Appendix I Mayfly and algal toxicity tests

ESNZ (2025b) Cobalt and nickel toxicity to alga and mayfly species, in mine receiving waters. p. 72. Earth Sciences New Zealand (ESNZ) report by K. Thompson for BT Mining Ltd.

Memo

From	**Karen Thompson**
To	[redacted]
CC	Chris Hickey, RMA Science
Date	24 November 2025
Subject	Cobalt and nickel toxicity to alga and mayfly species, in mine receiving waters
File path	[redacted]

Introduction

BT Mining Ltd engaged Earth Sciences NZ to undertake chronic ecotoxicity testing to two freshwater species, a green alga (72-hour growth test) and a mayfly nymph (14-day survival test). Testing was conducted to support a risk assessment for the Escarpment Mine, a mine located in the Buller Coalfield.

Toxicity testing was undertaken with two chemicals, cobalt and nickel, using supplied Whareatea River water, both 'unmodified' (buffered and pH adjusted) and 'modified' (hardness and pH adjusted) for the chemical dilutions and as controls. The 'unmodified' Whareatea River water was buffered with MES to ensure maintenance of target pH (pH 5.5) throughout the testing duration. The 'modified' Whareatea River water was hardness adjusted with CaO and adjusted to pH 7.5 as required for testing. In addition to the chronic 14-day endpoint, mayfly nymph survival was also evaluated at two acute endpoints, 48 and 96 hours (2- and 4-days respectively), throughout the chronic mayfly tests.

The chronic tests conducted were:

- Algae to cobalt in unmodified Whareatea River water (pH 5.5 ± 0.1).
- Algae to nickel in unmodified Whareatea River water (pH 5.5 ± 0.1).
- Mayfly nymph to cobalt in unmodified Whareatea River water (pH 5.5 ± 0.1).
- Mayfly nymph to nickel in unmodified Whareatea River water (pH 5.5 ± 0.1).
- Algae to cobalt in modified Whareatea River water (pH 7.5 ± 0.1).
- Algae to nickel in modified Whareatea River water (pH 7.5 ± 0.1).
- Mayfly nymph to cobalt in modified Whareatea River water (pH 7.5 ± 0.1).
- Mayfly nymph to nickel in modified Whareatea River water (pH 7.5 ± 0.1).

Methods

Dilution water

A water sample was collected to facilitate the ecotoxicity testing. A 300 L grab sample to be used as dilution water was collected from Whareatea River by B T Mining Ltd personnel in August 2025 (exact date not supplied). Additionally, approximately 3 kg of calcium oxide (CaO) consistent with the quality currently used by BT Mining Ltd for mine wastewater treatment was also supplied by B T Mining Ltd.

The samples were transported to Earth Sciences NZ, Hamilton and upon arrival sample codes were assigned to the Whareatea River dilution water (25.023.1). The physico-chemical parameters were measured. Sub-samples were taken from the bulk sample and sent to Hill Labs for inorganics analysis. The remaining bulk sample was stored at ambient laboratory temperature until testing preparation commenced and throughout the testing period.

For the "unmodified" tests, buffered Whareatea River water was used as the diluent. Buffer was added to maintain the pH, as algal metabolism and aeration within the mayfly test were likely to cause an increase in pH. MES buffer (Sigma M8250) which has a useful buffering range of pH 5.5-6.7 and it does not form complexes with most metals[1] was added at 0.5 mM (97 g/m^3) to half of the supplied Whareatea River water and the pH adjusted to the target level, 5.5 ± 0.1 units.

For the "modified" tests, the remainder of the supplied Whareatea River water was hardness and pH modified prior to use. The hardness was adjusted to a target 66 g/m^3 as Ca (as for a preceding toxicity study with kōura[2]) using supplied CaO as used for mine treatment. The pH was adjusted to the target pH level, 7.5 ± 0.1 units.

Test waters were prepared in batches in advance of testing (and mayfly nymph test solution changes) and allowed to equilibrate with aeration for a minimum 12 hours prior to use. Sub-samples were taken from the first prepared batch of 'unmodified' and 'modified' Whareatea River dilution waters and sent to Hill Labs for inorganics analysis.

Toxicity testing

Toxicity testing included standard freshwater chronic tests with an alga (green alga, *Raphidocelis subcapitata*[3]) and an invertebrate (mayfly nymph, *Deleatidium* sp). Testing procedures were

[1] Cardwell, A.S., Rodriguez, P.H., Stubblefield, W.A., DeForest, D.K. and Adams, W.J. (2023), Chronic Toxicity of Iron to Aquatic Organisms under Variable pH, Hardness, and Dissolved Organic Carbon Conditions. Environ Toxicol Chem, 42: 1371-1385. https://doi.org/10.1002/etc.5627

Stauber, J., Golding, L., Peters, A., Merrington, G., Adams, M., Binet, M., Batley, G., Gissi, F., McKnight, K., Garman, E., Middleton, E., Gadd, J. & Schlekat, C. (2021) Application of Bioavailability Models to Derive Chronic Guideline Values for Nickel in Freshwaters of Australia and New Zealand. Environmental Toxicology and Chemistry, 40, 100-112.

[2] Thompson, K., Shepherd, A. (2025) Kōura ecotoxicity testing for mine wastewater samples at various pH levels. NIWA Client Report, 2025202HN: 80

[3] Formerly known as *Selenastrum capricornutum* and *Pseudokirchneriella subcapitata* (Nygaard et al. 1987). Nygaard, G., Komárek, J., Kristiansen, J., Skulberg, O.M. (1987 '1986') Taxonomic designations of the bioassay alga NIVA-CHL 1 ("*Selenastrum capricornum*") and some related strains. Opera Botanica, 90: 1-46, 35 figs, 9 tables.

undertaken based on the laboratory's standard operating procedures for alga (NIWA 2022[4]) and mayfly (NIWA 2024[5]).

For the algal test, 1 x 10^4 exponentially growing cells/mL were exposed in a 96 well plate for 72 hours in a static test system, to assess growth inhibition compared to the control. Organisms were exposed to a dilution series with ten concentrations (Table 1) of each cobalt and nickel diluted with unmodified (pH5.5) and modified (pH 7.5) Whareatea River water. Each concentration was tested in five replicates and ten additional replicates of each aged ultraviolet treated nanopure water (UVNP) and the test waters used to prepare the dilutions (Whareatea River (unmodified and modified)) were also included as controls. Replicate 96 well plates were prepared to ensure adequate volume was available for chemical analysis at test termination. pH was measured at the test initiation (T_0) and termination (T_{14}) in one replicate from each of the control and treatment concentrations.

Four days prior to test initiation mayfly nymphs were gradually acclimated from laboratory water to the test dilution waters (unmodified and modified Whareatea River waters). This was achieved by sequentially exposing the nymphs to a higher concentration of test water e.g., day 1, 25%; day 2, 50%; day 3, 75%; and day 4, 100% test dilution water.

For the mayfly test, ten *Deleatidium* sp. early instar (<5 mm) larvae per replicate were exposed in 500 mL test chambers for 14 days in an aerated static renewal test system, whereby approximately 75% of the test solution was replaced at set intervals (Days 0, 4, 8 and 11) during the experiment to assess survival. Acute 48-h and 96-h survival was also assessed as part of the chronic testing. Organisms were exposed to a dilution series with five concentrations (Table 1) of each cobalt and nickel diluted with unmodified (pH 5.5) and modified (pH 7.5) Whareatea River water, with each concentration tested in three replicates. Five additional replicates of each Waihou Spring River Water (laboratory control) and the test waters used to prepare the dilutions (Whareatea River (unmodified and modified)) were also included as controls. Monitoring throughout the mayfly test included food replenishment via replacement of natural biofilm on a rock substrate and assessments of dissolved oxygen (DO), pH, temperature, and ammonia concentration levels. Throughout the test period, the pH of the solutions was maintained within the target range by adjusting with 0.1 M HCl or 0.1 M NaOH as needed. Temperature, DO, conductivity and pH values were measured at the test initiation (T_0) and termination (T_{14}) and at each solution replacement in one replicate from each of the control and treatment concentrations.

Table 1 Summary of nominal test concentrations for the alga and mayfly tests.

Test species	Cobalt ug/L	Nickel ug/L
Alga	0, 1.0, 2.0, 3.9, 7.8, 15.6, 31.3, 62.5,125, 250, 500	0, 1.0, 2.0, 3.9, 7.8, 15.6, 31.3, 62.5,125, 250, 500
Mayfly	0, 125, 250, 500, 1000, 2000	0, 22, 46, 100, 220, 460

Test acceptability criteria

The alga and mayfly tests have criteria that must be met for the test to be considered acceptable (Appendix A). In the alga tests, the increase in cell density in the control must be greater than 16-fold and the coefficient of variation (CV) for the control replicates must be less than 20% (NIWA 2022). For

[4] NIWA (2022) Freshwater Alga (*Raphidocelis subcapitata*) Chronic Toxicity Test Ecotoxicology Standard Operating Procedure 15.0 Version 4. *National Institute of Water and Atmospheric Research,* Hamilton, New Zealand: 51.

[5] NIWA (2024) Mayfly Nymph (*Deleatidium* sp.) Acute Toxicity Test, Ecotoxicology Standard Operating Procedure 61.0. Version 1.0. March 2024. Prepared for Internal Use Only, National Institute of Water and Atmospheric Research Ltd. (NIWA) Ecotoxicology Laboratory, Hamilton, New Zealand.

the chronic mayfly test the mean control survival must be greater than 80% and survival in each replicate must be 80% or greater (NIWA 2024).

Statistics

Statistical analyses were completed using CETIS v2.1.4.5 (Comprehensive Environmental Toxicity Information System) software by Tidepool Scientific. CETIS™ is a statistical application designed for analysing and reporting dose-response results from aquatic, terrestrial and sediment toxicity tests. All statistical analyses follow US EPA standard guidelines for toxicity data analysis.

Initial analysis determined if there was a survival concentration relationship and if so, an ANOVA compared the survival at each concentration to determine the no observed effect concentration (NOEC) and the lowest observed effect concentration (LOEC). If applicable, a non-linear regression or linear interpolation model was conducted to calculate point estimates (e.g. EC_{50} and EC_{10}) with associated 95% confidence intervals (α=0.05) (Appendix B).

The concentrations used in the statistical analyses were mean concentrations of those measured at the test initiation (T_0) and termination (T_{72} (alga) and T_{14} (mayfly)) (Appendix C).

Chemical analysis

Subsamples of the Whareatea River dilution water (as received) and the unmodified and modified dilution waters were analysed by Hill Labs for acidity to pH 7, dissolved metals (aluminium, cadmium, chromium, cobalt, copper, iron, lead, manganese, nickel, zinc), sulfate, dissolved organic carbon (as DNPOC), turbidity, and hardness (measured as dissolved calcium and dissolved magnesium) using trace level analysis where applicable. Subsamples of test controls and selected test treatment concentrations were collected at test initiations and test terminations and analysed. At test termination only selected analytes, as test volumes allowed, were analysed by Hill Labs. The analytical methods used are outlined in Appendix C.

Results

Results are summarised and described in this section – raw data and, statistical data and concentration-response plots from the statistical analyses are provided for all test samples in Appendix A. Laboratory results from water quality analyses are provided in Appendix B. Mean concentrations used in the statistical analyses were calculated from measurements taken at test initiation (T0) and termination (T72 for algae, T14 for mayfly). At T0, measured concentrations closely matched nominal concentrations in both tests. At test termination, concentrations in the algae test remained consistent with T0 values. However, in the mayfly test, T14 concentrations were significantly lower than those measured at T0 (see Appendix C).

Table 1 presents the physicochemical measurements of the sample before adjustments for toxicity testing. A summary of the mayfly survival data can be found in Table 2 and a summary of relevant toxicity metrics for the algal and mayfly tests can be found in Table 3.

Mean concentrations used in the statistical analyses were calculated from measurements taken at test initiation (T_0) and termination (T_{72} for algae, T_{14} for mayfly). At T_0, measured concentrations closely matched nominal concentrations in both tests. At test termination, concentrations in the algae test remained consistent with T_0 values. However, in the mayfly test, T_{14} concentrations were significantly lower than those measured at T_0 (see Appendix C).

Table 1: Physicochemical measurements of the water sample upon arrival at the laboratory.

NIWA Lab ID	Sample ID	Sample Received	Sample Type	pH	Conductivity µS cm^{-1}	Dissolved Oxygen mg L^{-1} O_2	Temp °C[a]
25.023.1	Whareatea River	21/8/25	Dilution water	4.51	46.8	9.1	20.2

[a] Temperature at time of measurements.

Alga chronic toxicity test

Test acceptability criteria

The cell density of algae grown in the laboratory control water met the test acceptability criteria, showing a coefficient of variation below 20% (4.6%) and a 25-fold increase in cell density after 72 hours. In contrast, the test water controls did not meet acceptability criteria due to lower algal growth. The unmodified test water control (pH 5.5) showed the lowest growth, with only 4.3-fold and 3.9-fold increases in the unmodified cobalt and nickel tests, respectively. Growth was higher in the modified test water controls, with 11-fold and 12-fold increases observed in the modified cobalt and nickel tests after 72 hours (see Appendix B and Table 3). Due to limited growth observed in both the unmodified (pH 5.5) and modified (pH 7.5) controls, the reliability of the algal test results is considered low—particularly for the unmodified pH 5.5 treatments, which also falls outside the recommended test pH range of 6.5 to 8.5.

Physico-chem

Throughout the 72-hour exposure period, pH levels remained stable across all test treatments. At test termination, unmodified treatments had a mean pH of 5.56, while modified treatments had a mean pH of 7.57.

Toxicity

The alga exposed to cobalt with the unmodified Whareatea River water (pH 5.5) showed no progressive growth decline until concentrations greater than 107 µg/L Co after 72 hours. Significant toxicity was observed at 210 µg/L Co with a 25% decrease in alga cell density compared to that observed in the unmodified controls. This resulted in a LOEC of 210 µg/L Co and a NOEC of 107 µg/L Co (Appendix B and Table 3). Similarly, algae exposed to cobalt with the modified Whareatea River water (pH 7.5) for 72 hours showed no progressive growth decline until concentrations greater than 110 µg/L Co. Significant toxicity was observed at 215 µg/L Co with a 41% decrease in alga cell density compared to that observed in the modified controls. This resulted in a LOEC of 215 µg/L Co and a NOEC of 110 µg/L Co (Appendix B and Table 3).

The alga exposed to nickel with the unmodified Whareatea River water (pH 5.5) showed no progressive growth decline until concentrations greater than 125 µg/L Ni after 72 hours. Significant toxicity was observed at 240 µg/L Ni with a 21% decrease in alga cell density compared to that observed in the modified controls. This resulted in a LOEC of 240 µg/L Ni and a NOEC of 125 µg/L Ni (Appendix B and Table 3). Algae exposed to nickel with the modified Whareatea River water (pH 7.5) for 72 hours showed no progressive growth decline until concentrations greater than 55 µg/L Ni. Significant toxicity was observed at 108 µg/L Ni with a 21% decrease in alga cell density compared to that observed in the modified controls. This resulted in a LOEC of 108 µg/L Ni and a NOEC of 55 µg/L Ni (Appendix B and Table 3).

Mayfly nymph chronic toxicity test

Test acceptability criteria

All mayfly tests met the control acceptability criteria, with 14-day mean survival in control groups ≥80% (ranging from 84% to 88%), and survival in each individual control replicate meeting or exceeding the 80% threshold. No significant differences in survival were observed between the laboratory control (88%), unmodified control (84%), and modified control (88%) (see Appendix B and Table 3).

Physico-chem

During the 14-day exposure period, pH levels were actively monitored and adjusted daily to maintain target values of 5.5 in unmodified treatments and 7.5 in modified treatments. The unmodified treatments had a mean pH of 5.63, ranging from 5.38 to 6.10, while the modified treatments maintained a mean pH of 7.45, with a range of 6.93 to 8.06. Dissolved oxygen levels averaged 9.3 mg/L O_2, with values ranging from 8.5 to 9.8 mg/L O_2. Conductivity measurements were taken both after water changes (fresh solution) and prior to water changes (aged solution), with mean values and ranges recorded as 88 (43-513) and 105 (72-166) for unmodified tests and 442 (396-508) and 514 (419-969) for modified tests, respectively.

Toxicity

Mayfly nymphs exposed to cobalt in unmodified (pH 5.5) and modified (pH 7.5) Whareatea River water showed no significant progressive reduction in survival after 14 days (or the 48-h and 96-h endpoints). No toxicity was observed at the highest tested concentrations—1230 µg/L Co and 1685 µg/L Co, respectively—resulting in LOECs of >1230 µg/L and >1685 µg/L Co, and NOECs of 1230 µg/L and 1685 µg/L Co (Appendix B and Table 3).

Mayfly nymphs exposed to nickel in unmodified Whareatea River water (pH 5.5) for 96 hours and 14 days showed no significant progressive reduction in survival until concentrations exceeded 138 µg/L Ni resulting in LOEC's of 307 µg/L and NOEC's of 138 µg/L Ni. In contrast, no significant reduction in 14-day (or 48-h and 96-h) survival was observed in the modified water (pH 7.5) at nickel

concentrations up to 308 µg/L Ni resulting in a LOEC of >308 µg/L Ni and NOEC of 308 µg/L Ni (Appendix B and Table 3).

Table 2: Summary of mayfly nymph survival data at reported test endpoints (i.e., 48-h, 96-h and 14-d).

Treatment	Mean measured concentration ug/L	Mean survival % (days)		
		T_{48} (2 days)	T_{96} (4 days)	T_{14} (14 days)
Laboratory control	0	98	94	88
Unmodified pH 5.5 - Co/Ni	0.7/1.4	96	92	84
Unmodified pH 5.5 - Co	70	100	100	83
Unmodified pH 5.5 - Co	139	97	93	83
Unmodified pH 5.5 - Co	290	100	97	87
Unmodified pH 5.5 - Co	610	100	90	83
Unmodified pH 5.5 - Co	1230	93	87	73
Unmodified pH 5.5 - Ni	15	93	93	77
Unmodified pH 5.5 - Ni	31	100	100	90
Unmodified pH 5.5 - Ni	62	100	100	83
Unmodified pH 5.5 - Ni	138	100	100	83
Unmodified pH 5.5 - Ni	307	93	73[a]	63
Modified pH 7.5 - Co/Ni	0.7/1.3	94	94	88
Modified pH 7.5 - Co	68	100	100	87
Modified pH 7.5 - Co	171	100	97	83
Modified pH 7.5 - Co	335	100	97	83
Modified pH 7.5 - Co	750	90	87	83
Modified pH 7.5 - Co	1685	100	93	87
Modified pH 7.5 - Ni	15	90	87	77
Modified pH 7.5 - Ni	30	93	93	80
Modified pH 7.5 - Ni	66	93	93	80
Modified pH 7.5 - Ni	143	90	87	77
Modified pH 7.5 - Ni	308	90	90	83

[a] Significant effect.

Table 3: Toxicity statistics as derived by CETIS™ (µg L^{-1} cobalt or nickel) for alga and mayfly nymphs in unmodified (pH 5.5) and modified (pH 7.5) Whareatea River water. Values in parentheses are the EC_X value 95% confidence intervals.

Test organism	Dilution water	Treatment	Control performance	EC_{10}[a] (95% CL) µg L^{-1}	EC_{50}[a] (95% CL) µg L^{-1}	NOEC[b] µg L^{-1}	LOEC[c] µg L^{-1}	TEC[d] µg L^{-1}
			Density increase					
Alga 72 h	Laboratory water	Nil	25 x (CV 4.6%)					
Alga 72 h[e]	Unmodified pH 5.5	Cobalt	4.3 x (CV 16%)	72 (31-117)	591 (370-943)	107	210	150
Alga 72 h[e]	Modified pH 7.5	Cobalt	11 x (CV 8.9%)	92 (68-112)	247 (222-274)	110	215	154
Alga 72 h[e]	Unmodified pH 5.5	Nickel	3.9 x (CV 17%)	171 (74-235)	457 (371-564)	125	240	173
Alga 72 h[e]	Modified pH 7.5	Nickel	12 x (CV 7.9%)	68 (52-81)	148 (134-163)	55	108	77
			Mean survival %					
Mayfly nymph 14 d	Laboratory water	Nil	88					
Mayfly nymph 14 d	Unmodified pH 5.5	Cobalt	84	>1230[f]	>1230	1230	>1230	>1230
Mayfly nymph 14 d	Modified pH 7.5	Cobalt	88	>1685	>1685	1685	>1685	>1685
Mayfly nymph 96 h	Unmodified pH 5.5	Nickel	84	226[f] (124-N/A)	>307	138	307	206
Mayfly nymph 14 d	Unmodified pH 5.5	Nickel	84	223 (N/A-348)	>307	138	307	206
Mayfly nymph 14 d	Modified pH 7.5	Nickel	88	>308	>308	308	>308	>308

[a] EC_x: The statistically determined test Concentration causing a X% Effect on the endpoint after the specified exposure period. [b] NOEC: The highest tested Concentration causing No Observed Effect relative to the controls. [c] LOEC: The Lowest tested Concentration causing an Observed Effect relative to the controls. [d] TEC: Threshold Effect Concentration, the geometric mean of NOEC and LOEC. [e] Low reliability values due to low control growth. [F] EC_{15} value as EC_{10} not available with the linear interpolation analysis used.

Appendices

Appendix A – Test summaries

Parameter	Condition for algal test	Condition for mayfly test
Reference method	Environment Canada (1992 and 2007); USEPA (1987)	ASTM (2014) and USEPA (2002)
Test protocol	NIWA SOP 15.0 (2022)	NIWA SOP 61.0 (2024)
Test species	*Raphidocelis subcapitata*	*Deleatidium* sp.
Effect measured	Growth inhibition relative to controls	Survival (48 h, 96 h, 14d)
Organism size	N/A	Early instar <5 mm
Source	University of Texas, USA	Waimakariri Stream, Waikato
Dilution water	Aged UVNP water (Lab control), unmodified and modified Whareatea River water	Upper Waihou River water (Lab control), unmodified and modified Whareatea River water
Test type	Static, non-renewal	Static, renewal
Organisms/container	10,000 ± 1000 cells/mL	10
Test concentrations	Nominally 0, 1.0, 2.0, 3.9, 7.8, 15.6, 31.3, 62.5,125, 250, 500 µg/L Co and Ni	Nominally 0, 125, 250, 500, 1000, 2000 µg/L Co and 0, 22, 46, 100, 220, 460 µg/L Ni
Test duration	72 hours	14 days
Replicates	10 for controls, 5 for treatments	5 for control; 3 for treatment dilutions
Sample pre-treatment	0.45 µm filtration	Nil
Test chambers	96 well polystyrene microplates	500 mL plastic beakers
Test volume	220 µL	500 mL
Lighting	Continuous lighting	12:12h light:dark, moderately low light
Temperature	24 ± 1°C	15 ± 1°C
Aeration	Nil	Moderate aeration at >100 bubbles/min
Feeding	10 for controls, 5 for treatments	Nil
Physico-chem data	Initial and final temperature pH	Initial and final temperature, conductivity, dissolved oxygen, pH
Reference toxicant	72 hr exposure to zinc sulfate	96 hr exposure to zinc sulfate
Zn sensitivity current test; long term mean (EC_{50}±2sd)	0.03 mg L^{-1} Zn^{2+}; 0.02 (0.00-0.04) mg L^{-1} Zn^{2+}; n=20	14.5 mg L^{-1} Zn^{2+}; 14.5 (N/A) mg L^{-1} Zn^{2+}, n=2 at hardness 14 mg L^{-1} $CaCO_3$
Test acceptability	Control coefficient of variation within 20%; at least 16x cell growth increase in controls.	Mean control survival ≥ 80% Survival in each control replicate must be ≥ 80%.

Appendix B – Statistical Analysis

Cobalt - Unmodified pH 5.5 Alga 72 h growth inhibition

CETIS Analytical Report

Report Date: 03 Oct-25 13:13 (p 1 of 2)
Test Code/ID: 25.023.1 / 01-3938-2623

Phytoplankton Growth Inhibition Test — **NIWA Ecotoxicology**

Analysis ID:	06-3297-3374	**Endpoint:**	Cell Density	**CETIS Version:**	CETISv2.1.4
Analyzed:	03 Oct-25 13:12	**Analysis:**	Nonparametric-Multiple Comparison	**Status Level:**	1
Edit Date:		**MD5 Hash:**	E519C29E2B51A87E4A6F678CE14183B5	**Editor ID:**	
Batch ID:	03-6075-2646	**Test Type:**	Cell Growth	**Analyst:**	K Thompson
Start Date:	05 Sep-25	**Protocol:**	NIWA(2004)	**Diluent:**	Whareatea River
Ending Date:	08 Sep-25	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	Not Applicable
Test Length:	72h	**Taxon:**	Chlorophyta	**Source:**	University of Texas-Botany **Age:**
Sample ID:	00-3521-9710	**Code:**	25.023.1	**Project:**	BAT26201
Sample Date:	05 Sep-25	**Material:**	Cobalt chloride	**Source:**	Solution made by NIWA
Receipt Date:	05 Sep-25	**CAS (PC):**		**Station:**	Lab Solution
Sample Age:	---	**Client:**	BT Mining Ltd		

Comments: Whareatea River unmodified MES buffered pH5.5
Whareatea River unmodified MES buffered pH5.5

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	Tox Units	MSDu	PMSD
Untransformed	C > T	107	210	149.9	---	6305	14.56%

Wilcoxon/Bonferroni Adj Test

Control	vs	Conc-µg/L	df	Test Stat	Critical	Ties	P-Type	P-Value	Decision(α:5%)
Dilution Water		2.6	13	40	---	0	Exact	1.0000	Non-Significant Effect
		3.4	12	29	---	0	Exact	1.0000	Non-Significant Effect
		5.1	13	44	---	0	Exact	1.0000	Non-Significant Effect
		8.4	13	51	---	0	Exact	1.0000	Non-Significant Effect
		16	13	47	---	0	Exact	1.0000	Non-Significant Effect
		28	13	31	---	0	Exact	1.0000	Non-Significant Effect
		55	13	22	---	0	Exact	0.1399	Non-Significant Effect
		107	12	28	---	0	Exact	1.0000	Non-Significant Effect
		210*	13	17	---	0	Exact	0.0133	Significant Effect
		425*	13	15	---	0	Exact	0.0033	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	2.081E+09	208142000	10	11.32	<1.0E-05	Significant Effect
Error	864082000	18384700	47			
Total	2.946E+09		57			

ANOVA Assumptions Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variance	Bartlett Equality of Variance Test	28.31	23.21	0.0016	Unequal Variances
	Levene Equality of Variance Test	3.271	2.724	0.0028	Unequal Variances
	Mod Levene Equality of Variance Test	1.625	2.814	0.1356	Equal Variances
Distribution	Anderson-Darling A2 Test	0.4339	3.878	0.3060	Normal Distribution
	D'Agostino Kurtosis Test	1.225	2.576	0.2207	Normal Distribution
	D'Agostino Skewness Test	1.017	2.576	0.3092	Normal Distribution
	D'Agostino-Pearson K2 Omnibus Test	2.534	9.21	0.2817	Normal Distribution
	Kolmogorov-Smirnov D Test	0.08981	0.1353	0.2711	Normal Distribution
	Shapiro-Wilk W Normality Test	0.982	0.9443	0.5401	Normal Distribution

Convergent Rounding (4 sf) CETIS™ v2.1.4.5 (009-951-268-0) Analyst:_____ QA:_____

Phytoplankton Growth Inhibition Test NIWA Ecotoxicology

Analysis ID:	06-3297-3374	**Endpoint:**	Cell Density	**CETIS Version:**	CETISv2.1.4
Analyzed:	03 Oct-25 13:12	**Analysis:**	Nonparametric-Multiple Comparison	**Status Level:**	1
Edit Date:		**MD5 Hash:**	E519C29E2B51A87E4A6F678CE14183B5	**Editor ID:**	

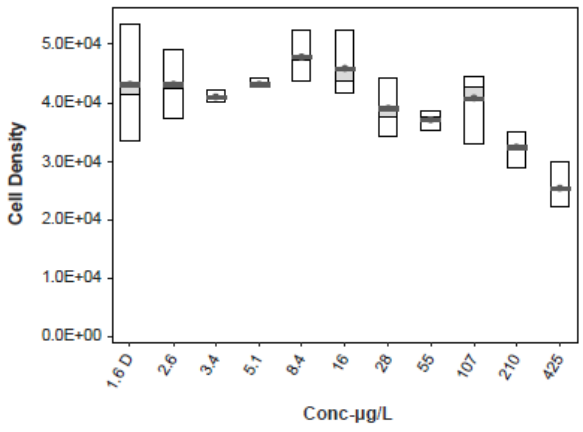
Cell Density Summary

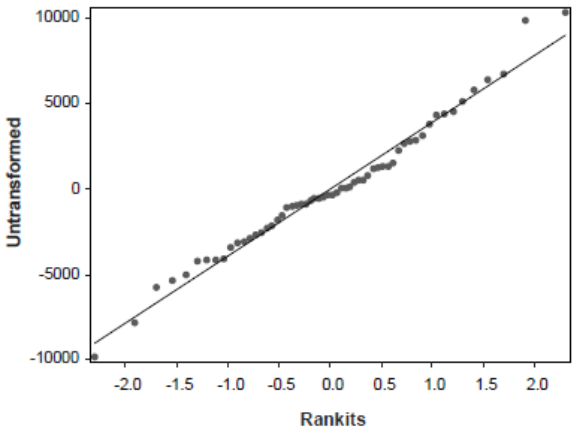
Conc-µg/L	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
1.6	D	10	43310	38440	48180	41490	33470	53670	2153	15.72%	0.00%
2.6		5	43260	37590	48920	42370	37470	49070	2041	10.55%	0.13%
3.4		4	41100	39660	42550	41040	40070	42270	453.4	2.21%	5.10%
5.1		5	43180	42220	44140	42820	42620	44470	345.5	1.79%	0.31%
8.4		5	47930	43410	52450	47270	43770	52470	1627	7.59%	-10.66%
16		5	45890	40360	51410	43770	41770	52620	1989	9.69%	-5.95%
28		5	39210	33610	44800	37670	34170	44320	2016	11.50%	9.48%
55		5	37270	35530	39010	37820	35420	38820	627.3	3.76%	13.96%
107		4	40890	32380	49390	42930	33020	44670	2672	13.07%	5.60%
210		5	32480	29590	35370	32870	29030	35120	1039	7.16%	25.01%
425		5	25490	22080	28900	25170	22320	29870	1228	10.78%	41.15%

Cell Density Detail

Conc-µg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
1.6	D	40220	37970	53220	53670	43870	49720	39170	42770	33470	39070
2.6		37470	42370	49070	46420	40970					
3.4		40070	40920	42270	41170						
5.1		42820	42620	42670	43320	44470					
8.4		52470	47270	50770	45370	43770					
16		41770	52620	43170	48120	43770					
28		34170	43570	37670	44320	36320					
55		38820	35420	36220	37820	38070					
107		42200	43670	44670	33020						
210		32870	33820	31570	35120	29030					
425		25170	29870	25520	22320	24570					

Graphics





Test/Analysis Comments

Whareatea River unmodified MES buffered pH5.5

Phytoplankton Growth Inhibition Test — **NIWA Ecotoxicology**

Analysis ID:	16-9477-6968	**Endpoint:**	Cell Density	**CETIS Version:**	CETISv2.1.4
Analyzed:	03 Oct-25 13:12	**Analysis:**	Nonlinear Regression (NLR)	**Status Level:**	1
Edit Date:		**MD5 Hash:**	E519C29E2B51A87E4A6F678CE14183B5	**Editor ID:**	
Batch ID:	03-6075-2646	**Test Type:**	Cell Growth	**Analyst:**	K Thompson
Start Date:	05 Sep-25	**Protocol:**	NIWA(2004)	**Diluent:**	Whareatea River
Ending Date:	08 Sep-25	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	Not Applicable
Test Length:	72h	**Taxon:**	Chlorophyta	**Source:**	University of Texas-Botany **Age:**
Sample ID:	00-3521-9710	**Code:**	25.023.1	**Project:**	BAT26201
Sample Date:	05 Sep-25	**Material:**	Cobalt chloride	**Source:**	Solution made by NIWA
Receipt Date:	05 Sep-25	**CAS (PC):**		**Station:**	Lab Solution
Sample Age:	---	**Client:**	BT Mining Ltd		

Comments: Whareatea River unmodified MES buffered pH5.5
Whareatea River unmodified MES buffered pH5.5

Non-Linear Regression Options

Model Name and Function	Weighting Function	PTBS Function	X Trans	Y Trans
3P Log-Logistic: μ=α/[1+[x/δ]^γ]	Normal [ω=1]	Off [μ*=μ]	None	None

Regression Summary

Iters	LL	AICc	BIC	Adj R2	PMSD	Thresh	Optimize	F Stat	P-Value	Decision(α:5%)
6	-488.6	983.6	989.4	0.5838	4.36%	43850	Yes	2.167	0.0475	Significant Lack-of-Fit

Point Estimates

Level	μg/L	95% LCL	95% UCL
IC5	35.36	6.334	65.67
IC10	72.25	31.26	117.4
IC15	112.5	64.31	166.8
IC20	156.9	104.5	216.7
IC25	206.6	149.7	272.1
IC40	400.9	284	552.8
IC50	590.8	370.3	942.7

Regression Parameters

Parameter	Estimate	Std Error	95% LCL	95% UCL	t Stat	P-Value	Decision(α:5%)
α	43850	954.7	41940	45760	45.93	<1.0E-05	Significant Parameter
γ	1.046	0.2642	0.5163	1.575	3.958	0.0002	Significant Parameter
δ	590.8	128.8	332.6	849	4.586	2.6E-05	Significant Parameter

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Model	9.573E+10	3.191E+10	3	1484	<1.0E-05	Significant Effect
Lack of Fit	318700000	39840000	8	2.167	0.0475	Significant Lack-of-Fit
Pure Error	864100000	18380000	47			
Residual	1.183E+09	21510000	55			

Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Variance	Bartlett Equality of Variance Test	28.31	18.31	0.0016	Unequal Variances
	Mod Levene Equality of Variance	1.625	2.084	0.1356	Equal Variances
Distribution	Anderson-Darling A2 Test	0.7114	2.492	0.0632	Normal Distribution
	Shapiro-Wilk W Normality Test	0.9688	0.9594	0.1401	Normal Distribution

Phytoplankton Growth Inhibition Test **NIWA Ecotoxicology**

Analysis ID:	16-9477-6968	**Endpoint:**	Cell Density	**CETIS Version:**	CETISv2.1.4
Analyzed:	03 Oct-25 13:12	**Analysis:**	Nonlinear Regression (NLR)	**Status Level:**	1
Edit Date:		**MD5 Hash:**	E519C29E2B51A87E4A6F678CE14183B5	**Editor ID:**	

Cell Density Summary

			Calculated Variate							
Conc-µg/L	Code	Count	Mean	Median	Min	Max	Std Err	Std Dev	CV%	%Effect
1.6	D	10	43310	41490	33470	53670	2153	6809	15.72%	0.00%
2.6		5	43260	42370	37470	49070	2041	4563	10.55%	0.13%
3.4		4	41100	41040	40070	42270	453.4	906.8	2.21%	5.10%
5.1		5	43180	42820	42620	44470	345.5	772.5	1.79%	0.31%
8.4		5	47930	47270	43770	52470	1627	3639	7.59%	-10.66%
16		5	45890	43770	41770	52620	1989	4448	9.69%	-5.95%
28		5	39210	37670	34170	44320	2016	4507	11.50%	9.48%
55		5	37270	37820	35420	38820	627.3	1403	3.76%	13.96%
107		4	40890	42930	33020	44670	2672	5344	13.07%	5.60%
210		5	32480	32870	29030	35120	1039	2324	7.16%	25.01%
425		5	25490	25170	22320	29870	1228	2747	10.78%	41.15%

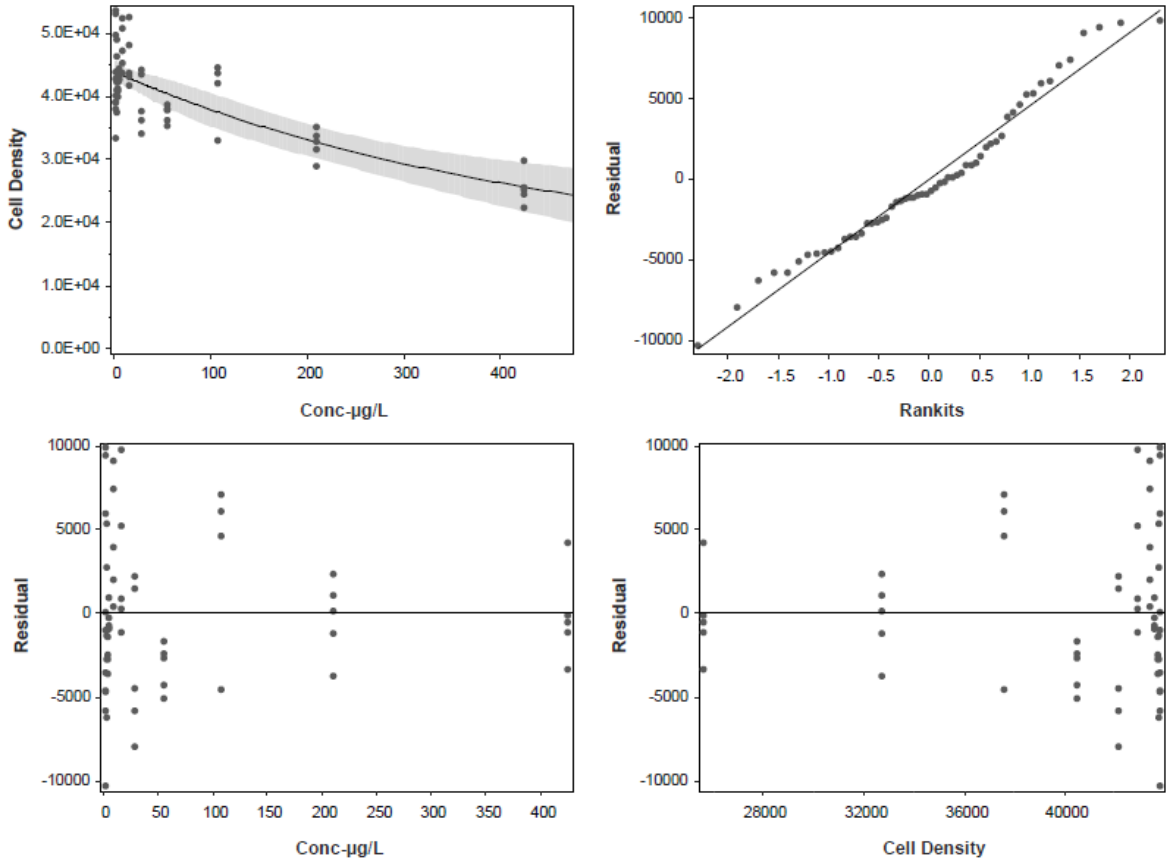
Cell Density Detail

Conc-µg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
1.6	D	40220	37970	53220	53670	43870	49720	39170	42770	33470	39070
2.6		37470	42370	49070	46420	40970					
3.4		40070	40920	42270	41170						
5.1		42820	42620	42670	43320	44470					
8.4		52470	47270	50770	45370	43770					
16		41770	52620	43170	48120	43770					
28		34170	43570	37670	44320	36320					
55		38820	35420	36220	37820	38070					
107		42200	43670	44670	33020						
210		32870	33820	31570	35120	29030					
425		25170	29870	25520	22320	24570					

Phytoplankton Growth Inhibition Test **NIWA Ecotoxicology**

Analysis ID:	16-9477-6968	**Endpoint:**	Cell Density	**CETIS Version:**	CETISv2.1.4
Analyzed:	03 Oct-25 13:12	**Analysis:**	Nonlinear Regression (NLR)	**Status Level:**	1
Edit Date:		**MD5 Hash:**	E519C29E2B51A87E4A6F678CE14183B5	**Editor ID:**	

Graphics Model: 3P Log-Logistic: μ=α/[1+[x/δ]^γ] Distribution: Normal [ω=1]



Cobalt - Modified pH 7.5 Alga 72 h growth inhibition

CETIS Analytical Report

Report Date: 09 Oct-25 11:40 (p 1 of 2)
Test Code/ID: 25.023.1 Co / 10-3026-5219

Phytoplankton Growth Inhibition Test — **NIWA Ecotoxicology**

Analysis ID:	08-8335-5550	**Endpoint:**	Cell Density	**CETIS Version:**	CETISv2.1.4
Analyzed:	09 Oct-25 11:39	**Analysis:**	Parametric-Multiple Comparison	**Status Level:**	1
Edit Date:		**MD5 Hash:**	C57C0D0EE42DFCB682A964AEF93044B9	**Editor ID:**	
Batch ID:	18-1449-3038	**Test Type:**	Cell Growth	**Analyst:**	K Thompson
Start Date:	05 Sep-25	**Protocol:**	NIWA(2004)	**Diluent:**	Whareatea River
Ending Date:	08 Sep-25	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	Not Applicable
Test Length:	72h	**Taxon:**	Chlorophyta	**Source:**	University of Texas-Botany **Age:**
Sample ID:	15-8345-6015	**Code:**	25.023.1 Co	**Project:**	BAT26201
Sample Date:	05 Sep-25	**Material:**	Cobalt chloride	**Source:**	Solution made by NIWA
Receipt Date:	05 Sep-25	**CAS (PC):**		**Station:**	Lab Solution
Sample Age:	---	**Client:**	BT Mining Ltd		

Comments: Whareatea River modified with CaO and adjusted pH 7.5
Whareatea River modified with CaO and adjusted pH 7.5

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	Tox Units	MSDu	PMSD
Untransformed	C > T	110	215	153.8	---	12530	11.84%

Bonferroni Adj t Test

Control	vs	Conc-µg/L	df	Test Stat	Critical	MSD	P-Type	P-Value	Decision(α:5%)
Dilution Water		2.5	13	-3.71	2.68	12530	CDF	1.0000	Non-Significant Effect
		3.1	13	-3.691	2.68	12530	CDF	1.0000	Non-Significant Effect
		4.6	13	-2.214	2.68	12530	CDF	1.0000	Non-Significant Effect
		8.1	13	-2.224	2.68	12530	CDF	1.0000	Non-Significant Effect
		15	13	-1.968	2.68	12530	CDF	1.0000	Non-Significant Effect
		28	13	-1.446	2.68	12530	CDF	1.0000	Non-Significant Effect
		55	13	-0.571	2.68	12530	CDF	1.0000	Non-Significant Effect
		110	13	0.5133	2.68	12530	CDF	1.0000	Non-Significant Effect
		215*	13	9.226	2.68	12530	CDF	<1.0E-05	Significant Effect
		440*	13	16.88	2.68	12530	CDF	<1.0E-05	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	4.417E+10	4.417E+09	10	60.61	<1.0E-05	Significant Effect
Error	3.571E+09	72875100	49			
Total	4.774E+10		59			

ANOVA Assumptions Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variance	Bartlett Equality of Variance Test	7.782	23.21	0.6501	Equal Variances
	Levene Equality of Variance Test	0.5822	2.706	0.8205	Equal Variances
	Mod Levene Equality of Variance Test	0.4093	2.814	0.9339	Equal Variances
Distribution	Anderson-Darling A2 Test	0.3676	3.878	0.4354	Normal Distribution
	D'Agostino Kurtosis Test	0.2381	2.576	0.8118	Normal Distribution
	D'Agostino Skewness Test	0.1741	2.576	0.8618	Normal Distribution
	D'Agostino-Pearson K2 Omnibus Test	0.087	9.21	0.9574	Normal Distribution
	Kolmogorov-Smirnov D Test	0.08478	0.1331	0.3262	Normal Distribution
	Shapiro-Wilk W Normality Test	0.9838	0.9459	0.6058	Normal Distribution

Convergent Rounding (4 sf) CETIS™ v2.1.4.5 (009-951-268-0) Analyst:_____ QA:_____

Phytoplankton Growth Inhibition Test **NIWA Ecotoxicology**

Analysis ID:	08-8335-5550	**Endpoint:**	Cell Density	**CETIS Version:**	CETISv2.1.4
Analyzed:	09 Oct-25 11:39	**Analysis:**	Parametric-Multiple Comparison	**Status Level:**	1
Edit Date:		**MD5 Hash:**	C57C0D0EE42DFCB682A964AEF93044B9	**Editor ID:**	

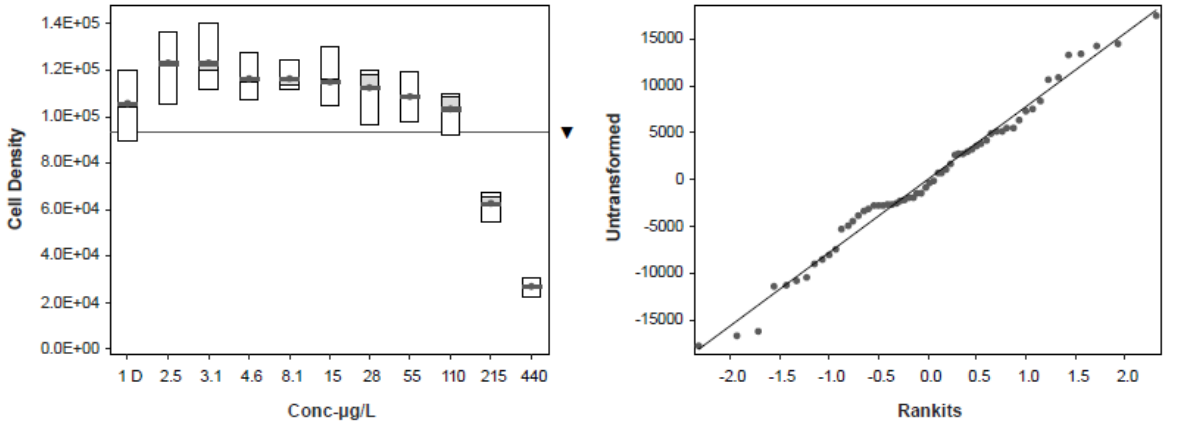
Cell Density Summary

Conc-µg/L	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
1	D	10	1.058E+5	9.913E+4	1.125E+5	1.042E+5	8.917E+4	1.201E+5	2.966E+3	8.86%	0.00%
2.5		5	1.232E+5	1.083E+5	1.381E+5	1.218E+5	1.054E+5	1.366E+5	5.364E+3	9.74%	-16.39%
3.1		5	1.231E+5	1.099E+5	1.363E+5	1.204E+5	1.117E+5	1.406E+5	4.762E+3	8.65%	-16.31%
4.6		5	1.162E+5	1.071E+5	1.252E+5	1.148E+5	1.071E+5	1.272E+5	3.262E+3	6.28%	-9.78%
8.1		5	1.162E+5	1.099E+5	1.226E+5	1.136E+5	1.113E+5	1.239E+5	2.296E+3	4.42%	-9.83%
15		5	1.150E+5	1.028E+5	1.272E+5	1.158E+5	1.045E+5	1.296E+5	4.397E+3	8.55%	-8.69%
28		5	1.126E+5	1.005E+5	1.247E+5	1.178E+5	9.632E+4	1.200E+5	4.366E+3	8.67%	-6.39%
55		5	1.085E+5	9.874E+4	1.183E+5	1.084E+5	9.767E+4	1.192E+5	3.519E+3	7.25%	-2.52%
110		5	1.034E+5	9.364E+4	1.132E+5	1.084E+5	9.212E+4	1.099E+5	3.528E+3	7.63%	2.27%
215		5	6.270E+4	5.636E+4	6.903E+4	6.532E+4	5.462E+4	6.687E+4	2.282E+3	8.14%	40.76%
440		5	2.692E+4	2.198E+4	3.185E+4	2.762E+4	2.252E+4	3.082E+4	1.778E+3	14.77%	74.57%

Cell Density Detail

Conc-µg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
1	D	9.727E+4	1.033E+5	1.069E+5	8.917E+4	1.025E+5	1.050E+5	1.035E+5	1.201E+5	1.113E+5	1.193E+5
2.5		1.366E+5	1.054E+5	1.205E+5	1.218E+5	1.317E+5					
3.1		1.228E+5	1.406E+5	1.117E+5	1.204E+5	1.200E+5					
4.6		1.179E+5	1.140E+5	1.071E+5	1.148E+5	1.272E+5					
8.1		1.239E+5	1.135E+5	1.136E+5	1.113E+5	1.190E+5					
15		1.296E+5	1.045E+5	1.075E+5	1.178E+5	1.158E+5					
28		1.178E+5	9.632E+4	1.107E+5	1.182E+5	1.200E+5					
55		1.115E+5	9.767E+4	1.084E+5	1.058E+5	1.192E+5					
110		9.817E+4	1.086E+5	9.212E+4	1.099E+5	1.084E+5					
215		6.532E+4	6.597E+4	6.072E+4	6.687E+4	5.462E+4					
440		2.762E+4	2.252E+4	2.307E+4	3.082E+4	3.057E+4					

Graphics



Test/Analysis Comments

Whareatea River modified with CaO and adjusted pH 7.5

Phytoplankton Growth Inhibition Test — **NIWA Ecotoxicology**

Analysis ID:	14-2119-9656	**Endpoint:**	Cell Density	**CETIS Version:**	CETISv2.1.4
Analyzed:	09 Oct-25 11:39	**Analysis:**	Nonlinear Regression (NLR)	**Status Level:**	1
Edit Date:		**MD5 Hash:**	C57C0D0EE42DFCB682A964AEF93044B9	**Editor ID:**	

Batch ID:	18-1449-3038	**Test Type:**	Cell Growth	**Analyst:**	K Thompson
Start Date:	05 Sep-25	**Protocol:**	NIWA(2004)	**Diluent:**	Whareatea River
Ending Date:	08 Sep-25	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	Not Applicable
Test Length:	72h	**Taxon:**	Chlorophyta	**Source:**	University of Texas-Botany **Age:**

Sample ID:	15-8345-6015	**Code:**	25.023.1 Co	**Project:**	BAT26201
Sample Date:	05 Sep-25	**Material:**	Cobalt chloride	**Source:**	Solution made by NIWA
Receipt Date:	05 Sep-25	**CAS (PC):**		**Station:**	Lab Solution
Sample Age:	---	**Client:**	BT Mining Ltd		

Comments: Whareatea River modified with CaO and adjusted pH 7.5
Whareatea River modified with CaO and adjusted pH 7.5

Non-Linear Regression Options

Model Name and Function	Weighting Function	PTBS Function	X Trans	Y Trans
3P Log-Logistic: μ=α/[1+[x/δ]^γ]	Normal [ω=1]	Off [μ*=μ]	None	None

Regression Summary

Iters	LL	AICc	BIC	Adj R2	PMSD	Thresh	Optimize	F Stat	P-Value	Decision(α:5%)
6	-549.6	1106	1111	0.8844	2.63%	114900	Yes	3.02	0.0077	Significant Lack-of-Fit

Point Estimates

Level	μg/L	95% LCL	95% UCL
IC5	65.98	38.92	84.64
IC10	92.2	67.81	112.2
IC15	113.4	89.85	134.4
IC20	132.6	109.7	154.1
IC25	150.8	128.5	172.7
IC40	205.7	183.7	229.1
IC50	246.6	221.8	274.3

Regression Parameters

Parameter	Estimate	Std Error	95% LCL	95% UCL	t Stat	P-Value	Decision(α:5%)
α	114900	1511	111900	117900	76.03	<1.0E-05	Significant Parameter
γ	2.233	0.2619	1.709	2.757	8.527	<1.0E-05	Significant Parameter
δ	246.6	13.58	219.4	273.8	18.16	<1.0E-05	Significant Parameter

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Model	6.621E+11	2.207E+11	3	2360	<1.0E-05	Significant Effect
Lack of Fit	1.761E+09	220100000	8	3.02	0.0077	Significant Lack-of-Fit
Pure Error	3.571E+09	72880000	49			
Residual	5.332E+09	93540000	57			

Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Variance	Bartlett Equality of Variance Test	7.782	18.31	0.6501	Equal Variances
	Mod Levene Equality of Variance	0.4093	2.084	0.9339	Equal Variances
Distribution	Anderson-Darling A2 Test	0.2624	2.492	0.7303	Normal Distribution
	Shapiro-Wilk W Normality Test	0.99	0.9605	0.9043	Normal Distribution

Phytoplankton Growth Inhibition Test **NIWA Ecotoxicology**

Analysis ID:	14-2119-9656	**Endpoint:**	Cell Density	**CETIS Version:**	CETISv2.1.4
Analyzed:	09 Oct-25 11:39	**Analysis:**	Nonlinear Regression (NLR)	**Status Level:**	1
Edit Date:		**MD5 Hash:**	C57C0D0EE42DFCB682A964AEF93044B9	**Editor ID:**	

Cell Density Summary

			Calculated Variate							
Conc-µg/L	**Code**	**Count**	**Mean**	**Median**	**Min**	**Max**	**Std Err**	**Std Dev**	**CV%**	**%Effect**
1	D	10	1.058E+5	1.042E+5	8.917E+4	1.201E+5	2.966E+3	9.380E+3	8.86%	0.00%
2.5		5	1.232E+5	1.218E+5	1.054E+5	1.366E+5	5.364E+3	1.199E+4	9.74%	-16.39%
3.1		5	1.231E+5	1.204E+5	1.117E+5	1.406E+5	4.762E+3	1.065E+4	8.65%	-16.31%
4.6		5	1.162E+5	1.148E+5	1.071E+5	1.272E+5	3.262E+3	7.293E+3	6.28%	-9.78%
8.1		5	1.162E+5	1.136E+5	1.113E+5	1.239E+5	2.296E+3	5.134E+3	4.42%	-9.83%
15		5	1.150E+5	1.158E+5	1.045E+5	1.296E+5	4.397E+3	9.831E+3	8.55%	-8.69%
28		5	1.126E+5	1.178E+5	9.632E+4	1.200E+5	4.366E+3	9.762E+3	8.67%	-6.39%
55		5	1.085E+5	1.084E+5	9.767E+4	1.192E+5	3.519E+3	7.870E+3	7.25%	-2.52%
110		5	1.034E+5	1.084E+5	9.212E+4	1.099E+5	3.528E+3	7.888E+3	7.63%	2.27%
215		5	6.270E+4	6.532E+4	5.462E+4	6.687E+4	2.282E+3	5.103E+3	8.14%	40.76%
440		5	2.692E+4	2.762E+4	2.252E+4	3.082E+4	1.778E+3	3.975E+3	14.77%	74.57%

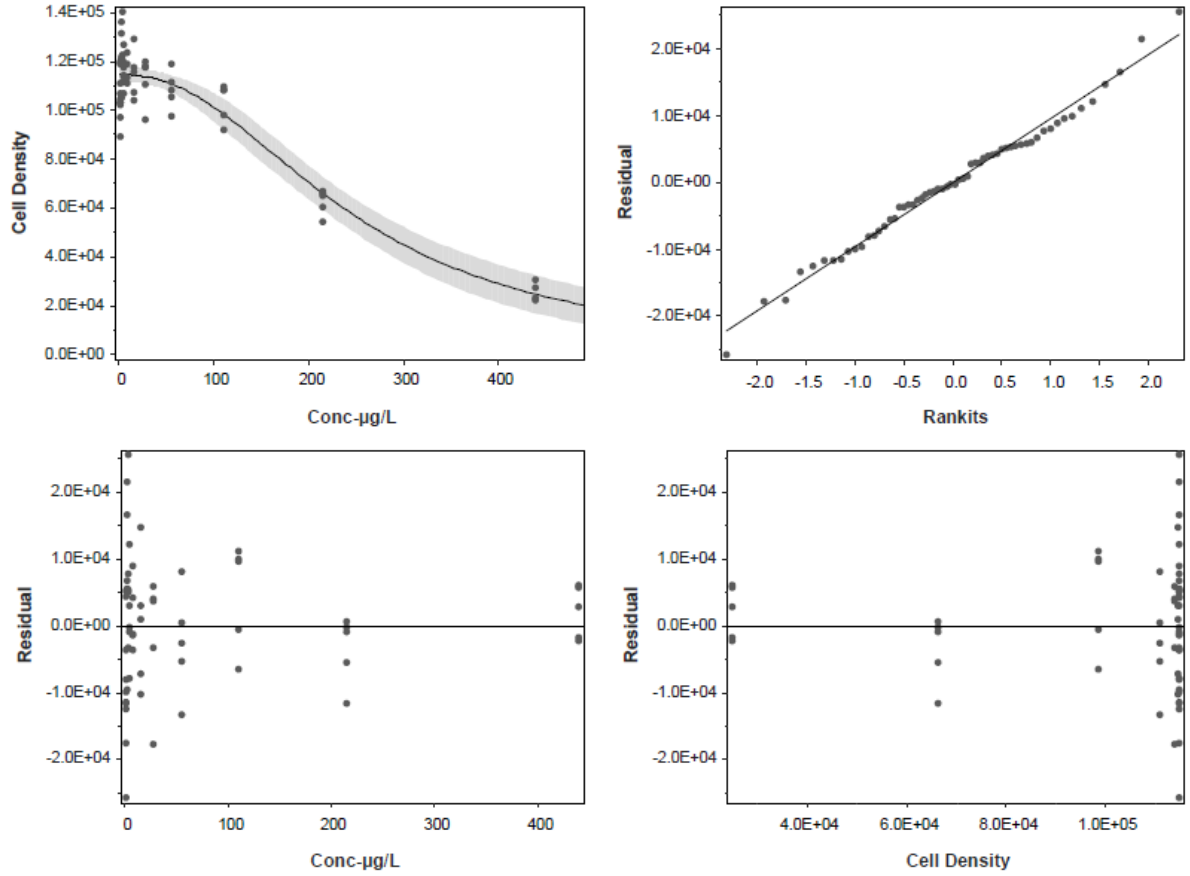
Cell Density Detail

Conc-µg/L	**Code**	**Rep 1**	**Rep 2**	**Rep 3**	**Rep 4**	**Rep 5**	**Rep 6**	**Rep 7**	**Rep 8**	**Rep 9**	**Rep 10**
1	D	9.727E+4	1.033E+5	1.069E+5	8.917E+4	1.025E+5	1.050E+5	1.035E+5	1.201E+5	1.113E+5	1.193E+5
2.5		1.366E+5	1.054E+5	1.205E+5	1.218E+5	1.317E+5					
3.1		1.228E+5	1.406E+5	1.117E+5	1.204E+5	1.200E+5					
4.6		1.179E+5	1.140E+5	1.071E+5	1.148E+5	1.272E+5					
8.1		1.239E+5	1.135E+5	1.136E+5	1.113E+5	1.190E+5					
15		1.296E+5	1.045E+5	1.075E+5	1.178E+5	1.158E+5					
28		1.178E+5	9.632E+4	1.107E+5	1.182E+5	1.200E+5					
55		1.115E+5	9.767E+4	1.084E+5	1.058E+5	1.192E+5					
110		9.817E+4	1.086E+5	9.212E+4	1.099E+5	1.084E+5					
215		6.532E+4	6.597E+4	6.072E+4	6.687E+4	5.462E+4					
440		2.762E+4	2.252E+4	2.307E+4	3.082E+4	3.057E+4					

Phytoplankton Growth Inhibition Test **NIWA Ecotoxicology**

Analysis ID:	14-2119-9656	**Endpoint:**	Cell Density	**CETIS Version:**	CETISv2.1.4
Analyzed:	09 Oct-25 11:39	**Analysis:**	Nonlinear Regression (NLR)	**Status Level:**	1
Edit Date:		**MD5 Hash:**	C57C0D0EE42DFCB682A964AEF93044B9	**Editor ID:**	

Graphics Model: 3P Log-Logistic: μ=α/[1+[x/δ]^γ] Distribution: Normal [ω=1]



Convergent Rounding (4 sf) CETIS™ v2.1.4.5 (009-951-268-0) Analyst:_____ QA:_____

Nickel - Unmodified pH 5.5 Alga 72 h growth inhibition

CETIS Analytical Report

Report Date: 03 Oct-25 13:08 (p 1 of 2)
Test Code/ID: 25.023.1 Rsub / 01-9756-0736

Phytoplankton Growth Inhibition Test — **NIWA Ecotoxicology**

Analysis ID:	11-2679-2771	**Endpoint:**	Cell Density	**CETIS Version:**	CETISv2.1.4
Analyzed:	03 Oct-25 13:07	**Analysis:**	Parametric-Multiple Comparison	**Status Level:**	1
Edit Date:		**MD5 Hash:**	C5DA072424FCFE015E0BA962B06BFFD9	**Editor ID:**	
Batch ID:	11-6699-2326	**Test Type:**	Cell Growth	**Analyst:**	K Thompson
Start Date:	05 Sep-25	**Protocol:**	NIWA(2004)	**Diluent:**	Whareatea River
Ending Date:	08 Sep-25	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	Not Applicable
Test Length:	72h	**Taxon:**	Chlorophyta	**Source:**	University of Texas-Botany **Age:**
Sample ID:	18-8507-5630	**Code:**	25.023.1 Rsub	**Project:**	BAT26201
Sample Date:	05 Sep-25	**Material:**	Nickel chloride	**Source:**	Solution made by NIWA
Receipt Date:	05 Sep-25	**CAS (PC):**		**Station:**	Lab Solution
Sample Age:	---	**Client:**	BT Mining Ltd		

Comments: Whareatea River unmodified MES buffered pH5.5
Whareatea River unmodified MES buffered pH5.5

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	Tox Units	MSDu	PMSD
Untransformed	C > T	125	240	173.2	---	6927	17.96%

Bonferroni Adj t Test

Control	vs	Conc-µg/L	df	Test Stat	Critical	MSD	P-Type	P-Value	Decision(α:5%)
Dilution Water		3.2	13	0.2921	2.68	6927	CDF	1.0000	Non-Significant Effect
		4.3	13	0.6712	2.68	6927	CDF	1.0000	Non-Significant Effect
		6.9	13	1.143	2.68	6927	CDF	1.0000	Non-Significant Effect
		11	13	1.17	2.68	6927	CDF	1.0000	Non-Significant Effect
		20	13	0.09354	2.68	6927	CDF	1.0000	Non-Significant Effect
		35	13	2.048	2.68	6927	CDF	0.2295	Non-Significant Effect
		65	13	0.9536	2.68	6927	CDF	1.0000	Non-Significant Effect
		125	13	1.623	2.68	6927	CDF	0.5552	Non-Significant Effect
		240*	13	3.159	2.68	6927	CDF	0.0136	Significant Effect
		445*	13	7.685	2.68	6927	CDF	<1.0E-05	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	1.685E+09	168452000	10	7.563	<1.0E-05	Significant Effect
Error	1.091E+09	22272600	49			
Total	2.776E+09		59			

ANOVA Assumptions Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variance	Bartlett Equality of Variance Test	12.46	23.21	0.2554	Equal Variances
	Levene Equality of Variance Test	1.93	2.706	0.0632	Equal Variances
	Mod Levene Equality of Variance Test	0.9949	2.814	0.4643	Equal Variances
Distribution	Anderson-Darling A2 Test	0.5297	3.878	0.1799	Normal Distribution
	D'Agostino Kurtosis Test	0.4993	2.576	0.6175	Normal Distribution
	D'Agostino Skewness Test	1.36	2.576	0.1738	Normal Distribution
	D'Agostino-Pearson K2 Omnibus Test	2.1	9.21	0.3500	Normal Distribution
	Kolmogorov-Smirnov D Test	0.1006	0.1331	0.1304	Normal Distribution
	Shapiro-Wilk W Normality Test	0.9777	0.9459	0.3400	Normal Distribution

Convergent Rounding (4 sf) CETIS™ v2.1.4.5 (009-951-268-0) Analyst:_____ QA:_____

Phytoplankton Growth Inhibition Test **NIWA Ecotoxicology**

Analysis ID:	11-2679-2771	**Endpoint:**	Cell Density	**CETIS Version:**	CETISv2.1.4
Analyzed:	03 Oct-25 13:07	**Analysis:**	Parametric-Multiple Comparison	**Status Level:**	1
Edit Date:		**MD5 Hash:**	C5DA072424FCFE015E0BA962B06BFFD9	**Editor ID:**	

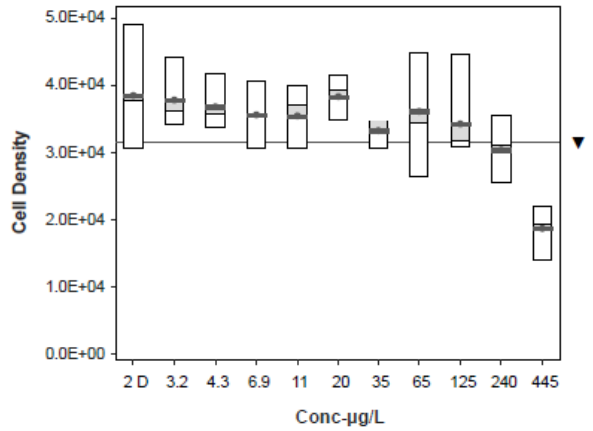
Cell Density Summary

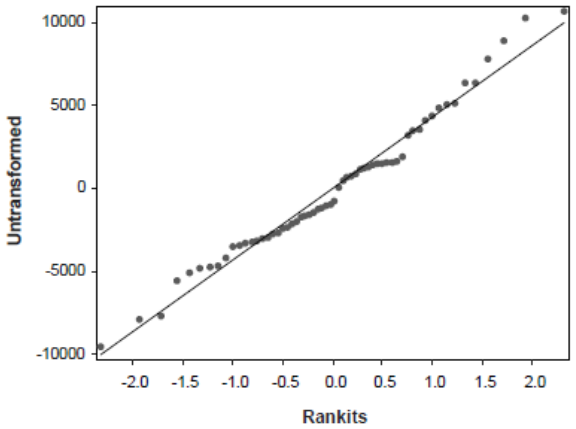
Conc-µg/L	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
2	D	10	38570	33990	43150	37620	30670	49270	2026	16.61%	0.00%
3.2		5	37820	32950	42680	36170	34320	44220	1752	10.36%	1.96%
4.3		5	36840	33120	40550	35870	33870	41720	1338	8.12%	4.50%
6.9		5	35620	30920	40310	35720	30520	40670	1690	10.61%	7.66%
11		5	35550	30840	40250	37020	30770	39970	1694	10.66%	7.84%
20		5	38330	34940	41720	39470	35070	41570	1221	7.12%	0.63%
35		5	33280	30610	35940	34820	30570	34870	960.7	6.46%	13.73%
65		5	36110	26660	45550	34520	26570	45020	3403	21.07%	6.39%
125		5	34380	27140	41610	31720	30970	44670	2605	16.94%	10.88%
240		5	30410	25760	35060	31120	25670	35520	1676	12.32%	21.17%
445		5	18710	14850	22560	19470	14070	22220	1388	16.60%	51.50%

Cell Density Detail

Conc-µg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
2	D	30920	42170	37820	37420	33020	35370	46370	49270	42720	30670
3.2		44220	34320	36170	35670	38720					
4.3		37320	41720	33870	35420	35870					
6.9		33920	40670	30520	35720	37270					
11		39970	37020	37470	30770	32520					
20		39470	41570	39620	35070	35930					
35		34820	34820	34870	31320	30570					
65		45020	42520	31920	34520	26570					
125		31220	31720	30970	33320	44670					
240		31120	25670	28070	31670	35520					
445		22220	20320	14070	19470	17470					

Graphics





Test/Analysis Comments

Whareatea River unmodified MES buffered pH5.5

Phytoplankton Growth Inhibition Test — **NIWA Ecotoxicology**

Analysis ID:	05-0517-2521	**Endpoint:**	Cell Density	**CETIS Version:**	CETISv2.1.4
Analyzed:	03 Oct-25 13:08	**Analysis:**	Nonlinear Regression (NLR)	**Status Level:**	1
Edit Date:		**MD5 Hash:**	C5DA072424FCFE015E0BA962B06BFFD9	**Editor ID:**	
Batch ID:	11-6699-2326	**Test Type:**	Cell Growth	**Analyst:**	K Thompson
Start Date:	05 Sep-25	**Protocol:**	NIWA(2004)	**Diluent:**	Whareatea River
Ending Date:	08 Sep-25	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	Not Applicable
Test Length:	72h	**Taxon:**	Chlorophyta	**Source:**	University of Texas-Botany **Age:**
Sample ID:	18-8507-5630	**Code:**	25.023.1 Rsub	**Project:**	BAT26201
Sample Date:	05 Sep-25	**Material:**	Nickel chloride	**Source:**	Solution made by NIWA
Receipt Date:	05 Sep-25	**CAS (PC):**		**Station:**	Lab Solution
Sample Age:	---	**Client:**	BT Mining Ltd		

Comments: Whareatea River unmodified MES buffered pH5.5
Whareatea River unmodified MES buffered pH5.5

Non-Linear Regression Options

Model Name and Function	Weighting Function	PTBS Function	X Trans	Y Trans
3P Log-Logistic: μ=α/[1+[x/δ]^γ]	Normal [ω=1]	Off [μ*=μ]	None	None

Regression Summary

Iters	LL	AICc	BIC	Adj R2	PMSD	Thresh	Optimize	F Stat	P-Value	Decision(α:5%)
15	-505.3	1017	1023	0.5463	3.86%	36800	Yes	0.7042	0.6863	Non-Significant Lack-of-Fit

Point Estimates

Level	μg/L	95% LCL	95% UCL
IC5	122.5	---	180.5
IC10	171.1	73.59	234.5
IC15	210.5	130.7	274.8
IC20	245.9	176.3	308.9
IC25	279.7	217	340.5
IC40	381.4	318.6	450.4
IC50	457.2	370.8	563.6

Regression Parameters

Parameter	Estimate	Std Error	95% LCL	95% UCL	t Stat	P-Value	Decision(α:5%)
α	36800	709.2	35380	38220	51.89	<1.0E-05	Significant Parameter
γ	2.236	0.5991	1.037	3.436	3.733	0.0004	Significant Parameter
δ	457.2	46.99	363.1	551.3	9.73	<1.0E-05	Significant Parameter

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Model	7.303E+10	2.434E+10	3	1140	<1.0E-05	Significant Effect
Lack of Fit	125500000	15680000	8	0.7042	0.6863	Non-Significant Lack-of-Fit
Pure Error	1.091E+09	22270000	49			
Residual	1.217E+09	21350000	57			

Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Variance	Bartlett Equality of Variance Test	12.46	18.31	0.2554	Equal Variances
	Mod Levene Equality of Variance	0.9949	2.084	0.4643	Equal Variances
Distribution	Anderson-Darling A2 Test	0.696	2.492	0.0691	Normal Distribution
	Shapiro-Wilk W Normality Test	0.9695	0.9605	0.1372	Normal Distribution

Phytoplankton Growth Inhibition Test **NIWA Ecotoxicology**

Analysis ID:	05-0517-2521	**Endpoint:**	Cell Density	**CETIS Version:**	CETISv2.1.4
Analyzed:	03 Oct-25 13:08	**Analysis:**	Nonlinear Regression (NLR)	**Status Level:**	1
Edit Date:		**MD5 Hash:**	C5DA072424FCFE015E0BA962B06BFFD9	**Editor ID:**	

Cell Density Summary

			Calculated Variate							
Conc-µg/L	**Code**	**Count**	**Mean**	**Median**	**Min**	**Max**	**Std Err**	**Std Dev**	**CV%**	**%Effect**
2	D	10	38570	37620	30670	49270	2026	6406	16.61%	0.00%
3.2		5	37820	36170	34320	44220	1752	3917	10.36%	1.96%
4.3		5	36840	35870	33870	41720	1338	2993	8.12%	4.50%
6.9		5	35620	35720	30520	40670	1690	3779	10.61%	7.66%
11		5	35550	37020	30770	39970	1694	3789	10.66%	7.84%
20		5	38330	39470	35070	41570	1221	2730	7.12%	0.63%
35		5	33280	34820	30570	34870	960.7	2148	6.46%	13.73%
65		5	36110	34520	26570	45020	3403	7609	21.07%	6.39%
125		5	34380	31720	30970	44670	2605	5824	16.94%	10.88%
240		5	30410	31120	25670	35520	1676	3747	12.32%	21.17%
445		5	18710	19470	14070	22220	1388	3105	16.60%	51.50%

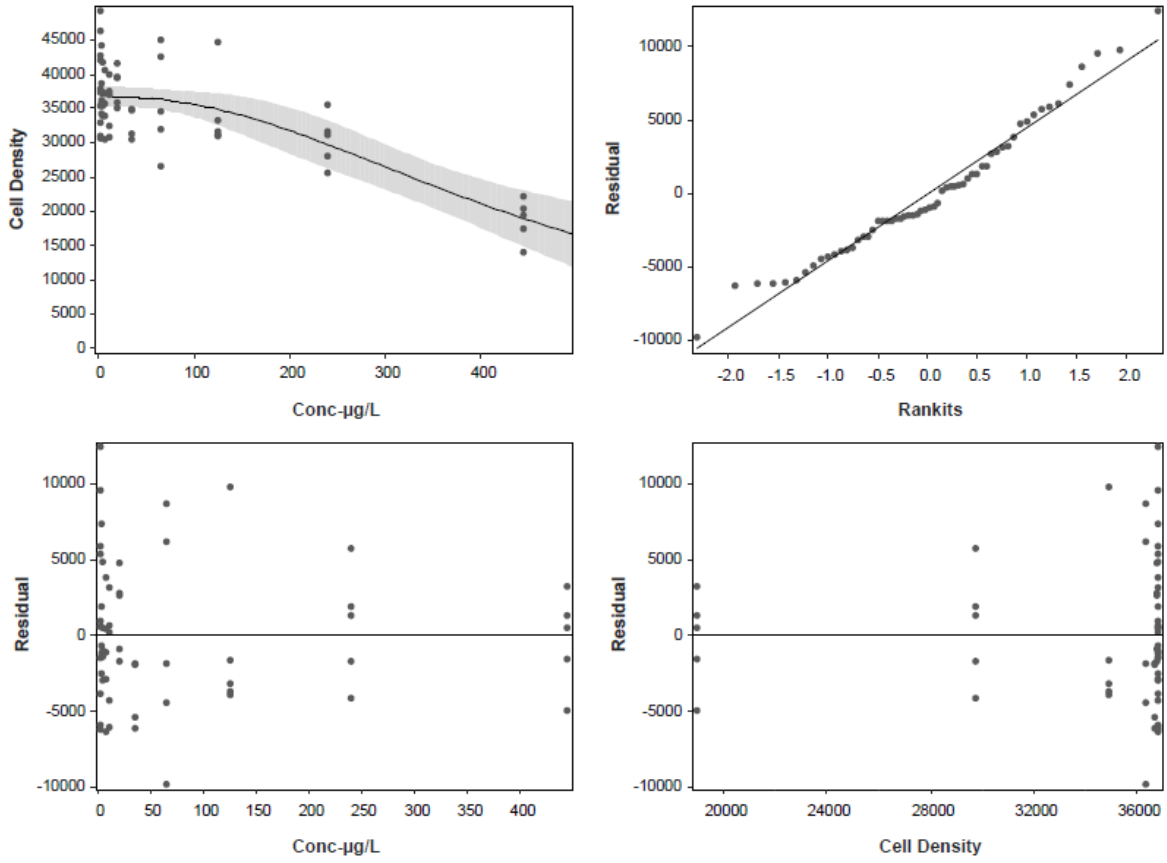
Cell Density Detail

Conc-µg/L	**Code**	**Rep 1**	**Rep 2**	**Rep 3**	**Rep 4**	**Rep 5**	**Rep 6**	**Rep 7**	**Rep 8**	**Rep 9**	**Rep 10**
2	D	30920	42170	37820	37420	33020	35370	46370	49270	42720	30670
3.2		44220	34320	36170	35670	38720					
4.3		37320	41720	33870	35420	35870					
6.9		33920	40670	30520	35720	37270					
11		39970	37020	37470	30770	32520					
20		39470	41570	39620	35070	35930					
35		34820	34820	34870	31320	30570					
65		45020	42520	31920	34520	26570					
125		31220	31720	30970	33320	44670					
240		31120	25670	28070	31670	35520					
445		22220	20320	14070	19470	17470					

Phytoplankton Growth Inhibition Test **NIWA Ecotoxicology**

Analysis ID:	05-0517-2521	**Endpoint:**	Cell Density	**CETIS Version:**	CETISv2.1.4
Analyzed:	03 Oct-25 13:08	**Analysis:**	Nonlinear Regression (NLR)	**Status Level:**	1
Edit Date:		**MD5 Hash:**	C5DA072424FCFE015E0BA962B06BFFD9	**Editor ID:**	

Graphics Model: 3P Log-Logistic: μ=α/[1+[x/δ]^γ] Distribution: Normal [ω=1]



Nickel - Modified pH 7.5 Alga 72 h growth inhibition

CETIS Analytical Report

Report Date: 10 Oct-25 13:35 (p 1 of 2)
Test Code/ID: 25.023.1 Ni / 05-8757-0822

Phytoplankton Growth Inhibition Test — **NIWA Ecotoxicology**

Analysis ID:	15-6301-8400	**Endpoint:**	Cell Density	**CETIS Version:**	CETISv2.1.4
Analyzed:	10 Oct-25 13:34	**Analysis:**	Parametric-Multiple Comparison	**Status Level:**	1
Edit Date:		**MD5 Hash:**	3B0A36DF67C4315CFA813F0DA37382EE	**Editor ID:**	
Batch ID:	07-3803-1962	**Test Type:**	Cell Growth	**Analyst:**	K Thompson
Start Date:	05 Sep-25	**Protocol:**	NIWA(2004)	**Diluent:**	Whareatea River
Ending Date:	08 Sep-25	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	Not Applicable
Test Length:	72h	**Taxon:**	Chlorophyta	**Source:**	University of Texas-Botany **Age:**
Sample ID:	06-7666-5501	**Code:**	25.023.1 Ni	**Project:**	BAT26201
Sample Date:	05 Sep-25	**Material:**	Nickel chloride	**Source:**	Solution made by NIWA
Receipt Date:	05 Sep-25	**CAS (PC):**		**Station:**	Lab Solution
Sample Age:	---	**Client:**	BT Mining Ltd		

Comments: Whareatea River modified with CaO and adjusted pH 7.5
Whareatea River modified with CaO and adjusted pH 7.5

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	Tox Units	MSDu	PMSD
Untransformed	C > T	55	108	77.07	---	13080	10.55%

Bonferroni Adj t Test

Control	vs	Conc-µg/L	df	Test Stat	Critical	MSD	P-Type	P-Value	Decision(α:5%)
Dilution Water		2	13	-4.396	2.68	13080	CDF	1.0000	Non-Significant Effect
		2.8	13	-3.718	2.68	13080	CDF	1.0000	Non-Significant Effect
		4.6	13	-3.756	2.68	13080	CDF	1.0000	Non-Significant Effect
		7.8	13	-2.598	2.68	13080	CDF	1.0000	Non-Significant Effect
		15	13	-6.203	2.68	13080	CDF	1.0000	Non-Significant Effect
		28	13	-2.029	2.68	13080	CDF	1.0000	Non-Significant Effect
		55	13	-2.137	2.68	13080	CDF	1.0000	Non-Significant Effect
		108*	13	5.212	2.68	13080	CDF	1.9E-05	Significant Effect
		215*	13	18.88	2.68	13080	CDF	<1.0E-05	Significant Effect
		435*	13	21.97	2.68	13080	CDF	<1.0E-05	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	1.108E+11	1.108E+10	10	139.5	<1.0E-05	Significant Effect
Error	3.892E+09	79424800	49			
Total	1.147E+11		59			

ANOVA Assumptions Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variance	Bartlett Equality of Variance Test	17.81	23.21	0.0582	Equal Variances
	Levene Equality of Variance Test	2.071	2.706	0.0454	Equal Variances
	Mod Levene Equality of Variance Test	0.9709	2.814	0.4834	Equal Variances
Distribution	Anderson-Darling A2 Test	0.3352	3.878	0.5139	Normal Distribution
	D'Agostino Kurtosis Test	1.969	2.576	0.0490	Normal Distribution
	D'Agostino Skewness Test	1.633	2.576	0.1024	Normal Distribution
	D'Agostino-Pearson K2 Omnibus Test	6.542	9.21	0.0380	Normal Distribution
	Kolmogorov-Smirnov D Test	0.05768	0.1331	0.9382	Normal Distribution
	Shapiro-Wilk W Normality Test	0.9669	0.9459	0.1030	Normal Distribution

Convergent Rounding (4 sf) CETIS™ v2.1.4.5 (009-951-268-0) Analyst:_____ QA:_____

Phytoplankton Growth Inhibition Test **NIWA Ecotoxicology**

Analysis ID:	15-6301-8400	**Endpoint:**	Cell Density	**CETIS Version:**	CETISv2.1.4
Analyzed:	10 Oct-25 13:34	**Analysis:**	Parametric-Multiple Comparison	**Status Level:**	1
Edit Date:		**MD5 Hash:**	3B0A36DF67C4315CFA813F0DA37382EE	**Editor ID:**	

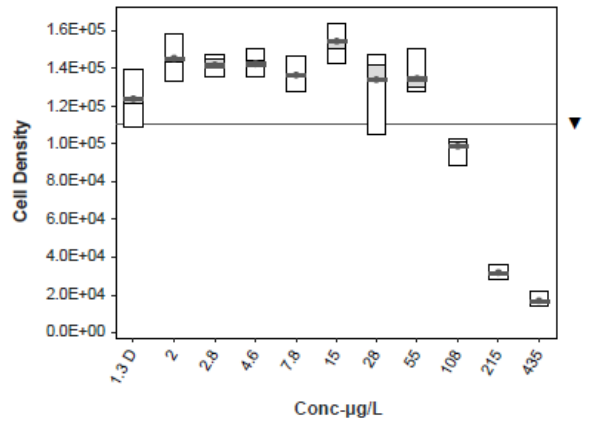
Cell Density Summary

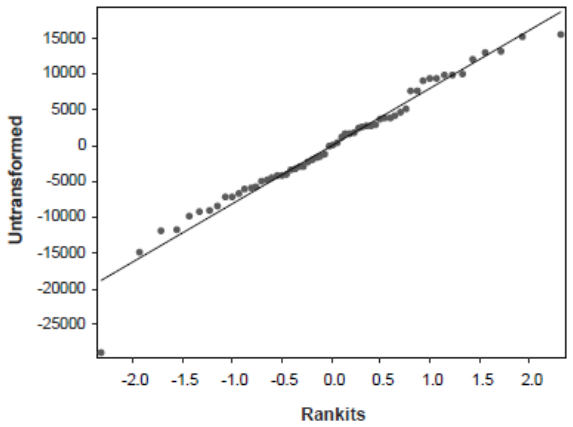
Conc-µg/L	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
1.3	D	10	1.240E+5	1.170E+5	1.310E+5	1.213E+5	1.092E+5	1.394E+5	3.096E+3	7.89%	0.00%
2		5	1.455E+5	1.317E+5	1.593E+5	1.438E+5	1.336E+5	1.587E+5	4.956E+3	7.62%	-17.30%
2.8		5	1.422E+5	1.353E+5	1.490E+5	1.446E+5	1.362E+5	1.474E+5	2.468E+3	3.88%	-14.63%
4.6		5	1.424E+5	1.352E+5	1.495E+5	1.441E+5	1.353E+5	1.501E+5	2.583E+3	4.06%	-14.78%
7.8		5	1.367E+5	1.275E+5	1.460E+5	1.366E+5	1.277E+5	1.468E+5	3.334E+3	5.45%	-10.22%
15		5	1.543E+5	1.428E+5	1.658E+5	1.512E+5	1.426E+5	1.642E+5	4.151E+3	6.01%	-24.41%
28		5	1.339E+5	1.128E+5	1.551E+5	1.417E+5	1.050E+5	1.470E+5	7.611E+3	12.71%	-7.99%
55		5	1.345E+5	1.229E+5	1.460E+5	1.300E+5	1.274E+5	1.500E+5	4.168E+3	6.93%	-8.41%
108		5	9.859E+4	9.164E+4	1.056E+5	1.012E+5	8.883E+4	1.026E+5	2.506E+3	5.68%	20.51%
215		5	3.187E+4	2.761E+4	3.613E+4	3.193E+4	2.793E+4	3.563E+4	1.534E+3	10.77%	74.31%
435		5	1.677E+4	1.297E+4	2.056E+4	1.560E+4	1.383E+4	2.150E+4	1.367E+3	18.23%	86.48%

Cell Density Detail

Conc-µg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
1.3	D	1.174E+5	1.193E+5	1.092E+5	1.156E+5	1.269E+5	1.394E+5	1.207E+5	1.218E+5	1.361E+5	1.340E+5
2		1.336E+5	1.364E+5	1.549E+5	1.438E+5	1.587E+5					
2.8		1.464E+5	1.446E+5	1.474E+5	1.362E+5	1.363E+5					
4.6		1.501E+5	1.441E+5	1.442E+5	1.353E+5	1.382E+5					
7.8		1.406E+5	1.468E+5	1.366E+5	1.318E+5	1.277E+5					
15		1.512E+5	1.502E+5	1.426E+5	1.642E+5	1.634E+5					
28		1.470E+5	1.050E+5	1.434E+5	1.417E+5	1.325E+5					
55		1.500E+5	1.274E+5	1.288E+5	1.361E+5	1.300E+5					
108		1.014E+5	1.012E+5	8.883E+4	9.903E+4	1.026E+5					
215		3.563E+4	2.793E+4	2.897E+4	3.193E+4	3.487E+4					
435		1.383E+4	1.490E+4	2.150E+4	1.800E+4	1.560E+4					

Graphics





Test/Analysis Comments

Whareatea River modified with CaO and adjusted pH 7.5

Phytoplankton Growth Inhibition Test **NIWA Ecotoxicology**

Analysis ID:	21-1618-4108	**Endpoint:**	Cell Density	**CETIS Version:**	CETISv2.1.4
Analyzed:	10 Oct-25 13:34	**Analysis:**	Nonlinear Regression (NLR)	**Status Level:**	1
Edit Date:		**MD5 Hash:**	3B0A36DF67C4315CFA813F0DA37382EE	**Editor ID:**	
Batch ID:	07-3803-1962	**Test Type:**	Cell Growth	**Analyst:**	K Thompson
Start Date:	05 Sep-25	**Protocol:**	NIWA(2004)	**Diluent:**	Whareatea River
Ending Date:	08 Sep-25	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	Not Applicable
Test Length:	72h	**Taxon:**	Chlorophyta	**Source:**	University of Texas-Botany **Age:**
Sample ID:	06-7666-5501	**Code:**	25.023.1 Ni	**Project:**	BAT26201
Sample Date:	05 Sep-25	**Material:**	Nickel chloride	**Source:**	Solution made by NIWA
Receipt Date:	05 Sep-25	**CAS (PC):**		**Station:**	Lab Solution
Sample Age:	---	**Client:**	BT Mining Ltd		

Comments: Whareatea River modified with CaO and adjusted pH 7.5
Whareatea River modified with CaO and adjusted pH 7.5

Non-Linear Regression Options

Model Name and Function	Weighting Function	PTBS Function	X Trans	Y Trans
3P Log-Logistic: μ=α/[1+[x/δ]^γ]	Normal [ω=1]	Off [μ*=μ]	None	None

Regression Summary

Iters	LL	AICc	BIC	Adj R2	PMSD	Thresh	Optimize	F Stat	P-Value	Decision(α:5%)
8	-563.3	1133	1139	0.9239	2.77%	138500	Yes	7.141	0.0000	Significant Lack-of-Fit

Point Estimates

Level	μg/L	95% LCL	95% UCL
IC5	52.57	32.23	64.79
IC10	68.36	51.96	80.77
IC15	80.43	65.32	93.1
IC20	90.9	76.65	103.7
IC25	100.6	86.96	113.4
IC40	128.3	115.5	141.7
IC50	148	134.3	163

Regression Parameters

Parameter	Estimate	Std Error	95% LCL	95% UCL	t Stat	P-Value	Decision(α:5%)
α	138500	1915	134600	142300	72.3	<1.0E-05	Significant Parameter
γ	2.846	0.3393	2.166	3.525	8.386	<1.0E-05	Significant Parameter
δ	148	7.397	133.2	162.8	20	<1.0E-05	Significant Parameter

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Model	9.053E+11	3.018E+11	3	2041	<1.0E-05	Significant Effect
Lack of Fit	4.537E+09	567200000	8	7.141	<1.0E-05	Significant Lack-of-Fit
Pure Error	3.892E+09	79420000	49			
Residual	8.429E+09	147900000	57			

Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Variance	Bartlett Equality of Variance Test	17.81	18.31	0.0582	Equal Variances
	Mod Levene Equality of Variance	0.9709	2.084	0.4834	Equal Variances
Distribution	Anderson-Darling A2 Test	0.6458	2.492	0.0925	Normal Distribution
	Shapiro-Wilk W Normality Test	0.9713	0.9605	0.1694	Normal Distribution

Phytoplankton Growth Inhibition Test **NIWA Ecotoxicology**

Analysis ID:	21-1618-4108	**Endpoint:**	Cell Density	**CETIS Version:**	CETISv2.1.4
Analyzed:	10 Oct-25 13:34	**Analysis:**	Nonlinear Regression (NLR)	**Status Level:**	1
Edit Date:		**MD5 Hash:**	3B0A36DF67C4315CFA813F0DA37382EE	**Editor ID:**	

Cell Density Summary

			Calculated Variate							
Conc-µg/L	Code	Count	Mean	Median	Min	Max	Std Err	Std Dev	CV%	%Effect
1.3	D	10	1.240E+5	1.213E+5	1.092E+5	1.394E+5	3.096E+3	9.790E+3	7.89%	0.00%
2		5	1.455E+5	1.438E+5	1.336E+5	1.587E+5	4.956E+3	1.108E+4	7.62%	-17.30%
2.8		5	1.422E+5	1.446E+5	1.362E+5	1.474E+5	2.468E+3	5.518E+3	3.88%	-14.63%
4.6		5	1.424E+5	1.441E+5	1.353E+5	1.501E+5	2.583E+3	5.776E+3	4.06%	-14.78%
7.8		5	1.367E+5	1.366E+5	1.277E+5	1.468E+5	3.334E+3	7.455E+3	5.45%	-10.22%
15		5	1.543E+5	1.512E+5	1.426E+5	1.642E+5	4.151E+3	9.281E+3	6.01%	-24.41%
28		5	1.339E+5	1.417E+5	1.050E+5	1.470E+5	7.611E+3	1.702E+4	12.71%	-7.99%
55		5	1.345E+5	1.300E+5	1.274E+5	1.500E+5	4.168E+3	9.320E+3	6.93%	-8.41%
108		5	9.859E+4	1.012E+5	8.883E+4	1.026E+5	2.506E+3	5.603E+3	5.68%	20.51%
215		5	3.187E+4	3.193E+4	2.793E+4	3.563E+4	1.534E+3	3.431E+3	10.77%	74.31%
435		5	1.677E+4	1.560E+4	1.383E+4	2.150E+4	1.367E+3	3.057E+3	18.23%	86.48%

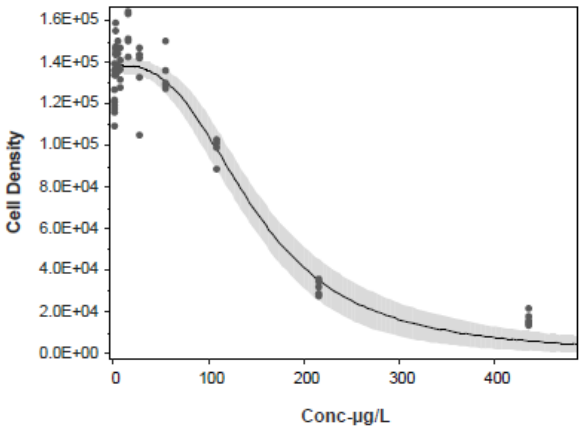
Cell Density Detail

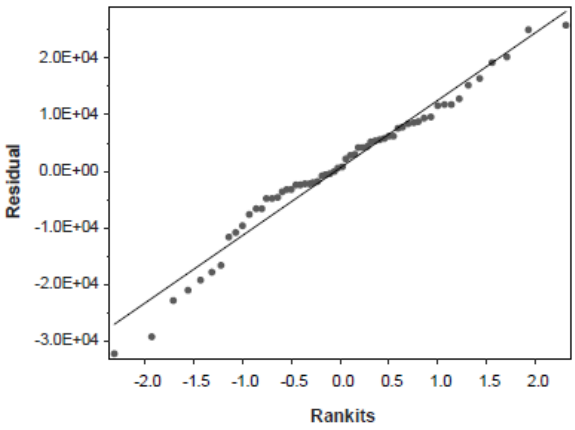
Conc-µg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
1.3	D	1.174E+5	1.193E+5	1.092E+5	1.156E+5	1.269E+5	1.394E+5	1.207E+5	1.218E+5	1.361E+5	1.340E+5
2		1.336E+5	1.364E+5	1.549E+5	1.438E+5	1.587E+5					
2.8		1.464E+5	1.446E+5	1.474E+5	1.362E+5	1.363E+5					
4.6		1.501E+5	1.441E+5	1.442E+5	1.353E+5	1.382E+5					
7.8		1.406E+5	1.468E+5	1.366E+5	1.318E+5	1.277E+5					
15		1.512E+5	1.502E+5	1.426E+5	1.642E+5	1.634E+5					
28		1.470E+5	1.050E+5	1.434E+5	1.417E+5	1.325E+5					
55		1.500E+5	1.274E+5	1.288E+5	1.361E+5	1.300E+5					
108		1.014E+5	1.012E+5	8.883E+4	9.903E+4	1.026E+5					
215		3.563E+4	2.793E+4	2.897E+4	3.193E+4	3.487E+4					
435		1.383E+4	1.490E+4	2.150E+4	1.800E+4	1.560E+4					

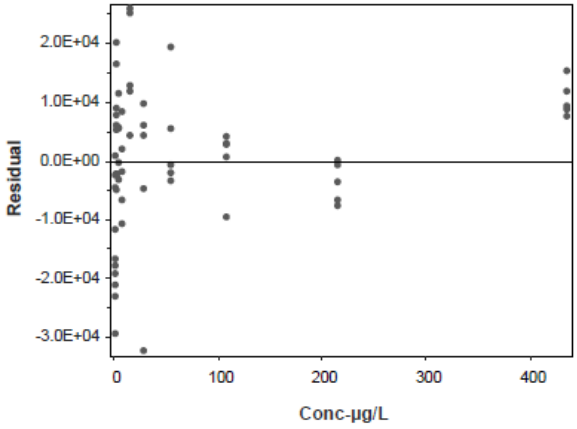
Phytoplankton Growth Inhibition Test **NIWA Ecotoxicology**

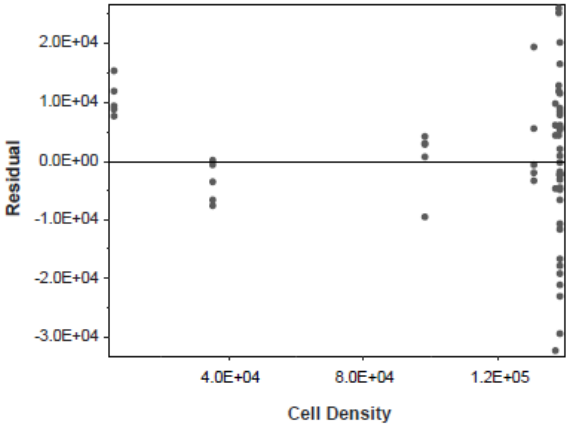
Analysis ID:	21-1618-4108	**Endpoint:**	Cell Density	**CETIS Version:**	CETISv2.1.4
Analyzed:	10 Oct-25 13:34	**Analysis:**	Nonlinear Regression (NLR)	**Status Level:**	1
Edit Date:		**MD5 Hash:**	3B0A36DF67C4315CFA813F0DA37382EE	**Editor ID:**	

Graphics Model: 3P Log-Logistic: μ=α/[1+[x/δ]^γ] Distribution: Normal [ω=1]









Cobalt - Unmodified pH 5.5 Mayfly 14 d survival

CETIS Analytical Report

Report Date: 09 Oct-25 11:34 (p 1 of 3)
Test Code/ID: 25.023.1 DSp Co / 10-9777-6919

Mayfly Chronic Survival — **NIWA Ecotoxicology**

Analysis ID:	19-5210-1121	**Endpoint:**	14 day survival	**CETIS Version:**	CETISv2.1.4
Analyzed:	09 Oct-25 11:33	**Analysis:**	Parametric-Multiple Comparison	**Status Level:**	1
Edit Date:	16 Sep-25 11:19	**MD5 Hash:**	F998E22F72286465DCDD85C18D5A7D1E	**Editor ID:**	008-408-407-6
Batch ID:	15-3366-6135	**Test Type:**	Survival (14d)	**Analyst:**	K Thompson
Start Date:	01 Sep-25	**Protocol:**	Not Applicable	**Diluent:**	Whareatea River
Ending Date:	15 Sep-25	**Species:**	Deleatidium sp	**Brine:**	Not Applicable
Test Length:	14d 0h	**Taxon:**		**Source:**	Waimakariri Stream
					Age:
Sample ID:	11-4359-8011	**Code:**	25.023.1 DSp Co	**Project:**	Special Studies
Sample Date:	01 Sep-25	**Material:**	Cobalt chloride	**Source:**	Solution made by NIWA
Receipt Date:	01 Sep-25	**CAS (PC):**		**Station:**	Lab Solution
Sample Age:	---	**Client:**	BT Mining Ltd		

Comments: Whareatea River unmodified MES buffered pH5.5
Whareatea River unmodified MES buffered pH5.5

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	Tox Units	MSDu	PMSD
Angular (Corrected)	C > T	1230	>1230	---	---	0.1545	18.39%

Bonferroni Adj t Test

Control	vs	Conc-µg/L	df	Test Stat	Critical	MSD	P-Type	P-Value	Decision(α:5%)
Dilution Water		70	6	0.1317	2.624	0.1885	CDF	1.0000	Non-Significant Effect
		139	6	0.1317	2.624	0.1885	CDF	1.0000	Non-Significant Effect
		290	6	-0.6248	2.624	0.1885	CDF	1.0000	Non-Significant Effect
		610	6	0.1317	2.624	0.1885	CDF	1.0000	Non-Significant Effect
		1230	6	1.867	2.624	0.1885	CDF	0.2074	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0545578	0.0109116	5	1.129	0.3901	Non-Significant Effect
Error	0.135364	0.0096688	14			
Total	0.189921		19			

ANOVA Assumptions Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variance	Bartlett Equality of Variance Test	2.783	15.09	0.7334	Equal Variances
	Levene Equality of Variance Test	2.964	4.695	0.0497	Equal Variances
	Mod Levene Equality of Variance Test	0.1897	6.632	0.9582	Equal Variances
Distribution	Anderson-Darling A2 Test	2.048	3.878	<1.0E-05	Non-Normal Distribution
	D'Agostino Kurtosis Test	0.03678	2.576	0.9707	Normal Distribution
	D'Agostino Skewness Test	1.754	2.576	0.0794	Normal Distribution
	D'Agostino-Pearson K2 Omnibus Test	3.079	9.21	0.2145	Normal Distribution
	Kolmogorov-Smirnov D Test	0.3265	0.2235	<1.0E-05	Non-Normal Distribution
	Shapiro-Wilk W Normality Test	0.8188	0.866	0.0017	Non-Normal Distribution

14 day survival Summary

Conc-µg/L	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0.7	D	5	0.8400	0.7720	0.9080	0.8000	0.8000	0.9000	0.0245	6.52%	0.00%
70		3	0.8333	0.6899	0.9768	0.8000	0.8000	0.9000	0.0333	6.93%	0.79%
139		3	0.8333	0.6899	0.9768	0.8000	0.8000	0.9000	0.0333	6.93%	0.79%
290		3	0.8667	0.5798	1.0000	0.8000	0.8000	1.0000	0.0667	13.32%	-3.17%
610		3	0.8333	0.6899	0.9768	0.8000	0.8000	0.9000	0.0333	6.93%	0.79%
1230		3	0.7333	0.5899	0.8768	0.7000	0.7000	0.8000	0.0333	7.87%	12.70%

Convergent Rounding (4 sf) CETIS™ v2.1.4.5 (009-951-268-0) Analyst:_____ QA:_____

Mayfly Chronic Survival NIWA Ecotoxicology

Analysis ID:	19-5210-1121	**Endpoint:**	14 day survival	**CETIS Version:**	CETISv2.1.4
Analyzed:	09 Oct-25 11:33	**Analysis:**	Parametric-Multiple Comparison	**Status Level:**	1
Edit Date:	16 Sep-25 11:19	**MD5 Hash:**	F998E22F72286465DCDD85C18D5A7D1E	**Editor ID:**	008-408-407-6

Angular (Corrected) Transformed Summary

Conc-µg/L	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0.7	D	5	1.1640	1.0670	1.2600	1.1070	1.1070	1.2490	0.0348	6.68%	0.00%
70		3	1.1540	0.9509	1.3580	1.1070	1.1070	1.2490	0.0473	7.10%	0.81%
139		3	1.1540	0.9509	1.3580	1.1070	1.1070	1.2490	0.0473	7.10%	0.81%
290		3	1.2090	0.7715	1.6460	1.1070	1.1070	1.4120	0.1016	14.56%	-3.85%
610		3	1.1540	0.9509	1.3580	1.1070	1.1070	1.2490	0.0473	7.10%	0.81%
1230		3	1.0300	0.8635	1.1960	0.9912	0.9912	1.1070	0.0387	6.50%	11.52%

14 day survival Detail

Conc-µg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0.7	D	0.8000	0.9000	0.9000	0.8000	0.8000
70		0.8000	0.9000	0.8000		
139		0.9000	0.8000	0.8000		
290		0.8000	1.0000	0.8000		
610		0.8000	0.8000	0.9000		
1230		0.7000	0.7000	0.8000		

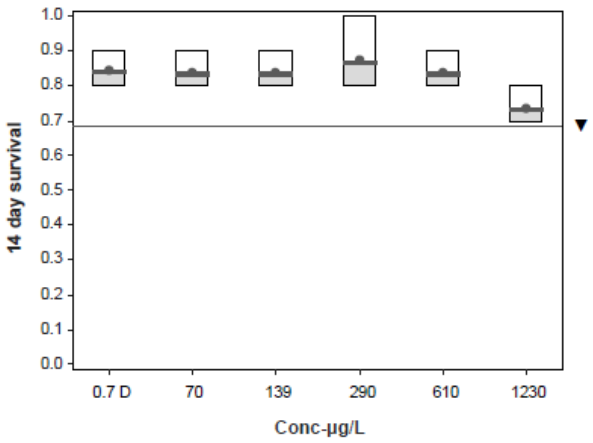
Angular (Corrected) Transformed Detail

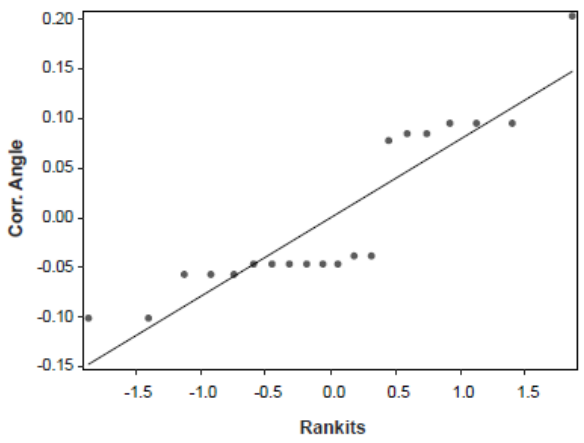
Conc-µg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0.7	D	1.1070	1.2490	1.2490	1.1070	1.1070
70		1.1070	1.2490	1.1070		
139		1.2490	1.1070	1.1070		
290		1.1070	1.4120	1.1070		
610		1.1070	1.1070	1.2490		
1230		0.9912	0.9912	1.1070		

14 day survival Binomials

Conc-µg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0.7	D	8/10	9/10	9/10	8/10	8/10
70		8/10	9/10	8/10		
139		9/10	8/10	8/10		
290		8/10	10/10	8/10		
610		8/10	8/10	9/10		
1230		7/10	7/10	8/10		

Graphics





Convergent Rounding (4 sf) CETIS™ v2.1.4.5 (009-951-268-0) Analyst:_____ QA:_____

Cobalt - Modified pH 7.5 Mayfly 14 d survival

CETIS Analytical Report

Report Date: 09 Oct-25 11:31 (p 1 of 3)
Test Code/ID: 25.023.1 DSp / 03-1092-5449

Mayfly Chronic Survival — **NIWA Ecotoxicology**

Analysis ID:	04-4530-8245	**Endpoint:**	14 day survival	**CETIS Version:**	CETISv2.1.4
Analyzed:	09 Oct-25 11:30	**Analysis:**	Parametric-Multiple Comparison	**Status Level:**	1
Edit Date:	16 Sep-25 11:02	**MD5 Hash:**	E60BCA2367610119771AF385184B1D1E	**Editor ID:**	008-408-407-6
Batch ID:	03-6225-8118	**Test Type:**	Survival (14d)	**Analyst:**	K Thompson
Start Date:	01 Sep-25	**Protocol:**	Not Applicable	**Diluent:**	Whareatea River
Ending Date:	15 Sep-25	**Species:**	Deleatidium sp	**Brine:**	Not Applicable
Test Length:	14d 0h	**Taxon:**		**Source:**	Waimakariri Stream **Age:**
Sample ID:	06-0799-1934	**Code:**	25.023.1 DSp	**Project:**	Special Studies
Sample Date:	01 Sep-25	**Material:**	Cobalt chloride	**Source:**	Solution made by NIWA
Receipt Date:	01 Sep-25	**CAS (PC):**		**Station:**	Lab Solution
Sample Age:	---	**Client:**	BT Mining Ltd		

Comments: Whareatea River modified with CaO and pH adjusted 7.5
Whareatea River modified with CaO and pH adjusted 7.5

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	Tox Units	MSDu	PMSD
Angular (Corrected)	C > T	1685	>1685	---	---	0.2014	22.89%

Bonferroni Adj t Test

Control	vs	Conc-µg/L	df	Test Stat	Critical	MSD	P-Type	P-Value	Decision(α:5%)
Dilution Water		68	6	0.2749	2.624	0.2611	CDF	1.0000	Non-Significant Effect
		171	6	0.7504	2.624	0.2611	CDF	1.0000	Non-Significant Effect
		335	6	0.7504	2.624	0.2611	CDF	1.0000	Non-Significant Effect
		750	6	0.593	2.624	0.2611	CDF	1.0000	Non-Significant Effect
		1685	6	0.2749	2.624	0.2611	CDF	1.0000	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0172388	0.0034478	5	0.1858	0.9632	Non-Significant Effect
Error	0.259733	0.0185523	14			
Total	0.276971		19			

ANOVA Assumptions Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variance	Bartlett Equality of Variance Test	3.932	15.09	0.5592	Equal Variances
	Levene Equality of Variance Test	3.989	4.695	0.0185	Equal Variances
	Mod Levene Equality of Variance Test	0.4166	6.632	0.8251	Equal Variances
Distribution	Anderson-Darling A2 Test	0.6188	3.878	0.1081	Normal Distribution
	D'Agostino Kurtosis Test	0.4719	2.576	0.6370	Normal Distribution
	D'Agostino Skewness Test	1.11	2.576	0.2670	Normal Distribution
	D'Agostino-Pearson K2 Omnibus Test	1.455	9.21	0.4832	Normal Distribution
	Kolmogorov-Smirnov D Test	0.2071	0.2235	0.0245	Normal Distribution
	Shapiro-Wilk W Normality Test	0.9364	0.866	0.2045	Normal Distribution

14 day survival Summary

Conc-µg/L	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0.7	D	5	0.8800	0.7440	1.0000	0.8000	0.8000	1.0000	0.0490	12.45%	0.00%
68		3	0.8667	0.7232	1.0000	0.9000	0.8000	0.9000	0.0333	6.66%	1.52%
171		3	0.8333	0.6899	0.9768	0.8000	0.8000	0.9000	0.0333	6.93%	5.30%
335		3	0.8333	0.6899	0.9768	0.8000	0.8000	0.9000	0.0333	6.93%	5.30%
750		3	0.8333	0.4539	1.0000	0.8000	0.7000	1.0000	0.0882	18.33%	5.30%
1685		3	0.8667	0.7232	1.0000	0.9000	0.8000	0.9000	0.0333	6.66%	1.52%

Convergent Rounding (4 sf) CETIS™ v2.1.4.5 (009-951-268-0) Analyst:_____ QA:_____

Mayfly Chronic Survival **NIWA Ecotoxicology**

Analysis ID:	04-4530-8245	**Endpoint:**	14 day survival	**CETIS Version:**	CETISv2.1.4
Analyzed:	09 Oct-25 11:30	**Analysis:**	Parametric-Multiple Comparison	**Status Level:**	1
Edit Date:	16 Sep-25 11:02	**MD5 Hash:**	E60BCA2367610119771AF385184B1D1E	**Editor ID:**	008-408-407-6

Angular (Corrected) Transformed Summary

Conc-µg/L	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0.7	D	5	1.2290	1.0220	1.4360	1.1070	1.1070	1.4120	0.0747	13.59%	0.00%
68		3	1.2020	0.9982	1.4050	1.2490	1.1070	1.2490	0.0473	6.82%	2.23%
171		3	1.1540	0.9509	1.3580	1.1070	1.1070	1.2490	0.0473	7.10%	6.07%
335		3	1.1540	0.9509	1.3580	1.1070	1.1070	1.2490	0.0473	7.10%	6.07%
750		3	1.1700	0.6301	1.7100	1.1070	0.9912	1.4120	0.1255	18.58%	4.80%
1685		3	1.2020	0.9982	1.4050	1.2490	1.1070	1.2490	0.0473	6.82%	2.23%

14 day survival Detail

Conc-µg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0.7	D	0.8000	0.8000	1.0000	1.0000	0.8000
68		0.9000	0.8000	0.9000		
171		0.8000	0.9000	0.8000		
335		0.9000	0.8000	0.8000		
750		0.8000	1.0000	0.7000		
1685		0.9000	0.9000	0.8000		

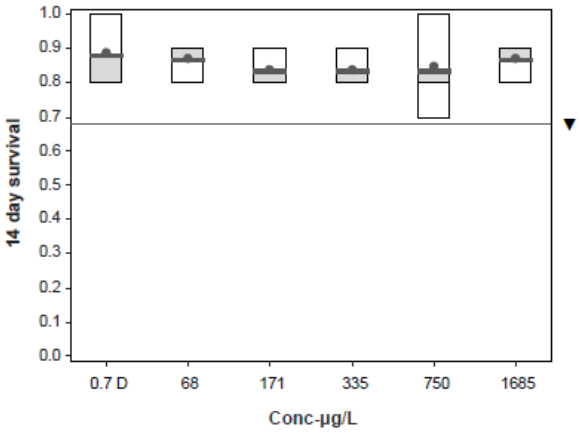
Angular (Corrected) Transformed Detail

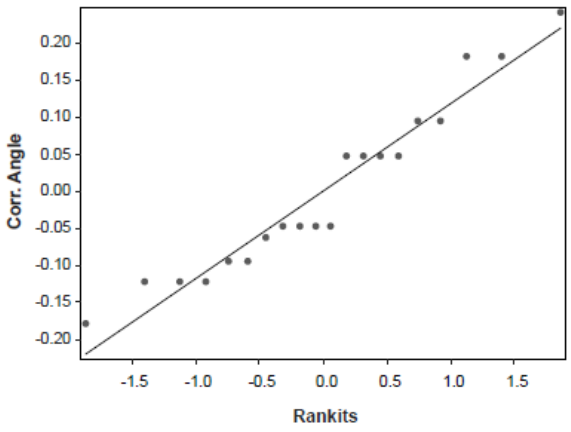
Conc-µg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0.7	D	1.1070	1.1070	1.4120	1.4120	1.1070
68		1.2490	1.1070	1.2490		
171		1.1070	1.2490	1.1070		
335		1.2490	1.1070	1.1070		
750		1.1070	1.4120	0.9912		
1685		1.2490	1.2490	1.1070		

14 day survival Binomials

Conc-µg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
0.7	D	8/10	8/10	10/10	10/10	8/10
68		9/10	8/10	9/10		
171		8/10	9/10	8/10		
335		9/10	8/10	8/10		
750		8/10	10/10	7/10		
1685		9/10	9/10	8/10		

Graphics





Nickel - Unmodified pH 5.5 Mayfly 96 h survival

CETIS Analytical Report

Report Date: 14 Oct-25 10:53 (p 1 of 3)
Test Code/ID: 25.023.1 DSp Ni / 04-4670-3311

Mayfly Chronic Survival — **NIWA Ecotoxicology**

Analysis ID:	05-3300-3106	**Endpoint:**	96 hour survival	**CETIS Version:**	CETISv2.1.4
Analyzed:	14 Oct-25 10:51	**Analysis:**	Parametric-Multiple Comparison	**Status Level:**	1
Edit Date:	17 Sep-25 16:10	**MD5 Hash:**	1C7C45A5967B8E78951B11EAD1C7EF51	**Editor ID:**	008-408-407-6
Batch ID:	03-6284-5053	**Test Type:**	Survival (14d)	**Analyst:**	K Thompson
Start Date:	03 Sep-25	**Protocol:**	Not Applicable	**Diluent:**	Whareatea River
Ending Date:	17 Sep-25	**Species:**	Deleatidium sp	**Brine:**	Not Applicable
Test Length:	14d 0h	**Taxon:**		**Source:**	Waimakariri Stream **Age:**
Sample ID:	01-1963-7146	**Code:**	25.023.1 DSp Ni	**Project:**	Special Studies
Sample Date:	03 Sep-25	**Material:**	Nickel chloride	**Source:**	Solution made by NIWA
Receipt Date:	03 Sep-25	**CAS (PC):**		**Station:**	Lab Solution
Sample Age:	---	**Client:**	BT Mining Ltd		

Comments: Whareatea River unmodified MES buffered pH5.5
Whareatea River unmodified MES buffered pH5.5

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	Tox Units	MSDu	PMSD
Angular (Corrected)	C > T	138	307	205.8	---	0.1405	15.27%

Bonferroni Adj t Test

Control	vs	Conc-µg/L	df	Test Stat	Critical	MSD	P-Type	P-Value	Decision(α:5%)
Dilution Water		15	6	-0.2857	2.624	0.1996	CDF	1.0000	Non-Significant Effect
		31	6	-1.714	2.624	0.1996	CDF	1.0000	Non-Significant Effect
		62	6	-1.714	2.624	0.1996	CDF	1.0000	Non-Significant Effect
		138	6	-1.714	2.624	0.1996	CDF	1.0000	Non-Significant Effect
		307*	6	3.083	2.624	0.1996	CDF	0.0203	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.304963	0.0609927	5	5.624	0.0048	Significant Effect
Error	0.15183	0.010845	14			
Total	0.456793		19			

ANOVA Assumptions Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variance	Bartlett Equality of Variance Test				Indeterminate
	Levene Equality of Variance Test	6.351	4.695	0.0028	Unequal Variances
	Mod Levene Equality of Variance Test	2.686	6.632	0.1033	Equal Variances
Distribution	Anderson-Darling A2 Test	1.897	3.878	<1.0E-05	Non-Normal Distribution
	D'Agostino Kurtosis Test	2.594	2.576	0.0095	Non-Normal Distribution
	D'Agostino Skewness Test	1.074	2.576	0.2830	Normal Distribution
	D'Agostino-Pearson K2 Omnibus Test	7.881	9.21	0.0194	Normal Distribution
	Kolmogorov-Smirnov D Test	0.3	0.2235	5.0E-05	Non-Normal Distribution
	Shapiro-Wilk W Normality Test	0.8207	0.866	0.0018	Non-Normal Distribution

96 hour survival Summary

Conc-µg/L	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
1.4	D	5	0.9200	0.8645	0.9755	0.9000	0.9000	1.0000	0.0200	4.86%	0.00%
15		3	0.9333	0.7899	1.0000	0.9000	0.9000	1.0000	0.0333	6.19%	-1.45%
31		3	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	-8.70%
62		3	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	-8.70%
138		3	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	-8.70%
307		3	0.7333	0.2162	1.0000	0.8000	0.5000	0.9000	0.1202	28.39%	20.29%

Convergent Rounding (4 sf) CETIS™ v2.1.4.5 (009-951-268-0) Analyst:_____ QA:_____

Mayfly Chronic Survival **NIWA Ecotoxicology**

Analysis ID:	05-3300-3106	**Endpoint:**	96 hour survival	**CETIS Version:**	CETISv2.1.4
Analyzed:	14 Oct-25 10:51	**Analysis:**	Parametric-Multiple Comparison	**Status Level:**	1
Edit Date:	17 Sep-25 16:10	**MD5 Hash:**	1C7C45A5967B8E78951B11EAD1C7EF51	**Editor ID:**	008-408-407-6

Angular (Corrected) Transformed Summary

Conc-µg/L	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
1.4	D	5	1.2820	1.1910	1.3720	1.2490	1.2490	1.4120	0.0326	5.69%	0.00%
15		3	1.3030	1.0700	1.5370	1.2490	1.2490	1.4120	0.0543	7.22%	-1.70%
31		3	1.4120	1.4110	1.4130	1.4120	1.4120	1.4120	0.0000	0.00%	-10.17%
62		3	1.4120	1.4110	1.4130	1.4120	1.4120	1.4120	0.0000	0.00%	-10.17%
138		3	1.4120	1.4110	1.4130	1.4120	1.4120	1.4120	0.0000	0.00%	-10.17%
307		3	1.0470	0.4570	1.6370	1.1070	0.7854	1.2490	0.1372	22.69%	18.29%

96 hour survival Detail

Conc-µg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
1.4	D	1.0000	0.9000	0.9000	0.9000	0.9000
15		0.9000	0.9000	1.0000		
31		1.0000	1.0000	1.0000		
62		1.0000	1.0000	1.0000		
138		1.0000	1.0000	1.0000		
307		0.5000	0.9000	0.8000		

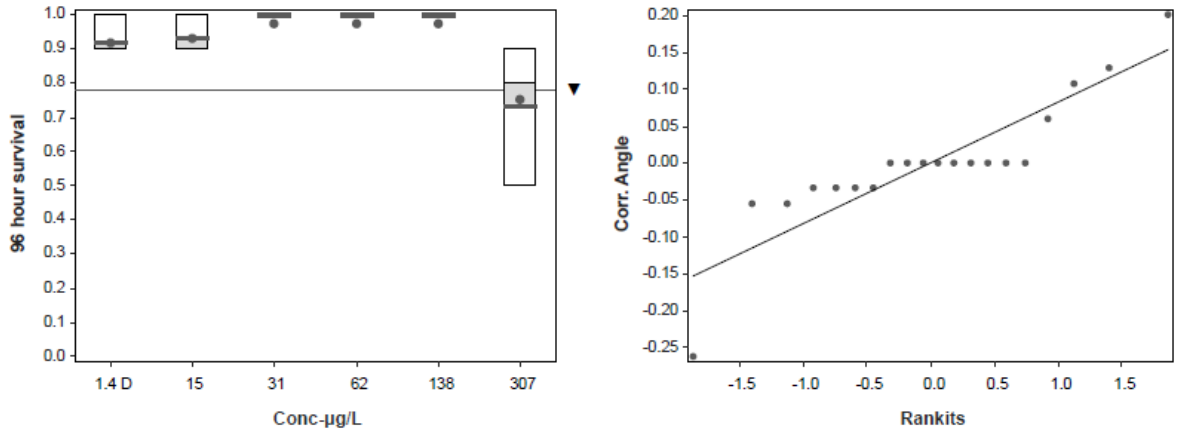
Angular (Corrected) Transformed Detail

Conc-µg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
1.4	D	1.4120	1.2490	1.2490	1.2490	1.2490
15		1.2490	1.2490	1.4120		
31		1.4120	1.4120	1.4120		
62		1.4120	1.4120	1.4120		
138		1.4120	1.4120	1.4120		
307		0.7854	1.2490	1.1070		

96 hour survival Binomials

Conc-µg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
1.4	D	10/10	9/10	9/10	9/10	9/10
15		9/10	9/10	10/10		
31		10/10	10/10	10/10		
62		10/10	10/10	10/10		
138		10/10	10/10	10/10		
307		5/10	9/10	8/10		

Graphics



Convergent Rounding (4 sf) CETIS™ v2.1.4.5 (009-951-268-0) Analyst:_____ QA:_____

Mayfly Chronic Survival — NIWA Ecotoxicology

Analysis ID:	18-2926-6434	**Endpoint:**	96 hour survival	**CETIS Version:**	CETISv2.1.4
Analyzed:	14 Oct-25 10:52	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1
Edit Date:	17 Sep-25 16:10	**MD5 Hash:**	1C7C45A5967B8E78951B11EAD1C7EF51	**Editor ID:**	008-408-407-6
Batch ID:	03-6284-5053	**Test Type:**	Survival (14d)	**Analyst:**	K Thompson
Start Date:	03 Sep-25	**Protocol:**	Not Applicable	**Diluent:**	Whareatea River
Ending Date:	17 Sep-25	**Species:**	Deleatidium sp	**Brine:**	Not Applicable
Test Length:	14d 0h	**Taxon:**		**Source:**	Waimakariri Stream **Age:**
Sample ID:	01-1963-7146	**Code:**	25.023.1 DSp Ni	**Project:**	Special Studies
Sample Date:	03 Sep-25	**Material:**	Nickel chloride	**Source:**	Solution made by NIWA
Receipt Date:	03 Sep-25	**CAS (PC):**		**Station:**	Lab Solution
Sample Age:	---	**Client:**	BT Mining Ltd		

Comments: Whareatea River unmodified MES buffered pH5.5
Whareatea River unmodified MES buffered pH5.5

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	603558	200	Yes	Two-Point Interpolation

Point Estimates

Level	µg/L	95% LCL	95% UCL
LC15	225.5	123.7	---
LC20	265.5	111.7	---
LC25	>307	---	---
LC40	>307	---	---
LC50	>307	---	---

96 hour survival Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc-µg/L	Code	Count	Mean	Median	Min	Max	CV%	%Effect	ΣA/ΣB	Mean	%Effect
1.4	D	5	0.9200	0.9000	0.9000	1.0000	4.86%	0.00%	46/50	0.9707	0.00%
15		3	0.9333	0.9000	0.9000	1.0000	6.19%	-1.45%	28/30	0.9707	0.00%
31		3	1.0000	1.0000	1.0000	1.0000	0.00%	-8.70%	30/30	0.9707	0.00%
62		3	1.0000	1.0000	1.0000	1.0000	0.00%	-8.70%	30/30	0.9707	0.00%
138		3	1.0000	1.0000	1.0000	1.0000	0.00%	-8.70%	30/30	0.9707	0.00%
307		3	0.7333	0.8000	0.5000	0.9000	28.39%	20.29%	22/30	0.7333	24.46%

96 hour survival Detail

Conc-µg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
1.4	D	1.0000	0.9000	0.9000	0.9000	0.9000
15		0.9000	0.9000	1.0000		
31		1.0000	1.0000	1.0000		
62		1.0000	1.0000	1.0000		
138		1.0000	1.0000	1.0000		
307		0.5000	0.9000	0.8000		

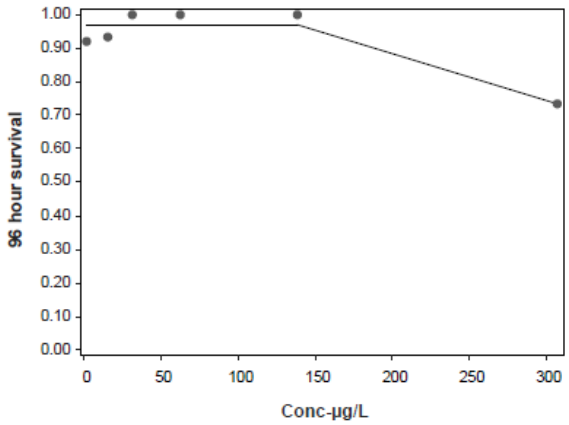
96 hour survival Binomials

Conc-µg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
1.4	D	10/10	9/10	9/10	9/10	9/10
15		9/10	9/10	10/10		
31		10/10	10/10	10/10		
62		10/10	10/10	10/10		
138		10/10	10/10	10/10		
307		5/10	9/10	8/10		

Mayfly Chronic Survival **NIWA Ecotoxicology**

Analysis ID:	18-2926-6434	**Endpoint:**	96 hour survival	**CETIS Version:**	CETISv2.1.4
Analyzed:	14 Oct-25 10:52	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1
Edit Date:	17 Sep-25 16:10	**MD5 Hash:**	1C7C45A5967B8E78951B11EAD1C7EF51	**Editor ID:**	008-408-407-6

Graphics



Nickel - Unmodified pH 5.5 Mayfly 14 d survival

CETIS Analytical Report

Report Date: 09 Oct-25 11:13 (p 1 of 3)
Test Code/ID: 25.023.1 DSp Ni / 04-4670-3311

Mayfly Chronic Survival — **NIWA Ecotoxicology**

Analysis ID:	08-6410-3998	**Endpoint:**	14 day survival	**CETIS Version:**	CETISv2.1.4
Analyzed:	09 Oct-25 11:11	**Analysis:**	Parametric-Multiple Comparison	**Status Level:**	1
Edit Date:	17 Sep-25 16:10	**MD5 Hash:**	8782D21236DC51196D712D99BB4B1D4C	**Editor ID:**	008-408-407-6
Batch ID:	03-6284-5053	**Test Type:**	Survival (14d)	**Analyst:**	K Thompson
Start Date:	03 Sep-25	**Protocol:**	Not Applicable	**Diluent:**	Whareatea River
Ending Date:	17 Sep-25	**Species:**	Deleatidium sp	**Brine:**	Not Applicable
Test Length:	14d 0h	**Taxon:**		**Source:**	Waimakariri Stream **Age:**
Sample ID:	01-1963-7146	**Code:**	25.023.1 DSp Ni	**Project:**	Special Studies
Sample Date:	03 Sep-25	**Material:**	Nickel chloride	**Source:**	Solution made by NIWA
Receipt Date:	03 Sep-25	**CAS (PC):**		**Station:**	Lab Solution
Sample Age:	---	**Client:**	BT Mining Ltd		

Comments: Whareatea River unmodified MES buffered pH5.5
Whareatea River unmodified MES buffered pH5.5

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	Tox Units	MSDu	PMSD
Angular (Corrected)	C > T	138	307	205.8	---	0.2013	23.97%

Bonferroni Adj t Test

Control	vs	Conc-µg/L	df	Test Stat	Critical	MSD	P-Type	P-Value	Decision(α:5%)
Dilution Water		15	6	1.052	2.624	0.238	CDF	0.7762	Non-Significant Effect
		31	6	-1.016	2.624	0.238	CDF	1.0000	Non-Significant Effect
		62	6	0.1043	2.624	0.238	CDF	1.0000	Non-Significant Effect
		138	6	-0.06837	2.624	0.238	CDF	1.0000	Non-Significant Effect
		307*	6	2.662	2.624	0.238	CDF	0.0465	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.200268	0.0400536	5	2.598	0.0729	Non-Significant Effect
Error	0.215832	0.0154166	14			
Total	0.4161		19			

ANOVA Assumptions Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variance	Bartlett Equality of Variance Test	4.237	15.09	0.5158	Equal Variances
	Levene Equality of Variance Test	1.862	4.695	0.1652	Equal Variances
	Mod Levene Equality of Variance Test	0.8008	6.632	0.5790	Equal Variances
Distribution	Anderson-Darling A2 Test	0.4182	3.878	0.3331	Normal Distribution
	D'Agostino Kurtosis Test	0.1657	2.576	0.8684	Normal Distribution
	D'Agostino Skewness Test	0.7635	2.576	0.4452	Normal Distribution
	D'Agostino-Pearson K2 Omnibus Test	0.6103	9.21	0.7370	Normal Distribution
	Kolmogorov-Smirnov D Test	0.1714	0.2235	0.1271	Normal Distribution
	Shapiro-Wilk W Normality Test	0.9628	0.866	0.6010	Normal Distribution

14 day survival Summary

Conc-µg/L	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
1.4	D	5	0.8400	0.7720	0.9080	0.8000	0.8000	0.9000	0.0245	6.52%	0.00%
15		3	0.7667	0.6232	0.9101	0.8000	0.7000	0.8000	0.0333	7.53%	8.73%
31		3	0.9000	0.6516	1.0000	0.9000	0.8000	1.0000	0.0577	11.11%	-7.14%
62		3	0.8333	0.6899	0.9768	0.8000	0.8000	0.9000	0.0333	6.93%	0.79%
138		3	0.8333	0.4539	1.0000	0.8000	0.7000	1.0000	0.0882	18.33%	0.79%
307		3	0.6333	0.3465	0.9202	0.7000	0.5000	0.7000	0.0667	18.23%	24.60%

Convergent Rounding (4 sf) CETIS™ v2.1.4.5 (009-951-268-0) Analyst:_____ QA:_____

Mayfly Chronic Survival NIWA Ecotoxicology

Analysis ID:	08-6410-3998	**Endpoint:**	14 day survival	**CETIS Version:**	CETISv2.1.4
Analyzed:	09 Oct-25 11:11	**Analysis:**	Parametric-Multiple Comparison	**Status Level:**	1
Edit Date:	17 Sep-25 16:10	**MD5 Hash:**	8782D21236DC51196D712D99BB4B1D4C	**Editor ID:**	008-408-407-6

Angular (Corrected) Transformed Summary

Conc-µg/L	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
1.4	D	5	1.1640	1.0670	1.2600	1.1070	1.1070	1.2490	0.0348	6.68%	0.00%
15		3	1.0680	0.9021	1.2350	1.1070	0.9912	1.1070	0.0387	6.27%	8.20%
31		3	1.2560	0.8771	1.6350	1.2490	1.1070	1.4120	0.0881	12.15%	-7.92%
62		3	1.1540	0.9509	1.3580	1.1070	1.1070	1.2490	0.0473	7.10%	0.81%
138		3	1.1700	0.6301	1.7100	1.1070	0.9912	1.4120	0.1255	18.58%	-0.53%
307		3	0.9226	0.6275	1.2180	0.9912	0.7854	0.9912	0.0686	12.88%	20.74%

14 day survival Detail

Conc-µg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
1.4	D	0.8000	0.9000	0.9000	0.8000	0.8000
15		0.8000	0.8000	0.7000		
31		0.8000	0.9000	1.0000		
62		0.8000	0.8000	0.9000		
138		0.8000	1.0000	0.7000		
307		0.5000	0.7000	0.7000		

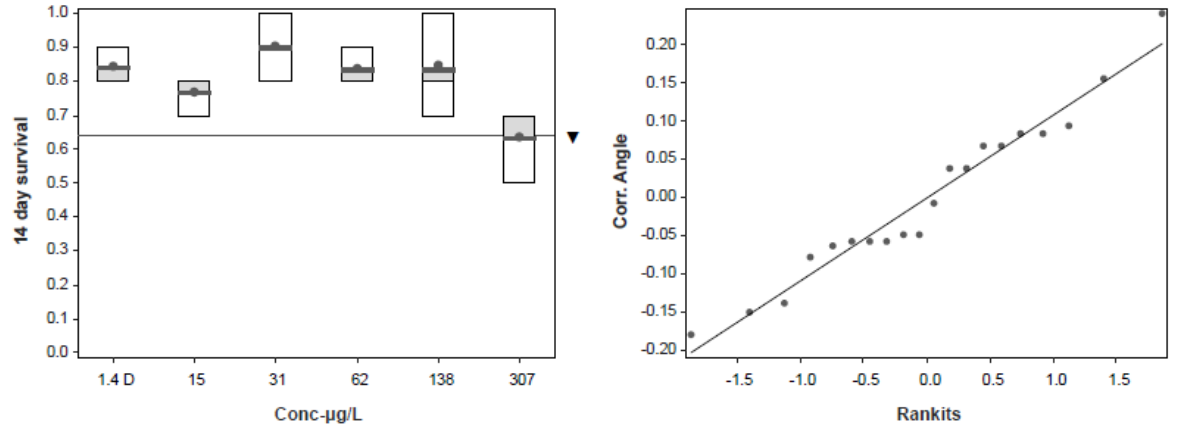
Angular (Corrected) Transformed Detail

Conc-µg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
1.4	D	1.1070	1.2490	1.2490	1.1070	1.1070
15		1.1070	1.1070	0.9912		
31		1.1070	1.2490	1.4120		
62		1.1070	1.1070	1.2490		
138		1.1070	1.4120	0.9912		
307		0.7854	0.9912	0.9912		

14 day survival Binomials

Conc-µg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
1.4	D	8/10	9/10	9/10	8/10	8/10
15		8/10	8/10	7/10		
31		8/10	9/10	10/10		
62		8/10	8/10	9/10		
138		8/10	10/10	7/10		
307		5/10	7/10	7/10		

Graphics



Convergent Rounding (4 sf) CETIS™ v2.1.4.5 (009-951-268-0) Analyst:_____ QA:_____

CETIS Analytical Report

Report Date: 09 Oct-25 11:14 (p 1 of 2)
Test Code/ID: 25.023.1 DSp Ni / 04-4670-3311

Mayfly Chronic Survival — **NIWA Ecotoxicology**

Analysis ID:	08-0857-6528	**Endpoint:**	14 day survival	**CETIS Version:**	CETISv2.1.4
Analyzed:	09 Oct-25 11:12	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1
Edit Date:	17 Sep-25 16:10	**MD5 Hash:**	8782D21236DC51196D712D99BB4B1D4C	**Editor ID:**	008-408-407-6

Batch ID:	03-6284-5053	**Test Type:**	Survival (14d)	**Analyst:**	K Thompson	
Start Date:	03 Sep-25	**Protocol:**	Not Applicable	**Diluent:**	Whareatea River	
Ending Date:	17 Sep-25	**Species:**	Deleatidium sp	**Brine:**	Not Applicable	
Test Length:	14d 0h	**Taxon:**		**Source:**	Waimakariri Stream	**Age:**

Sample ID:	01-1963-7146	**Code:**	25.023.1 DSp Ni	**Project:**	Special Studies
Sample Date:	03 Sep-25	**Material:**	Nickel chloride	**Source:**	Solution made by NIWA
Receipt Date:	03 Sep-25	**CAS (PC):**		**Station:**	Lab Solution
Sample Age:	---	**Client:**	BT Mining Ltd		

Comments: Whareatea River unmodified MES buffered pH5.5
Whareatea River unmodified MES buffered pH5.5

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	942207	200	Yes	Two-Point Interpolation

Point Estimates

Level	µg/L	95% LCL	95% UCL
LC15	222.5	---	348.2
LC20	263.1	45.35	---
LC25	>307	---	---
LC40	>307	---	---
LC50	>307	---	---

14 day survival Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc-µg/L	Code	Count	Mean	Median	Min	Max	CV%	%Effect	ΣA/ΣB	Mean	%Effect
1.4	D	5	0.8400	0.8000	0.8000	0.9000	6.52%	0.00%	42/50	0.8400	0.00%
15		3	0.7667	0.8000	0.7000	0.8000	7.53%	8.73%	23/30	0.8333	0.80%
31		3	0.9000	0.9000	0.8000	1.0000	11.11%	-7.14%	27/30	0.8333	0.80%
62		3	0.8333	0.8000	0.8000	0.9000	6.93%	0.79%	25/30	0.8333	0.80%
138		3	0.8333	0.8000	0.7000	1.0000	18.33%	0.79%	25/30	0.8333	0.80%
307		3	0.6333	0.7000	0.5000	0.7000	18.23%	24.60%	19/30	0.6333	24.61%

14 day survival Detail

Conc-µg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
1.4	D	0.8000	0.9000	0.9000	0.8000	0.8000
15		0.8000	0.8000	0.7000		
31		0.8000	0.9000	1.0000		
62		0.8000	0.8000	0.9000		
138		0.8000	1.0000	0.7000		
307		0.5000	0.7000	0.7000		

14 day survival Binomials

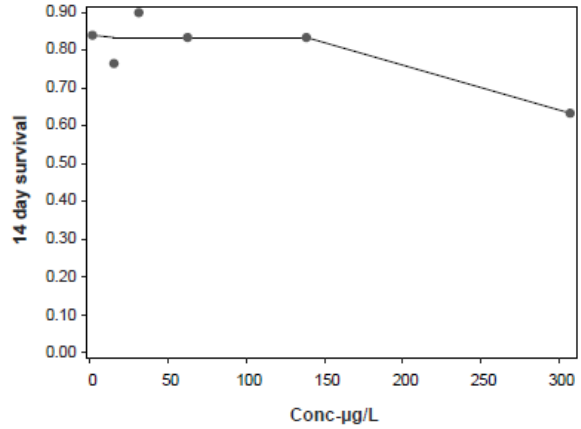
Conc-µg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
1.4	D	8/10	9/10	9/10	8/10	8/10
15		8/10	8/10	7/10		
31		8/10	9/10	10/10		
62		8/10	8/10	9/10		
138		8/10	10/10	7/10		
307		5/10	7/10	7/10		

Convergent Rounding (4 sf) CETIS™ v2.1.4.5 (009-951-268-0) Analyst:_____ QA:_____

Mayfly Chronic Survival **NIWA Ecotoxicology**

Analysis ID:	08-0857-6528	**Endpoint:**	14 day survival	**CETIS Version:**	CETISv2.1.4
Analyzed:	09 Oct-25 11:12	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1
Edit Date:	17 Sep-25 16:10	**MD5 Hash:**	8782D21236DC51196D712D99BB4B1D4C	**Editor ID:**	008-408-407-6

Graphics



Nickel - Modified pH 7.5 Mayfly 14 d survival

CETIS Analytical Report

Report Date: 09 Oct-25 10:52 (p 1 of 3)
Test Code/ID: 25.023.1 N / 17-1210-7602

Mayfly Chronic Survival — **NIWA Ecotoxicology**

Analysis ID:	14-8447-3982	**Endpoint:**	14 day survival	**CETIS Version:**	CETISv2.1.4
Analyzed:	09 Oct-25 10:50	**Analysis:**	Parametric-Multiple Comparison	**Status Level:**	1
Edit Date:	17 Sep-25 16:27	**MD5 Hash:**	9B258BE934D28D83A39EF5BEDB6F5413	**Editor ID:**	008-408-407-6
Batch ID:	17-4424-7768	**Test Type:**	Survival (14d)	**Analyst:**	K Thompson
Start Date:	03 Sep-25	**Protocol:**	Not Applicable	**Diluent:**	Whareatea River
Ending Date:	17 Sep-25	**Species:**	Deleatidium sp	**Brine:**	Not Applicable
Test Length:	14d 0h	**Taxon:**		**Source:**	Waimakariri Stream **Age:**
Sample ID:	11-8425-4870	**Code:**	25.023.1 N	**Project:**	Special Studies
Sample Date:	03 Sep-25	**Material:**	Nickel chloride	**Source:**	Solution made by NIWA
Receipt Date:	03 Sep-25	**CAS (PC):**		**Station:**	Lab Solution
Sample Age:	---	**Client:**	BT Mining Ltd		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	Tox Units	MSDu	PMSD
Angular (Corrected)	C > T	308	>308	---	---	0.1756	19.96%

Bonferroni Adj t Test

Control	vs	Conc-µg/L	df	Test Stat	Critical	MSD	P-Type	P-Value	Decision(α:5%)
Dilution Water		15	6	1.808	2.624	0.2332	CDF	0.2304	Non-Significant Effect
		30	6	1.275	2.624	0.2332	CDF	0.5572	Non-Significant Effect
		66	6	1.373	2.624	0.2332	CDF	0.4786	Non-Significant Effect
		143	6	1.808	2.624	0.2332	CDF	0.2304	Non-Significant Effect
		308	6	0.7431	2.624	0.2332	CDF	1.0000	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0766061	0.0153212	5	1.035	0.4349	Non-Significant Effect
Error	0.207175	0.0147982	14			
Total	0.283781		19			

ANOVA Assumptions Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variance	Bartlett Equality of Variance Test				Indeterminate
	Levene Equality of Variance Test	6.613	4.695	0.0023	Unequal Variances
	Mod Levene Equality of Variance Test	0.4718	6.632	0.7881	Equal Variances
Distribution	Anderson-Darling A2 Test	0.4654	3.878	0.2577	Normal Distribution
	D'Agostino Kurtosis Test	0.8606	2.576	0.3895	Normal Distribution
	D'Agostino Skewness Test	0.2901	2.576	0.7717	Normal Distribution
	D'Agostino-Pearson K2 Omnibus Test	0.8248	9.21	0.6621	Normal Distribution
	Kolmogorov-Smirnov D Test	0.1286	0.2235	0.5367	Normal Distribution
	Shapiro-Wilk W Normality Test	0.9465	0.866	0.3166	Normal Distribution

14 day survival Summary

Conc-µg/L	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
1.3	D	5	0.8800	0.7440	1.0000	0.8000	0.8000	1.0000	0.0490	12.45%	0.00%
15		3	0.7667	0.6232	0.9101	0.8000	0.7000	0.8000	0.0333	7.53%	12.88%
30		3	0.8000	0.5516	1.0000	0.8000	0.7000	0.9000	0.0577	12.50%	9.09%
66		3	0.8000	0.7995	0.8005	0.8000	0.8000	0.8000	0.0000	0.00%	9.09%
143		3	0.7667	0.6232	0.9101	0.8000	0.7000	0.8000	0.0333	7.53%	12.88%
308		3	0.8333	0.5465	1.0000	0.9000	0.7000	0.9000	0.0667	13.86%	5.30%

Convergent Rounding (4 sf) CETIS™ v2.1.4.5 (009-951-268-0) Analyst:_____ QA:_____

Mayfly Chronic Survival **NIWA Ecotoxicology**

Analysis ID:	14-8447-3982	**Endpoint:**	14 day survival	**CETIS Version:**	CETISv2.1.4
Analyzed:	09 Oct-25 10:50	**Analysis:**	Parametric-Multiple Comparison	**Status Level:**	1
Edit Date:	17 Sep-25 16:27	**MD5 Hash:**	9B258BE934D28D83A39EF5BEDB6F5413	**Editor ID:**	008-408-407-6

Angular (Corrected) Transformed Summary

Conc-µg/L	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
1.3	D	5	1.2290	1.0220	1.4360	1.1070	1.1070	1.4120	0.0747	13.59%	0.00%
15		3	1.0680	0.9021	1.2350	1.1070	0.9912	1.1070	0.0387	6.27%	13.07%
30		3	1.1160	0.7949	1.4370	1.1070	0.9912	1.2490	0.0746	11.58%	9.22%
66		3	1.1070	1.1060	1.1080	1.1070	1.1070	1.1070	0.0000	0.00%	9.92%
143		3	1.0680	0.9021	1.2350	1.1070	0.9912	1.1070	0.0387	6.27%	13.07%
308		3	1.1630	0.7932	1.5330	1.2490	0.9912	1.2490	0.0860	12.80%	5.37%

14 day survival Detail

Conc-µg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
1.3	D	0.8000	0.8000	1.0000	1.0000	0.8000
15		0.7000	0.8000	0.8000		
30		0.9000	0.8000	0.7000		
66		0.8000	0.8000	0.8000		
143		0.8000	0.7000	0.8000		
308		0.9000	0.7000	0.9000		

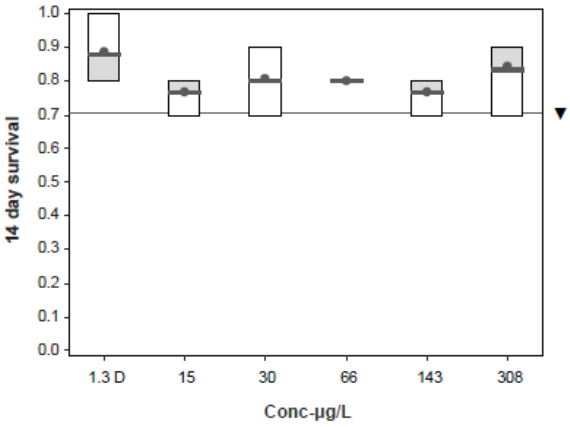
Angular (Corrected) Transformed Detail

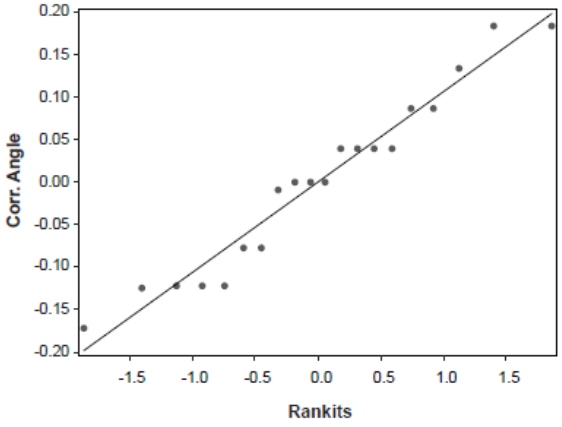
Conc-µg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
1.3	D	1.1070	1.1070	1.4120	1.4120	1.1070
15		0.9912	1.1070	1.1070		
30		1.2490	1.1070	0.9912		
66		1.1070	1.1070	1.1070		
143		1.1070	0.9912	1.1070		
308		1.2490	0.9912	1.2490		

14 day survival Binomials

Conc-µg/L	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
1.3	D	8/10	8/10	10/10	10/10	8/10
15		7/10	8/10	8/10		
30		9/10	8/10	7/10		
66		8/10	8/10	8/10		
143		8/10	7/10	8/10		
308		9/10	7/10	9/10		

Graphics





Convergent Rounding (4 sf) CETIS™ v2.1.4.5 (009-951-268-0) Analyst:_____ QA:_____

Appendix C – Chemical Analysis

Whareatea River Water (as received)

R J Hill Laboratories Limited [redacted]
www.hill-labs.co.nz

Certificate of Analysis

Client:	New Zealand Institute for Earth Science Limited - Cor	**Lab No:**	3975945	SPv1
Contact:	K Thompson	**Date Received:**	02-Sep-2025	
	[redacted]	**Date Reported:**	11-Sep-2025	
	Hillcrest	**Quote No:**	140344	
	Hamilton 3251	**Order No:**	U345651	
		Client Reference:	Dilution Water	
		Submitted By:	K Thompson	

Sample Type: Aqueous		
Sample Name:		Whareatea River 01-Sep-2025
Lab Number:		3975945.1
Turbidity	NTU	0.75
Acidity (pH 7.0)	g/m³ as $CaCO_3$	4.0
Total Hardness	g/m³ as $CaCO_3$	3.9
Dissolved Aluminium	g/m³	0.115
Dissolved Cadmium	g/m³	< 0.00005
Dissolved Calcium	g/m³	0.34
Dissolved Chromium	g/m³	< 0.0005
Dissolved Cobalt	g/m³	0.0015
Dissolved Copper	g/m³	< 0.0005
Dissolved Iron	g/m³	0.05
Dissolved Lead	g/m³	0.00015
Dissolved Magnesium	g/m³	0.75
Dissolved Manganese	g/m³	0.0099
Dissolved Nickel	g/m³	0.0017
Dissolved Zinc	g/m³	0.0100
Sulphate	g/m³	5.1
Dissolved Non-Purgeable Organic Carbon (DNPOC)	g/m³	2.6

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request.
Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1
Turbidity	Analysis by Turbidity meter. APHA 2130 B (modified) : Online Edition.	0.05 NTU	1
Total Acidity (pH 7.0)	Titration to pH 7.0 with standard sodium hydroxide solution, pH meter. APHA 2310 B : Online Edition.	1.0 g/m³ as $CaCO_3$	1
Total Hardness	Calculation from Dissolved Calcium and Dissolved Magnesium. APHA 2340 B : Online Edition.	1.0 g/m³ as $CaCO_3$	1
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B : Online Edition.	-	1
Dissolved Aluminium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.003 g/m³	1
Dissolved Cadmium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.00005 g/m³	1
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.05 g/m³	1
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1

This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.
The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked * or any comments and interpretations, which are not accredited.

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Dissolved Cobalt	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0002 g/m³	1
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.02 g/m³	1
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.00010 g/m³	1
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.02 g/m³	1
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1
Dissolved Nickel	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0010 g/m³	1
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m³	1
Dissolved Non-Purgeable Organic Carbon (DNPOC)	Acidification, purging to remove inorganic C, super-critical persulphate oxidation at 375°C, IR detection. APHA 5310 C (modified) : Online Edition.	0.3 g/m³	1

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 03-Sep-2025 and 09-Sep-2025. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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[redacted]
Client Services Manager - Environmental

Controls - Unmodified pH 5.5 and Modified pH 7.5 Alga T0 and T72

Hill Labs

R J Hill Laboratories Limited [redacted]

Certificate of Analysis

Client:	New Zealand Institute for Earth Science Limited - Cor	**Lab No:**	3982068 SPv1
Contact:	K Thompson	**Date Received:**	10-Sep-2025
	C/- New Zealand Institute for Earth Science Limite	**Date Reported:**	19-Sep-2025
	[redacted]	**Quote No:**	140344
		Order No:	U345651
		Client Reference:	T0 & T72 Algal Test
		Add. Client Ref:	Controls
		Submitted By:	K Thompson

Sample Type: Aqueous

		Sample Name:	T0 modified control pH 7.5 05-Sep-2025	T0 unmodified control pH 5.5 05-Sep-2025	T72 modified control pH 7.5 08-Sep-2025	T72 unmodified control pH 5.5 08-Sep-2025
		Lab Number:	3982068.1	3982068.2	3982068.3	3982068.4
Total Hardness	g/m^3 as $CaCO_3$		148	20	153	20
Dissolved Aluminium	g/m^3		0.164	0.090	0.148	0.075
Dissolved Cadmium	g/m^3		< 0.00005	< 0.00005	< 0.00005	< 0.00005
Dissolved Calcium	g/m^3		52	1.76	54	1.76
Dissolved Chromium	g/m^3		0.0006	< 0.0005	0.0008	< 0.0005
Dissolved Cobalt	g/m^3		0.0010	0.0015	0.0010	0.0016
Dissolved Copper	g/m^3		< 0.0005	0.0006	0.0017	0.0032
Dissolved Iron	g/m^3		< 0.02	0.03	< 0.02	< 0.02
Dissolved Lead	g/m^3		< 0.00010	0.00012	0.00012	0.00037
Dissolved Magnesium	g/m^3		4.3	3.9	4.4	3.9
Dissolved Manganese	g/m^3		0.134	0.133	0.137	0.133
Dissolved Nickel	g/m^3		0.0014	0.0019	0.0011	0.0020
Dissolved Zinc	g/m^3		0.0018	0.0135	0.0066	0.021

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Total Hardness	Calculation from Dissolved Calcium and Dissolved Magnesium. APHA 2340 B : Online Edition.	1.0 g/m^3 as $CaCO_3$	1-4
Dissolved Aluminium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.003 g/m^3	1-4
Dissolved Cadmium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.00005 g/m^3	1-4
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.05 g/m^3	1-4
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m^3	1-4
Dissolved Cobalt	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0002 g/m^3	1-4
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m^3	1-4
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.02 g/m^3	1-4
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.00010 g/m^3	1-4
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.02 g/m^3	1-4
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m^3	1-4

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This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised. The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked * or any comments and interpretations, which are not accredited.

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Dissolved Nickel	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-4
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0010 g/m³	1-4

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 16-Sep-2025 and 19-Sep-2025. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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[redacted]
Client Services Manager - Environmental

Cobalt - Unmodified pH 5.5 Alga T0 and T72

R J Hill Laboratories Limited [redacted]

Certificate of Analysis

Client:	New Zealand Institute for Earth Science Limited - Cor	**Lab No:**	3982071 SPv1
Contact:	K Thompson	**Date Received:**	10-Sep-2025
	C/- New Zealand Institute for Earth Science Limite	**Date Reported:**	18-Sep-2025
	[redacted]	**Quote No:**	140344
		Order No:	U345651
		Client Reference:	To Algal Test
		Add. Client Ref:	Unmodified Co pH 5.5
		Submitted By:	K Thompson

Sample Type: Aqueous

	Sample Name:	1.0 mg/L Co T0 05-Sep-2025	2.0 mg/L Co T0 05-Sep-2025	3.9 mg/L Co T0 05-Sep-2025	7.8 mg/L Co T0 05-Sep-2025	15.6 mg/L Co T0 05-Sep-2025
	Lab Number:	3982071.1	3982071.2	3982071.3	3982071.4	3982071.5
Total Hardness	g/m^3 as $CaCO_3$	20	20	20	20	20
Dissolved Aluminium	g/m^3	0.092	0.089	0.092	0.089	0.092
Dissolved Cadmium	g/m^3	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Dissolved Calcium	g/m^3	1.78	1.76	1.82	1.80	1.78
Dissolved Chromium	g/m^3	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Dissolved Cobalt	g/m^3	0.0024	0.0031	0.0049	0.0081	0.0150
Dissolved Copper	g/m^3	0.0006	0.0006	0.0007	0.0006	0.0007
Dissolved Iron	g/m^3	0.03	0.03	0.03	0.03	0.03
Dissolved Lead	g/m^3	0.00012	0.00012	0.00012	0.00012	0.00012
Dissolved Magnesium	g/m^3	3.8	3.9	3.9	3.9	3.9
Dissolved Manganese	g/m^3	0.131	0.135	0.133	0.134	0.138
Dissolved Nickel	g/m^3	0.0018	0.0018	0.0018	0.0017	0.0017
Dissolved Zinc	g/m^3	0.0148	0.0134	0.0142	0.0133	0.0138

	Sample Name:	31.3 mg/L Co T0 05-Sep-2025	62.5 mg/L Co T0 05-Sep-2025	125 mg/L Co T0 05-Sep-2025	250 mg/L Co T0 05-Sep-2025	500 mg/L Co T0 05-Sep-2025
	Lab Number:	3982071.6	3982071.7	3982071.8	3982071.9	3982071.10
Total Hardness	g/m^3 as $CaCO_3$	20	20	19.9	19.9	20
Dissolved Aluminium	g/m^3	0.092	0.091	0.090	0.089	0.091
Dissolved Cadmium	g/m^3	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Dissolved Calcium	g/m^3	1.82	1.76	1.77	1.77	1.78
Dissolved Chromium	g/m^3	< 0.0005	0.0006	< 0.0005	< 0.0005	< 0.0005
Dissolved Cobalt	g/m^3	0.028	0.054	0.109	0.21	0.43
Dissolved Copper	g/m^3	0.0006	0.0006	0.0006	0.0006	0.0006
Dissolved Iron	g/m^3	0.03	0.03	0.03	0.03	0.03
Dissolved Lead	g/m^3	0.00011	0.00012	0.00012	0.00011	0.00012
Dissolved Magnesium	g/m^3	3.8	3.9	3.8	3.8	3.8
Dissolved Manganese	g/m^3	0.134	0.136	0.136	0.140	0.139
Dissolved Nickel	g/m^3	0.0018	0.0018	0.0018	0.0018	0.0020
Dissolved Zinc	g/m^3	0.0139	0.0137	0.0147	0.0146	0.0144

	Sample Name:	1.0 mg/L Co T72 08-Sep-2025	2.0 mg/L Co T72 08-Sep-2025	3.9 mg/L Co T72 08-Sep-2025	7.8 mg/L Co T72 08-Sep-2025	15.6 mg/L Co T72 08-Sep-2025
	Lab Number:	3982071.11	3982071.12	3982071.13	3982071.14	3982071.15
Total Hardness	g/m^3 as $CaCO_3$	22	22	21	22	21
Dissolved Aluminium	g/m^3	0.078	0.078	0.077	0.077	0.079
Dissolved Cadmium	g/m^3	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Dissolved Calcium	g/m^3	2.1	1.95	1.93	1.96	1.90
Dissolved Chromium	g/m^3	0.0006	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Dissolved Cobalt	g/m^3	0.0027	0.0037	0.0053	0.0087	0.0160

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Sample Type: Aqueous						
	Sample Name:	1.0 mg/L Co T72 08-Sep-2025	2.0 mg/L Co T72 08-Sep-2025	3.9 mg/L Co T72 08-Sep-2025	7.8 mg/L Co T72 08-Sep-2025	15.6 mg/L Co T72 08-Sep-2025
	Lab Number:	3982071.11	3982071.12	3982071.13	3982071.14	3982071.15
Dissolved Copper	g/m³	0.0092	0.0015	0.0012	0.0009	0.0008
Dissolved Iron	g/m³	0.02	< 0.02	< 0.02	< 0.02	< 0.02
Dissolved Lead	g/m³	0.00088	0.00013	0.00013	0.00012	< 0.00010
Dissolved Magnesium	g/m³	4.0	4.1	4.0	4.1	4.0
Dissolved Manganese	g/m³	0.140	0.144	0.142	0.143	0.135
Dissolved Nickel	g/m³	0.0022	0.0019	0.0020	0.0019	0.0020
Dissolved Zinc	g/m³	0.028	0.0187	0.0188	0.0172	0.0174

	Sample Name:	31.3 mg/L Co T72 08-Sep-2025	62.5 mg/L Co T72 08-Sep-2025	125 mg/L Co T72 08-Sep-2025	250 mg/L Co T72 08-Sep-2025	500 mg/L Co T72 08-Sep-2025
	Lab Number:	3982071.16	3982071.17	3982071.18	3982071.19	3982071.20
Total Hardness	g/m³ as $CaCO_3$	21	20	19.9	21	20
Dissolved Aluminium	g/m³	0.079	0.074	0.073	0.079	0.078
Dissolved Cadmium	g/m³	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Dissolved Calcium	g/m³	1.93	1.84	1.78	1.85	1.81
Dissolved Chromium	g/m³	0.0005	< 0.0005	< 0.0005	< 0.0005	0.0005
Dissolved Cobalt	g/m³	0.028	0.055	0.104	0.21	0.42
Dissolved Copper	g/m³	0.0008	0.0007	0.0005	0.0005	0.0005
Dissolved Iron	g/m³	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Dissolved Lead	g/m³	0.00016	0.00011	< 0.00010	< 0.00010	< 0.00010
Dissolved Magnesium	g/m³	3.9	3.8	3.8	3.9	3.8
Dissolved Manganese	g/m³	0.136	0.132	0.134	0.133	0.130
Dissolved Nickel	g/m³	0.0020	0.0019	0.0018	0.0020	0.0020
Dissolved Zinc	g/m³	0.024	0.0183	0.0171	0.0181	0.0183

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request.
Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Total Hardness	Calculation from Dissolved Calcium and Dissolved Magnesium. APHA 2340 B : Online Edition.	1.0 g/m³ as $CaCO_3$	1-20
Dissolved Aluminium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.003 g/m³	1-20
Dissolved Cadmium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.00005 g/m³	1-20
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.05 g/m³	1-20
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-20
Dissolved Cobalt	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0002 g/m³	1-20
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-20
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.02 g/m³	1-20
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.00010 g/m³	1-20
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.02 g/m³	1-20
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-20
Dissolved Nickel	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-20
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0010 g/m³	1-20

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 16-Sep-2025 and 18-Sep-2025. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Client Services Manager - Environmental

Cobalt - Modified pH 7.5 Alga T0

R J Hill Laboratories Limited [redacted] [redacted]

Certificate of Analysis

Client:	New Zealand Institute for Earth Science Limited - Cor	**Lab No:**	3982072	SPv1
Contact:	K Thompson	**Date Received:**	10-Sep-2025	
	C/- New Zealand Institute for Earth Science Limite	**Date Reported:**	02-Oct-2025	
	[redacted]	**Quote No:**	140344	
		Order No:	U345651	
		Client Reference:	T0 & T72 Modified	
		Add. Client Ref:	Modified Co pH 7.5	
		Submitted By:	K Thompson	

Sample Type: Aqueous

	Sample Name:	1.0 mg/L Co 05-Sep-2025	2.0 mg/L Co 05-Sep-2025	3.9 mg/L Co 05-Sep-2025	7.8 mg/L Co 05-Sep-2025	15.6 mg/L Co 05-Sep-2025
	Lab Number:	3982072.1	3982072.2	3982072.3	3982072.4	3982072.5
Total Hardness	g/m^3 as $CaCO_3$	150	149	148	147	148
Dissolved Aluminium	g/m^3	0.170	0.167	0.166	0.165	0.170
Dissolved Cadmium	g/m^3	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Dissolved Calcium	g/m^3	53	53	52	52	52
Dissolved Chromium	g/m^3	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Dissolved Cobalt	g/m^3	0.0020	0.0030	0.0046	0.0080	0.0151
Dissolved Copper	g/m^3	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Dissolved Iron	g/m^3	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Dissolved Lead	g/m^3	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Dissolved Magnesium	g/m^3	4.3	4.2	4.3	4.3	4.3
Dissolved Manganese	g/m^3	0.132	0.132	0.133	0.132	0.132
Dissolved Nickel	g/m^3	0.0014	0.0013	0.0012	0.0013	0.0014
Dissolved Zinc	g/m^3	0.0016 #1	0.0019	0.0020	0.0017	0.0019

	Sample Name:	31.3 mg/L Co 05-Sep-2025	62.5 mg/L Co 05-Sep-2025	125 mg/L Co 05-Sep-2025	250 mg/L Co 05-Sep-2025	500 mg/L Co 05-Sep-2025
	Lab Number:	3982072.6	3982072.7	3982072.8	3982072.9	3982072.10
Total Hardness	g/m^3 as $CaCO_3$	145	147	148	146	147
Dissolved Aluminium	g/m^3	0.166	0.168	0.166	0.170	0.165
Dissolved Cadmium	g/m^3	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Dissolved Calcium	g/m^3	51	52	52	51	52
Dissolved Chromium	g/m^3	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Dissolved Cobalt	g/m^3	0.028	0.056	0.110	0.21	0.45
Dissolved Copper	g/m^3	0.0026	< 0.0005	< 0.0005	< 0.0005	0.0005
Dissolved Iron	g/m^3	< 0.02	< 0.02	< 0.02	< 0.02	0.02
Dissolved Lead	g/m^3	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Dissolved Magnesium	g/m^3	4.2	4.2	4.4	4.3	4.2
Dissolved Manganese	g/m^3	0.135	0.134	0.134	0.132	0.138
Dissolved Nickel	g/m^3	0.0014	0.0013	0.0013	0.0014	0.0032
Dissolved Zinc	g/m^3	0.0021	0.0017	0.0020	0.0023	0.0025

Analyst's Comments

#1 It should be noted that a prep blank contained an elevated level of zinc (0.0067g/m3 c.f. detection limit of 0.001g/m3). This has not been corrected for on the sample and should be kept in mind when interpreting the result. There was insufficient sample for re-analysis.

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Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Hardness	Calculation from Dissolved Calcium and Dissolved Magnesium. APHA 2340 B : Online Edition.	1.0 g/m³ as $CaCO_3$	1-10
Dissolved Aluminium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.003 g/m³	1-10
Dissolved Cadmium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.00005 g/m³	1-10
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.05 g/m³	1-10
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-10
Dissolved Cobalt	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0002 g/m³	1-10
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-10
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.02 g/m³	1-10
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.00010 g/m³	1-10
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.02 g/m³	1-10
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-10
Dissolved Nickel	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-10
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0010 g/m³	1-10

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 16-Sep-2025 and 02-Oct-2025. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Client Services Manager - Environmental

Cobalt - Modified pH 7.5 Alga T72

R J Hill Laboratories Limited [redacted]

Certificate of Analysis

Client:	New Zealand Institute for Earth Science Limited - Cor	**Lab No:**	3982073	SUPv1
Contact:	K Thompson	**Date Received:**	10-Sep-2025	
	C/- New Zealand Institute for Earth Science Limite	**Date Reported:**	18-Sep-2025	
	[redacted]	**Quote No:**	140344	
		Order No:	U345651	
		Client Reference:	T72 Algal Test	
		Add. Client Ref:	modified Co pH 7.5	
		Submitted By:	K Thompson	

Sample Type: Aqueous

	Sample Name:	1.0 mg/L Co T72 08-Sep-2025	2.0 mg/L Co T72 08-Sep-2025	3.9 mg/L Co T72 08-Sep-2025	7.8 mg/L Co T72 08-Sep-2025
	Lab Number:	3982073.1	3982073.2	3982073.3	3982073.4
Total Hardness	g/m^3 as $CaCO_3$	165.0 ± 9.3	174.2 ± 9.8	164.4 ± 9.2	168.4 ± 9.5
Dissolved Aluminium	g/m^3	0.164 ± 0.014	0.171 ± 0.014	0.157 ± 0.013	0.163 ± 0.013
Dissolved Cadmium	g/m^3	< 0.00005 ± 0.000034	< 0.00005 ± 0.000034	< 0.00005 ± 0.000034	< 0.00005 ± 0.000034
Dissolved Calcium	g/m^3	58.6 ± 3.7	61.8 ± 3.9	58.2 ± 3.7	59.8 ± 3.8
Dissolved Chromium	g/m^3	< 0.0005 ± 0.00034	0.00070 ± 0.00034	< 0.0005 ± 0.00034	< 0.0005 ± 0.00034
Dissolved Cobalt	g/m^3	0.00303 ± 0.00018	0.00306 ± 0.00018	0.00461 ± 0.00023	0.00820 ± 0.00035
Dissolved Copper	g/m^3	0.00746 ± 0.00076	0.00106 ± 0.00035	0.00064 ± 0.00034	0.00057 ± 0.00034
Dissolved Iron	g/m^3	< 0.02 ± 0.014	< 0.02 ± 0.014	< 0.02 ± 0.014	< 0.02 ± 0.014
Dissolved Lead	g/m^3	0.00116 ± 0.00011	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067
Dissolved Magnesium	g/m^3	4.57 ± 0.31	4.82 ± 0.33	4.63 ± 0.32	4.65 ± 0.32
Dissolved Manganese	g/m^3	0.134 ± 0.012	0.145 ± 0.013	0.140 ± 0.013	0.138 ± 0.012
Dissolved Nickel	g/m^3	0.00153 ± 0.00034	0.00118 ± 0.00034	0.00108 ± 0.00034	0.00120 ± 0.00034
Dissolved Zinc	g/m^3	0.0143 ± 0.0015	0.00460 ± 0.00079	0.00388 ± 0.00076	0.00383 ± 0.00075

	Sample Name:	15.6 mg/L Co T72 08-Sep-2025	31.3 mg/L Co T72 08-Sep-2025	62.5 mg/L Co T72 08-Sep-2025	125 mg/L Co T72 08-Sep-2025
	Lab Number:	3982073.5	3982073.6	3982073.7	3982073.8
Total Hardness	g/m^3 as $CaCO_3$	162.5 ± 9.1	158.3 ± 8.9	155.0 ± 8.7	156.1 ± 8.8
Dissolved Aluminium	g/m^3	0.157 ± 0.013	0.157 ± 0.013	0.151 ± 0.013	0.151 ± 0.013
Dissolved Cadmium	g/m^3	< 0.00005 ± 0.000034	< 0.00005 ± 0.000034	< 0.00005 ± 0.000034	< 0.00005 ± 0.000034
Dissolved Calcium	g/m^3	57.7 ± 3.7	56.0 ± 3.5	54.9 ± 3.5	55.3 ± 3.5
Dissolved Chromium	g/m^3	0.00075 ± 0.00034	0.00054 ± 0.00034	< 0.0005 ± 0.00034	< 0.0005 ± 0.00034
Dissolved Cobalt	g/m^3	0.01459 ± 0.00059	0.0278 ± 0.0012	0.0542 ± 0.0022	0.1086 ± 0.0043
Dissolved Copper	g/m^3	< 0.0005 ± 0.00034	< 0.0005 ± 0.00034	< 0.0005 ± 0.00034	< 0.0005 ± 0.00034
Dissolved Iron	g/m^3	< 0.02 ± 0.014	< 0.02 ± 0.014	< 0.02 ± 0.014	< 0.02 ± 0.014
Dissolved Lead	g/m^3	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	0.000136 ± 0.000067
Dissolved Magnesium	g/m^3	4.48 ± 0.31	4.50 ± 0.31	4.33 ± 0.30	4.38 ± 0.30
Dissolved Manganese	g/m^3	0.134 ± 0.012	0.138 ± 0.012	0.132 ± 0.012	0.132 ± 0.012
Dissolved Nickel	g/m^3	0.00103 ± 0.00034	0.00109 ± 0.00034	0.00111 ± 0.00034	0.00126 ± 0.00034
Dissolved Zinc	g/m^3	0.00345 ± 0.00074	0.00336 ± 0.00074	0.00412 ± 0.00077	0.00388 ± 0.00076

	Sample Name:	250 mg/L Co T72 08-Sep-2025	500 mg/L Co T72 08-Sep-2025
	Lab Number:	3982073.9	3982073.10
Total Hardness	g/m^3 as $CaCO_3$	156.0 ± 8.8	153.0 ± 8.6
Dissolved Aluminium	g/m^3	0.161 ± 0.013	0.156 ± 0.013
Dissolved Cadmium	g/m^3	< 0.00005 ± 0.000034	< 0.00005 ± 0.000034
Dissolved Calcium	g/m^3	55.3 ± 3.5	54.0 ± 3.4
Dissolved Chromium	g/m^3	0.00070 ± 0.00034	0.00076 ± 0.00034
Dissolved Cobalt	g/m^3	0.2232 ± 0.0088	0.426 ± 0.017
Dissolved Copper	g/m^3	< 0.0005 ± 0.00034	0.00054 ± 0.00034

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Sample Type: Aqueous			
	Sample Name:	250 mg/L Co T72 08-Sep-2025	500 mg/L Co T72 08-Sep-2025
	Lab Number:	3982073.9	3982073.10
Dissolved Iron	g/m³	< 0.02 ± 0.014	< 0.02 ± 0.014
Dissolved Lead	g/m³	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067
Dissolved Magnesium	g/m³	4.34 ± 0.30	4.38 ± 0.30
Dissolved Manganese	g/m³	0.140 ± 0.013	0.134 ± 0.012
Dissolved Nickel	g/m³	0.00123 ± 0.00034	0.00149 ± 0.00034
Dissolved Zinc	g/m³	0.00447 ± 0.00078	0.00444 ± 0.00078

The reported uncertainty is an expanded uncertainty with a level of confidence of approximately 95 percent (i.e. two standard deviations, calculated using a coverage factor of 2). Reported uncertainties are calculated from the performance of typical matrices, and do not include variation due to sampling.

For further information on uncertainty of measurement at Hill Laboratories, refer to the technical note on our website: www.hill-laboratories.com/files/Intro_To_UOM.pdf, or contact the laboratory.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Hardness	Calculation from Dissolved Calcium and Dissolved Magnesium. APHA 2340 B : Online Edition.	1.0 g/m³ as $CaCO_3$	1-10
Dissolved Aluminium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.003 g/m³	1-10
Dissolved Cadmium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.00005 g/m³	1-10
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.05 g/m³	1-10
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-10
Dissolved Cobalt	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0002 g/m³	1-10
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-10
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.02 g/m³	1-10
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.00010 g/m³	1-10
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.02 g/m³	1-10
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-10
Dissolved Nickel	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-10
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0010 g/m³	1-10

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 15-Sep-2025 and 18-Sep-2025. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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[redacted]
Client Services Manager - Environmental

Nickel - Unmodified pH 5.5 Alga T0 and T72

Hill Labs

R J Hill Laboratories Limited [redacted]

Certificate of Analysis

Client:	New Zealand Institute for Earth Science Limited - Cor	**Lab No:**	3982070 SUPv1
Contact:	K Thompson	**Date Received:**	10-Sep-2025
	C/- New Zealand Institute for Earth Science Limite	**Date Reported:**	18-Sep-2025
	[redacted]	**Quote No:**	140344
		Order No:	U345651
		Client Reference:	T0 & T72 unmodified Ni
		Add. Client Ref:	Algal Test pH 5.5
		Submitted By:	K Thompson

Sample Type: Aqueous

		Sample Name:	1.0 ug/L Ni T0 05-Sep-2025	2.0 ug/L Ni T0 05-Sep-2025	3.9 ug/L Ni T0 05-Sep-2025	7.8 ug/L Ni T0 05-Sep-2025
		Lab Number:	3982070.1	3982070.2	3982070.3	3982070.4
Total Hardness	g/m³ as $CaCO_3$		22.3 ± 1.3	22.5 ± 1.3	22.0 ± 1.3	22.0 ± 1.3
Dissolved Aluminium	g/m³		0.0899 ± 0.0074	0.0876 ± 0.0072	0.0884 ± 0.0073	0.0893 ± 0.0073
Dissolved Cadmium	g/m³		< 0.00005 ± 0.000034	< 0.00005 ± 0.000034	< 0.00005 ± 0.000034	< 0.00005 ± 0.000034
Dissolved Calcium	g/m³		1.82 ± 0.12	1.84 ± 0.12	1.79 ± 0.12	1.78 ± 0.12
Dissolved Chromium	g/m³		< 0.0005 ± 0.00034	< 0.0005 ± 0.00034	< 0.0005 ± 0.00034	0.00058 ± 0.00034
Dissolved Cobalt	g/m³		0.00144 ± 0.00015	0.00153 ± 0.00015	0.00150 ± 0.00015	0.00150 ± 0.00015
Dissolved Copper	g/m³		0.00060 ± 0.00034	0.00056 ± 0.00034	0.00066 ± 0.00034	0.00061 ± 0.00034
Dissolved Iron	g/m³		0.034 ± 0.014	0.034 ± 0.014	0.035 ± 0.014	0.038 ± 0.014
Dissolved Lead	g/m³		0.000114 ± 0.000067	0.000128 ± 0.000067	0.000124 ± 0.000067	0.000108 ± 0.000067
Dissolved Magnesium	g/m³		4.30 ± 0.29	4.34 ± 0.30	4.26 ± 0.29	4.27 ± 0.29
Dissolved Manganese	g/m³		0.137 ± 0.012	0.136 ± 0.012	0.134 ± 0.012	0.139 ± 0.012
Dissolved Nickel	g/m³		0.00299 ± 0.00035	0.00414 ± 0.00037	0.00638 ± 0.00041	0.01084 ± 0.00051
Dissolved Zinc	g/m³		0.0146 ± 0.0016	0.0139 ± 0.0015	0.0153 ± 0.0016	0.0145 ± 0.0015

		Sample Name:	15.6 ug/L Ni T0 05-Sep-2025	31.3 ug/L Ni T0 05-Sep-2025	62.5 ug/L Ni T0 05-Sep-2025	125 ug/L Ni T0 05-Sep-2025
		Lab Number:	3982070.5	3982070.6	3982070.7	3982070.8
Total Hardness	g/m³ as $CaCO_3$		20.8 ± 1.2	20.7 ± 1.2	20.9 ± 1.2	20.9 ± 1.2
Dissolved Aluminium	g/m³		0.0901 ± 0.0074	0.0892 ± 0.0073	0.1072 ± 0.0087	0.0891 ± 0.0073
Dissolved Cadmium	g/m³		< 0.00005 ± 0.000034	< 0.00005 ± 0.000034	< 0.00005 ± 0.000034	< 0.00005 ± 0.000034
Dissolved Calcium	g/m³		1.79 ± 0.12	1.81 ± 0.12	1.82 ± 0.12	1.85 ± 0.13
Dissolved Chromium	g/m³		< 0.0005 ± 0.00034	0.00062 ± 0.00034	< 0.0005 ± 0.00034	0.00053 ± 0.00034
Dissolved Cobalt	g/m³		0.00157 ± 0.00015	0.00156 ± 0.00015	0.00154 ± 0.00015	0.00158 ± 0.00015
Dissolved Copper	g/m³		0.00064 ± 0.00034	0.00062 ± 0.00034	0.00060 ± 0.00034	0.00067 ± 0.00034
Dissolved Iron	g/m³		0.034 ± 0.014	0.034 ± 0.014	0.033 ± 0.014	0.034 ± 0.014
Dissolved Lead	g/m³		0.000123 ± 0.000067	0.000117 ± 0.000067	0.000124 ± 0.000067	0.000118 ± 0.000067
Dissolved Magnesium	g/m³		3.96 ± 0.27	3.92 ± 0.27	3.97 ± 0.27	3.97 ± 0.27
Dissolved Manganese	g/m³		0.128 ± 0.012	0.132 ± 0.012	0.127 ± 0.011	0.128 ± 0.011
Dissolved Nickel	g/m³		0.02026 ± 0.00079	0.0350 ± 0.0013	0.0663 ± 0.0024	0.1240 ± 0.0044
Dissolved Zinc	g/m³		0.0138 ± 0.0015	0.0136 ± 0.0015	0.0144 ± 0.0015	0.0138 ± 0.0015

		Sample Name:	250 ug/L Ni T0 05-Sep-2025	500 ug/L Ni T0 08-Sep-2025	1.0 ug/L Ni T72 08-Sep-2025	2.0 ug/L Ni T72 08-Sep-2025
		Lab Number:	3982070.9	3982070.10	3982070.11	3982070.12
Total Hardness	g/m³ as $CaCO_3$		20.7 ± 1.2	33.2 ± 1.8	21.1 ± 1.2	20.7 ± 1.2
Dissolved Aluminium	g/m³		0.0892 ± 0.0073	0.0825 ± 0.0068	0.0762 ± 0.0064	0.0741 ± 0.0062
Dissolved Cadmium	g/m³		< 0.00005 ± 0.000034	< 0.00005 ± 0.000034	< 0.00005 ± 0.000034	< 0.00005 ± 0.000034
Dissolved Calcium	g/m³		1.81 ± 0.12	2.95 ± 0.19	1.86 ± 0.13	1.81 ± 0.12
Dissolved Chromium	g/m³		< 0.0005 ± 0.00034	< 0.0005 ± 0.00034	< 0.0005 ± 0.00034	< 0.0005 ± 0.00034
Dissolved Cobalt	g/m³		0.00160 ± 0.00015	0.00168 ± 0.00015	0.00229 ± 0.00017	0.00198 ± 0.00016

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Sample Type: Aqueous					
	Sample Name:	250 ug/L Ni T0 05-Sep-2025	500 ug/L Ni T0 08-Sep-2025	1.0 ug/L Ni T72 08-Sep-2025	2.0 ug/L Ni T72 08-Sep-2025
	Lab Number:	3982070.9	3982070.10	3982070.11	3982070.12
Dissolved Copper	g/m³	0.00063 ± 0.00034	0.00075 ± 0.00034	0.00132 ± 0.00036	0.00058 ± 0.00034
Dissolved Iron	g/m³	0.031 ± 0.014	0.035 ± 0.014	< 0.02 ± 0.014	< 0.02 ± 0.014
Dissolved Lead	g/m³	0.000119 ± 0.000067	0.000148 ± 0.000068	0.000240 ± 0.000069	0.000132 ± 0.000067
Dissolved Magnesium	g/m³	3.93 ± 0.27	6.27 ± 0.43	4.00 ± 0.27	3.92 ± 0.27
Dissolved Manganese	g/m³	0.131 ± 0.012	0.215 ± 0.019	0.130 ± 0.012	0.126 ± 0.011
Dissolved Nickel	g/m³	0.2465 ± 0.0087	0.416 ± 0.015	0.00327 ± 0.00036	0.00450 ± 0.00037
Dissolved Zinc	g/m³	0.0146 ± 0.0016	0.0157 ± 0.0017	0.0188 ± 0.0019	0.0174 ± 0.0018

	Sample Name:	3.9 ug/L Ni T72 08-Sep-2025	7.8 ug/L Ni T72 08-Sep-2025	15.6 ug/L Ni T72 08-Sep-2025	31.3 ug/L Ni T72 08-Sep-2025
	Lab Number:	3982070.13	3982070.14	3982070.15	3982070.16
Total Hardness	g/m³ as $CaCO_3$	21.4 ± 1.2	21.6 ± 1.2	20.7 ± 1.2	20.5 ± 1.2
Dissolved Aluminium	g/m³	0.0787 ± 0.0065	0.0820 ± 0.0068	0.0755 ± 0.0063	0.0763 ± 0.0064
Dissolved Cadmium	g/m³	< 0.00005 ± 0.000034	< 0.00005 ± 0.000034	< 0.00005 ± 0.000034	< 0.00005 ± 0.000034
Dissolved Calcium	g/m³	1.87 ± 0.13	1.91 ± 0.13	1.80 ± 0.12	1.81 ± 0.12
Dissolved Chromium	g/m³	0.00062 ± 0.00034	0.00117 ± 0.00035	< 0.0005 ± 0.00034	0.00052 ± 0.00034
Dissolved Cobalt	g/m³	0.00197 ± 0.00016	0.00174 ± 0.00015	0.00182 ± 0.00016	0.00173 ± 0.00015
Dissolved Copper	g/m³	0.00064 ± 0.00034	0.00058 ± 0.00034	< 0.0005 ± 0.00034	0.00051 ± 0.00034
Dissolved Iron	g/m³	< 0.02 ± 0.014	0.024 ± 0.014	< 0.02 ± 0.014	0.021 ± 0.014
Dissolved Lead	g/m³	0.000167 ± 0.000068	0.000113 ± 0.000067	0.000103 ± 0.000067	< 0.00010 ± 0.000067
Dissolved Magnesium	g/m³	4.07 ± 0.28	4.09 ± 0.28	3.92 ± 0.27	3.87 ± 0.27
Dissolved Manganese	g/m³	0.128 ± 0.011	0.132 ± 0.012	0.128 ± 0.012	0.130 ± 0.012
Dissolved Nickel	g/m³	0.00725 ± 0.00042	0.01091 ± 0.00051	0.01945 ± 0.00076	0.0350 ± 0.0013
Dissolved Zinc	g/m³	0.0175 ± 0.0018	0.0189 ± 0.0019	0.0172 ± 0.0018	0.0173 ± 0.0018

	Sample Name:	62.5 ug/L Ni T72 08-Sep-2025	125 ug/L Ni T72 08-Sep-2025	250 ug/L Ni T72 08-Sep-2025	500 ug/L Ni T72 08-Sep-2025
	Lab Number:	3982070.17	3982070.18	3982070.19	3982070.20
Total Hardness	g/m³ as $CaCO_3$	21.6 ± 1.2	21.3 ± 1.2	21.1 ± 1.2	20.9 ± 1.2
Dissolved Aluminium	g/m³	0.0801 ± 0.0066	0.0770 ± 0.0064	0.0762 ± 0.0064	0.0765 ± 0.0064
Dissolved Cadmium	g/m³	< 0.00005 ± 0.000034	< 0.00005 ± 0.000034	< 0.00005 ± 0.000034	< 0.00005 ± 0.000034
Dissolved Calcium	g/m³	1.91 ± 0.13	1.87 ± 0.13	1.82 ± 0.12	1.80 ± 0.12
Dissolved Chromium	g/m³	0.00134 ± 0.00035	0.00056 ± 0.00034	0.00056 ± 0.00034	0.00063 ± 0.00034
Dissolved Cobalt	g/m³	0.00174 ± 0.00015	0.00178 ± 0.00016	0.00168 ± 0.00015	0.00171 ± 0.00015
Dissolved Copper	g/m³	0.00053 ± 0.00034	0.00051 ± 0.00034	< 0.0005 ± 0.00034	< 0.0005 ± 0.00034
Dissolved Iron	g/m³	0.024 ± 0.014	0.020 ± 0.014	< 0.02 ± 0.014	< 0.02 ± 0.014
Dissolved Lead	g/m³	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067
Dissolved Magnesium	g/m³	4.08 ± 0.28	4.05 ± 0.28	4.02 ± 0.28	4.00 ± 0.27
Dissolved Manganese	g/m³	0.133 ± 0.012	0.130 ± 0.012	0.129 ± 0.012	0.125 ± 0.011
Dissolved Nickel	g/m³	0.0643 ± 0.0023	0.1249 ± 0.0044	0.2326 ± 0.0082	0.474 ± 0.017
Dissolved Zinc	g/m³	0.0178 ± 0.0018	0.0165 ± 0.0017	0.0169 ± 0.0017	0.0170 ± 0.0018

The reported uncertainty is an expanded uncertainty with a level of confidence of approximately 95 percent (i.e. two standard deviations, calculated using a coverage factor of 2). Reported uncertainties are calculated from the performance of typical matrices, and do not include variation due to sampling.

For further information on uncertainty of measurement at Hill Laboratories, refer to the technical note on our website: www.hill-laboratories.com/files/Intro_To_UOM.pdf, or contact the laboratory.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Hardness	Calculation from Dissolved Calcium and Dissolved Magnesium. APHA 2340 B : Online Edition.	1.0 g/m³ as $CaCO_3$	1-20
Dissolved Aluminium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.003 g/m³	1-20

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Dissolved Cadmium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.00005 g/m³	1-20
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.05 g/m³	1-20
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-20
Dissolved Cobalt	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0002 g/m³	1-20
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-20
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.02 g/m³	1-20
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.00010 g/m³	1-20
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.02 g/m³	1-20
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-20
Dissolved Nickel	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-20
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0010 g/m³	1-20

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 17-Sep-2025 and 18-Sep-2025. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Client Services Manager - Environmental

Nickel - Modified pH 7.5 Alga T0 and T72

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R J Hill Laboratories Limited [redacted]

Certificate of Analysis

Client:	New Zealand Institute for Earth Science Limited - Cor	**Lab No:**	3982069	SPv1
Contact:	K Thompson	**Date Received:**	10-Sep-2025	
	C/- New Zealand Institute for Earth Science Limite	**Date Reported:**	17-Sep-2025	
	[redacted]	**Quote No:**	140344	
		Order No:	U345651	
		Client Reference:	T0 & T72 Algal Test	
		Add. Client Ref:	Algal Test pH 7.5	
		Submitted By:	K Thompson	

Sample Type: Aqueous

	Sample Name:	1.0 ug/L Ni T0 05-Sep-2025	2.0 ug/L Ni T0 05-Sep-2025	3.9 ug/L Ni T0 05-Sep-2025	7.8 ug/L Ni T0 05-Sep-2025	15.6 ug/L Ni T0 05-Sep-2025
	Lab Number:	3982069.1	3982069.2	3982069.3	3982069.4	3982069.5
Total Hardness	g/m³ as $CaCO_3$	150	148	151	146	150
Dissolved Aluminium	g/m³	0.174	0.173	0.174	0.174	0.173
Dissolved Cadmium	g/m³	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Dissolved Calcium	g/m³	52	52	53	51	52
Dissolved Chromium	g/m³	< 0.0005	< 0.0005	< 0.0005	0.0006	< 0.0005
Dissolved Cobalt	g/m³	0.0010	0.0010	0.0010	0.0011	0.0011
Dissolved Copper	g/m³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Dissolved Iron	g/m³	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Dissolved Lead	g/m³	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Dissolved Magnesium	g/m³	4.7	4.7	4.8	4.7	4.7
Dissolved Manganese	g/m³	0.133	0.136	0.133	0.133	0.133
Dissolved Nickel	g/m³	0.0022	0.0029	0.0050	0.0082	0.0154
Dissolved Zinc	g/m³	0.0028	0.0016	0.0018	0.0015	0.0016

	Sample Name:	31.3 ug/L Ni T0 05-Sep-2025	62.5 ug/L Ni T0 05-Sep-2025	125 ug/L Ni T0 05-Sep-2025	250 ug/L Ni T0 05-Sep-2025	500 ug/L Ni T0 05-Sep-2025
	Lab Number:	3982069.6	3982069.7	3982069.8	3982069.9	3982069.10
Total Hardness	g/m³ as $CaCO_3$	150	149	150	150	150
Dissolved Aluminium	g/m³	0.173	0.170	0.176	0.175	0.168
Dissolved Cadmium	g/m³	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Dissolved Calcium	g/m³	52	52	52	52	52
Dissolved Chromium	g/m³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Dissolved Cobalt	g/m³	0.0010	0.0010	0.0010	0.0010	0.0010
Dissolved Copper	g/m³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Dissolved Iron	g/m³	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Dissolved Lead	g/m³	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Dissolved Magnesium	g/m³	4.7	4.6	4.8	4.7	4.6
Dissolved Manganese	g/m³	0.133	0.132	0.137	0.135	0.135
Dissolved Nickel	g/m³	0.029	0.057	0.110	0.22	0.44
Dissolved Zinc	g/m³	0.0013	0.0014	0.0015	0.0014	0.0024

	Sample Name:	1.0 ug/L Ni T72 09-Sep-2025	2.0 ug/L Ni T72 09-Sep-2025	3.9 ug/L Ni T72 09-Sep-2025	7.8 ug/L Ni T72 09-Sep-2025	15.6 ug/L Ni T72 09-Sep-2025
	Lab Number:	3982069.11	3982069.12	3982069.13	3982069.14	3982069.15
Total Hardness	g/m³ as $CaCO_3$	171	164	163	160	159
Dissolved Aluminium	g/m³	0.147	0.165	0.172	0.168	0.165
Dissolved Cadmium	g/m³	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Dissolved Calcium	g/m³	60	58	57	56	56
Dissolved Chromium	g/m³	< 0.0005	0.0007	0.0011	0.0006	0.0008
Dissolved Cobalt	g/m³	0.0014	0.0011	0.0010	0.0010	0.0010

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Sample Type: Aqueous						
	Sample Name:	1.0 ug/L Ni T72 09-Sep-2025	2.0 ug/L Ni T72 09-Sep-2025	3.9 ug/L Ni T72 09-Sep-2025	7.8 ug/L Ni T72 09-Sep-2025	15.6 ug/L Ni T72 09-Sep-2025
	Lab Number:	3982069.11	3982069.12	3982069.13	3982069.14	3982069.15
Dissolved Copper	g/m³	0.0014	0.0006	0.0005	< 0.0005	< 0.0005
Dissolved Iron	g/m³	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Dissolved Lead	g/m³	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Dissolved Magnesium	g/m³	5.0	4.9	4.9	4.9	4.8
Dissolved Manganese	g/m³	0.144	0.140	0.136	0.139	0.135
Dissolved Nickel	g/m³	0.0018	0.0026	0.0041	0.0073	0.0136
Dissolved Zinc	g/m³	0.0053	0.0029	0.0034	0.0031	0.0032

	Sample Name:	31.3 ug/L Ni T72 09-Sep-2025	62.5 ug/L Ni T72 09-Sep-2025	125 ug/L Ni T72 09-Sep-2025	250 ug/L Ni T72 09-Sep-2025	500 ug/L Ni T72 09-Sep-2025
	Lab Number:	3982069.16	3982069.17	3982069.18	3982069.19	3982069.20
Total Hardness	g/m³ as $CaCO_3$	150	160	153	151	156
Dissolved Aluminium	g/m³	0.165	0.144	0.148	0.154	0.157
Dissolved Cadmium	g/m³	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Dissolved Calcium	g/m³	53	56	54	53	55
Dissolved Chromium	g/m³	0.0005	< 0.0005	0.0005	0.0005	< 0.0005
Dissolved Cobalt	g/m³	0.0011	0.0011	0.0010	0.0011	0.0014
Dissolved Copper	g/m³	< 0.0005	0.0005	0.0009	0.0005	< 0.0005
Dissolved Iron	g/m³	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Dissolved Lead	g/m³	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Dissolved Magnesium	g/m³	4.6	4.7	4.7	4.8	4.9
Dissolved Manganese	g/m³	0.134	0.136	0.138	0.138	0.140
Dissolved Nickel	g/m³	0.026	0.053	0.105	0.21	0.43
Dissolved Zinc	g/m³	0.0033	0.0030	0.0043	0.0040	0.0042

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request.
Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Hardness	Calculation from Dissolved Calcium and Dissolved Magnesium. APHA 2340 B : Online Edition.	1.0 g/m³ as $CaCO_3$	1-20
Dissolved Aluminium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.003 g/m³	1-20
Dissolved Cadmium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.00005 g/m³	1-20
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.05 g/m³	1-20
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-20
Dissolved Cobalt	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0002 g/m³	1-20
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-20
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.02 g/m³	1-20
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.00010 g/m³	1-20
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.02 g/m³	1-20
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-20
Dissolved Nickel	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-20
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0010 g/m³	1-20

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed on 17-Sep-2025. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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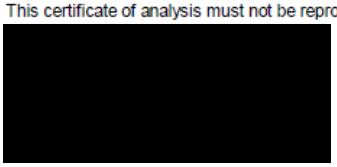

Client Services Manager - Environmental

Control and Cobalt - Unmodified pH 5.5 Mayfly T0

Hill Labs

R J Hill Laboratories Limited [redacted] [redacted]

Certificate of Analysis

Client:	New Zealand Institute for Earth Science Limited - Cor	**Lab No:**	3975944 SPv1
Contact:	K Thompson	**Date Received:**	02-Sep-2025
	C/- New Zealand Institute for Earth Science Limite	**Date Reported:**	11-Sep-2025
	[redacted]	**Quote No:**	140344
		Order No:	U345651
		Client Reference:	Unmodified Cobalt Mayfly
		Add. Client Ref:	ph 5.5 TO
		Submitted By:	K Thompson

Sample Type: Aqueous

Sample Name:		Unmodified Control 0 mg/L 01-Sep-2025	Unmodified 125 mg/L Co 01-Sep-2025	Unmodified 250 mg/L Co 01-Sep-2025	Unmodified 500 mg/L Co 01-Sep-2025	Unmodified 1000 mg/L Co 01-Sep-2025
Lab Number:		3975944.1	3975944.2	3975944.3	3975944.4	3975944.5
Turbidity	NTU	0.41	-	-	-	-
Acidity (pH 7.0)	g/m³ as $CaCO_3$	17.3	-	-	-	-
Total Hardness	g/m³ as $CaCO_3$	3.8	-	-	-	-
Dissolved Aluminium	g/m³	0.108	0.110	0.111	0.107	0.107
Dissolved Cadmium	g/m³	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Dissolved Calcium	g/m³	0.34	-	-	-	-
Dissolved Chromium	g/m³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Dissolved Cobalt	g/m³	0.0013	0.126	0.25	0.51	1.00
Dissolved Copper	g/m³	0.0009	0.0010	0.0010	0.0009	0.0009
Dissolved Iron	g/m³	0.04	0.04	0.04	0.04	0.04
Dissolved Lead	g/m³	0.00012	0.00015	0.00011	0.00012	0.00014
Dissolved Magnesium	g/m³	0.72	-	-	-	-
Dissolved Manganese	g/m³	0.0098	0.0104	0.0097	0.0099	0.0095
Dissolved Nickel	g/m³	0.0018	0.0020	0.0020	0.0020	0.0020
Dissolved Zinc	g/m³	0.0113	0.0172	0.0141	0.0118	0.0117
Sulphate	g/m³	5.2	-	-	-	-
Dissolved Non-Purgeable Organic Carbon (DNPOC)	g/m³	35	-	-	-	-

Sample Name:		Unmodified 2000 mg/L Co 01-Sep-2025
Lab Number:		3975944.6
Dissolved Aluminium	g/m³	0.108
Dissolved Cadmium	g/m³	< 0.00005
Dissolved Chromium	g/m³	< 0.0005
Dissolved Cobalt	g/m³	2.0
Dissolved Copper	g/m³	0.0009
Dissolved Iron	g/m³	0.04
Dissolved Lead	g/m³	0.00013
Dissolved Manganese	g/m³	0.0098
Dissolved Nickel	g/m³	0.0022
Dissolved Zinc	g/m³	0.0113

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The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked * or any comments and interpretations, which are not accredited.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request.
Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1
Turbidity	Analysis by Turbidity meter. APHA 2130 B (modified) : Online Edition.	0.05 NTU	1
Total Acidity (pH 7.0)	Titration to pH 7.0 with standard sodium hydroxide solution, pH meter. APHA 2310 B : Online Edition.	1.0 g/m³ as $CaCO_3$	1
Total Hardness	Calculation from Dissolved Calcium and Dissolved Magnesium. APHA 2340 B : Online Edition.	1.0 g/m³ as $CaCO_3$	1
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B : Online Edition.	-	1-6
Dissolved Aluminium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.003 g/m³	1-6
Dissolved Cadmium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.00005 g/m³	1-6
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.05 g/m³	1
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-6
Dissolved Cobalt	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0002 g/m³	1-6
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-6
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.02 g/m³	1-6
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.00010 g/m³	1-6
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.02 g/m³	1
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-6
Dissolved Nickel	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-6
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0010 g/m³	1-6
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m³	1
Dissolved Non-Purgeable Organic Carbon (DNPOC)	Acidification, purging to remove inorganic C, super-critical persulphate oxidation at 375°C, IR detection. APHA 5310 C (modified) : Online Edition.	0.3 g/m³	1

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 03-Sep-2025 and 09-Sep-2025. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Client Services Manager - Environmental

Control and Cobalt - Modified pH 7.5 Mayfly T0

R J Hill Laboratories Limited [redacted]

Certificate of Analysis

Client:	New Zealand Institute for Earth Science Limited - Cor	**Lab No:**	3975943 SPv1
Contact:	K Thompson	**Date Received:**	02-Sep-2025
	C/- New Zealand Institute for Earth Science Limite	**Date Reported:**	11-Sep-2025
	[redacted]	**Quote No:**	140344
		Order No:	U345651
		Client Reference:	Modified Cobalt Mayfly
		Add. Client Ref:	ph 7.5 TO
		Submitted By:	K Thompson

Sample Type: Aqueous

Sample Name:		Modified Control 0mg/L 01-Sep-2025	Modified 125 mg/L Co 01-Sep-2025	Modified 250 mg/L Co 01-Sep-2025	Modified 500 mg/L Co 01-Sep-2025	Modified 1000 mg/L Co 01-Sep-2025
Lab Number:		3975943.1	3975943.2	3975943.3	3975943.4	3975943.5
Turbidity	NTU	2.6	-	-	-	-
Acidity (pH 7.0)	g/m³ as $CaCO_3$	< 1.0	-	-	-	-
Total Hardness	g/m³ as $CaCO_3$	158	-	-	-	-
Dissolved Aluminium	g/m³	0.119	0.136	0.144	0.106	0.105
Dissolved Cadmium	g/m³	< 0.00005	0.00007	0.00006	< 0.00005	0.00005
Dissolved Calcium	g/m³	61	-	-	-	-
Dissolved Chromium	g/m³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Dissolved Cobalt	g/m³	0.0010	0.117	0.24	0.45	0.97
Dissolved Copper	g/m³	0.0010	0.0010	0.0008	0.0009	0.0010
Dissolved Iron	g/m³	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Dissolved Lead	g/m³	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Dissolved Magnesium	g/m³	1.67	-	-	-	-
Dissolved Manganese	g/m³	0.0116	0.0123	0.0117	0.0122	0.0121
Dissolved Nickel	g/m³	0.0019	0.0018	0.0019	0.0021	0.0020
Dissolved Zinc	g/m³	0.0092	0.0086	0.0071	0.0086	0.0074
Sulphate	g/m³	5.4	-	-	-	-
Dissolved Non-Purgeable Organic Carbon (DNPOC)	g/m³	2.2	-	-	-	-

Sample Name:		Modified 2000 mg/L Co 01-Sep-2025
Lab Number:		3975943.6
Dissolved Aluminium	g/m³	0.21
Dissolved Cadmium	g/m³	< 0.00005
Dissolved Chromium	g/m³	< 0.0005
Dissolved Cobalt	g/m³	1.91
Dissolved Copper	g/m³	0.0006
Dissolved Iron	g/m³	0.03
Dissolved Lead	g/m³	< 0.00010
Dissolved Manganese	g/m³	0.0119
Dissolved Nickel	g/m³	0.0021
Dissolved Zinc	g/m³	0.0056

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Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1
Turbidity	Analysis by Turbidity meter. APHA 2130 B (modified) : Online Edition.	0.05 NTU	1
Total Acidity (pH 7.0)	Titration to pH 7.0 with standard sodium hydroxide solution, pH meter. APHA 2310 B : Online Edition.	1.0 g/m³ as $CaCO_3$	1
Total Hardness	Calculation from Dissolved Calcium and Dissolved Magnesium. APHA 2340 B : Online Edition.	1.0 g/m³ as $CaCO_3$	1
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B : Online Edition.	-	1-6
Dissolved Aluminium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.003 g/m³	1-6
Dissolved Cadmium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.00005 g/m³	1-6
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.05 g/m³	1
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-6
Dissolved Cobalt	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0002 g/m³	1-6
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-6
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.02 g/m³	1-6
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.00010 g/m³	1-6
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.02 g/m³	1
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-6
Dissolved Nickel	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-6
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0010 g/m³	1-6
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m³	1
Dissolved Non-Purgeable Organic Carbon (DNPOC)	Acidification, purging to remove inorganic C, super-critical persulphate oxidation at 375°C, IR detection. APHA 5310 C (modified) : Online Edition.	0.3 g/m³	1

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 03-Sep-2025 and 09-Sep-2025. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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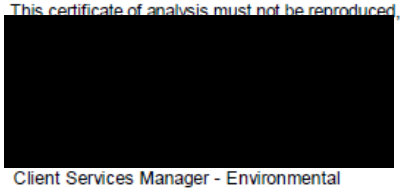

Client Services Manager - Environmental

Cobalt - Unmodified pH 5.5 and Modified pH 7.5 Mayfly T14

Hill Labs

R J Hill Laboratories Limited [redacted]

Certificate of Analysis

Client:	New Zealand Institute for Earth Science Limited - Cor	**Lab No:**	3987529 SPv1
Contact:	K Thompson	**Date Received:**	17-Sep-2025
	C/- New Zealand Institute for Earth Science Limite	**Date Reported:**	03-Oct-2025
	[redacted]	**Quote No:**	140344
		Order No:	U346157
		Client Reference:	Mayfly T14 Co
		Add. Client Ref:	Modified & Unmodified
		Submitted By:	K Thompson

Sample Type: Aqueous

Sample Name:		125mg/L Co Modified pH 7.5	250mg/L Co Modified pH 7.5	500mg/L Co Modified pH 7.5	1000mg/L Co Modified pH 7.5	2000mg/L Co Modified pH 7.5
Lab Number:		3987529.1	3987529.2	3987529.3	3987529.4	3987529.5
Turbidity	NTU	-	-	-	-	3.1
Acidity (pH 7.0)	g/m³ as $CaCO_3$	-	-	-	-	< 1.0
Total Hardness	g/m³ as $CaCO_3$	-	-	-	-	200
Dissolved Aluminium	g/m³	0.034	0.043	0.037	0.037	0.032
Dissolved Cadmium	g/m³	< 0.00005	< 0.00005	< 0.00005	0.00006	0.00006
Dissolved Calcium	g/m³	-	-	-	-	69
Dissolved Chromium	g/m³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Dissolved Cobalt	g/m³	0.0190	0.102	0.22	0.53	1.46
Dissolved Copper	g/m³	0.0016	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Dissolved Iron	g/m³	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Dissolved Lead	g/m³	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Dissolved Magnesium	g/m³	-	-	-	-	6.8
Dissolved Manganese	g/m³	0.0014	0.0023	0.0021	0.0026	0.0051
Dissolved Nickel	g/m³	0.0007	0.0008	0.0010	0.0014	0.0018
Dissolved Zinc	g/m³	0.0035	0.0039	0.0054	0.0069	0.0101
Sulphate	g/m³	6.7	6.6	6.7	7.0	7.5
Dissolved Non-Purgeable Organic Carbon (DNPOC)	g/m³	-	-	-	-	2.6

Sample Name:		125mg/L Co Unmodified pH 5.5	250mg/L Co Unmodified pH 5.5	500mg/L Co Unmodified pH 5.5	1000mg/L Co Unmodified pH 5.5	2000mg/L Co Unmodified pH 5.5
Lab Number:		3987529.6	3987529.7	3987529.8	3987529.9	3987529.10
Turbidity	NTU	-	-	-	-	3.8
Acidity (pH 7.0)	g/m³ as $CaCO_3$	-	-	-	-	33
Total Hardness	g/m³ as $CaCO_3$	-	-	-	-	28
Dissolved Aluminium	g/m³	0.058	0.058	0.059	0.058	0.058
Dissolved Cadmium	g/m³	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Dissolved Calcium	g/m³	-	-	-	-	6.1
Dissolved Chromium	g/m³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Dissolved Cobalt	g/m³	0.0140	0.028	0.069	0.22	0.46
Dissolved Copper	g/m³	0.0005	0.0006	< 0.0005	< 0.0005	0.0006
Dissolved Iron	g/m³	0.02	0.02	0.02	0.02	0.03
Dissolved Lead	g/m³	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Dissolved Magnesium	g/m³	-	-	-	-	3.2
Dissolved Manganese	g/m³	0.0078	0.0100	0.0123	0.0104	0.0119
Dissolved Nickel	g/m³	0.0006	0.0005	0.0006	0.0008	0.0010
Dissolved Zinc	g/m³	0.0082	0.0100	0.0100	0.0097	0.0164
Sulphate	g/m³	7.1	7.6	8.3	7.8	13.1

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The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked * or any comments and interpretations, which are not accredited.

Sample Type: Aqueous					
Sample Name:	125mg/L Co Unmodified pH 5.5	250mg/L Co Unmodified pH 5.5	500mg/L Co Unmodified pH 5.5	1000mg/L Co Unmodified pH 5.5	2000mg/L Co Unmodified pH 5.5
Lab Number:	3987529.6	3987529.7	3987529.8	3987529.9	3987529.10
Dissolved Non-Purgeable Organic Carbon g/m³ (DNPOC)	-	-	-	-	77

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request.
Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-10
Turbidity	Analysis by Turbidity meter. APHA 2130 B (modified) : Online Edition.	0.05 NTU	5, 10
Total Acidity (pH 7.0)	Titration to pH 7.0 with standard sodium hydroxide solution, pH meter. APHA 2310 B : Online Edition.	1.0 g/m³ as $CaCO_3$	5, 10
Total Hardness	Calculation from Dissolved Calcium and Dissolved Magnesium. APHA 2340 B : Online Edition.	1.0 g/m³ as $CaCO_3$	5, 10
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B : Online Edition.	-	1-10
Dissolved Aluminium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.003 g/m³	1-10
Dissolved Cadmium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.00005 g/m³	1-10
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.05 g/m³	5, 10
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-10
Dissolved Cobalt	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0002 g/m³	1-10
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-10
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.02 g/m³	1-10
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.00010 g/m³	1-10
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.02 g/m³	5, 10
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-10
Dissolved Nickel	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-10
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0010 g/m³	1-10
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m³	1-10
Dissolved Non-Purgeable Organic Carbon (DNPOC)	Acidification, purging to remove inorganic C, super-critical persulphate oxidation at 375°C, IR detection. APHA 5310 C (modified) : Online Edition.	0.3 g/m³	5, 10

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 18-Sep-2025 and 23-Sep-2025. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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[redacted]
Client Services Manager - Environmental

Nickel - Unmodified pH 5.5 Mayfly T0

Hill Labs

R J Hill Laboratories Limited [redacted]

Certificate of Analysis

Client:	New Zealand Institute for Earth Science Limited - Cor	**Lab No:**	3976901 SPv1
Contact:	K Thompson	**Date Received:**	03-Sep-2025
	C/- New Zealand Institute for Earth Science Limite	**Date Reported:**	11-Sep-2025
	[redacted]	**Quote No:**	140344
		Order No:	U345651
		Client Reference:	Nickel Unmodified To Mayflies
		Submitted By:	K Thompson

Sample Type: Aqueous

Sample Name:		22 mg/L	46 mg/L	100 mg/L	220 mg/L	460 mg/L
Lab Number:		3976901.1	3976901.2	3976901.3	3976901.4	3976901.5
Dissolved Aluminium	g/m³	0.112	0.107	0.108	0.108	0.109
Dissolved Cadmium	g/m³	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Dissolved Chromium	g/m³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Dissolved Cobalt	g/m³	0.0013	0.0013	0.0013	0.0012	0.0013
Dissolved Copper	g/m³	0.0009	0.0008	0.0008	0.0007	0.0008
Dissolved Iron	g/m³	0.04	0.04	0.04	0.04	0.04
Dissolved Lead	g/m³	0.00014	0.00012	0.00012	0.00011	0.00011
Dissolved Manganese	g/m³	0.0106	0.0102	0.0104	0.0102	0.0104
Dissolved Nickel	g/m³	0.025	0.049	0.101	0.22	0.46
Dissolved Zinc	g/m³	0.0147	0.022	0.023	0.024	0.026

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B : Online Edition.	-	1-5
Dissolved Aluminium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.003 g/m³	1-5
Dissolved Cadmium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.00005 g/m³	1-5
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-5
Dissolved Cobalt	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0002 g/m³	1-5
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-5
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.02 g/m³	1-5
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.00010 g/m³	1-5
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-5
Dissolved Nickel	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-5
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0010 g/m³	1-5

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These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 04-Sep-2025 and 05-Sep-2025. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Client Services Manager - Environmental

Nickel - Modified pH 7.5 Mayfly T0

Hill Labs

R J Hill Laboratories Limited [redacted]

Certificate of Analysis

Client:	New Zealand Institute for Earth Science Limited - Con	**Lab No:**	3976900 SPv1
Contact:	K Thompson	**Date Received:**	03-Sep-2025
	C/- New Zealand Institute for Earth Science Limite	**Date Reported:**	11-Sep-2025
	[redacted]	**Quote No:**	140344
		Order No:	U345651
		Client Reference:	Nickel Modified To Mayflies
		Submitted By:	K Thompson

Sample Type: Aqueous

Sample Name:		22 mg/L	46 mg/L	100 mg/L	220 mg/L	460 mg/L
Lab Number:		3976900.1	3976900.2	3976900.3	3976900.4	3976900.5
Dissolved Aluminium	g/m³	0.172	0.183	0.190	0.21	0.187
Dissolved Cadmium	g/m³	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Dissolved Chromium	g/m³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Dissolved Cobalt	g/m³	0.0019	0.0011	0.0010	0.0010	0.0011
Dissolved Copper	g/m³	0.0010	0.0005	0.0005	0.0005	0.0005
Dissolved Iron	g/m³	0.03	0.03	0.03	0.03	0.03
Dissolved Lead	g/m³	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Dissolved Manganese	g/m³	0.0132	0.0139	0.0134	0.0134	0.0143
Dissolved Nickel	g/m³	0.022	0.045	0.097	0.21	0.45
Dissolved Zinc	g/m³	0.0068	0.0043	0.0051	0.0051	0.0053

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B : Online Edition.	-	1-5
Dissolved Aluminium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.003 g/m³	1-5
Dissolved Cadmium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.00005 g/m³	1-5
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-5
Dissolved Cobalt	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0002 g/m³	1-5
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-5
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.02 g/m³	1-5
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.00010 g/m³	1-5
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-5
Dissolved Nickel	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-5
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0010 g/m³	1-5

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These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 04-Sep-2025 and 09-Sep-2025. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Client Services Manager - Environmental

Nickel - Unmodified pH 5.5 and Modified pH 7.5 Mayfly T14

R J Hill Laboratories Limited [redacted] [redacted]

Certificate of Analysis

Client:	New Zealand Institute for Earth Science Limited - Cor	**Lab No:**	3987527	SPv1
Contact:	K Thompson	**Date Received:**	17-Sep-2025	
	C/- New Zealand Institute for Earth Science Limite	**Date Reported:**	03-Oct-2025	
	[redacted]	**Quote No:**	140344	
		Order No:	U346155	
		Client Reference:	Mayfly T14 Ni	
		Add. Client Ref:	Modified & Unmodified	
		Submitted By:	K Thompson	

Sample Type: Aqueous

Sample Name:		22mg/L Ni Modified pH 7.5 17-Sep-2025	46mg/L Ni Modified pH 7.5 17-Sep-2025	100mg/L Ni Modified pH 7.5 17-Sep-2025	220mg/L Ni Modified pH 7.5 17-Sep-2025	460mg/L Ni Modified pH 7.5 17-Sep-2025
Lab Number:		3987527.1	3987527.2	3987527.3	3987527.4	3987527.5
Turbidity	NTU	-	-	-	-	9.4
Acidity (pH 7.0)	g/m³ as $CaCO_3$	-	-	-	-	< 1.0
Total Hardness	g/m³ as $CaCO_3$	-	-	-	-	185
Dissolved Aluminium	g/m³	0.054	0.057	0.049	0.044	0.049
Dissolved Cadmium	g/m³	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Dissolved Calcium	g/m³	-	-	-	-	64
Dissolved Chromium	g/m³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Dissolved Cobalt	g/m³	< 0.0002	0.0002	< 0.0002	< 0.0002	0.0002
Dissolved Copper	g/m³	0.0007	0.0006	0.0006	0.0006	0.0007
Dissolved Iron	g/m³	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Dissolved Lead	g/m³	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Dissolved Magnesium	g/m³	-	-	-	-	6.2
Dissolved Manganese	g/m³	< 0.0005	0.0006	0.0006	0.0008	0.0016
Dissolved Nickel	g/m³	0.0070	0.0157	0.034	0.076	0.165
Dissolved Zinc	g/m³	0.0015	0.0018	0.0018	0.0022	0.0022
Sulphate	g/m³	6.0	6.2	5.9	5.7	6.0
Dissolved Non-Purgeable Organic Carbon (DNPOC)	g/m³	-	-	-	-	2.5

Sample Name:		22mg/L Ni Unmodified pH 5.5 17-Sep-2025	46mg/L Ni Unmodified pH 5.5 17-Sep-2025	100mg/L Ni Unmodified pH 5.5 17-Sep-2025	220mg/L Ni Unmodified pH 5.5 17-Sep-2025	460mg/L Ni Unmodified pH 5.5 17-Sep-2025
Lab Number:		3987527.6	3987527.7	3987527.8	3987527.9	3987527.10
Turbidity	NTU	-	-	-	-	1.10
Acidity (pH 7.0)	g/m³ as $CaCO_3$	-	-	-	-	24
Total Hardness	g/m³ as $CaCO_3$	-	-	-	-	8.2
Dissolved Aluminium	g/m³	0.062	0.059	0.058	0.059	0.071
Dissolved Cadmium	g/m³	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Dissolved Calcium	g/m³	-	-	-	-	1.64
Dissolved Chromium	g/m³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Dissolved Cobalt	g/m³	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Dissolved Copper	g/m³	0.0007	0.0006	0.0007	0.0006	0.0006
Dissolved Iron	g/m³	0.03	0.02	0.02	0.02	0.03
Dissolved Lead	g/m³	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Dissolved Magnesium	g/m³	-	-	-	-	1.01
Dissolved Manganese	g/m³	0.0095	0.0115	0.0117	0.0123	0.0137
Dissolved Nickel	g/m³	0.0043	0.0134	0.022	0.056	0.154
Dissolved Zinc	g/m³	0.0066	0.0076	0.0089	0.0123	0.0088
Sulphate	g/m³	7.5	6.1	5.9	6.5	7.2

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The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked * or any comments and interpretations, which are not accredited.

Sample Type: Aqueous					
Sample Name:	22mg/L Ni Unmodified pH 5.5 17-Sep-2025	46mg/L Ni Unmodified pH 5.5 17-Sep-2025	100mg/L Ni Unmodified pH 5.5 17-Sep-2025	220mg/L Ni Unmodified pH 5.5 17-Sep-2025	460mg/L Ni Unmodified pH 5.5 17-Sep-2025
Lab Number:	3987527.6	3987527.7	3987527.8	3987527.9	3987527.10
Dissolved Non-Purgeable Organic Carbon (DNPOC) g/m³	-	-	-	-	48

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-10
Turbidity	Analysis by Turbidity meter. APHA 2130 B (modified) : Online Edition.	0.05 NTU	5, 10
Total Acidity (pH 7.0)	Titration to pH 7.0 with standard sodium hydroxide solution, pH meter. APHA 2310 B : Online Edition.	1.0 g/m³ as $CaCO_3$	5, 10
Total Hardness	Calculation from Dissolved Calcium and Dissolved Magnesium. APHA 2340 B : Online Edition.	1.0 g/m³ as $CaCO_3$	5, 10
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B : Online Edition.	-	1-10
Dissolved Aluminium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.003 g/m³	1-10
Dissolved Cadmium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.00005 g/m³	1-10
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.05 g/m³	5, 10
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-10
Dissolved Cobalt	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0002 g/m³	1-10
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-10
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.02 g/m³	1-10
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.00010 g/m³	1-10
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.02 g/m³	5, 10
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-10
Dissolved Nickel	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1-10
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0010 g/m³	1-10
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m³	1-10
Dissolved Non-Purgeable Organic Carbon (DNPOC)	Acidification, purging to remove inorganic C, super-critical persulphate oxidation at 375°C, IR detection. APHA 5310 C (modified) : Online Edition.	0.3 g/m³	5, 10

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 18-Sep-2025 and 22-Sep-2025. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Client Services Manager - Environmental

Appendix J Guideline values calculated for the lowest applicable hardness values and low pH.

Table J-1: Guideline values calculated for differing levels of protection (LoP) for an **Index Condition-Low** for toxicity modifying factors (**TMFs = pH 5.5 (pH 6.5 for Al; pH 6.0 for Cu), hardness = minimum value from Table 6-2 g $CaCO_3/m^3$, DOC 3.5 g/m^3**) using equations provided in Table 6-2. Analytical detection limit for trace analysis limit of quantitation (LOQ) with chronic GV/LOQ ratio calculated (RED if chronic GV <LOQ).

					Analytical detection limit (Trace)	
Element	**LoP**	**Chronic GV**	**Chronic GV**	**Acute GV**	**LOQ**	**Chronic GV/LOQ**
		g/m^3	mg/m^3	mg/m^3	g/m^3	
Dissolved Aluminium	95%	0.12	124	No GV	0.003	41
Dissolved Aluminium	90%	0.16	157	No GV	0.003	52
Dissolved Aluminium	80%	0.21	214	No GV	0.003	71
Dissolved Cobalt	95%	0.0014	1.4	8.9	0.0002	7
Dissolved Cobalt	90%	0.0033	3.3	13	0.0002	17
Dissolved Cobalt	80%	0.0090	9.0	23	0.0002	45
Dissolved Copper	95%	0.0029	2.9	2.8	0.0005	6
Dissolved Copper	90%	0.0035	3.5	3.7	0.0005	7
Dissolved Copper	80%	0.0055	5.5	6.2	0.0005	11
Dissolved Iron	All	0.5	500	No GV	0.02	25
Dissolved Manganese	95%	0.32	325	1,002	0.0005	649
Dissolved Manganese	90%	0.50	499	7,864	0.0005	998
Dissolved Manganese	80%	0.81	815	10,615	0.0005	1630
Dissolved Nickel	95%	0.011	11	69	0.0005	22
Dissolved Nickel	90%	0.013	13	100	0.0005	26
Dissolved Nickel	80%	0.017	17	177	0.0005	34
Dissolved Zinc	95%	0.021	21	37	0.0010	21
Dissolved Zinc	90%	0.034	34	55	0.0010	31
Dissolved Zinc	80%	0.060	60	90	0.0010	54
Dissolved Cadmium	95%	0.00004	0.04	0.05	0.0001	**0.4**
Dissolved Cadmium	90%	0.00007	0.07	0.06	0.0001	0.7
Dissolved Cadmium	80%	0.00015	0.15	0.20	0.0001	1.5

Appendix K Lookup table for compliance for discrete samples

The following table provides the number of permissible exceedances for differing confidence intervals for a given number of samples in a compliance monitoring period (from Bell et al. (2002); see also (McBride, 2016; McBride and Ellis, 2001)). (Note: Numerical calculation of percentile values should use Hazen method for comparison with compliance limits).

Table 13.2: Number of exceedances (e) out of n samples permitted to meet percentile discharge compliance standards based on a discharger's risk of no more than 10%.

Number of samples taken in monitoring period (*n*)	Number of permitted exceedances (*e*) for a 10% discharger's risk to meet the performance standards listed.			
	Median (50%ile)	80%ile	90%ile	95%ile
5	4	2	1	1
6	5	2	2	1
7	5	3	2	1
8	6	3	2	1
9	6	3	2	1
10	7	4	2	1
11	8	4	2	2
12	8	4	3	2
13	9	4	3	2
14	9	5	3	2
15	10	5	3	2
16	11	5	3	2
17	11	6	3	2
18	12	6	3	2
19	12	6	4	2
20	13	6	4	2
21	13	7	4	2
22	14	7	4	2
23	15	7	4	3
24	15	7	4	3
25	16	8	4	3
26	16	8	5	3
27	17	8	5	3
28	17	8	5	3
29	18	9	5	3
30	19	9	5	3
31	19	9	5	3
32	20	9	5	3
33	20	10	6	3
34	21	10	6	3
35	21	10	6	3
36	22	10	6	4
40	24	11	6	4
50	30	14	8	5
100	56	25	14	8

Note: These numbers are in fact pessimistic because their calculation is based on the assumption that the effluent is in fact always borderline for compliance. Such an assumption is necessary using standard statistical methods. But in general this assumption is *not true* An alternative (Bayesian) approach to the calculations does not make this assumption and so results in smaller numbers of samples being required (McBride & Ellis 2001). Note that this alternative approach has already been used in the compliance rules in new drinking-water standards (MoH 2000), and will be explained in some detail in the Ministry of Health's forthcoming Guidelines for Drinking-Water Management.

Appendix L Summary of monitoring proposed for reference and compliance sites: background, construction, operational and post-closure stages

Table L1: Site summary and monitoring frequency for reference and compliance sites for background/baseline

					Background / baseline work (until end of 2026)					
Project sub-area	Stream/ River	Code	Type	Level of protection	Flow (continuous)	Turbidity (continuous)	High flow / flood samples (as and when)	Water quality 'Basic'	Water quality 'Compliance'	Ecology
UWHR	Waimangaroa River	15W	Performance	80%				Fortnightly		min 3
MFS	Waimangaroa River	16W	Reference (Performance)	80%	use 2W					min 3
MFS / UWHR	Waimangaroa River	2W	Compliance	80%	existing	Y	Yes		Fortnightly	min 3
MFS / UWHR	Waimangaroa River	17W	Compliance	80%	Use 2W & SW03	Y	Yes		Fortnightly	min 3
MFS / UWHR	Waimangaroa River trib	WIL.MS1	Reference	95%						min 3
MFS / UWHR	Waimangaroa River trib	CED.MS1	Reference	95%						min 3
MFS	Billo Stream trib	BIL.L1	Reference	95%						min 3
MFS	Deep Stream	SW01	Compliance	95%	existing	Y	Yes		Fortnightly	min 3
MFS	Deep Stream	SW03	Compliance	95%	Yes	Y	Yes		Fortnightly	min 3
ESE	Whareatea River trib	V70	Reference (+ Performance turbidity)	n/a	Yes	Y	No	Fortnightly		min 3
ESE	Rapid Stream trib	RAP.R1	Reference	n/a						min 3
ESE	Rapid Stream	W07	Compliance	95%	Yes				Fortnightly	min 3
ESE	Whareatea River	KEL	Compliance	95%	Yes	Y	Yes		Monthly	min 3
ESE	Cascade Creek trib (V8)	MM1	Compliance	80%					Monthly	min 3
ESE	Whareatea River trib	V62	Compliance	95%	Yes	Y	Yes		Fortnightly	min 3

Notes: 1. "High flow samplers" = Storm Water Samplers (section 5.1.4, Figure E-1). Analysis suite indicated in Table L-6; 2. "Water quality – Basic" listed in Table L-5; 3. "Water quality – Comprehensive" listed in Table L-6; 4. Ecology suite (provisional) listed in Table L-7.

Table L2: Site summary and monitoring frequency for reference and compliance sites during construction stage

					Construction					
Project sub-area	Stream/ River	Code	Type	Level of protection	Turbidity (sample)	EC + pH + temp (continuous) (performan	High flow samplers	Water quality 'Basic'	Water quality 'Comprehensive'	Ecology
UWHR	Waimangaroa River	15W	Performance	80%	weekly			Monthly		
MFS	Waimangaroa River	16W	Reference (Performance)	80%	weekly			Monthly		annually
MFS / UWHR	Waimangaroa River	2W	Compliance	80%	weekly	Yes	Yes		Weekly	annually*
MFS / UWHR	Waimangaroa River	17W	Compliance	80%	weekly		Yes		Weekly	annually*
MFS / UWHR	Waimangaroa River trib	WIL.MS1	Reference	95%						annually
MFS / UWHR	Waimangaroa River trib	CED.MS1	Reference	95%						annually
MFS	Billo Stream trib	BIL.L1	Reference	95%						annually
MFS	Deep Stream	SW01	Compliance	95%		Yes	Yes		Fornightly	annually*
MFS	Deep Stream	SW03	Compliance	95%		Yes	Yes		Fornightly	annually*
ESE	Whareatea River trib	V70	Reference (+ Performance turbidity)	n/a			No	Monthly		annually
ESE	Rapid Stream trib	RAP.R1	Reference	n/a						annually
ESE	Rapid Stream	W07	Compliance	95%					Fornightly	annually*
ESE	Whareatea River	KEL	Compliance	95%			Yes		Fornightly	annually*
ESE	Cascade Creek trib (V8)	MM1	Compliance	80%		Yes			Fornightly	annually*
ESE	Whareatea River trib	V62	Compliance	95%			No		Fornightly	annually*

Notes: 1. “High flow samplers” = Storm Water Samplers (section 5.1.4, Figure E-1). Analysis suite indicated in Table L-6; 2. “Water quality – Basic” listed in Table L-5; 3. “Water quality – Comprehensive” listed in Table L-6; 4. Ecology suite (provisional) listed in Table L-7.

Table L-3: Site summary and monitoring frequency for reference and compliance sites during operations/active mining/active closure

					Operations / active mining / active closure						
Project sub-area	Stream/ River	Code	Type	Level of protection	Flow continuous	Turbidity (continuous)	Turbidity (sample)	EC + pH + temp (continuous) (perform	High flow samplers	Water quality 'compliance suite'	Ecology
UWHR	Waimangaroa River	15W	Performance	80%		Yes	monthly				
MFS	Waimangaroa River	16W	Reference (Performance)	80%	use 2W	Yes				Weekly	annually
MFS / UWHR	Waimangaroa River	2W	Compliance	80%	existing	Yes	weekly	Yes	Yes	Weekly	annually*
MFS / UWHR	Waimangaroa River	17W	Compliance	80%	Use 2W & SW03	Yes	weekly		Yes	Weekly	annually*
MFS / UWHR	Waimangaroa River trib	WIL.MS1	Reference	95%							annually
MFS / UWHR	Waimangaroa River trib	CED.MS1	Reference	95%							annually
MFS	Billo Stream trib	BIL.L1	Reference	95%			weekly				annually
MFS	Deep Stream	SW01	Compliance	95%	existing	Yes	weekly	Yes	Yes	Weekly	annually*
MFS	Deep Stream	SW03	Compliance	95%	Yes	Yes	weekly	Yes	Yes	Weekly	annually*
ESE	Whareatea River trib	V70	Reference (+ Performance turbidity)	n/a	Yes	Yes	weekly		No	Weekly	annually
ESE	Rapid Stream trib	RAP.R1	Reference	n/a							annually
ESE	Rapid Stream	W07	Compliance	95%	Yes	Yes	weekly			Weekly	annually*
ESE	Whareatea River	KEL	Compliance	95%	Yes	Yes	weekly	Yes	Yes	Weekly	annually*
ESE	Cascade Creek trib (V8)	MM1	Compliance	80%			weekly	Yes		Weekly	annually*
ESE	Whareatea River trib	V62	Compliance	95%	Yes	Yes	weekly		Yes	Weekly	annually*

Notes: 1. "High flow samplers" = Storm Water Samplers (section 5.1.4, Figure E-1). Analysis suite indicated in Table L-6; 2. "Water quality – Basic" listed in Table L-5; 3. "Water quality – Comprehensive" listed in Table L-6; 4. Ecology suite (provisional) listed in Table L-7.

Table L-4: Site summary and monitoring frequency for reference and compliance sites during post-closure (passive treatment)

					Post-closure (all passive treatment)				
Project sub-area	Stream/ River	Code	Type	Level of protection	Turbidity (continuous)	Turbidity (sample)	Water quality 'Basic'	Water quality 'compliance suite'	Ecology
UWHR	Waimangaroa River	15W	Performance	80%					
MFS	Waimangaroa River	16W	Reference (Performance)	80%					annually
MFS / UWHR	Waimangaroa River	2W	Compliance	80%				Monthly	annually*
MFS / UWHR	Waimangaroa River	17W	Compliance	80%				Monthly	annually*
MFS / UWHR	Waimangaroa River trib	WIL.MS1	Reference	95%				?	annually
MFS / UWHR	Waimangaroa River trib	CED.MS1	Reference	95%				?	annually
MFS	Billo Stream trib	BIL.L1	Reference	95%				Monthly	annually
MFS	Deep Stream	SW01	Compliance	95%				Monthly	annually*
MFS	Deep Stream	SW03	Compliance	95%				Monthly	annually*
ESE	Whareatea River trib	V70	Reference (+ Performance turbidity)	n/a				Monthly	annually
ESE	Rapid Stream trib	RAP.R1	Reference	n/a				Monthly	annually
ESE	Rapid Stream	W07	Compliance	95%				Monthly	annually*
ESE	Whareatea River	KEL	Compliance	95%				Monthly	annually*
ESE	Cascade Creek trib (V8)	MM1	Compliance	80%				Monthly	annually*
ESE	Whareatea River trib	V62	Compliance	95%				Monthly	annually*

Notes: 1. “High flow samplers” = Storm Water Samplers (section 5.1.4, Figure E-1). Analysis suite indicated in Table L-6; 2. “Water quality – Basic” listed in Table L-5; 3. “Water quality – Comprehensive” listed in Table L-6; 4. Ecology suite (provisional) listed in Table L-7.

Table L-5: Chemical monitoring parameter list for 'Basic' chemistry

Physico/chem	Dissolved metals
pH	Aluminium (Al)
Temperature	Calcium (Ca)
Electrical conductivity (EC)	Magnesium (Mg)
Turbidity	Zinc (Zn)
DOC (DNPOC)	
Sulphate	

Abbreviations: DOC = dissolved organic carbon;
DNPOC = dissolved non-purgeable organic carbon

Table L-6: Chemical monitoring parameter list for 'Compliance' chemistry

Physico/chem	Dissolved metals	Nutrients
pH[a]	Aluminium (Al) [a]	nitrate-N
Temperature	Cadmium (Cd)	nitrite-N
Electrical conductivity (EC) [a]	Calcium (Ca) [a]	ammoniacal-N
Turbidity[a]	Cobalt (Co)	
DOC (DNPOC)	Copper (Cu)	
Sulphate	Iron (Fe) [a]	
	Magnesium (Mg) [a]	
	Manganese (Mn)	
	Nickel (Ni)	
	Zinc (Zn)	

Abbreviations: DOC = dissolved organic carbon; DNPOC = dissolved non-purgeable organic carbon.
Notes: [a] Indicates routine analytes for Storm Water Samplers. Trace metals analysis will require special acid non-routine acid washing procedures.

Table L-7: Biological monitoring parameter list

Ecology
periphyton
bryophytes
macroinvertebrates
fish
kōura

Appendix M WLBM predicted exceedance frequencies for ESE and MFS

Table M-1: WLBM predicted exceedance frequencies for ESE for chronic guidelines based on a daily modelling time-step.

			Element									
Statio	Exceedance	Scenari	Al	Co	Cu	Cd	Fe	Ni	Mn	Pb	Cr	Zn
V62	Average	Base Case	1.1	0.7	0.1	0.7	0.7	0.7	0	0	0	1.8
V62	Maximum yearly	Base Case	4.4	4.4	1.6	4.4	4.4	4.4	0	0	0	4.9
V62	Average	Scenario 1	1.0	0.8	0	0.7	0.7	0.7	0	0	0	1.6
V62	Maximum yearly	Scenario 1	4.9	4.7	1.1	4.7	4.4	4.7	0	0	0	5.2
V62	Average	Scenario 2	0.6	0.4	0	0.4	0.4	0.4	0	0	0	1.0
V62	Maximum yearly	Scenario 2	4.1	3.8	0.8	3.8	3.0	3.8	0	0	0	4.1
V62	Average	Scenario 3	1.4	0.9	0.3	0.7	0.7	0.8	0	0	0	2.2
V62	Maximum yearly	Scenario 3	4.4	4.4	2.5	4.4	4.4	4.4	0	0	0	4.9
V62	Average	Scenario 4	0.8	0.7	0	0.7	0.6	0.7	0	0	0	1.4
V62	Maximum yearly	Scenario 4	4.4	4.4	1.4	4.4	4.1	4.4	0	0	0	4.9
KEL	Average	Base Case	1.3	0.9	0.1	0.2	0.8	0.6	0	0	0	1.2
KEL	Maximum yearly	Base Case	6.6	4.4	1.9	3.3	7.7	3.8	0	0.3	0.3	5.7
KEL	Average	Scenario 1	2.4	1.7	0.1	0.3	1.4	1.0	0	0	0	1.8
KEL	Maximum yearly	Scenario 1	15	7.4	0.8	1.6	13	4.1	0.3	0.3	0.3	5.5
KEL	Average	Scenario 2	1.4	1.0	0.1	0.3	0.9	0.7	0	0	0	1.4
KEL	Maximum yearly	Scenario 2	8.5	4.9	2.2	5.2	9.3	4.4	0.3	0.8	0.3	8.2
KEL	Average	Scenario 3	1.3	0.9	0.1	0.2	0.9	0.6	0	0	0	1.2
KEL	Maximum yearly	Scenario 3	5.7	4.4	1.9	3.0	7.7	3.8	0.3	0.3	0.3	5.7
KEL	Average	Scenario 4	1.3	0.8	0.1	0.2	0.6	0.5	0	0	0	1.1
KEL	Maximum yearly	Scenario 4	6.8	4.1	1.9	3.3	7.7	3.8	0	0.3	0.3	5.7
W07	Average	Base Case	0	0	0	0	0	0	0	0	0	0
W07	Maximum yearly	Base Case	0	0	0	0	0	0	0	0	0	0
W07	Average	Scenario 1	0	0	0	0	0	0	0	0	0	0.1
W07	Maximum yearly	Scenario 1	0	0	0	0	0	0	0	0	0	0.8
W07	Average	Scenario 2	0	0	0	0	0	0	0	0	0	0
W07	Maximum yearly	Scenario 2	0	0	0	0	0	0	0	0	0	0
W07	Average	Scenario 3	0	0	0	0	0	0	0	0	0	0.1
W07	Maximum yearly	Scenario 3	0	0	0	0	0	0	0	0	0	1.6
W07	Average	Scenario 4	0	0	0	0	0	0	0	0	0	0
W07	Maximum yearly	Scenario 4	0	0	0	0	0	0	0	0	0	0
MM1	Average	Base Case	0	0	0	0	0	0	0	0	0	0
MM1	Maximum yearly	Base Case	0	0	0	0	0	0	0	0	0	0
MM1	Average	Scenario 1	0.1	0	0	0	0.1	0	0	0	0	0.1
MM1	Maximum yearly	Scenario 1	0.8	0.3	0	0	0.8	0.8	0	0	0	0.8
MM1	Average	Scenario 2	0.1	0	0	0	0.1	0.1	0	0	0	0.1
MM1	Maximum yearly	Scenario 2	1.9	0.5	0.3	0	1.9	1.9	0	0	0	1.9
MM1	Average	Scenario 3	0	0	0	0	0	0	0	0	0	0
MM1	Maximum yearly	Scenario 3	0	0	0	0	0	0	0	0	0	0
MM1	Average	Scenario 4	0	0	0	0	0	0	0	0	0	0
MM1	Maximum yearly	Scenario 4	0	0	0	0	0	0	0	0	0	0

Table M-2: WLBM predicted exceedance frequencies for ESE for acute guidelines based on a daily modelling time-step.

			Element					
Station	Acute exceedance frequency	Scenario	Co	Cu	Cd	Ni	Mn	Zn
V62	Average	Base Case	0	0.1	0	0	0	1.0
V62	Maximum yearly	Base Case	1.1	1.6	0	0	0	4.4
V62	Average	Scenario 1	0	0	0	0	0	0.9
V62	Maximum yearly	Scenario 1	0.5	1.1	0	0	0	4.9
V62	Average	Scenario 2	0	0	0	0	0	0.5
V62	Maximum yearly	Scenario 2	0.3	0.8	0	0	0	4.1
V62	Average	Scenario 3	0.1	0.3	0	0	0	1.3
V62	Maximum yearly	Scenario 3	1.6	2.5	0	0	0	4.4
V62	Average	Scenario 4	0	0	0	0	0	0.7
V62	Maximum yearly	Scenario 4	1.1	1.4	0	0	0	4.4
KEL	Average	Base Case	0	0	0	0	0	0.8
KEL	Maximum yearly	Base Case	0.3	0.8	1.9	0	0	4.1
KEL	Average	Scenario 1	0	0	0	0	0	1.2
KEL	Maximum yearly	Scenario 1	0.3	0.3	0.5	0.3	0	4.7
KEL	Average	Scenario 2	0	0	0	0	0	0.9
KEL	Maximum yearly	Scenario 2	0.5	0.8	1.4	0.3	0	4.4
KEL	Average	Scenario 3	0	0	0.1	0	0	0.8
KEL	Maximum yearly	Scenario 3	0.3	0.8	1.9	0	0	4.1
KEL	Average	Scenario 4	0	0	0.1	0	0	0.8
KEL	Maximum yearly	Scenario 4	0.3	0.8	1.9	0	0	4.1
W07	Average	Base Case	0	0	0	0	0	0
W07	Maximum yearly	Base Case	0	0	0	0	0	0
W07	Average	Scenario 1	0	0	0	0	0	0
W07	Maximum yearly	Scenario 1	0	0	0	0	0	0
W07	Average	Scenario 2	0	0	0	0	0	0
W07	Maximum yearly	Scenario 2	0	0	0	0	0	0
W07	Average	Scenario 3	0	0	0	0	0	0
W07	Maximum yearly	Scenario 3	0	0	0	0	0	0
W07	Average	Scenario 4	0	0	0	0	0	0
W07	Maximum yearly	Scenario 4	0	0	0	0	0	0
MM1	Average	Base Case	0	0	0	0	0	0
MM1	Maximum yearly	Base Case	0	0	0	0	0	0
MM1	Average	Scenario 1	0	0	0	0	0	0
MM1	Maximum yearly	Scenario 1	0	0	0	0	0	0.5
MM1	Average	Scenario 2	0	0.0	0	0	0	0.1
MM1	Maximum yearly	Scenario 2	0	0.3	0	0	0	1.6
MM1	Average	Scenario 3	0	0	0	0	0	0
MM1	Maximum yearly	Scenario 3	0	0	0	0	0	0
MM1	Average	Scenario 4	0	0	0	0	0	0
MM1	Maximum yearly	Scenario 4	0	0	0	0	0	0

Table M-3: WLBM predicted exceedance frequencies for MFS for chronic guidelines based on a daily modelling time-step.

			Element									
Station	Chronic exceedance frequency	Scenario	Al	Co	Cu	Cd	Fe	Ni	Mn	Pb	Cr	Zn
SW01	Average	Base Case	0	0	0	0.6	0	0	0	0	0	1.1
SW01	Maximum yearly	Base Case	0.5	0.5	0.5	3.0	0.5	0.5	0	0	0	3.6
SW01	Average	Scenario 1	0	0	0	0	0	0	0	0	0	2.1
SW01	Maximum yearly	Scenario 1	0.3	0.3	0.3	0.3	0.3	0.3	0	0	0	5.5
SW01	Average	Scenario 2	0	0.1	0	0.4	0.3	0	0	0	0	2.0
SW01	Maximum yearly	Scenario 2	0.3	1.9	0	2.7	2.7	0	0	0	0	7.1
SW01	Average	Scenario 3	0	0	0	0.7	0	0	0	0	0	1.3
SW01	Maximum yearly	Scenario 3	0.5	0.5	0.5	3.0	0.5	0.5	0	0	0	4.4
SW01	Average	Scenario 4	0	0	0	0.6	0	0	0	0	0	1.2
SW01	Maximum yearly	Scenario 4	0.5	0.5	0.5	2.7	0.5	0.5	0	0	0	3.8
SW03	Average	Base Case	0	0.1	0	0.5	0.1	0.1	0	0	0	1.9
SW03	Maximum yearly	Base Case	0.8	0.8	0.5	2.2	0.8	1.1	0	0.5	0	4.7
SW03	Average	Scenario 1	0	0	0	0	0	0	0	0	0	3.1
SW03	Maximum yearly	Scenario 1	0.3	0.3	0.3	0.3	0.3	0.3	0	0.3	0	5.5
SW03	Average	Scenario 2	0	0.2	0	0.3	0.3	0	0	0	0	2.5
SW03	Maximum yearly	Scenario 2	0.5	1.6	0	2.2	2.5	0.8	0	0	0	5.8
SW03	Average	Scenario 3	0	0.1	0	0.6	0.1	0.2	0	0	0	2.2
SW03	Maximum yearly	Scenario 3	0.8	1.1	0.5	2.2	0.8	1.9	0	0.5	0	6.0
SW03	Average	Scenario 4	0	0.1	0	0.5	0.1	0.1	0	0	0	2.1
SW03	Maximum yearly	Scenario 4	0.8	0.8	0.5	2.2	0.8	1.1	0	0.5	0	5.8
2W	Average	Base Case	0	0	0	0	0	0	0	0	0	0
2W	Maximum yearly	Base Case	0	0	0	0	0	0	0	0	0	0
2W	Average	Scenario 1	0	0	0	0	0	0	0	0	0	0
2W	Maximum yearly	Scenario 1	0	0	0	0	0	0	0	0	0	0
2W	Average	Scenario 2	0	0	0	0	0	0	0	0	0	0
2W	Maximum yearly	Scenario 2	0	0	0.3	0	0	0	0	0	0	0
2W	Average	Scenario 3	0	0	0	0	0	0	0	0	0	0
2W	Maximum yearly	Scenario 3	0	0	0.3	0	0	0	0	0	0	0
2W	Average	Scenario 4	0	0	0	0	0	0	0	0	0	0
2W	Maximum yearly	Scenario 4	0	0	0.3	0	0	0	0	0	0	0
17W	Average	Base Case	0	0	0	0	0	0	0	0	0	0
17W	Maximum yearly	Base Case	0	0	0	0	0	0	0	0	0	0
17W	Average	Scenario 1	0	0	0	0	0	0	0	0	0	0
17W	Maximum yearly	Scenario 1	0	0	0	0	0	0	0	0	0	0
17W	Average	Scenario 2	0	0	0	0	0	0	0	0	0	0
17W	Maximum yearly	Scenario 2	0	0	0	0	0	0	0	0	0	0
17W	Average	Scenario 3	0	0	0	0	0	0	0	0	0	0
17W	Maximum yearly	Scenario 3	0	0	0	0	0	0	0	0	0	0
17W	Average	Scenario 4	0	0	0	0	0	0	0	0	0	0
17W	Maximum yearly	Scenario 4	0	0	0	0	0	0	0	0	0	0

Table M-4: WLBM predicted exceedance frequencies for MFS for acute guidelines based on a daily modelling time-step.

			Element					
Station	Acute exceedance frequency	Scenario	Co	Cu	Cd	Ni	Mn	Zn
SW01	Average	Base Case	0	0	0	0	0	0.5
SW01	Maximum yearly	Base Case	0	0.5	0	0	0	1.6
SW01	Average	Scenario 1	0	0	0	0	0	0.9
SW01	Maximum yearly	Scenario 1	0	0.3	0	0	0	3.0
SW01	Average	Scenario 2	0	0	0	0	0	0.7
SW01	Maximum yearly	Scenario 2	0	0	0	0	0	3.8
SW01	Average	Scenario 3	0	0	0	0	0	0.6
SW01	Maximum yearly	Scenario 3	0	0.5	0	0	0	1.9
SW01	Average	Scenario 4	0	0	0	0	0	0.5
SW01	Maximum yearly	Scenario 4	0	0.5	0	0	0	1.6
SW03	Average	Base Case	0	0	0	0	0	0.5
SW03	Maximum yearly	Base Case	0	0.5	0	0	0	2.5
SW03	Average	Scenario 1	0	0	0	0	0	0.6
SW03	Maximum yearly	Scenario 1	0	0.3	0	0	0	1.6
SW03	Average	Scenario 2	0	0	0	0	0	0.5
SW03	Maximum yearly	Scenario 2	0	0	0	0	0	2.2
SW03	Average	Scenario 3	0	0	0	0	0	0.7
SW03	Maximum yearly	Scenario 3	0	0.5	0	0	0	2.5
SW03	Average	Scenario 4	0	0	0	0	0	0.7
SW03	Maximum yearly	Scenario 4	0	0.5	0	0.0	0.0	2.5
2W	Average	Base Case	0	0	0	0	0	0
2W	Maximum yearly	Base Case	0	0	0	0	0	0
2W	Average	Scenario 1	0	0	0	0	0	0
2W	Maximum yearly	Scenario 1	0	0	0	0	0	0
2W	Average	Scenario 2	0	0	0	0	0	0
2W	Maximum yearly	Scenario 2	0	0	0	0	0	0
2W	Average	Scenario 3	0	0	0	0	0	0
2W	Maximum yearly	Scenario 3	0	0	0	0	0	0
2W	Average	Scenario 4	0	0	0	0	0	0
2W	Maximum yearly	Scenario 4	0	0	0	0	0	0
17W	Average	Base Case	0	0	0	0	0	0
17W	Maximum yearly	Base Case	0	0	0	0	0	0
17W	Average	Scenario 1	0	0	0	0	0	0
17W	Maximum yearly	Scenario 1	0	0	0	0	0	0
17W	Average	Scenario 2	0	0	0	0	0	0
17W	Maximum yearly	Scenario 2	0	0	0	0	0	0
17W	Average	Scenario 3	0	0	0	0	0	0
17W	Maximum yearly	Scenario 3	0	0	0	0	0	0
17W	Average	Scenario 4	0	0	0	0	0	0
17W	Maximum yearly	Scenario 4	0	0.3	0	0	0	0