	Compliant

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REF#	Requirement	Triggered for audit cycle	Evidence collected	Audit findings and recommendations	Compliance Status (Compliant/Non compliant/ Not triggered)
5.1.2	Internal and external environmental audits should be undertaken throughout the construction process to ensure that the project environmental requirements and Contractors CEMP are implemented appropriately. The auditing process should be designed to identify any non-conformances, providing an opportunity to apply corrective and / or preventative action where appropriate. The Audit schedule is to include: · Internal environmental audit by the Contractor's Environmental Manager on a three monthly basis during construction; · Regular attendance at the site by the KIWEF Area 2 Closure Works Independent Auditor; and · Independent audit of compliance with the notice of determination conditions following the completion of onsite construction works and prior to completion of the project works period.	Triggered	The Coffeys monthly environmental report is included as an Appendix to the Daracon monthly reports, available in Daracon Monthly Reports. Ramboll monthly reports in Ramboll Monthly Audit Reports.	Monthly Independent EMR inspections were undertaken throughout the project, HCCDCD 6 monthly inspections were undertaken for Capping and UoN GGBF monitoring is also undertaken. This audit is also an independent audit of the works as part of the EPBC approval.	Compliant
5.2.1	The daily record of material management is required to summarise material interaction for the day and include: · Description of earthworks activity undertaken; · Description of cut to fill or cut to stockpile activities including locations; · Notification of HCCDC of suspected contaminated or otherwise hazardous material encountered and description of handling, current location, further assessment required; and · Summary of any handling of previously notified material including update on current location. All notifications are also to be tracked through a notifications register to record final disposal location.	Triggered	Daracon Daily Tracking (Appendix B, Daily Tracking Sheets) Coffey Daily Fieldsheets (Appendix I Validation Report) Level 2 notifications are available within Folder 16 Level 2 Notifications.	Records of the materials management on the site is carefully tracked by the site team. A selection of records were reviewed which identified that a through process is in place. Interviews confirmed that site management was well aware of the tracking of materials across the site during works.	Compliant
5.2.2	Monthly Progress Reporting is to include details of the implementation environmental management requirements including: · Update on any environmental risks and opportunities, and significant environmental impacts associated with the work; · Progress against environmental objectives, targets and measures of performance; and · Management actions, including environmental controls, training, inspections and testing. Specifically, the environmental monthly reporting is to include such items as: · Characterisation, site management and fate of contaminated material, collated materials tracking information; · Quality assurance on placed material; · Non-compliances and corrective actions; · Environmental monitoring requirements; and · Monthly logs and photographs and other records of the progressive compilation of information that will be integrated into the Validation Report on completion.	Triggered	Daracon Monthly Reports	Monthly reports are prepared and contain these requirements	Compliant

EPBC 2016-7670 Kooragang Island Waste Emplacement Facility Compliance Table - Conditions of Approval

REF#	Requirement	Triggered for audit cycle	Evidence collected	Audit findings and recommendations	Compliance Status (Compliant/Non compliant/ Not triggered)
5.2.3	The Validation Report is required to satisfy Condition 4h of the Surrender Notice which requires that there is written confirmation that the cap was established in accordance with relevant specifications as follows: “Within three months of completion of the installation of the final cap, the licensee must provide the EPA with a written Validation Report that includes: i) Advice that the final cap has been installed; ii) Advice from a suitably qualified and experienced person as to whether or not the cap was installed in accordance with Chapter 7 of the Landform and Capping Strategy and relevant conditions of this Notice, or future variations to this Notice; iii) Provision of the results of all relevant test results to validate that the permeability of the final capping layer is less than or equal to K = 1 x 10-7m/s. Permeability testing must be taken of the sealing layer material at a rate of not less than 1 per 2000T (or 1250m3); iv) Provision of information that establishes the thickness of the installed sealing and revegetation layers in the format of either: (i) As constructed drawings, including cross sections, of the surfaces of the coal washery reject layer; and (ii) The results of surveys undertaken for each capping layer by a registered surveyor”. The Contractor is to allow for all effort necessary to assemble adequate validation evidence throughout the implementation of the Closure Works and for the preparation of the validation report. For the avoidance of doubt, the Contractor is required to validate that the Closure works have been delivered in accordance with the design and Tender Specification in relation to capping parameters and the Materials Management Plan in relation to materials handling and tracking. The environmental performance expectations within this CEMF must be achieved as part of the Contract but are not required to be incorporated into the Validation Report. Evidence of compliance is to be available on request by HCCDC.	Triggered	Daracon Monthly Reports, Coffey Monthly reports, Validation report	The validation report has been prepared as required and bi-annual survey of the capping activities was undertaken by HCCDC and monthly reports by engineering consultants (Coffey).	Compliant
5.2.4	During the performance of the contract, and as a condition of satisfaction of the care and maintenance obligations, the Contractor will be responsible for the preparation of an annual compliance report against the conditions of the notice of determination.	Triggered	Website	Compliance Reports are available on the HCCDC website.	Compliant
5.3	All environmental non-conformances with project approvals, this EMP or Contractor procedures is to be recorded as an incident, investigated and closed out by the Contractor. Close-out is required to include Construction supervisor sign-off that corrective actions have been implemented or alternative solutions substituted. A summary of all non-conformances and associated corrective actions is to be provided to the HCCDC. The POEO Act requires incidents causing or threatening material harm to the environment to immediately notify the relevant authorities, which include: · the EPA; · Newcastle Council; · the Ministry of Health; · the WorkCover Authority; and · Fire and Rescue NSW. The POEO Act outlines responsibilities down to an individual level to notify incidents threatening material harm to the environment immediately. In general terms all individuals are responsible for reporting such incidents to the Construction Project Manager who in turn will inform HCCDC. HCCDC would then notify relevant authorities. It also requires that an individual notify the incident where they cannot make contact with their employer. Relevant authority contact details are included in the table below and should be displayed where all site workers can access them easily in the event of a notifiable incident occurring.	Triggered	Email: Ground Fire Emergency at KIWEF Area 2	A ground fire was identified burning in the Stage 2 area, this was reported and became an emergency and was managed by NSW Fire and Rescue. Reporting and updates were provided for this emergency although it was not considered an NCR as it was not related to construction activities.	Compliant

Appendix C
Auditor’s certification

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C.1 Auditor's certification

David Bone
Sector Lead – Construction
National Technical Leader – Construction Environmental Management
Associate Director

Registered environmental practitioner with the EIANZ (CENVP #137)

Lead Environmental Auditor course at the University of NSW

Auditor's declaration:

I, **David Bone**, certify that, to the best of my knowledge, all information provided in the audit report attached to this audit certification statement is true, correct and complete.

I am aware that section 491 of the EPBC Act makes it an offence in certain circumstances to knowingly provide false or misleading information or documents to specified persons who are known to be performing a duty or carrying out a function under the EPBC Act or the regulations The offence is punishable on conviction by imprisonment for not more than 1 year, a fine not more than 60 penalty units, or both.

Signature:

Date: __28__/__02__/__2023__

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Appendix D
Photos of site inspection

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D.1 Photos from site inspection 12 October 2022

GGBF habitat areas K7 area

GGBF in Constructed Pond in K5 Area

Typical GGBF fencing arrangements

Constructed ponds in the Wedge area

Habitat areas K2 North Area

Frog habitat area signage

Australia

SYDNEY
Ground floor 20 Chandos Street
St Leonards NSW 2065
T 02 9493 9500

NEWCASTLE
Level 3 175 Scott Street
Newcastle NSW 2300
T 02 4907 4800

BRISBANE
Level 1 87 Wickham Terrace
Spring Hill QLD 4000
T 07 3648 1200

CANBERRA
Suite 2.04 Level 2
15 London Circuit
Canberra City ACT 2601

ADELAIDE
Level 4 74 Pirie Street
Adelaide SA 5000
T 08 8232 2253

MELBOURNE
Suite 8.03 Level 8
454 Collins Street
Melbourne VIC 3000
T 03 9993 1900

PERTH
Suite 9.02 Level 9
109 St Georges Terrace
Perth WA 6000
T 08 6430 4800

Canada

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2345 Younge Street Suite 300
Toronto ON M4P 2E5
T 647 467 1605

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