



Waste Discharge License 166-07  
Monitoring Report  
1 November 2023 – 31 October 2024  
Pine Creek Project Area



**AGNICO EAGLE**

## Document Details

Version Record:

| Date        | Distributed to | Prepared By                 | Version |
|-------------|----------------|-----------------------------|---------|
| 31 Oct 2024 | NT EPA         | Emily Ordogh / Emer McGowan | 1.0     |

## Certification Details

I Sam (Dong) Yang Environmental Superintendent, have reviewed this report and I confirm that to the best of my knowledge and ability all the information provided in the report is true and accurate.

|           |                                                                                   |
|-----------|-----------------------------------------------------------------------------------|
| Signature |  |
| Date      | Oct 31, 2024                                                                      |

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# 1 EXECUTIVE SUMMARY

## 1.1 Scope

The environmental impacts of treated mine water discharged from the Pine Creek Project Area (PCPA) are regulated by Waste Discharge Licence (WDL) 166-07. This license, which includes monitoring and reporting requirements, commenced on 31 October 2022 and will remain in effect until 1 November 2032. This report is prepared in the format described in the *Guideline for Reporting on Environmental Monitoring* by the Northern Territory Environment Protection Authority (NT EPA), May 2016.

This report's content includes results and interpretation for each aspect of the monitoring program as detailed under Item 13 and Conditions 39-40 of WDL 180-08 for the period 1 November 2023 to 31 October 2024. The monitoring program as detailed in Item 11 and conditions 27, includes; surface water, ecotoxicological, macroinvertebrate and sediment monitoring.

The first surface water monitoring event was captured at PCCK06, once creek flow had commenced on the 8 January 2024. During the reporting period there were 12 sampling events undertaken at PCCK06. Authorised discharges of wastewater occurred from Process Water Dam to Copperfield Creek, with a total of 2615 ML released during the reporting period.

Water quality at compliance location PCCK06 during the 2023-24 reporting period showed elevated concentrations of copper, cobalt, cadmium, zinc and turbidity. Long-term data showed elevated median concentrations for cadmium, copper, zinc and turbidity.

The ecotoxicity report found both acute and chronic toxicity at PCCK06, mainly due to high levels of cadmium, cobalt, and zinc from PCPWD discharge. Zinc was the primary cause. For 2024/25, it is recommended to continue the current monitoring program. The macroinvertebrate and sediment report showed that Copperfield Creek had high metal levels in sediments at PCCK06, but these did not exceed guidelines. Zinc levels were high at PCCK06 but decreased downstream at PCCK22, indicating recovery over 22 km. Macroinvertebrate analysis suggested that habitat characteristics, not sediment metal levels, mainly influence community composition. Similarity between upstream and downstream communities supports this. However, lower macroinvertebrate metrics at PCCK22 highlight the need for ongoing monitoring to track health trends.

A performance improvement plan has been developed to ensure future compliance with the WDL condition. These include cleaning the spillway, installing a sluice gate, reconstructing the low flow channel, and decommissioning the Coffey Dam. WDL signage will also be installed for better site identification and monitoring. These actions aim to enhance water management, ensure compliance, and protect the environment.

## 1.2 Assumptions

Data used by NTMO was utilised in this report where relevant on the basis that NTMO have undertaken the necessary appropriate quality assurance and quality control procedures in the sampling, analysis and reporting of data for all monitoring locations.

## 2 MONITORING OBJECTIVES

### 2.1 Background on Project Area

The Pine Creek project area (PCPA) is located within the Daly River catchment. Localised sub-catchments relevant to PCPA are Copperfield Creek, which flows into the Cullen River, a large tributary of the Douglas-Daly River.

The Copperfield Creek sub-catchment represents an area of 9.2 km<sup>2</sup>. Grazing was the major land use and occurred on thinned native pastures and cleared native pastures. The sub-section consists of open woodlands, savannahs, and ephemeral creeks with riparian vegetation.

Copperfield Creek and Pine Creek flow into the Cullen River, a tributary of the Daly River and ultimately flow into the ocean, some 200 km west of the Project Area. The Daly River flows year-round but many of the associated tributaries draining its catchment area are ephemeral, flowing only during the wet season. Stream flows are highly variable and extremely responsive to rainfall, reaching peak levels between February and March each year.

Kirkland Lake Gold, NT Mining Operations (NTMO) have adopted an integrated, multiple lines of evidence approach to managing the environmental influences from active discharges entering Copperfield Creek. This approach includes:

- Surface water monitoring;
- Ecotoxicological assessment;
- Macroinvertebrate, and
- Sediment monitoring programs.

The results from the above programs are used to assess for potential effects to freshwater aquatic ecosystems from active discharges within the NTMO operational area.

The most important aspect of the multiple lines of evidence approach to environmental monitoring and management are the macroinvertebrate monitoring results and ecotoxicity assessments. By monitoring the macroinvertebrates and assessing toxicity, an integrated assessment of potential long-term impacts from exposure to treated mine water can be determined.

## 2.2 Background of the Surface Water Quality Monitoring Program

The area around Pine Creek has been mined intermittently for over 100 years. Several historic mining leases existed within the vicinity of the PCPA. Those in the immediate vicinity of the site include Democrat, Chin Phillips, North Australia, Eleanor and Kohinoor. Most of these had ceased operations by 1900. The main activity in recent years has centered on the former Enterprise Mine.

While no mining activities have been undertaken by NT Mining Operations Pty Ltd (NTMO) at the PCPA, mining has been undertaken by previous operators. No mining operations are planned at the PCPA for this reporting period, however, there is some possibility that limited exploration activities may occur during the 2023/24 period. The PCPA will remain in care and maintenance.

Currently, NTMO is actively discharging mine water from (PCPWD) Process Water Dam into Creek 6. PCCK06 sits on the boundary of the PCPA lease and acts as a compliance point for monitoring wastewater discharged from PCPWD. PCPWD collects passively discharged water from the surrounding WRDs and TSFs, resulting in high concentrations of cadmium, cobalt, copper sulphate and zinc in its water.

This Report assesses all water quality from the 2023/24 wet season to comply with WDL 166-07 conditions. Where further interrogation of the data is required, the historical water quality (2018-2024) has been used to aid in interpretation.

SSTVs do not apply to standing water bodies or to water quality within mixing zones and in such instances NTMO applies the stock watering guidelines (SWG), where applicable.

## 2.3 Waste Discharge Licence Conditions

This monitoring report fulfils the requirements of WDL 166-07 for the period 1 November 2023 – 31 October 2024 as per the following conditions:

39. *The licensee must complete and provide to the Administering Agency a report of data and information obtained through the implementation and performance of the Monitoring Program (the Monitoring Report), as prescribed by this licence, on the dates specified in Item 13.*
40. *The licensee must ensure that each Monitoring Report:*
  - 40.1. *is prepared in accordance with the requirements of the Administering Agency 'Guideline for Reporting on Environmental Monitoring' (or any other guideline as adopted by the Administering Agency from time to time);*
  - 40.2. *includes a tabulation, in Microsoft® Excel® format or another format requested by the Administering Agency, of all monitoring data required to be collected in accordance with this licence for the preceding 12 month period;*
  - 40.3. *includes a tabulation of monthly and annual contaminant loads discharged from the authorised discharge point specified in Item 5 for the preceding 12 month period. Contaminant loads must be calculated for metals, metalloids, nutrients and other parameters (excluding field parameters) listed in the monitoring program specified in Item 11. The calculations must be based on the daily discharge volume and the concentration of contaminant present in the discharge on that day. On the days when a sample was not taken then the concentration of the contaminant must be estimated using Linear Interpolation methodology;*
  - 40.4. *includes long term trend analysis of monitoring data to demonstrate any environmental impact associated with the Licensed Action over a minimum period of three years (of part thereof);*
  - 40.5. *includes a summary of any investigations undertaken by the licensee in accordance with this licence for the preceding 12 month period; and*
  - 40.6. *includes an assessment of environmental impact from the Licensed Action.*

## 2.4 Surface Water Monitoring Program

Surface water monitoring requirements are specified in WDL 166-07. The results of these monitoring programs are used to understand the influence of treated mine water discharge from the project area to the receiving environment in the Copperfield Creek system and the Daly River catchment. The results of the monitoring programs assist in identifying trends and assess the success of the various surface water management measures implemented by NTMO. Surface water WDL monitoring locations for PCPA are shown in Table 1 and Figure 1. The surface water quality program incorporates the monitoring of the location on-site, upstream locations, discharge waters, downstream compliance site, and further downstream locations. Analytes are shown in Table 2 and sampling frequencies are shown in WDL 166-07.

**Table 1 Surface Water Monitoring Locations**

| Description | Copperfield Creek                                                                                                                                                                      |                                                                                                          |                                                                      |                                                                    |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|--------------------------------------------------------------------|
| Site Code   | PCPWD                                                                                                                                                                                  | PCCK16                                                                                                   | PCCK22                                                               | PCCK06                                                             |
| Latitude    | -13.847°                                                                                                                                                                               | -13.862°                                                                                                 | -14.011°                                                             | -13.862°                                                           |
| Longitude   | 131.834°                                                                                                                                                                               | 131.820°                                                                                                 | 131.917°                                                             | 131.833°                                                           |
| Description | (Authorised Discharge Point)<br>Pine Creek Process Water Dam. Wastewater from the Process Water Dam is discharged via weir boards at the southern end of the Dam to Copperfield Creek. | Copperfield Creek upstream of any mine site discharge at the Jindare/Umbrawarra Road Crossing (control). | PCCK22 is 26 km downstream of PCCK06. Down Bonrook Stations driveway | 100 m downstream of the confluence of Copperfield Creek and PCPWD. |

**Table 2 Surface Water Monitoring Analytes**

| Type                               | Analytes                                                                                                             |
|------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| Field measurements                 | Flow, water level, pH, electrical conductivity, dissolved oxygen, temperature                                        |
| Dissolved metals (0.45 µm)<br>µg/L | Aluminium, arsenic (Total), cadmium, cobalt, copper, iron, lead, manganese, nickel, zinc                             |
| Environmental indicators mg/L      | Turbidity, total suspended solids, total dissolved solids, calcium, magnesium, potassium, sodium, chloride, Sulphate |
| Nutrients                          | Total nitrogen (µg/L – unfiltered), total phosphorus (µg/L – unfiltered), organic carbon (mg/L – unfiltered)         |

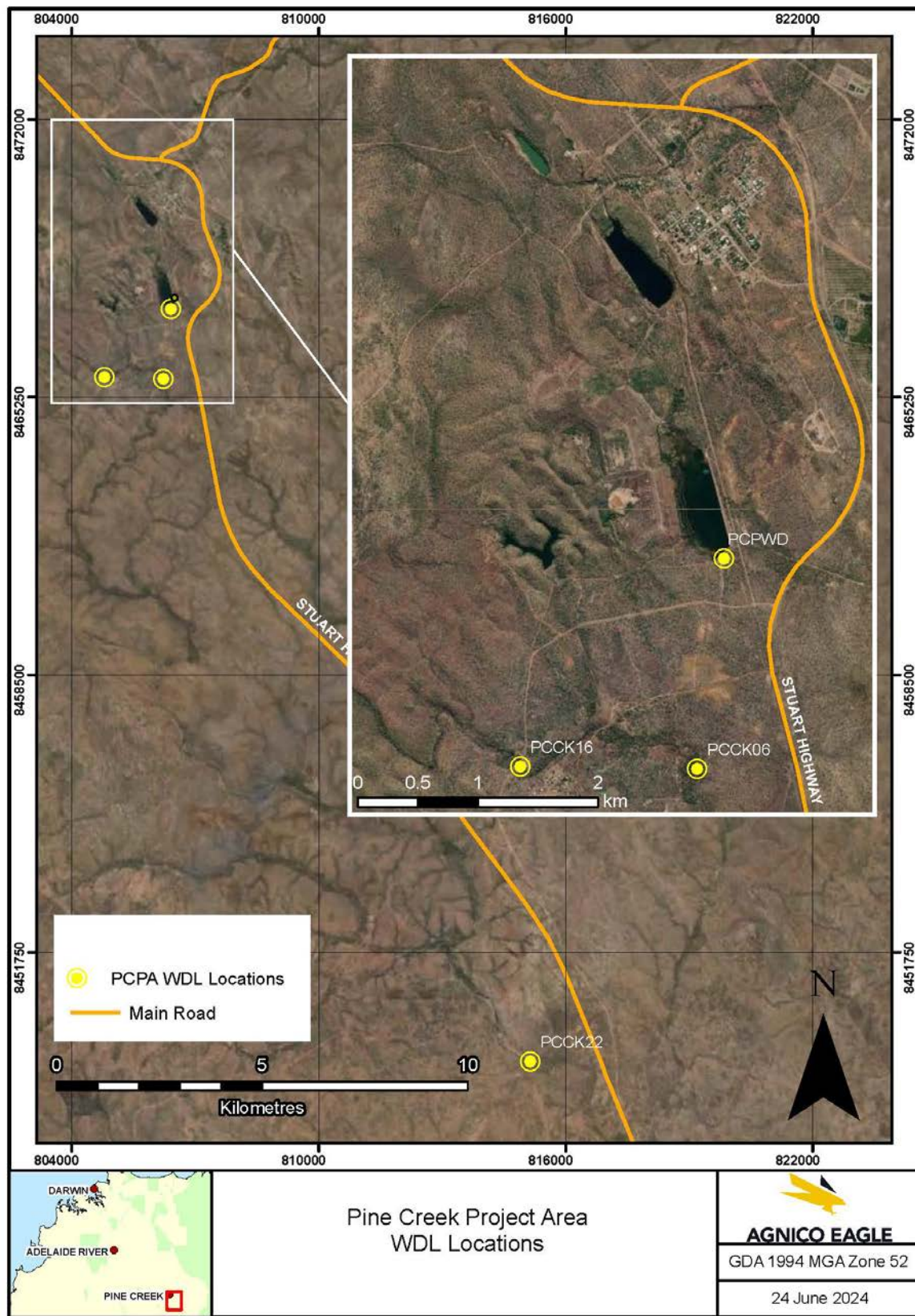


Figure 1 Regulatory Surface Water Monitoring Locations

## 2.5 Mine Affected Water Sources

The sources of mine affected waters from PCPA to Copperfield Creek originate from the legacy infrastructure associated with historical mining activity including Dams, waste rock dumps (WRDs) and tailings dams. Influences on water quality from site infrastructure are identified and discussed in the 2024 Notification and Investigation Reports.

The sources of mine-affected water from PCPA originate from seepage of WRDs, TSFs and historic heap leach pads. Table 3 shows the main sources of mine water to the receiving creek. Conceptual model of water movement within the PCPA are shown in Figure 2.

**Table 3 Wastewater Sources**

| Site              | Source                  | Receiving Sites |
|-------------------|-------------------------|-----------------|
| Copperfield Creek | Process Water Dam       | PCCK06          |
|                   | PCPWD Catchment A       | PCPWD           |
|                   | PCPWD Catchment B (TSF) |                 |
|                   | Upper PCPWD Catchment   |                 |

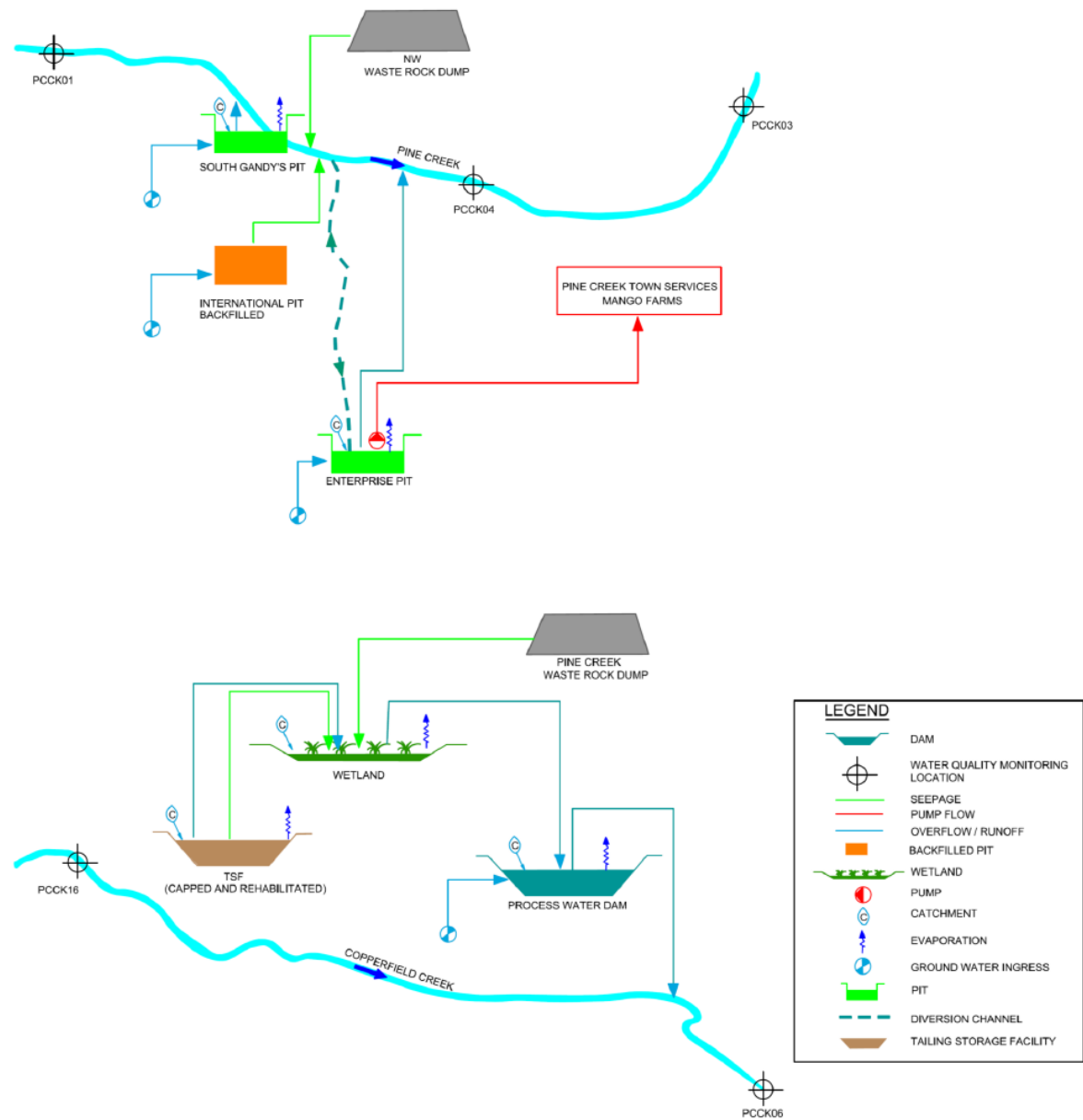


Figure 2 Conceptual Models Of PCPA Water Source

### 2.5.1 Contributing Factors to PCCK06 Water Quality

Pine Creek Process Water Dam (PCPWD) is the primary catchment in PCPA for low quality site waters which captures most of surface water runoff from the Tailing Storage Facility (TSF) and the main Waste Rock Dump (WRD). Water quality at PCCK06, downstream of PCPWD is influenced by the low water quality found in PCPWD whilst under active discharge conditions.

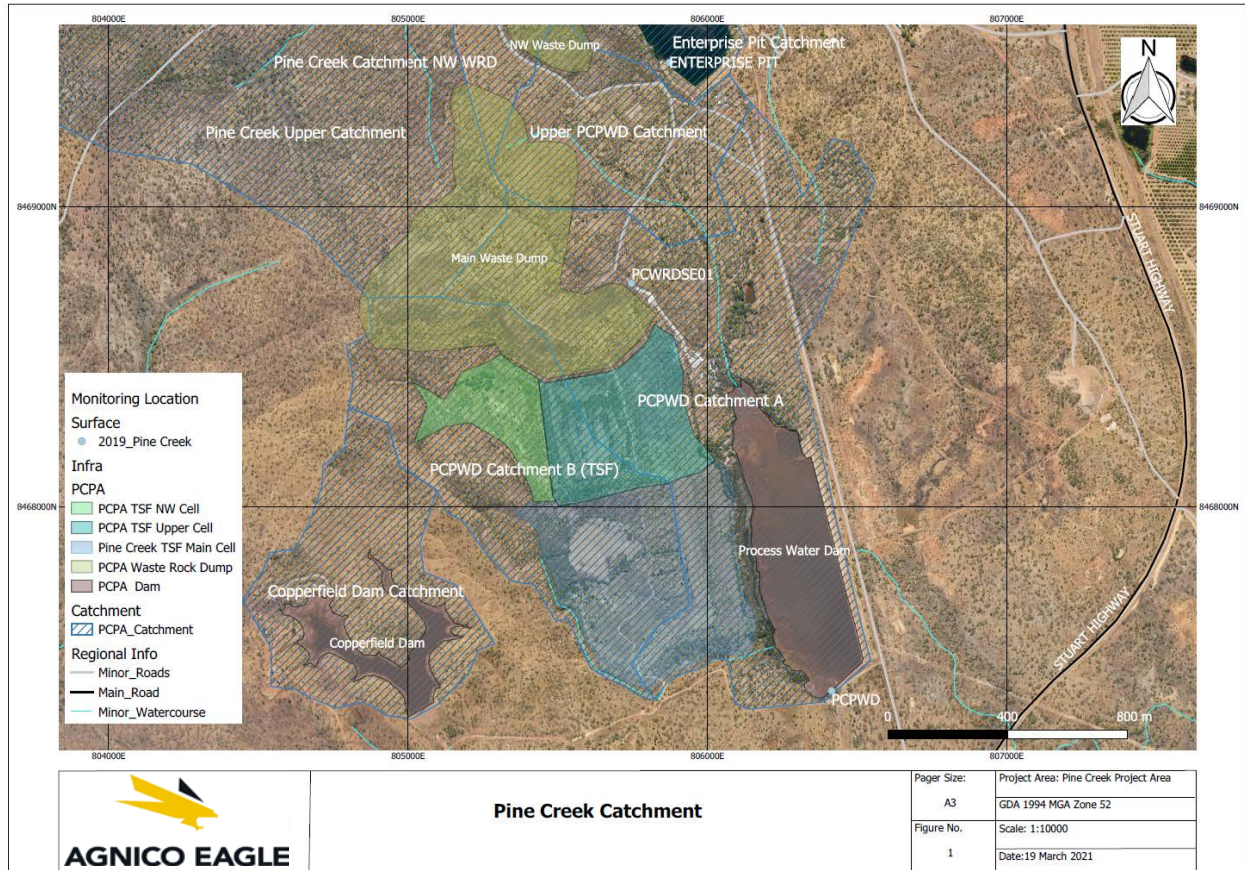


Figure 3 Process Water Dam Catchment

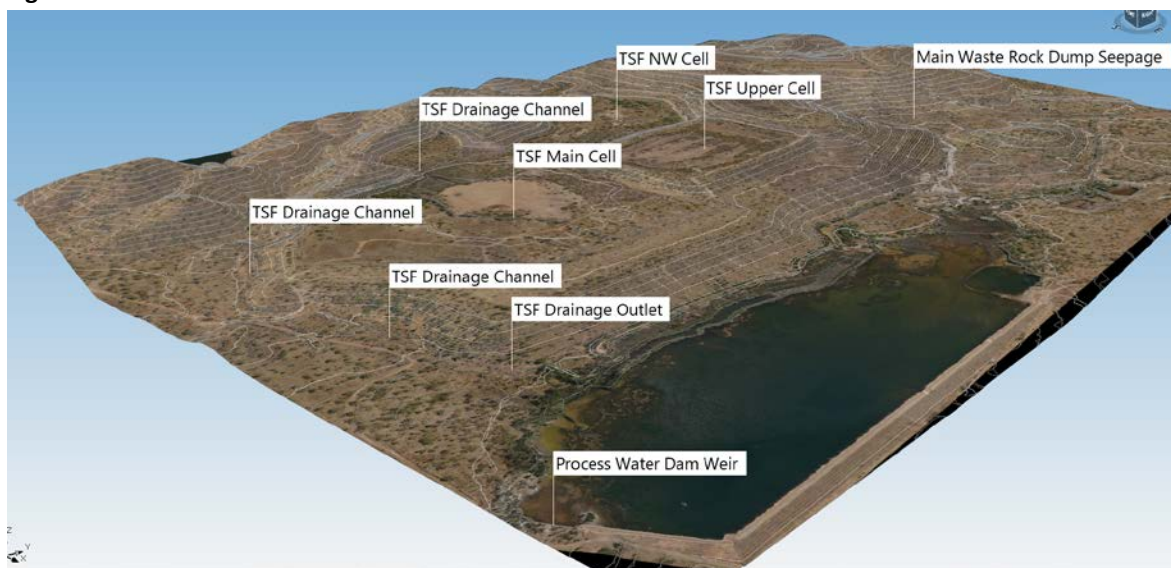


Figure 4 Process Water Source Location

## 2.6 Rainfall Data

A rain gauge is located at Union Reefs and is used to collect rainfall data for PCPA. During the current reporting period, maximum rainfall occurred during January 2024 and total rainfall recorded was 1713.2 mm (Table 4).

**Table 4 Pine Creek Rainfall**

| Month     | Total Rainfall (mm) |
|-----------|---------------------|
| November  | 56.4                |
| December  | 157.6               |
| January   | 681.6               |
| February  | 334                 |
| March     | 405.2               |
| April     | 1.2                 |
| May       | 0                   |
| June      | 0                   |
| July      | 0                   |
| August    | 0.2                 |
| September | 54.6                |
| October   | 26.6                |
|           | 1717.4              |

## 2.7 Discharge Regime

NTMO manages the discharge of mine wastewater following the company's standard operating procedure. Wastewater was discharged from the Process Water Dam through PCCK06 from January to March. The active discharge was based on the flow and electrical conductivity in PCCK06 and rainfall in the Pine Creek Catchment. This was measured by using a combination of data from weekly sampling and recorded pumping rates including overflow from PCPWD.

### 2.7.1 Volume of Water Discharged

Process Water Dam water is untreated water and relies on the clean water of PCCK16 to dilute its metal content. During the reporting period's wet season, NTMO discharged a total of 2614.88 ML from Process Water Dam into PCCK06. The discharge quality is measured at PCCK06, 100m downstream of the confluence of Copperfield Creek and PCPWD.

**Table 5 PCPWD Discharge Volumes to PCCK06**

| Month    | Total Discharge Volume (ML) | Average Discharge Flow Rate (L/S) |
|----------|-----------------------------|-----------------------------------|
| January  | 1235.78                     | 601.25                            |
| February | 568.50                      | 226.83                            |
| March    | 810.60                      | 302.61                            |
|          | 2,614.88                    | 1,130.69                          |

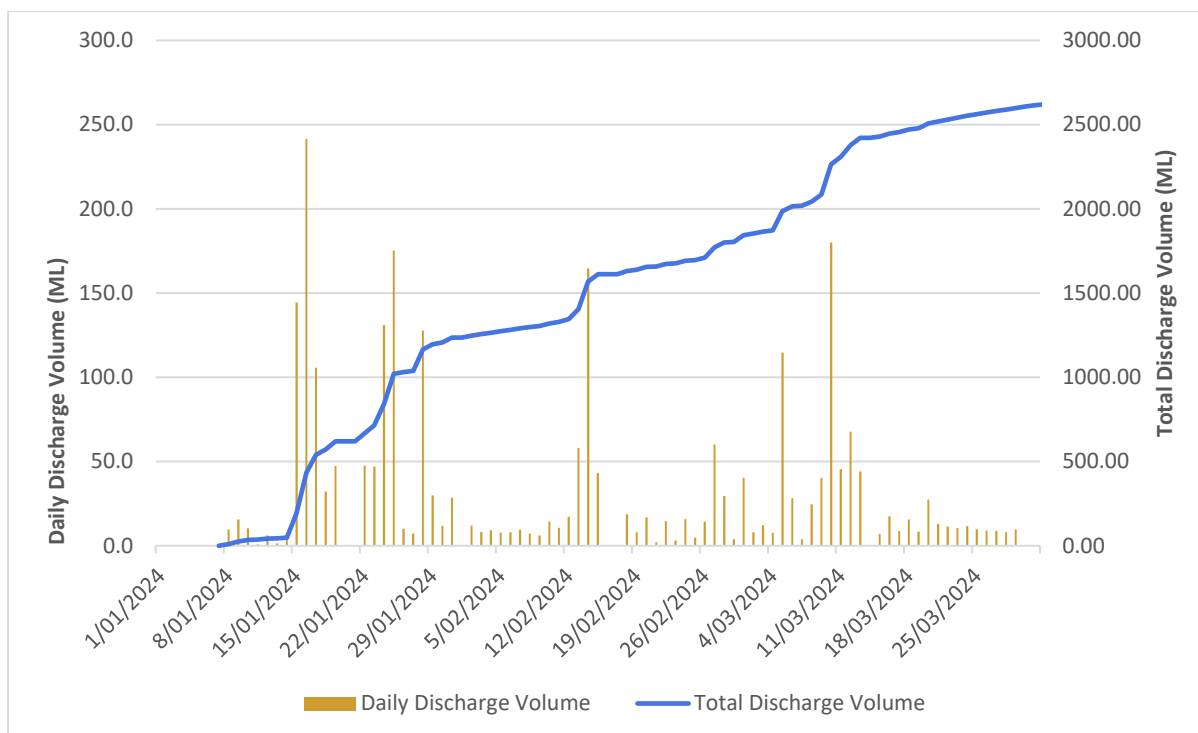


**Figure 5 PCPA All Water Discharge Events within Reporting Period**

## 2.7.2 Contaminant Loads

A tabulation of monthly and annual contaminant loads for PCPWD is shown in Table 6.

**Table 6 PCPWD Contaminant Loads**

| Analyte                              | Units | Month<br>January | February | March | Total |
|--------------------------------------|-------|------------------|----------|-------|-------|
| Dissolved Metals (Filtered, 0.45 µm) |       |                  |          |       |       |
| Aluminium                            | kg    | 0.29             | 0.13     | 0.85  | 1.26  |
| Arsenic (total)                      |       | 0.26             | 0.00     | 0.01  | 0.27  |
| Cadmium                              |       | 0.25             | 0.01     | 0.02  | 0.27  |
| Cobalt                               |       | 0.32             | 0.08     | 0.15  | 0.55  |
| Copper                               |       | 0.25             | 0.01     | 0.05  | 0.30  |
| Iron                                 |       | 0.25             | 0.01     | 0.07  | 0.34  |
| Lead                                 |       | 0.24             | 0.00     | 0.01  | 0.25  |
| Manganese                            |       | 5.73             | 2.87     | 4.12  | 12.72 |
| Nickel                               |       | 0.35             | 0.06     | 0.12  | 0.53  |
| Zinc                                 |       | 7.73             | 5.53     | 10.28 | 23.54 |
| Major Chemistry (unfiltered)         |       |                  |          |       |       |
| Total Suspended Solids               | kg    | 10.65            | 8.64     | 7.51  | 26.81 |

### 3 MONITORING METHOD

The monitoring method is detailed in Appendix B.

### 4 QA/QC EVALUATION

Results presented in this report have been reviewed for data completeness, accuracy and precision. NTMO staff follow the standard operating procedure ES-SOP01 that ensures that surface water sampling is conducted consistently throughout all operational areas with appropriate quality assurance and quality control (QA/QC). Surface water sampling will be sampled as per the AS/NZS 5667.1.1998 guideline.

The collection and dispatch process for all samples is conducted the same for every surface water sample. This includes the correct labelling of each bottle, including its contents, date, author and location of sample. Samples are kept in a monitored fridge which is set at 4°C, until dispatch which occurs approx. 1-3 days after collection. As samples are dispatched, they are kept in an esky with freezer blocks to obtain a cool environment. All sample results are taken by qualified environmental scientists and results are logged both digitally and manually, these records are kept on file. The calibration probe is calibrated every week before entering out into the field, for each new site visited the probe is recalibrated regardless of if it has already been completed for that week. The calibration results are set within the standards of solution containers, if the results are not met then the probe is recalculated until the results are within an acceptable range. The results captured are accordance to the standard set out by the WDL.

Where samples could not be collected due to sampling limitations for example access to a sample site after high rainfall, sampling was undertaken in the next possible opportunity by NTMO staff. Samples are consistently taken at same sample point as per WDL requirements and samples are dispatched to external accredited water analysis laboratory.

Envirolab Services undertakes the external water analysis. Envirolab Services has a large NATA scope of accreditation – Accreditation number 2901. NTMO receives a certificate of analysis for each set of samples and is reviewed against standards set out in the WDL TVs and uploaded to internal data software INX Inviron.

## 5 MONITORING RESULTS

Water quality results of these monitoring programs are used to understand the influence of treated mine water discharge from the project area to the receiving environment in the Copperfield Creek system.

Water quality results for the WDL166-07 monitoring sites are included in the tables and figures below. Water quality data has been separated by catchment and monitoring site. Trigger values have been assessed for each monitoring event at the compliance points and median exceedances have been highlighted. Using medians was chosen to avoid data outliers which would otherwise skew average values. All other data has been included for comparison purposes.

### 5.1 PCCK06

The results for PCCK06 are shown in Table 7. The maximum value for electrical conductivity was 656.0 µS/cm. The maximum turbidity value was 69 NTU. The minimum values recorded were 6 µg/L for cobalt and 550 µg/L for zinc. The median value for cadmium was 1.85 µg/L. The maximum values recorded were 6.1 µg/L for copper and 54 µg/L for nickel. The maximum total suspended solids was 50 mg/L.

**Table 7 PCCK06 Water Quality Results**

| Analyte                                   | Units    | PCCK06 TV            | Count | Minimum | Median | Maximum |
|-------------------------------------------|----------|----------------------|-------|---------|--------|---------|
| Environmental Field Data (In situ)        |          |                      |       |         |        |         |
| pH                                        | pH Units | 6.0-8.0 <sup>3</sup> | 12    | 6.0     | 6.4    | 6.6     |
| Electrical Conductivity                   | µS/cm    | 250 <sup>3</sup>     | 12    | 119.5   | 189.5  | 656.0   |
| Dissolved Oxygen                          | % sat.   | 57-120 <sup>4</sup>  | 12    | 71.7    | 87.3   | 108.4   |
| Turbidity                                 | NTU      | 15 <sup>3</sup>      | 12    | 4       | 10.5   | 69      |
| Metals and Metalloids (Filtered, 0.45 µm) |          |                      |       |         |        |         |
| Aluminium                                 | µg/L     | 150 <sup>4</sup>     | 12    | 5       | 15     | 40      |
| Arsenic (total)                           |          | 42 <sup>1</sup>      | 12    | 0.5     | 1      | 6       |
| Cadmium                                   |          | 0.4 <sup>1</sup>     | 12    | 0.3     | 1.85   | 3.4     |
| Cobalt                                    |          | 1.4 <sup>2</sup>     | 12    | 6       | 15.5   | 40      |
| Copper                                    |          | 1.8 <sup>1</sup>     | 12    | 0.5     | 1.75   | 6.1     |
| Iron                                      |          | 830 <sup>4</sup>     | 12    | 20      | 30     | 60      |
| Lead                                      |          | 9.4 <sup>1</sup>     | 12    | 0.5     | 0.5    | 0.5     |
| Manganese                                 |          | 3600 <sup>1</sup>    | 12    | 340     | 580    | 2300    |
| Nickel                                    |          | 17 <sup>1</sup>      | 12    | 8       | 15.5   | 54      |
| Zinc                                      |          | 31 <sup>1</sup>      | 12    | 550     | 1350   | 3500    |
| Major Chemistry (Unfiltered)              |          |                      |       |         |        |         |
| Total suspended solids                    | mg/L     | 20                   | 12    | 5       | 11.5   | 50      |

<sup>1</sup> ANZG (2018) 90% species protection, freshwater.

<sup>2</sup> ANZG (2018) interim trigger value.

<sup>3</sup> ANZECC (2000) default trigger values for slightly disturbed ecosystems in lowland rivers within tropical Australia.

<sup>4</sup> 80th percentile of background data for surface water at PCCK16.

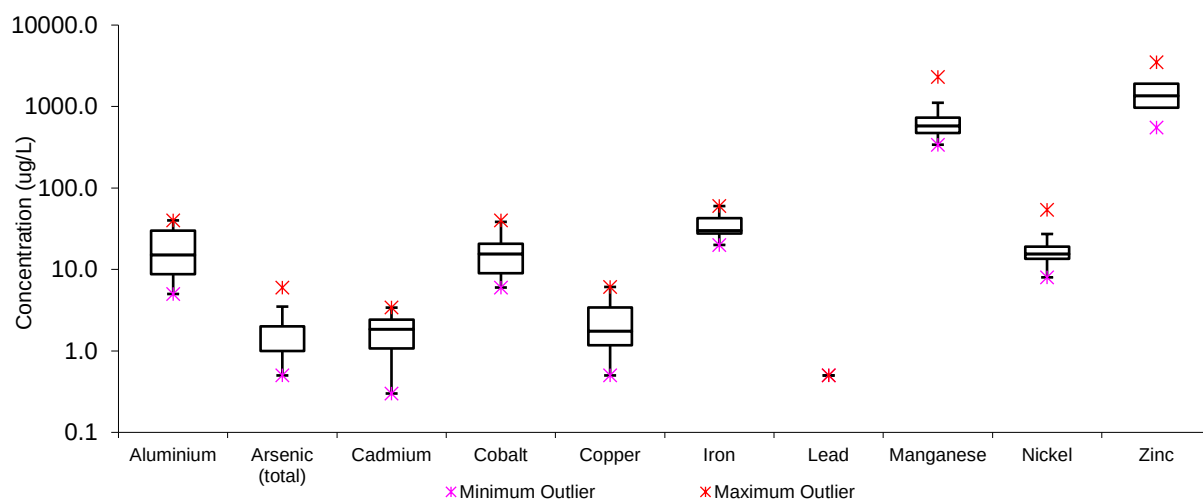


**Figure 6 PCCK06 Metals and Metalloids**

### 5.1.1 Water Quality Long Term Trend

The long-term water quality for PCCK06, based on median values from 2018-19 to 2023-24 reporting periods, are summarised in Table 8. The median turbidity results were 19.5 NTU for 2019/20, 18.0 NTU for 2021/22, and 10.5 NTU for 2023/24. The median concentrations of cadmium and cobalt were 0.8 µg/L and 10.0 µg/L, respectively, in 2020-21. During the 2023-24 period, these values increased to 1.85 µg/L for cadmium and 15.5 µg/L for cobalt. The median zinc concentrations were as follows: 36 µg/L in 2018/19, 50 µg/L in 2019/20, 750 µg/L in 2020/21, 31 µg/L in 2021/22, 165.0 µg/L in 2022/23, and 1350 µg/L in 2023/24.

**Table 8 PCCK06 Median Water Quality Comparison (2018 to 2024)**

| Analyte                                   | Units    | TV                   | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 |
|-------------------------------------------|----------|----------------------|---------|---------|---------|---------|---------|---------|
| Environmental Field Data (In situ)        |          |                      |         |         |         |         |         |         |
| pH                                        | pH Units | 6.0-8.0 <sup>3</sup> | 6.5     | 6.6     | 6.6     | 6.4     | 7.2     | 6.4     |
| Electrical Conductivity                   | µS/cm    | 250 <sup>3</sup>     | 62.7    | 63.9    | 131.7   | 46.7    | 191.7   | 189.5   |
| Dissolved Oxygen                          | % sat.   | 57-120 <sup>4</sup>  | 69.8    | 73.0    | 74.9    | 78.4    | 98.3    | 87.3    |
| Turbidity                                 | NTU      | 15 <sup>3</sup>      | 9.9     | 19.5    | 11.0    | 18.0    | 13.0    | 10.5    |
| Metals and Metalloids (Filtered, 0.45 µm) |          |                      |         |         |         |         |         |         |
| Aluminium                                 | µg/L     | 150 <sup>4</sup>     | 10.0    | 30.0    | 10.0    | 50.0    | 10.0    | 15      |
| Arsenic (total)                           |          | 42 <sup>1</sup>      | 2.0     | 2.0     | 2.0     | 1.5     | 2.0     | 1       |
| Cadmium                                   |          | 0.4 <sup>1</sup>     | 0.05    | 0.05    | 0.80    | 0.05    | 0.1     | 1.85    |
| Cobalt                                    |          | 1.4 <sup>2</sup>     | 0.5     | 0.5     | 10.0    | 0.5     | 1.5     | 15.5    |
| Copper                                    |          | 1.8 <sup>1</sup>     | 0.5     | 0.5     | 1.0     | 0.5     | 0.5     | 1.75    |
| Iron                                      |          | 830 <sup>4</sup>     | 250     | 290     | 54      | 280     | 60.0    | 30      |
| Lead                                      |          | 9.4 <sup>1</sup>     | 0.5     | 0.5     | 0.0     | 0.5     | 0.5     | 0.5     |
| Manganese                                 |          | 3600 <sup>1</sup>    | 44.5    | 30.5    | 770.0   | 28.5    | 99.0    | 580     |
| Nickel                                    |          | 17 <sup>1</sup>      | 0.5     | 0.8     | 11.0    | 0.5     | 3.0     | 15.5    |
| Zinc                                      |          | 31 <sup>1</sup>      | 36      | 50      | 750     | 31      | 165.0   | 1350    |
| Major Chemistry (Unfiltered)              |          |                      |         |         |         |         |         |         |
| Total suspended solids                    | mg/L     | 20 <sup>3</sup>      | 5.0     | 7.5     | 0.0     | 12.5    | 8.0     | 11.5    |

<sup>1</sup> ANZG (2018) 90% species protection, freshwater.

<sup>2</sup> ANZG (2018) interim trigger value.

<sup>3</sup> ANZECC (2000) default trigger values for slightly disturbed ecosystems in lowland rivers within tropical Australia.

<sup>4</sup> 80th percentile of background data for surface water at PCCK16.

### 5.1.2 Exceedances

There was a total of 36 exceedance events for PCCK06 as displayed in Table 9. During the 2024 reporting period Cobalt, Copper, Cadmium, Zinc and Turbidity exceeded their respective trigger values at PCCK06 under WDL166-07.

**Table 9 PCCK06 Exceedances**

|               |               | Cadmium | Cobalt | Copper | Zinc | Turbidity |
|---------------|---------------|---------|--------|--------|------|-----------|
| Trigger Value |               | 0.4     | 1.4    | 1.8    | 31   |           |
| Units         |               | µg/L    |        |        |      | NTU       |
| Date Sampled  | Date notified |         |        |        |      |           |
| 08/01/2024    | 16/01/2024    | -       | 18     | -      | 3500 | -         |
| 15/01/2024    | 24/01/2024    | -       | 6      | -      | 550  | 69        |
| 22/01/2024    | 01/02/2024    | -       | 9      | -      | 970  | -         |
| 29/01/2024    | 05/02/2024    | -       | 7      | -      | 580  | -         |
| 06/02/2024    | 14/02/2024    | -       | 9      | -      | 1100 | -         |
| 12/02/2024    | 20/02/2024    | 1.9     | 20     | -      | 1800 | -         |
| 19/02/2024    | 28/02/2024    | 1.8     | 23     | -      | 1400 | -         |
| 27/02/2024    | 08/03/2024    | 1.3     | 13     | -      | 960  | -         |
| 05/03/2024    | 13/03/2024    | 3.4     | 40     | 6.1    | 2200 | -         |
| 11/03/2024    | 19/03/2024    | 2.7     | 23     | 4.9    | 1900 | -         |
| 18/03/2024    | 04/04/2024    | 2.4     | 16     | 4.0    | 1400 | -         |
| 26/03/2024    | 04/04/2024    | 2.2     | 15     | 3.2    | 1300 | -         |
| Total         |               | 7       | 12     | 4      | 12   | 1         |

### 5.2 PCCK16

The results for PCCK16, presented in Table 10, showed maximum turbidity was 49 NTU and dissolved oxygen reached a maximum saturation of 129.1%. Note: Only 11 samples were taken for DO% due to a probe error, which resulted in negative DO% readings.

**Table 10 PCCK16 Water Quality Results**

| Analyte                                   | Units    | PCCK06 TV            | Count | Minimum | Median | Maximum |
|-------------------------------------------|----------|----------------------|-------|---------|--------|---------|
| Environmental Field Data (In situ)        |          |                      |       |         |        |         |
| pH                                        | pH Units | 6.0-8.0 <sup>3</sup> | 12    | 6.3     | 6.5    | 7.1     |
| Electrical Conductivity                   | µS/cm    | 250 <sup>3</sup>     | 12    | 19.1    | 30.75  | 50.2    |
| Dissolved Oxygen                          | % sat.   | 57-120 <sup>4</sup>  | 11    | 65.6    | 89.6   | 129.1   |
| Turbidity                                 | NTU      | 15 <sup>3</sup>      | 12    | 4.3     | 13     | 49      |
| Metals and Metalloids (Filtered, 0.45 µm) |          |                      |       |         |        |         |
| Aluminium                                 | µg/L     | 150 <sup>4</sup>     | 12    | 5       | 30     | 120     |
| Arsenic (total)                           |          | 42 <sup>1</sup>      | 12    | 0.5     | 0.5    | 1       |
| Cadmium                                   |          | 0.4 <sup>1</sup>     | 12    | 0.05    | 0.05   | 0.05    |
| Cobalt                                    |          | 1.4 <sup>2</sup>     | 12    | 0.5     | 0.5    | 0.5     |
| Copper                                    |          | 1.8 <sup>1</sup>     | 12    | 0.5     | 0.5    | 0.5     |
| Iron                                      |          | 830 <sup>4</sup>     | 12    | 90      | 160    | 420     |
| Lead                                      |          | 9.4 <sup>1</sup>     | 12    | 0.5     | 0.5    | 0.5     |
| Manganese                                 |          | 3600 <sup>1</sup>    | 12    | 2.5     | 7.5    | 15      |
| Nickel                                    |          | 17 <sup>1</sup>      | 12    | 0.5     | 0.5    | 1       |
| Zinc                                      |          | 31 <sup>1</sup>      | 12    | 0.5     | 3.5    | 21      |
| Major Chemistry (Unfiltered)              |          |                      |       |         |        |         |
| Total suspended solids                    | mg/L     | 20                   | 12    | 5       | 5      | 50      |

| Analyte                                                                                                                          | Units | PCCK06 TV | Count | Minimum | Median | Maximum |
|----------------------------------------------------------------------------------------------------------------------------------|-------|-----------|-------|---------|--------|---------|
| <sup>1</sup> ANZG (2018) 90% species protection, freshwater.                                                                     |       |           |       |         |        |         |
| <sup>2</sup> ANZG (2018) interim trigger value.                                                                                  |       |           |       |         |        |         |
| <sup>3</sup> ANZECC (2000) default trigger values for slightly disturbed ecosystems in lowland rivers within tropical Australia. |       |           |       |         |        |         |
| <sup>4</sup> 80th percentile of background data for surface water at PCCK16.                                                     |       |           |       |         |        |         |

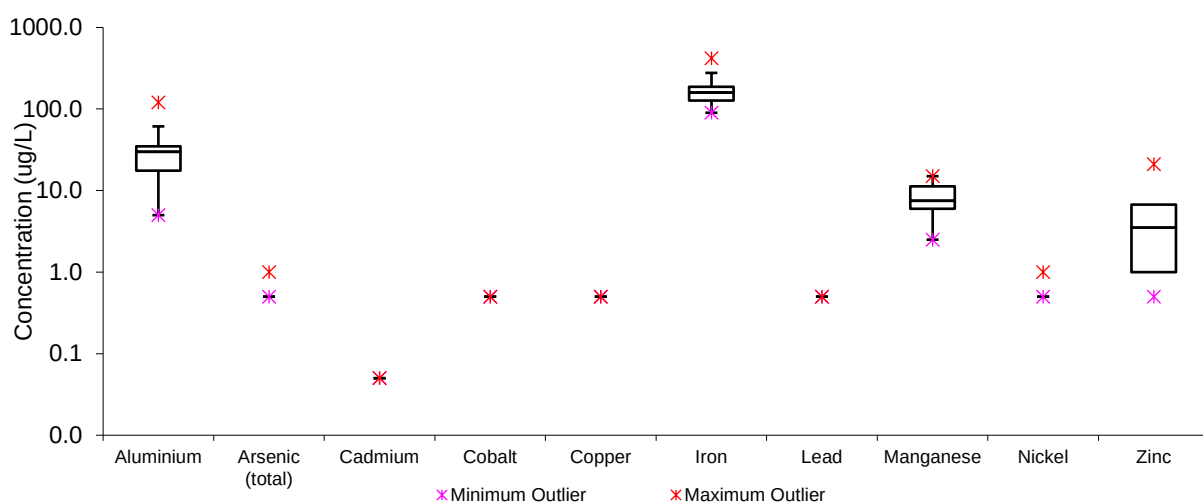


Figure 7 PCCK16 Metals and Metalloids

### 5.3 PCCK22

The results for PCCK22, presented in Table 11 indicate the median turbidity was 34 NTU. The total suspended solids had a median value of 40 mg/L. Note: Only 11 samples for all analytes taken due to road being flooded, restricting access to monitoring location.

Table 11 PCCK22 Water Quality Results

| Analyte                                   | Units    | PCCK06 TV            | Count | Minimum | Median | Maximum |
|-------------------------------------------|----------|----------------------|-------|---------|--------|---------|
| Environmental Field Data (In situ)        |          |                      |       |         |        |         |
| pH                                        | pH Units | 6.0-8.0 <sup>3</sup> | 11    | 6.3     | 6.7    | 7.1     |
| Electrical Conductivity                   | µS/cm    | 250 <sup>3</sup>     | 11    | 19.27   | 34.4   | 49.7    |
| Dissolved Oxygen                          | % sat.   | 57-120 <sup>4</sup>  | 11    | 68      | 93.2   | 96.8    |
| Turbidity                                 | NTU      | 15 <sup>3</sup>      | 11    | 8.1     | 34     | 92      |
| Metals and Metalloids (Filtered, 0.45 µm) |          |                      |       |         |        |         |
| Aluminium                                 | µg/L     | 150 <sup>4</sup>     | 11    | 20      | 30     | 230     |
| Arsenic (total)                           |          | 42 <sup>1</sup>      | 11    | 0.5     | 0.5    | 3       |
| Cadmium                                   |          | 0.4 <sup>1</sup>     | 11    | 0.05    | 0.05   | 0.05    |
| Cobalt                                    |          | 1.4 <sup>2</sup>     | 11    | 0.5     | 0.5    | 0.5     |
| Copper                                    |          | 1.8 <sup>1</sup>     | 11    | 0.5     | 0.5    | 1.3     |
| Iron                                      |          | 830 <sup>4</sup>     | 11    | 40      | 100    | 200     |
| Lead                                      |          | 9.4 <sup>1</sup>     | 11    | 0.5     | 0.5    | 0.5     |
| Manganese                                 |          | 3600 <sup>1</sup>    | 11    | 2.5     | 15     | 25      |
| Nickel                                    |          | 17 <sup>1</sup>      | 11    | 0.5     | 0.5    | 1       |
| Zinc                                      |          | 31 <sup>1</sup>      | 11    | 9       | 21     | 61      |
| Major Chemistry (Unfiltered)              |          |                      |       |         |        |         |
| Total suspended solids                    | mg/L     | 20                   | 11    | 5       | 40     | 110     |

| Analyte                                                                                                                          | Units | PCCK06 TV | Count | Minimum | Median | Maximum |
|----------------------------------------------------------------------------------------------------------------------------------|-------|-----------|-------|---------|--------|---------|
| <sup>1</sup> ANZG (2018) 90% species protection, freshwater.                                                                     |       |           |       |         |        |         |
| <sup>2</sup> ANZG (2018) interim trigger value.                                                                                  |       |           |       |         |        |         |
| <sup>3</sup> ANZECC (2000) default trigger values for slightly disturbed ecosystems in lowland rivers within tropical Australia. |       |           |       |         |        |         |
| <sup>4</sup> 80th percentile of background data for surface water at PCCK16.                                                     |       |           |       |         |        |         |

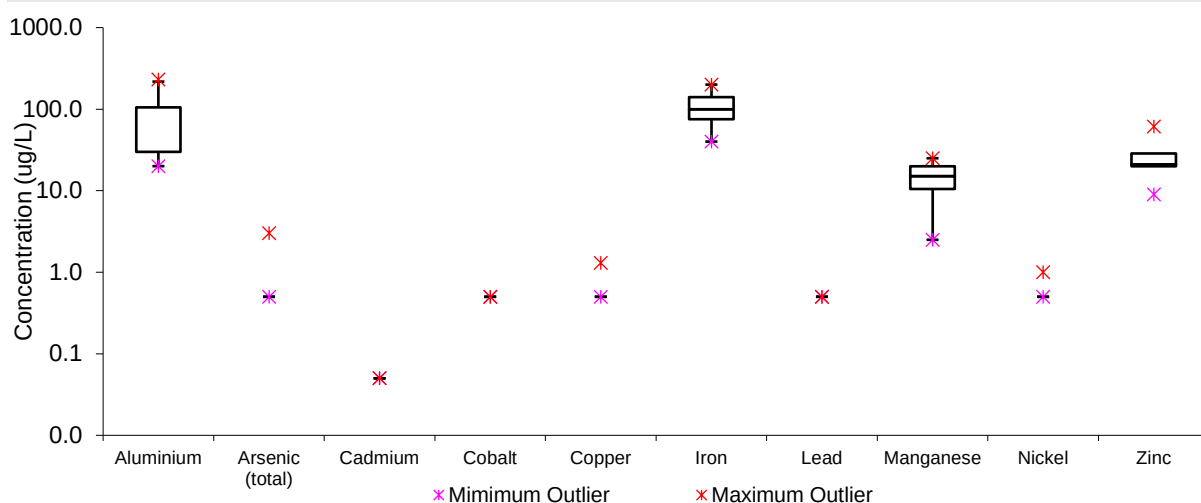


Figure 8 PCCK22 Metals and Metalloids

## 5.4 PCPWD

Table 12 presents the results for PCPWD during the discharge period. The minimum pH was 4.29 pH units. The minimum electrical conductivity was 396.1  $\mu\text{S}/\text{cm}$ . The minimum dissolved oxygen was 15.7 %. Turbidity maximum was 32 NTU. The minimum recorded values were 4.5  $\mu\text{g}/\text{L}$  for cadmium, 58  $\mu\text{g}/\text{L}$  for cobalt, 4100  $\mu\text{g}/\text{L}$  for manganese, 92  $\mu\text{g}/\text{L}$  for nickel, and 7100  $\mu\text{g}/\text{L}$  for zinc. The median metal concentrations that exceeded the PCCK06 values were 195  $\mu\text{g}/\text{L}$  for aluminium and 18  $\mu\text{g}/\text{L}$  for copper. The maximum recorded value for lead was 23  $\mu\text{g}/\text{L}$ . Total suspended solids maximum value was 24 mg/L.

Table 12 PCPWD Water Quality Results

| Analyte                                   | Units    | PCCK06 TV            | Count | Minimum | Median | Maximum |
|-------------------------------------------|----------|----------------------|-------|---------|--------|---------|
| Environmental Field Data (In situ)        |          |                      |       |         |        |         |
| pH                                        | pH Units | 6.0-8.0 <sup>3</sup> | 12    | 4.29    | 5.725  | 6.42    |
| Electrical Conductivity                   | µS/cm    | 250 <sup>3</sup>     | 12    | 396.1   | 990    | 2354    |
| Dissolved Oxygen                          | % sat.   | 57-120 <sup>4</sup>  | 12    | 67.2    | 98.95  | 113.9   |
| Turbidity                                 | NTU      | 15 <sup>3</sup>      | 12    | 0.3     | 3.4    | 32      |
| Metals and Metalloids (Filtered, 0.45 µm) |          |                      |       |         |        |         |
| Aluminium                                 | µg/L     | 150 <sup>4</sup>     | 12    | 20      | 195    | 2900    |
| Arsenic (total)                           |          | 42 <sup>1</sup>      | 12    | 5       | 8.5    | 25      |
| Cadmium                                   |          | 0.4 <sup>1</sup>     | 12    | 4.8     | 11     | 36      |
| Cobalt                                    |          | 1.4 <sup>2</sup>     | 12    | 58      | 135    | 280     |
| Copper                                    |          | 1.8 <sup>1</sup>     | 12    | 1.3     | 18     | 110     |
| Iron                                      |          | 830 <sup>4</sup>     | 12    | 5       | 25     | 140     |
| Lead                                      |          | 9.4 <sup>1</sup>     | 12    | 0.5     | 4      | 23      |
| Manganese                                 |          | 3600 <sup>1</sup>    | 12    | 4100    | 5050   | 8600    |
| Nickel                                    |          | 17 <sup>1</sup>      | 12    | 92      | 125    | 230     |
| Zinc                                      |          | 31 <sup>1</sup>      | 12    | 7100    | 9350   | 25000   |
| Major Chemistry (Unfiltered)              |          |                      |       |         |        |         |
| Total suspended solids                    | mg/L     | 20                   | 12    | 5       | 5      | 24      |

| Analyte                                                                                                                          | Units | PCCK06 TV | Count | Minimum | Median | Maximum |
|----------------------------------------------------------------------------------------------------------------------------------|-------|-----------|-------|---------|--------|---------|
| <sup>1</sup> ANZG (2018) 90% species protection, freshwater.                                                                     |       |           |       |         |        |         |
| <sup>2</sup> ANZG (2018) interim trigger value.                                                                                  |       |           |       |         |        |         |
| <sup>3</sup> ANZECC (2000) default trigger values for slightly disturbed ecosystems in lowland rivers within tropical Australia. |       |           |       |         |        |         |
| <sup>4</sup> 80th percentile of background data for surface water at PCCK16.                                                     |       |           |       |         |        |         |

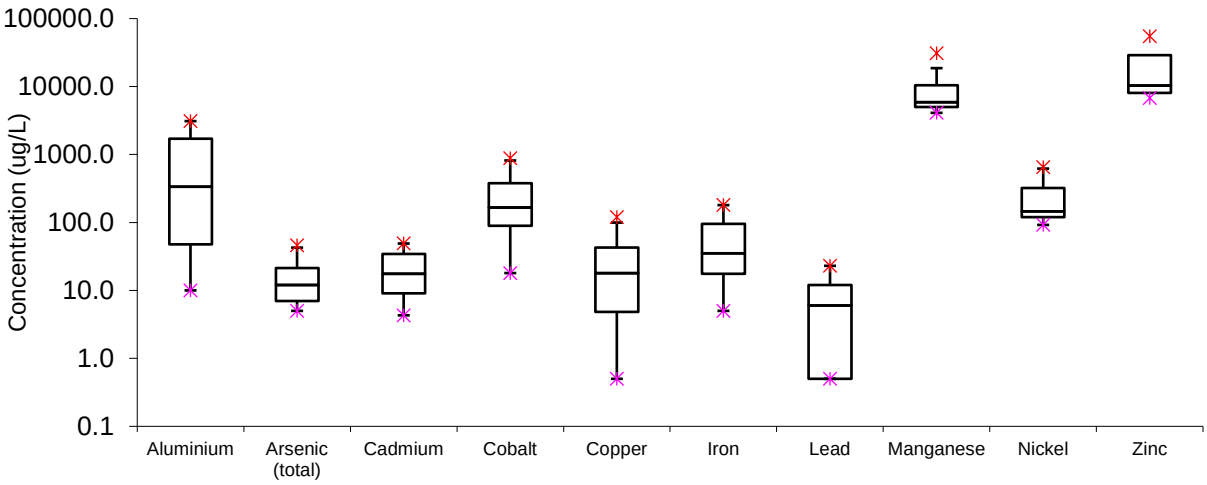


Figure 9 PCPWD Metals and Metalloids

## 5.5 Turbidity

Results for turbidity at Copperfield Creek are shown in Figure 10. PCCK06 turbidity levels consistently stayed below 20 NTU, except for an outlier on January 15. PCCK16 showed some variability, with the highest turbidity also occurring on January 15. PCCK22 exhibited high variability, with turbidity reaching up to 92 NTU.

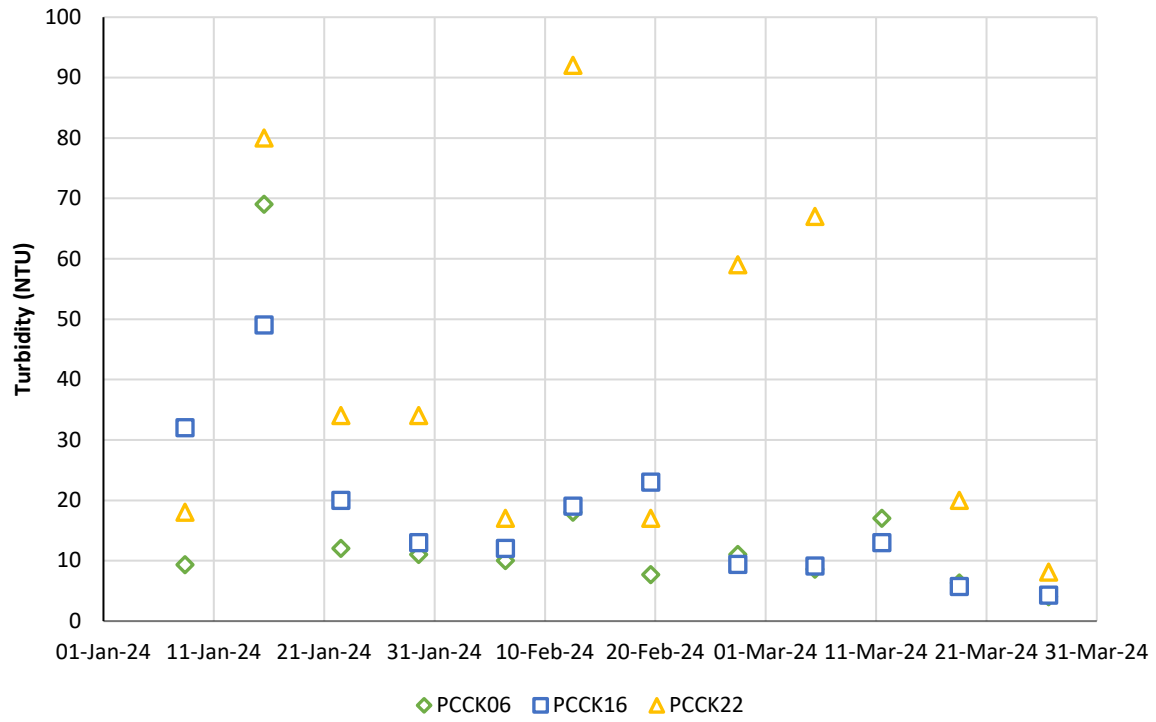


Figure 10 Copperfield Creek Turbidity results

## 5.6 Electrical Conductivity and pH

Figure 11 highlights the pH for PCCK06, PCCK16 and PCCK22 was consistently between 6 and 8 pH units. Figure 12 outlines the results captured for EC across all creek catchments over the reporting period. PCCK06 showed the greatest variability, with most samples ranging from 100 to 300  $\mu\text{S}/\text{cm}$ . The highest electrical conductivity (656  $\mu\text{S}/\text{cm}$ ) was recorded on January 8. PCCK16 and PCCK22 maintain a steady EC level below 100  $\mu\text{S}/\text{cm}$  throughout the wet season.

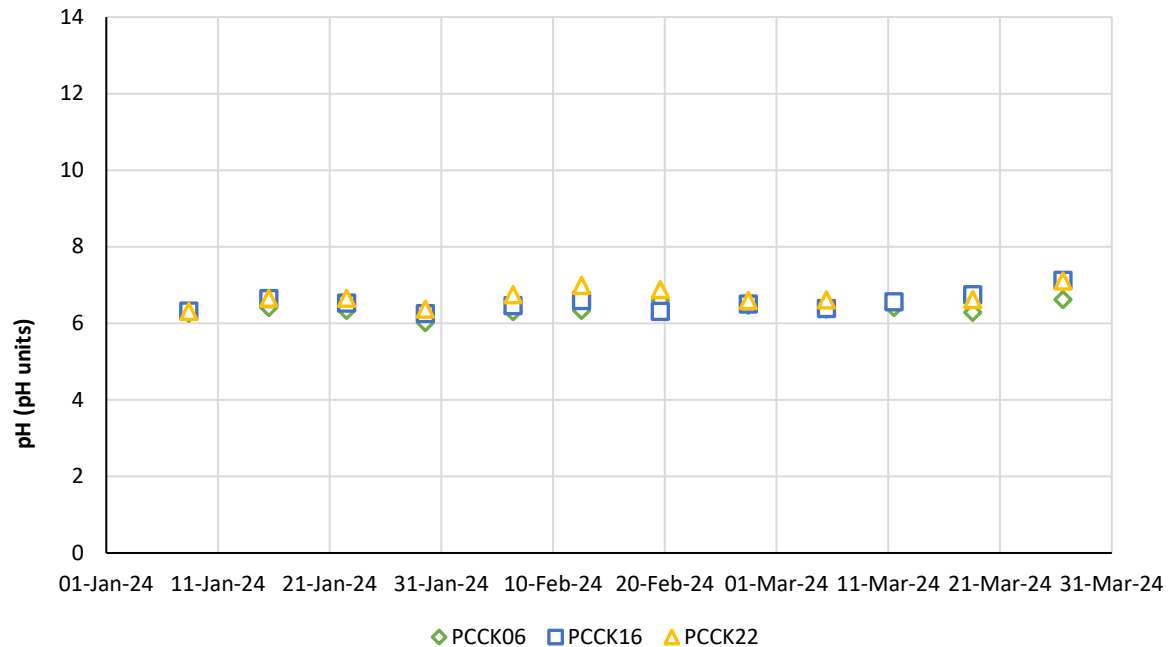


Figure 11 Copperfield Creek pH results

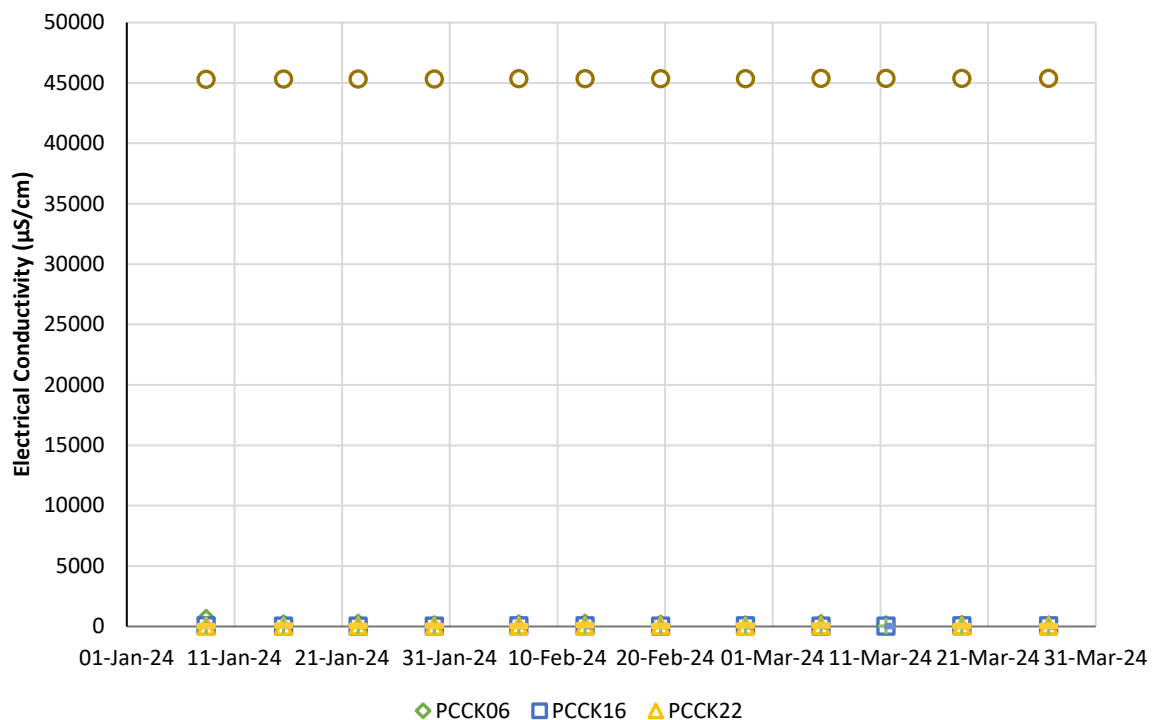


Figure 12 Copperfield Creek Electrical Conductivity Results

## 5.7 Ecotoxicological Results

The ecotoxicological report found in appendix C, detailed the results of toxicity at site PCCK06 and PCCK16 for 2024. The report highlighted that the Cladoceran reproduction and survival was 0% for PCCK06 in the PCCK06 during PCPWD discharge. The results for PCCK16 showed Cladoceran reproduction and survival was 102% and 90%, respectively. The water chemistry data for PCCK06 revealed elevated levels of cadmium, cobalt, and zinc, showing exceedance of the site's SSTVs. The acute toxicity in the PCCK06 sample is primarily attributed to the high zinc concentration. This high zinc level is directly linked to the PCPWD discharge. Key Results are noted below.

### Screening cladoceran bioassay for PCCK06 and PCCK16:

#### **PCCK06**

- EC: 120 µS/cm → Cladoceran Reproduction: 0% = Survival: 0%

#### **PCCK16**

- EC: 102 µS/cm → Cladoceran Reproduction: 102% = Survival: 90%

### Screening bioassays Toxic units (TU) for PCCK06 metals:

- Cadmium: 1.3 µg/L (TU = 3.3)
- Cobalt: 13 µg/L (TU = 9.3)
- Zinc: 960 µg/L (TU = 64)

### Dilution series bioassays for the PCPWD using PCCK16 diluent water:

- 100% mortality was observed in 1.6% PCPWD water.
- 0% reproduction was observed in 1.6% PCPWD water.
- The EC50 for both bioassays was 0.9%.

### Estimated Toxic Units (TU) in PCPWD at 0.9% Dilution for Cladoceran Survival at PCPWD:

- Cadmium: 17 µg/L (TU = 0.38)
- Cobalt: 190 µg/L (TU = 1.2)
- Copper: 40 µg/L (TU = 0.20)
- Nickel: 140 µg/L (TU = 0.09)
- Zinc: 9,700 µg/L (TU = 5.8)

## 5.8 Macroinvertebrate and Sediment Results

The macroinvertebrate and sediment report found in appendix D, detailed results for Copperfield Creek catchment (PCCK06, PCCK16 and PCCK22).

The sediment quality analysis showed:

### **Metal Concentrations:**

- No exceedances of SQGVs were found in Copperfield Creek, though acid-extractible zinc at PCCK06 approached the SQGV and showed a significant increase from 2023.
- Zinc concentrations decreased to below detection levels downstream at PCCK22.

### **Total Organic Carbon (TOC):**

- TOC proportions were variable but generally low, unlikely to affect metal bioavailability in sediments.

Macroinvertebrate data showed:

### **Relative Abundance:**

- Highest relative abundances were observed at sites furthest downstream.
- No significant differences were found between sites.

### **Family Taxa Richness:**

- Highest at PCCK06, with variable results on Pine Creek.
- Most samples on Copperfield Creek had less diversity than the long-term median.

### **Genus Taxa Richness:**

- Higher at PCCK22 compared to PCCK16, showing significant differences between site types on Copperfield Creek.

### **PET Richness:**

- In Copperfield Creek, PET richness decreased downstream, showing significant differences between site types.

### **SIGNAL-2 Scores:**

- High similarity in SIGNAL-2 scores across sites.

## 6 DISCUSSION

### 6.1 Copperfield Creek

The results for water quality at WDL166-07 monitoring points showed that PCCK06's electrical conductivity and total dissolved solids did not exceed the trigger value as defined in Item 10. Turbidity levels exceeded on one occasion for PCCK06. However, this exceedance was not attributed to discharge influences (PCPWD), as supported by the concurrent turbidity exceedance at PCCK16, which suggests that external factors, rather than the authorised discharge, were responsible for the elevated turbidity levels on that day. The long-term results for water quality at WDL166-07 monitoring sites showed significant increases in the median concentrations of cadmium, cobalt, and zinc. These increases are concerning as they exceed the respective trigger values, indicating potential environmental and health risks. While the analysis provides valuable insights, it is based on median values, which may not capture all variations and extremes in water quality.

The high discharge rates from PCPWD, combined with the elevated concentrations of metals recorded during the discharge period, provide strong evidence that the discharge contributed to the observed exceedances in cadmium, cobalt, copper, and zinc concentrations in PCCK06.

### 6.2 Ecotoxicology

The results from the 2023/24 ecotoxicology screening bioassay and the dilution series bioassays highlight significant toxicity issues, primarily driven by elevated zinc levels. The PCCK06 sample was taken during PCPWD discharge showed severe acute and chronic toxicity, with zinc being the major contributor. This is consistent with historical data, which also linked toxicity to elevated zinc concentrations. The 2022/23 PCCK06 sample showed no acute toxicity (100% survival), but chronic toxicity was observed, with a 48% reduction in reproduction. This chronic toxicity was likely related to a zinc concentration of 43 µg/L (TU = 2.8), although PCPWD was not discharging at the time of this sample been taken. These results highlight the need for monitoring and management of zinc levels in the PCPWD discharge to try mitigating the toxic effects been shown in the ecotoxicology testing. NTMO will address these elevated metal concentrations for the 2024/25 wet season as for ensuring the safety and health of the Copperfield Creek aquatic ecosystem as detailed in the performance improvement plan.

### 6.3 Macroinvertebrates and Sediment

In Copperfield Creek, elevated metal concentrations were found in sediments at PCCK06 compared to the upstream site, PCCK16. Despite these elevated values, there were no exceedances of guideline values, and water was pH neutral at all sites. Zinc concentrations at PCCK06 were the highest recorded to date, with historical data suggesting a trend towards ecotoxic levels. Further downstream at PCCK22, metal concentrations had decreased to levels similar to the upstream site, indicating recovery and sediment dilution over the 22 km from the PCPA boundary.

The analysis of macroinvertebrate health metrics and community composition in Copperfield Creek suggests that increased sediment metal concentrations are not significantly impacting aquatic ecosystems. The macroinvertebrate community in Copperfield Creek showed variable results, leading to significant differences between metrics upstream and downstream. However, these differences were not always due to decreases in health metrics downstream. For instance, genus-level taxa richness was higher downstream, while fewer PET taxa were found downstream. A significant difference in community composition was observed between site types on Copperfield Creek. This was primarily due to the variability in the presence or absence of certain genera at upstream or downstream sites. The greatest similarity was found between samples at each site, indicating that habitat characteristics are likely stronger drivers of community composition than discharges

from the PCPA. The similarity between the sampled communities at PCCK16 and PCCK06 further confirms that changes in sediment quality are not impacting aquatic ecosystems. This suggests that habitat characteristics play a more crucial role in shaping the macroinvertebrate community. The lower macroinvertebrate metric results at PCCK22 represent the first pronounced drop from median values observed at this site. Although this result appears anomalous, it highlights the need for continued monitoring to track future results and health trends at the site. Overall, while there are some variations in macroinvertebrate metrics and community composition, the data indicates that habitat characteristics are the primary drivers of community composition, rather than sediment metal concentrations. Continued monitoring is essential to ensure the health of aquatic ecosystems and to detect any potential long-term impacts.

## 7 CONCLUSION AND RECOMMENDATIONS

The ecotoxicity report showed acute and chronic toxicity at PCCK06 related to the cadmium, cobalt and zinc concentrations, with the majority of the toxicity due to the zinc concentration of the water discharged from PCPWD. Recommendations for the 2024/25 reporting period are to maintain the current program and interpret 2024 with macroinvertebrate data once available.

The macroinvertebrate and sediment report concluded that monitoring of Copperfield Creek showed elevated metal concentrations in sediments at PCCK06, but these levels did not exceed guidelines. Zinc levels at PCCK06 were high, nearing ecotoxic levels, but decreased downstream at PCCK22, indicating recovery over 22 km. Macroinvertebrate analysis suggests that habitat characteristics, rather than sediment metal concentrations, primarily influence community composition. The similarity between upstream and downstream communities supports this. Anomalous lower macroinvertebrate metrics at PCCK22 highlight the need for ongoing monitoring to track health trends and ensure ecosystem health. Overall, habitat characteristics are the main drivers of community composition, with sediment metal concentrations playing a lesser role. Continued monitoring is essential to detect any long-term impacts.

Detailed in the performance improvement report (appendix E), the water treatment for PCPWD aims to improve the water quality, reducing the exceedances at PCCK06 for the 2024-25 reporting period. Additional measures include cleaning the spillway to prevent erosion, installing a sluice gate to regulate water flow and control metal concentrations, reconstructing the low flow channel to manage surface water, and decommissioning the Coffey Dam to ensure consistent water flow. These efforts are complemented by the installation of WDL signage to aid in site identification and monitoring. Collectively, these initiatives aim to enhance water management practices, ensure regulatory compliance, and protect the surrounding environment.

## 8 REFERENCES

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Northern Territory Environment Protection Authority (NT EPA). (2016). Guideline for Reporting on Environmental Monitoring. Version 1.0.

Simpson, S. and Batley, G. (2016). Sediment quality assessment: a practical guide (2<sup>nd</sup> Ed.): CSIRO Publishing, Clayton South, VIC. 346 pp.

Standards Australia/Standards New Zealand. (1998). AS/NZS 5667.1:1998 Water quality – Sampling. Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples.

## 9 APPENDICES

Waste Discharge Licence 166-07  
Monitoring Report  
Pine Creek Project Area

Appendix A – Pine Creek Annual Return



**AGNICO EAGLE**

# Annual return - waste discharge licence

## Before you fill in the form

Information on this form is required in accordance with the conditions of a waste discharge licence issued under the *Water Act 1992*.

Failure to provide the information requested on this form and/or the provision of false or misleading information is an offence under the legislation and can attract heavy penalties.

|                                                                                                                           |            |                         |                       |
|---------------------------------------------------------------------------------------------------------------------------|------------|-------------------------|-----------------------|
| Fields marked with an asterisk (*) are required.<br>Fields marked with a caret (^) are for office use only.               |            |                         |                       |
| <b>Details of licence *</b>                                                                                               |            |                         |                       |
| Licence number                                                                                                            | WDL 166-07 | Reporting period        | 01/11/2023 - 31/10/24 |
| <b>Licence holder details *</b>                                                                                           |            |                         |                       |
| Are your business details and contact details including 24 hour emergency response published online <sup>1</sup> correct? |            |                         | YES                   |
| If 'YES', go to compliance section                                                                                        |            | If 'NO', complete below |                       |
| Licence holder                                                                                                            |            |                         |                       |
| ABN                                                                                                                       |            | ACN                     |                       |
| Registered business address                                                                                               |            |                         |                       |
| Postal address                                                                                                            |            |                         |                       |
| Contact details – for all correspondence about this licence.                                                              |            |                         |                       |
| First name                                                                                                                |            | Last name               |                       |
| Position title                                                                                                            |            |                         |                       |
| B/hours phone                                                                                                             |            | Mobile                  |                       |
| Email                                                                                                                     |            |                         |                       |

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<sup>1</sup> <https://ntepa.nt.gov.au/your-business/public-registers/licences-and-approvals-register/waste-discharge-licences>

|                                                                                                                                                  |                                                 |                                                           |           |
|--------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|-----------------------------------------------------------|-----------|
| <b>Emergency contact – details for someone who can respond to an incident related to the licence activity 24/7</b>                               |                                                 |                                                           |           |
| <b>First name</b>                                                                                                                                |                                                 | <b>Last name</b>                                          |           |
| <b>Position description</b>                                                                                                                      |                                                 |                                                           |           |
| <b>Phone number</b>                                                                                                                              |                                                 |                                                           |           |
| <b>Compliance *</b>                                                                                                                              |                                                 |                                                           |           |
| <b>Were all conditions of the licence/approval complied with during the reporting period?</b>                                                    |                                                 |                                                           | <b>NO</b> |
| If 'YES', go to declaration                                                                                                                      |                                                 | If 'NO', complete details below. Add more rows as needed. |           |
| <b>Incidents/non-compliances notified to the controller</b><br>List incidents/non-compliances notified to the controller in the reporting period |                                                 |                                                           |           |
| <b>Date of incident/non-compliance</b>                                                                                                           | 08/01/2024                                      | <b>Condition number</b>                                   | Item 10   |
| <b>Date and method of notification</b>                                                                                                           | 15/01/2024 via email<br>Zinc, cobalt            |                                                           |           |
| <b>Date of incident/non-compliance</b>                                                                                                           | 15/01/2024                                      | <b>Condition number</b>                                   | Item 10   |
| <b>Date and method of notification</b>                                                                                                           | 24/01/2024 via email<br>Zinc, cobalt, turbidity |                                                           |           |
| <b>Date of incident/non-compliance</b>                                                                                                           | 22/01/2024                                      | <b>Condition number</b>                                   | Item 10   |
| <b>Date and method of notification</b>                                                                                                           | 01/02/2024 via email<br>Zinc, cobalt            |                                                           |           |
| <b>Date of incident/non-compliance</b>                                                                                                           | 29/01/2024                                      | <b>Condition number</b>                                   | Item 10   |
| <b>Date and method of notification</b>                                                                                                           | 05/02/2024 via email<br>Zinc, cobalt            |                                                           |           |
| <b>Date of incident/non-compliance</b>                                                                                                           | 06/02/2024                                      | <b>Condition number</b>                                   | Item 10   |

|                                        |                                                       |                         |         |
|----------------------------------------|-------------------------------------------------------|-------------------------|---------|
| <b>Date and method of notification</b> | 14/02/2024 via email<br>Zinc, cobalt                  |                         |         |
| <b>Date of incident/non-compliance</b> | 12/02/2024                                            | <b>Condition number</b> | Item 10 |
| <b>Date and method of notification</b> | 20/02/2024 via email<br>Zinc, cobalt, cadmium         |                         |         |
| <b>Date of incident/non-compliance</b> | 19/02/2024                                            | <b>Condition number</b> | Item 10 |
| <b>Date and method of notification</b> | 28/02/2024 via email<br>Zinc, cobalt, cadmium         |                         |         |
| <b>Date of incident/non-compliance</b> | 27/02/2024                                            | <b>Condition number</b> | Item 10 |
| <b>Date and method of notification</b> | 08/03/2024 via email<br>Zinc, cobalt, cadmium         |                         |         |
| <b>Date of incident/non-compliance</b> | 05/03/2024                                            | <b>Condition number</b> | Item 10 |
| <b>Date and method of notification</b> | 13/03/2024 via email<br>Zinc, cobalt, cadmium, copper |                         |         |
| <b>Date of incident/non-compliance</b> | 11/03/2024                                            | <b>Condition number</b> | Item 10 |
| <b>Date and method of notification</b> | 19/03/2024 via email<br>Zinc, cobalt, cadmium, copper |                         |         |
| <b>Date of incident/non-compliance</b> | 18/03/2024                                            | <b>Condition number</b> | Item 10 |
| <b>Date and method of notification</b> | 04/04/2024 via email<br>Zinc, cobalt, cadmium, copper |                         |         |
| <b>Date of incident/non-compliance</b> | 26/03/2024                                            | <b>Condition number</b> | Item 10 |
| <b>Date and method of notification</b> | 04/04/2024 via email<br>Zinc, cobalt, cadmium, copper |                         |         |

| <b>Other incidents/non-compliance</b>                                                                                                                                                                   |  |                         |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-------------------------|--|
| List incidents/non-compliances not reported to the controller in the reporting period. Attach a document with any details required to be reported as set out in the waste discharge licence conditions. |  |                         |  |
| <b>Date of incident/non-compliance</b>                                                                                                                                                                  |  | <b>Condition number</b> |  |
| <b>Details</b>                                                                                                                                                                                          |  |                         |  |
| <b>Date of incident/non-compliance</b>                                                                                                                                                                  |  | <b>Condition number</b> |  |
| <b>Details</b>                                                                                                                                                                                          |  |                         |  |
| <b>Date of incident/non-compliance</b>                                                                                                                                                                  |  | <b>Condition number</b> |  |
| <b>Details</b>                                                                                                                                                                                          |  |                         |  |
| <b>Date of incident/non-compliance</b>                                                                                                                                                                  |  | <b>Condition number</b> |  |
| <b>Details</b>                                                                                                                                                                                          |  |                         |  |
| <b>Date of incident/non-compliance</b>                                                                                                                                                                  |  | <b>Condition number</b> |  |
| <b>Details</b>                                                                                                                                                                                          |  |                         |  |

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If you have any questions about how your personal information will be handled or would like to gain access to your personal information, you can contact Environment Division within the Department of Environment, Parks and Water Security. For more information, read our privacy policy<sup>3</sup>.

<sup>2</sup> <https://ntepa.nt.gov.au/your-business/public-registers/licences-and-approvals-register/waste-discharge-licences>

<sup>3</sup> <https://depws.nt.gov.au/consultation-publications/privacy-policy>

**Declaration \***

A person with legal authority must sign the declaration. For a licence to be granted in the name of each person in a partnership or a joint interest, each partner or joint interest must sign the declaration.

I hereby declare that the information provided in this application and accompanying document/s is, to the best of my knowledge, true and correct.

**Signatory 1****Signature**

**First name**

Ian

**Last name**

Hann

**Positon**

Vice President, Australian Operations

**Date**

Oct 31, 2024

**Seal (if signing under seal)****Signatory 2****Signature**

**First name**

John

**Last name**

Landmark

**Positon**

Vice President, Corporate Affairs (Australia)

**Date**

Oct 31, 2024

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| Date form approved | 14/12/2023                                  |             |  |
| Approved by        | Executive Director Environmental Regulation |             |  |

## How to submit this form

Email the completed application and attachments to [environmentalregulation@nt.gov.au](mailto:environmentalregulation@nt.gov.au)

Waste Discharge Licence 166-07  
Monitoring Report  
Pine Creek Project Area

Appendix B – Pine Creek Biological  
Monitoring Plan



**AGNICO EAGLE**



Pine Creek Project Area  
Biological Monitoring Plan 2023/24  
WDL166-07



**AGNICO EAGLE**

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## Abbreviations

| Acronym  | Description                                                      |
|----------|------------------------------------------------------------------|
| ANZECC   | Australia and New Zealand Environmental and Conservation Council |
| AS       | Australian Standards                                             |
| AUSRIVAS | Australian River Assessment System                               |
| PCPA     | Pine Creek Project Area                                          |
| NTMO     | Northern Territory Mining Operations Pty Ltd                     |
| DENR     | Department of Environment and Natural Resources                  |
| DPIR     | Department of Primary Industry and Resources                     |
| EMP      | Environmental Management Plan                                    |
| MMP      | Mining Management Plan                                           |
| PET      | Potential Evapotranspiration                                     |
| NT       | Northern Territory                                               |
| SOP      | Standard Operating Procedure                                     |
| SSTV     | Site Specific Trigger Values                                     |
| SQG      | Sediment Quality Guidelines                                      |
| WDL      | Waste Discharge License                                          |

# 1. INTRODUCTION

## 1.1 Background

This Environment Management Plan (EMP) addresses the water and biological monitoring program for 2023/24 reporting period for the Pine Creek Project Area (PCPA).

The PCPA is located within the Daly River catchment and Fergusson River sub-catchment. The Copperfield Creek sub-section includes the ephemeral Copperfield Creek and Pine Creek, which are relevant to the PCPA. Both streams flow into the Cullen River, a large tributary of the Douglas Daly River. The Daly River flows into the ocean, some 200 km west of the project area.

Discharged water from the Process Water Dam (PWD), leads to an unnamed tributary of Copperfield Creek approximately 2 km away and drains to the south via a constructed concrete spillway and wooden weir. The release of this waste water from the Pine Creek PWD to Copperfield Creek was currently controlled by the Waste discharge License 166-07 pursuant to S74 of the Water act.

Enterprise and South Gandys Pits are connected to Pine Creek by diversion channels and as a result each wet season there is a passive exchange of water between the pits and Pine creek.

NTMO have adopted and integrated multiple lines of evidence approach within Pine and Copperfield Creeks through surface water, sediment, ecotoxicological and macroinvertebrate monitoring programs to assess the potential aquatic system impacts.

## 1.2 Objective

The primary objective of the water and biological EMP is to improve understanding of the impacts on Pine and Copperfield Creek from mine site waste water discharge, with the aim of investigating and assessing the potential aquatic system impacts on creek health.

## 1.3 Purpose

The purpose of this plan is to develop on previous biological monitoring and to identify improvements to implement in upcoming monitoring.

NTMO has procedures relating to specific aspects of environmental monitoring and this document provides an overarching plan for the biological monitoring of the integrated environmental monitoring program.

## 1.4 Strategies

Strategies of this Biological EMP are:

- Ensure compliance with the forth coming WDL 166-07 for the PCPA;
- Ensure thorough investigations are carried out within Pine and Copperfield Creek receiving system through completing water and biological monitoring and integration of associated plans;
- Ensuring a balance is maintained between mine discharge requirements and storm water accumulation through effective and efficient discharges at opportune times into Copperfield Creek during active discharges; and

- Ensure discharge is undertaken in a manner that enables appropriate environmental safeguards and controls in accordance with the current WDL 166-07.

## 2. LEGAL AND OTHER REQUIREMENTS

### 2.1 Legislation

Applicable legislation to Biological Monitoring at the PCPA includes:

*Mining Management Act;*

*Environment Protection and Biodiversity Conservation Act 1999;*

*Environmental Offences and Penalties Act;*

*Water Act 1992;*

*Waste Management and Pollution Control Act 1998*

### 2.2 Guidelines

The Darwin-Daly regional AusRivAS model has been developed by NTEPA as a user's manual for biological sampling in the Northern Territory.

AUSRIVAS Sampling and Processing Manual, has also been sourced as a useful document for the NTMO SOP.

Surface water quality is assessed against the Australian and New Zealand Environmental and Conservation Council (ANZECC) Water Quality Guidelines 2000.

Pine Creek and Copperfield Creek SSTV's (WDL166-07).

### 2.3 NTMO Standard Operating Procedures

NTMO Standard Operating Procedures (SOP) applicable to biological management within the project area includes:

- NTMO ES – SOP 01 Surface Water Sampling Procedure;
- NTMO ES – SOP 03 Water Sampling, Packaging and Delivery Procedure;
- NTMO ES – SOP 06 Sampling Remote Sites;
- NTMO ES – SOP 07 YSI Quatro Meter;
- NTMO ES – SOP 13 Sediment Sampling;
- NTMO ES – SOP 31 Incidents and Notification Reporting, and
- NTMO ES – SOP 38 Macroinvertebrate Sampling

### 2.4 Approval Conditions

Waste Discharge Licence 166-07, for the discharge of waste waters from the NTMO Pine Creek Project Area.

### 3. BIOLOGICAL MONITORING

#### 3.1 Study Design

The biological Monitoring program outlined in table 1 aims to provide comprehensive data over consecutive years at the same locations. Sampling frequency for macroinvertebrate and sediment is proposed to occur annually at the end of the wet season. These samples will be undertaken during wet season recessional flow period so as to capture the potential effects of mine site runoff.

Table 1 Pine Creek sampling site details

| Site Code      | Site type  | Description                                                                   | Zone | Easting | Northing | SW* | Macro* | Seds* | Ecotox |
|----------------|------------|-------------------------------------------------------------------------------|------|---------|----------|-----|--------|-------|--------|
| PCCK01         | Upstream   | Pine Creek upstream of Green Valley Road (control)                            | 52L  | 803839  | 8470765  | Y   | Y      | Y     | N      |
| PCCK02         | Downstream | Pine Creek, captures water from PCCK04. In PC township                        | 52L  | 806079  | 8470548  | Y   | Y      | Y     | N      |
| PCCK03a        | Downstream | 0.7km downstream of PCCK02                                                    | 52L  | 806509  | 8470981  | Y   | Y      | Y     | N      |
| PCCK04         | Downstream | Downstream monitoring point within Pine Creek on tenement boundary            | 52L  | 805619  | 8470439  | Y   | Y      | Y     | N      |
| PCCK06         | Downstream | 100m downstream of the confluence of Copperfield Creek and PWD. (Compliance)  | 52L  | 806230  | 8465696  | Y   | Y      | Y     | Y      |
| PCCK16         | Upstream   | Copperfield Creek upstream at the Jindare/Umbrawarra Road Crossing (control). | 52L  | 804801  | 8465732  | Y   | Y      | Y     | Y      |
| PCCK22         | Downstream | PCCK22 is 26 km downstream of PCCK06. Down Bonrook Stations driveway          | 52L  | 815136  | 8449095  | Y   | Y      | Y     | N      |
| PCWRDSE01      | -          | WRD seepage monitoring point                                                  | 52L  | 805747  | 8468746  | Y   | N      | N     | N      |
| PCPWD          | -          | Process Water Dam                                                             | 52L  | 806415  | 8467387  | Y   | N      | N     | Y      |
| ENTERPRISE PIT | -          | -                                                                             | 52L  | 805873  | 8469482  | Y   | N      | N     | N      |
| GANDYS PIT     | -          | -                                                                             | 52L  | 805065  | 8470481  | Y   | N      | N     | N      |

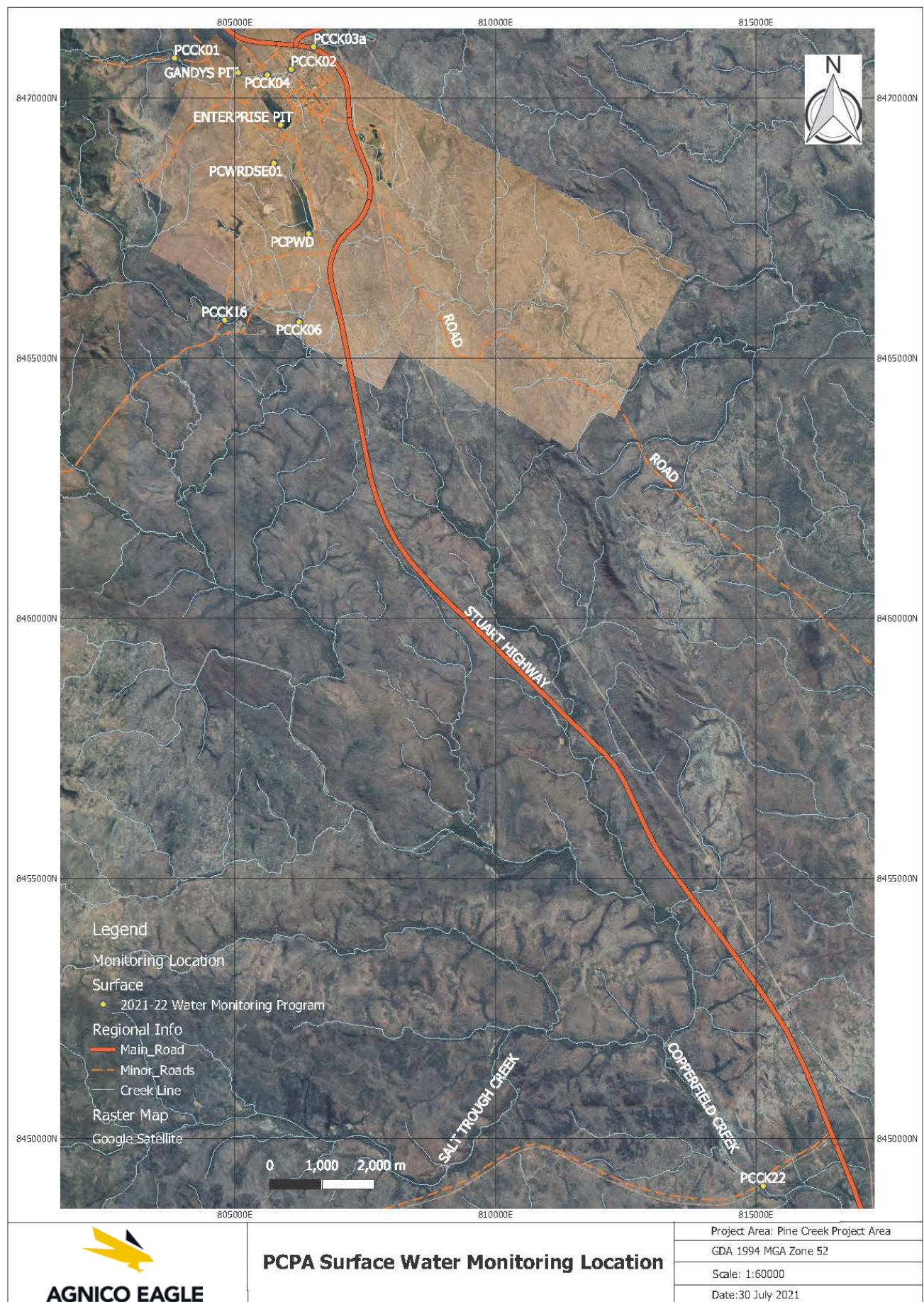
Y=Yes, N=No

SW\* is surface water sampling.

Marco\* is macroinvertebrate sampling (Annually)

Seds\* is sediment sampling (Annually)

Figure 1 Location of PCPA monitoring sites



### 3.2 Water Sampling Schedule and Analysis Type

Table 2 Surface water sampling frequency

| Site Code      | Analysis Type*     |                    |                    |                    |                    |                    | Comments                                            |
|----------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|-----------------------------------------------------|
|                | Type 0             | Type 1             | Type 2             | Type 3             | Type 4             | Type 6             |                                                     |
| PCKK01         |                    | F                  | F                  | F                  | F                  | F                  |                                                     |
| PCKK02         |                    | F                  | F                  | F                  | F                  | F                  |                                                     |
| PCKK03a        |                    | F                  | F                  | F                  | F                  | F                  |                                                     |
| PCKK04         |                    | F                  | F                  | F                  | F                  | F                  |                                                     |
| PCKK06         | W                  | W                  | W                  | W                  | W                  | W                  | weekly during creek flow                            |
| PCKK16         |                    | W                  | W                  | W                  | W                  | W                  |                                                     |
| PCKK22         |                    | W                  | W                  | W                  | W                  | W                  |                                                     |
| PCWRDSE01      |                    | M                  | M                  | M                  | M                  | M                  |                                                     |
| PCPWD          | W (Wet)<br>M (Dry) | W (Wet)<br>M (Dry) | W (Wet)<br>M (Dry) | W (Wet)<br>M (Dry) | W (Wet)<br>M (Dry) | W (Wet)<br>M (Dry) | weekly during wet season, monthly during dry season |
| ENTERPRISE PIT | A                  | Q                  | Q                  | Q                  | Q                  | Q                  |                                                     |
| GANDYS PIT     | A                  | Q                  | Q                  | Q                  | Q                  | Q                  |                                                     |

W-Weekly, F-Fortnightly, M-Monthly, Q-Quarterly, A-Annually.

#### Analysis Type

| Type   | Analytes                                                                                     |
|--------|----------------------------------------------------------------------------------------------|
| Type 0 | Level and Flow                                                                               |
| Type 1 | Temperature, pH, Electrical Conductivity (uS/cm), Salinity, ORP, Dissolved Oxygen            |
| Type 2 | Total & Filtered Metals (Al, As, Cd, Co, Cr, Cu, Fe, Pb, Mn, Ni, Se & Zn)                    |
| Type 3 | Total & Filtered Cations & Anions (Ca, Cl, K, Na & Mg) (SO4)                                 |
| Type 4 | Titrateable Acidity, Alkalinity, Hardness (CaCO3) & Total Suspended Solids (TSS) & Turbidity |
| Type 6 | Total Phosphorus (P), Total Nitrogen (N), Ammonia, Nitrogen Oxides, Total Organic Carbon     |

### 3.3 Macroinvertebrate Sampling Methodology

#### Sampling Collection

Sampling of macroinvertebrates under stable conditions allows for a robust characterisation of the macroinvertebrate community of the receiving waters and is consistent with the methodology stated in the NT Darwin Daly AUSRIVAS Sampling and Processing Manual (Lamche 2007). For consistency between years and to meet the guidelines set out by Lamche (2007)

Sampling has routinely been conducted in the post-wet season during the recessional flow period, to capture the potential effects of mine site runoff during the preceding wet season. The timing of sampling has generally been undertaken in late April to mid-May.

#### Physical Habitat Assessment

Descriptions of habitat conditions are to be recorded at each site following the criteria listed in the Northern Territory AUSRIVAS “Darwin-Daly Region Model” field sheets (Lamche, 2007). Habitat assessments will be undertaken in consideration of the whole reach sampled (100 m longitudinal section of the creeks) and include:

- Site description
- Water quality
- Characteristics of macroinvertebrate habitat
- Instream physical characteristics (flow velocity and depth, instream habitat characteristics, bank height, riparian width)
- Riparian vegetation characteristics (types, %cover, exotic species, erosion, land use)
- Water quality observations (clarity, odour, oils, foam/scum, plumes etc.)
- Sketches of the site, including a cross-section of the reach

The information recorded is used to help interpret biological data and to provide input data for the Northern Territory AUSRIVAS model. Data recorded is also used in conjunction with the biological community information as the basis of the overall health assessment.

Photos are to be taken of upstream and downstream portions of the reach sampled, as well as bank habitat and other key habitat features. This will further characterise the habitat conditions at each site, serving as a pictorial record of site conditions that can be tracked over time using photos taken from the same photo points.

#### Water and Sediment Quality

The physico-chemical parameters of the water at each site is to be measured in-situ using a calibrated multi-parameter water quality meter. In situ parameters to be recorded on the AUSRIVAS proforma are:

- pH
- Electrical conductivity (EC) ( $\mu\text{S}/\text{cm}$ )
- Water temperature ( $^{\circ}\text{C}$ )
- Dissolved oxygen (DO) concentrations (mg/L and % saturation)
- Turbidity

As per the WDL, field environmental data and sample collection must be undertaken in accordance with recognised Australian Standards and guidelines. Water quality grab samples are to be collected at the same time as macroinvertebrate samples during the annual monitoring event. Sediment sampling requirements are located in the Sediment SOP.

## Collection Method

The following methodology relates to macroinvertebrate samples collected using AUSRIVAS protocols. Macroinvertebrate monitoring has been previously selected as the bioindicator for biological monitoring in relation to the PCPA, and for consistency, it will be used in future programs to assess the impacts of the treated mine water discharge on the receiving ecosystem in the Edith River.

The macroinvertebrate monitoring techniques are based on AUSRIVAS Manual for the Darwin-Daly Region protocols (Lamche 2007). The following elements are discussed in Lamche (2007) and will be considered in relation to biological monitoring:

- Habitat sampled
- Collection procedure and equipment
- Sample replication
- Field processing method (e.g. live-pick or bulk)
- Lab processing method (e.g. sub-sorting)
- Level of identification
- Quality assurance

Macroinvertebrate samples will be in accordance with the Darwin-Daly AUSRIVAS (Australian Rivers Assessment System) protocols. AUSRIVAS is a rapid prediction system used to assess the biological health of Australian rivers. The protocols for sampling ensure that the temporal and spatial analyses are comparable amongst sites through repeatable and consistent sampling techniques.

The Darwin-Daly AUSRIVAS Early-Family-Edge Habitat model (Lamche, 2007) was selected as the appropriate model for data analysis due to:

- The locality of the study area within the catchment
- The timing of the surveys in the early dry season
- The level of identification applied (Family level)

Three replicate samples are to be collected at each site to increase the statistical power of any analyses required. All samples will be collected by trained environmental scientists.

Darwin-Daly AUSRIVAS sampling protocols involve the collection of a sample by disturbing the substrate, benthos and overlying habitat using a three-pronged rake and then capturing organisms via a 250 µm mesh dip net that is swept through the water column in the area adjacent the area disturbed by the rake. In order to provide sample replication for statistical analysis, three replicate AUSRIVAS sweep net samples will be collected per site.

Areas of riffle or fast flowing habitat, Pandanus roots and severe bank undercuts are to be avoided when collecting edge habitat samples.

Once collected, samples were washed through 10 mm and 250 µm mesh sieves. The coarse mesh sieve was examined for large, conspicuous taxa, and these were placed in the labelled sample container. The sample collected in the fine mesh sieve was also placed in the labelled sample container and filled with 70% ethanol. All samples were sent to the laboratory for further processing and macroinvertebrate identification.

Environmental variables were also recorded at each site on a standard Darwin-Daly AUSRIVAS field sheet (Lamche 2007). Habitat variables measured included flow and *in situ* water quality, as well as a description of the riparian zone and geomorphology at each site.

### 3.4 Laboratory Processing

Each sample received by the nominated macroinvertebrate laboratory will follow standard procedures for processing as set out by Lamche (2007).

Samples are to be washed through a series of sieves (10 mm, 500 µm and 250 µm mesh sizes). Any large, conspicuous taxa identified in the 10 mm mesh sieve are separated to be identified separately. The contents of the 500 µm mesh sieve are retained for macroinvertebrate identification and enumeration, while the 250 µm fraction is retained as sample residue for quality assurance purposes. The contents of the 500 µm mesh fraction is poured into a Marchant sub-sampler (Marchant, 1989) and extractions made randomly from cells (aliquots) in this apparatus. These extractions are placed under a microscope and the taxa identified and counted.

This process continues until either all aliquots are examined, or a total of 200 individuals have been counted and identified (excluding those from the 10 mm fraction). The number of aliquots required to be processed to obtain a minimum 200 individual sub-sample is recorded in order to calculate abundance.

Taxa are identified to family level where possible, with the exception of key taxa identified in Lamche (2007) as either requiring identification to sub-family level (e.g. Chironomidae) or only to order level (e.g. Acarina). All taxa are identified using the keys specified in Hawking (2000). Following identification, taxa counts are to be recorded in a database and samples preserved and archived.

Quality assurance is to be maintained by ensuring that identifiers are adequately trained and qualified. As specified in AUSRIVAS (Lamche 2007), 5% of samples identified in the laboratory are verified by a secondary check undertaken by a senior taxonomist.

### 3.5 Data Analyses

The macroinvertebrate data collected will be analysed using univariate and multivariate statistical techniques. Univariate metrics provide an indication of waterway 'health', whilst multivariate analysis focusses on variability in community composition between sites.

#### Univariate Techniques

Univariate measures (biotic indices) are used to assess the 'health' status of the macroinvertebrate community at each site. For each analysis, replicate samples are combined to provide an overall site community. The macroinvertebrate community biotic indices used for this study will include:

- Abundance
- Taxonomic Richness
- PET Richness
- SIGNAL-2
- Northern Territory AUSRIVAS Observed over Expected (O/E) scores and bandings

**Abundance** is the count of macroinvertebrates per sample, this is an applicable index in this program as sampling methods are quantitative. To derive whole of sample abundance counts, the percentage of the total sample counted is used with the count in the subsample to calculate the number of macroinvertebrates in the entire sample. This index can be useful in detecting impacts on pollution-affected sites if counts are significantly different between control and impact sites. It can also indicate declines in habitat availability and therefore will be interpreted with a degree of caution, in conjunction with other indices.

**Taxonomic Richness** refers to the number of different taxa contained in a sample. In theory, the higher the taxa richness value, the healthier a community is, but there are some instances where anthropogenic activities promote taxa richness

through increased supply of nutrients or habitat (e.g. riffles through additional flows). Therefore, taxa richness data needs to be interpreted on a case by case basis.

**EPT Richness** refers to the proportional representation of key macroinvertebrate taxa belonging to the sensitive macroinvertebrate orders of Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies). High EPT richness is indicative of a healthy macroinvertebrate community, though it must be noted that some EPT taxa have more tolerance to pollution than others, so generally EPT richness data is interpreted together with other data such as community composition and SIGNAL score information (discussed further below). It should be noted that in the Northern Territory there are no known Plecoptera species, so in this study, the number of EPT taxa is limited to the number of ephemeropteran and trichopteran families.

**SIGNAL 2 Scores** (Stream Invertebrate Grade Number – Average Level) are based on the sensitivity of each macroinvertebrate family to environmental conditions, including forms of water pollution (Chessman 2003). Macroinvertebrate families are assigned a pollution sensitivity grade between 1 (most tolerant) and 10 (most sensitive). Families in a sample that have not been assigned a grade are excluded from the analysis. This assessment allows an additional line of evidence for assessing the potential impacts of water quality. Lamche (2007) cautions against the use of the SIGNAL 2 index for assessing the status of Northern Territory macroinvertebrate communities, however, GHD still view the assessment of pollution-sensitive versus pollution-tolerant species as a useful indicator to provide some insight to the level of stress that the macroinvertebrate community is experiencing.

For this program, macroinvertebrate data will be assessed using the NT AUSRIVAS Darwin-Daly Early (dry season) Family level Edge habitat model.

Table 3 provides a summary of the univariate macroinvertebrate indices assessed as part of this study and, where relevant, a description of how to interpret results relating to those indices.

Table 3 Macroinvertebrate indices

| Macroinvertebrate Index | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Abundance               | The total number of individual taxa observed at each site. Generally increased abundance can be taken to mean better conditions and increased access to habitat and food resources. However, high abundances can also occur under degraded conditions where pollution-tolerant taxa proliferate. Hence, abundance is a measure that must be interpreted with caution and in context with other metrics and community composition data. Abundance was calculated based on the multiplication of raw abundance data by the inverse of the proportion of sample processed.                     |
| Taxa Richness           | The total number of taxa present at each site is a direct measure of diversity. It assumes that a high number of taxa within a site indicate that the various water quality, habitat and food requirements of taxa have been met (though this could also occur through anthropogenic effects that increase food or habitat supply). A negative environmental impact would normally result in the loss of taxa and a decline in Taxa Richness at a site.                                                                                                                                     |
| PET Richness            | PET Richness was calculated as the total number of families <sup>1</sup> from three orders of macroinvertebrates; Ephemeroptera (mayflies); Plecoptera (stoneflies); and Trichoptera (caddisflies). PET taxa include taxa that are very sensitive to disturbance (though some have moderate tolerances to pollution). Higher numbers of PET taxa indicate are generally taken to indicate a lower level of disturbance.                                                                                                                                                                     |
| Signal-2                | SIGNAL-2 is a biotic index that allocates a value to each macroinvertebrate family based upon their sensitivity to pollution. A macroinvertebrate family with a value of 10 indicates high sensitivity whilst a value of 1 indicates high pollution tolerance (Chessman, 1995). SIGNAL-2 represents the average pollution sensitivity SIGNAL-2 rating within a given sample, which in turn, represents the relative proportion of pollution-tolerant and pollution-sensitive taxa in a sample. Higher SIGNAL-2 scores indicate a higher proportion of pollution-sensitive taxa in a sample. |

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<sup>1</sup> Some specimens (particularly juveniles) could only be identified to order level. Hence, PET richness here refers to both family and order level PET richness. This is consistent with previous sampling rounds

## AUSRIVAS OE50

The AUSRIVAS model is a predictive system that uses macroinvertebrates to assess the biological health of rivers in the Darwin-Daly Region (Lamche 2007). AUSRIVAS uses site-specific predictions of the macroinvertebrate fauna expected to be present in the absence of environmental stress. The expected (E) fauna from reference sites with similar sets of predictor variables (physical and chemical characteristics which cannot be influenced due to human activities, e.g. altitude) are then compared to the observed (O) fauna that were actually collected at a given site and the ratio derived is then used to indicate the extent of any impact. Both O and E measures relate to macroinvertebrates that have a predicted probability greater than 50% of occurring at the site if it is in reference condition. Hence, the critical metric in the AUSRIVAS model is called OE50. The OE50 ratio can range from zero, when none of the expected taxa are found at a site, to >1, when either all the expected taxa are found in a sample or when more families are found in a sample than predicted by the model. The scores derived from the model can be placed in bands delineated by the Monitoring River Health Initiative which allows assessment of the level of environmental health at a site.

Table 4 Key to OE50 AUSRIVAS Scores and Bands

| Band   | OE50 Upper Limit                                                                             | Condition                                      | Band Description                                                                                                                                                             |
|--------|----------------------------------------------------------------------------------------------|------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Band X | O/E greater than 90th percentile of reference sites used to create the model.                | More biologically diverse than reference sites | More families found than expected.<br><br>Potential biodiversity "hot-spot" or mild organic enrichment.<br><br>Continuous irrigation flow in a normally intermittent stream. |
| Band A | O/E within range of central 80% of reference sites used to create the model.                 | Reference condition                            | Expected number of families within the range found at 80% of the reference sites.                                                                                            |
| Band B | O/E below 10th percentile of reference sites used to create the model. Same width as band A. | Significantly impaired                         | Potential impact either on water and/or habitat quality resulting in a loss of families.                                                                                     |
| Band C | O/E below band B. Same width as band A.                                                      | Severely impaired                              | Many fewer families than expected. Loss of families from substantial impairment of expected biota caused by water and/or habitat quality.                                    |
| Band D | O/E below band C down to zero.                                                               | Extremely impaired                             | Few of the expected families and only the hardy, pollution tolerant families remain. Severe impairment.                                                                      |

## Assessment of Impacts

Assessment of impacts from mine affected water release will consider the following:

- Qualitative assessment of community composition and sensitivity metrics
- Comparison of macroinvertebrate metrics and community composition between sites upstream and downstream of the release points
- Comparison of community composition and sensitivity metrics to historic data collected prior to commencement of releases
- Comparison of macroinvertebrate metrics to water quality and sediment quality collected at the time of sampling

The use of statistical analysis techniques such as Analysis of Variance (ANOVA) will be considered when determining impacts to macroinvertebrate metrics between sites upstream or downstream of release points as part of a hypothesis testing framework. Multivariate techniques such as ordination and cluster analysis may assist in identifying complex

patterns in biological data between sites, while community composition can be compared statistically between sites using techniques such as Analysis of Similarities (ANOSIM) or PERMANOVA. The use of these statistical methods will only be employed where sufficient and appropriate data are available. All statistical methodology used will be explained and justified.

### 3.6 Reporting

The Biological Monitoring will be reported to the DENR within the WDL annual monitoring report. The report will include:

- Clearly stated objectives of the study and predicted outcomes
- The date, time and location of sample collection
- A clear description of sampling and analysis methods, detailing quality assurance and controls
- Flow and hydrological information and environmental conditions in the interpretation of water quality and biological data
- Results of all monitoring conducted and samples analysed including the use of visual aids such as graphs and tables
- Application of guidelines from ANZECC & ARMCANZ (2000) and other relevant guideline documents, including comparisons to long-term water quality objectives and SSTVs
- A comparison of macroinvertebrate based metrics and community composition between sites upstream and downstream of release points and at the mining lease boundary
- Evaluation of the current study design and its ability to meet the objectives of the monitoring program
- Recommendations of improvements (if any) to be made for future monitoring

The *Biological Monitoring Plan* will be reviewed and updated when required for WDL applications. A review may occur sooner consequent to a material change in risk, legal requirements or an incident relevant to water discharge.

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Waste Discharge Licence 166-07  
Monitoring Report  
Pine Creek Project Area

Appendix C – Pine Creek  
Ecotoxicological Report



**AGNICO EAGLE**



# Pine Creek Ecotox 2024

## Interpretive Report

### Agnico Eagle

Dorat Road  
Hayes Creek NT 0822

Prepared by:

**SLR Consulting Australia**

SLR Project No.: 620.040786

29 April 2024

Revision: 1.0

## Revision Record

| Revision | Date                   | Prepared By  | Checked By | Authorised By |
|----------|------------------------|--------------|------------|---------------|
| V1.0     | 29 April 2024          | J. Woodworth | T. Hagen   | T. Hagen      |
|          | Click to enter a date. |              |            |               |
|          | Click to enter a date. |              |            |               |
|          | Click to enter a date. |              |            |               |
|          | Click to enter a date. |              |            |               |

## Basis of Report

This report has been prepared by SLR Consulting Australia (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Agnico Eagle (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.



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## 1.0 Introduction

Agnico Eagle Australia's Northern Territory Mining Operations (NTMO) manage the discharge of mine water from the Pine Creek Project Area (PCPA) under the Waste Discharge Licence (WDL) 166-07.

Currently passive discharge occurs from the site to Pine Creek from South Gandy's and Enterprise Pit and to Copperfield Creek from the Pine Creek Process Water Dam (PCPWD).

Under the WDL 166-07, NTMO is not required to conduct ecotoxicity testing on the discharges at PCPA or downstream of the site. Nevertheless, NTMO requested SLR to develop an ecotoxicological program to provide information used in a weight of evidence approach in assessing the environmental impacts of mine water discharge to Copperfield Creek from the PCPWD.

### 1.1 Ecotoxicology Plan

As mentioned above PCPA is not required to conduct an ecotoxicity testing program under WDL 166-07. However, an Ecotoxicological Plan had been written for another NTMO mining operation (Cosmo Howley) (Agnico Eagle 2022) and provides the background and methodology for assessing the potential toxicity of mine water prior to discharge in the Northern Territory. The methodology described in the Cosmo Howley Plan (Agnico Eagle 2022) has been applied to monitoring sites in Copperfield Creek to determine the potential toxicity in the creek downstream of the PCPWD during discharge. Section 2 discusses the PCPA ecotoxicity program in detail.

The results of the ecotoxicological testing will be used to confirm whether the discharge of PCPWD water is undertaken in a manner that enables appropriate environmental safeguards and controls in accordance with the PCPA Mine Management Plan (MMP).

### 1.2 Scope of Work

To determine potential impacts on the environment from discharges from the PCPWD the following work was conducted:

- Review and assessment of PCPA ecotoxicity testing results.
- Review and assessment of PCPA water chemistry results.
- Interpretation of PCPA ecotoxicity and chemistry results.
- Reporting ecotoxicity.

### 1.3 Objectives

This report has been developed to provide information on the potential impacts on aquatic organisms of a discharge of mine water from the PCPWD and for use in a weight of evidence assessment of impacts to the environment from PCPWD mine water discharges.

### 1.4 Assumptions

In interpreting the ecotoxicological and chemistry results provided by NTMO, SLR notes the following.



- It is assumed all samples collected by NTMO are representative of each of the identified sample sites and were handled in accordance with procedures identified by the laboratory.
- SLR did not independently verify the chemistry results provided by NTMO.
- The Ecotoxicology Report provided by Ecotox Services Australasia (ESA) included several errors in reporting. SLR has requested an amended version be provided. This SLR report (Appendix B) will be updated and resubmitted to Agnico Eagle when received. SLR has used professional judgement and knowledge of ToxCalc v5.0.23 to incorporate the correct data in this report.



## 2.0 Ecotoxicology Program

### 2.1 Introduction

An ecotoxicology monitoring program was initially developed for another NTMO mining operation (Cosmo Howley) for the 2018/19 wet season (GHD 2018). Aspects of that Plan have been used to develop an appropriate ecotoxicity testing program for application to the PCPA. The Agnico Eagle (2022) Biological Monitoring Plan provides the background and basis for the 2021, 2022, 2023 and 2024 ecotoxicology monitoring programs for PCPA, the results of the 2024 monitoring program are reported herein.

### 2.2 Direct Toxicity Assessment

The NTMO ecotoxicology program was designed to incorporate the recommendations contained in ANZG (2018) using direct toxicity assessment (DTA) to assess toxicity of treated mine water discharge. The toxicity of chemicals within a complex mixture may be a result of additive, synergistic or ameliorative activities and DTA provides an integrated measure of any interactions between compounds which affect toxicity. DTA provides a better representation of natural environmental conditions than single chemical testing and is therefore recommended by ANZG (2018) for assessing the environmental impact from complex effluents such as mine water.

DTAs using a range of concentrations of the Pine Creek Process Water Dam (PCPWD) were conducted in the 2021 (SLR 2021) and 2022 (SLR 2022) ecotox program. However, the 2023 ecotoxicology program only conducted a screening bioassay on the PCPWD sample (SLR 2023). The 2024 assessment included a DTA on the PCPWD sample.

### 2.3 Screening Bioassays

Screening bioassays are used to assess the toxicity of natural waterways where the water quality is not expected to show high toxicity. The screening bioassays use an undiluted water sample from each site for the assessment. The results of the screening bioassay are compared to controls including an upstream water sample and a laboratory water control sample. An observation of >80% successful reproduction or growth in the organisms tested when compared to controls indicates that the water quality of the tested sample shows no significant toxicity. The screening results can also be used to compare water chemistry and toxicity spatially across a site and temporally if historical results are available.

### 2.4 Selected Species

The cladoceran (*Ceriodaphnia dubia*) has been selected for use in the chronic undiluted screening bioassays based on its sensitivity to treated mine water as determined in previous ecotoxicity programs conducted at CHPA and PCPA. The cladoceran bioassay provides information on both chronic and acute endpoints. Information on the cladoceran bioassay is shown in **Table 2-1**.

**Table 2-1 Cladoceran bioassay details**

| Species                                     | Test duration and temperature | Endpoint                                      | Key reference |
|---------------------------------------------|-------------------------------|-----------------------------------------------|---------------|
| Cladoceran<br>( <i>Ceriodaphnia dubia</i> ) | 7 days<br>25 ± 1°C            | Reproduction<br>(Chronic)<br>Survival (Acute) | USEPA (2002)  |



The bioassays shown in **Table 2-1** are NATA accredited and conducted by Ecotox Services Australasia (ESA) located in Sydney.

## 2.5 Dilution Water

ANZG (2018) recommends the use of water upstream of the impact source as the diluent in DTAs. Copperfield Creek water was collected from the upstream site PCCK16 and used as the diluent in the PCPWD serial dilution bioassays. The low EC occurring naturally in the PCCK16 diluent may confound the toxicity of the test sample and for the 2024 program the EC was adjusted to ~100 µS/cm.

## 2.6 Dilution Series

Dilution series generally use a geometric progression series of 100% sample, 50%, 25%, 12.5%, 6.3%. However, these concentrations produced 100% mortalities in the 6.3% PCPWD water, therefore the dilution series was revised to 6.3%, 3.1%, 1.6%, 0.8% and 0.4% in order to obtain an EC<sub>10</sub> and EC<sub>50</sub> (effect concentration in 10 and 50% of the test population, respectively). A PCCK16 diluent control and a laboratory (DMW) control were also included in each bioassay.

## 2.7 Quality Assurance

The bioassays listed in **Table 2-1** are NATA accredited and are regulated to ensure quality assurance. The bioassay is conducted concurrently with a laboratory control (the water in which the organisms are grown) and a reference toxicant.

## 2.8 Water Chemistry

All water samples for ecotoxicology testing were analysed for the suite of analytes shown in **Table 2-2**. Analysis was conducted by a NATA accredited laboratory and samples collected according to Australian Standards and NTMO's Standard Operating Procedures (SOPs). It is recommended that samples are taken for ecotoxicology testing on the same day as routine WDL sampling occurs<sup>1</sup>, the routine chemistry results are then used to interpret the ecotoxicology assessment.

**Table 2-2 Analytes for surface water chemistry**

| Category                                                                                                                                                                                                                                                                                                                                   | Analytes                                                                                                                                                                                                                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>In Situ</i>                                                                                                                                                                                                                                                                                                                             | EC (µS/cm), pH, DO (%), temperature (°C), TSS (mg/L)                                                                                                                                                                                           |
| Metals (Total and Filtered 0.45 µm)                                                                                                                                                                                                                                                                                                        | Al, As, Cd, Co, Cr, Cu, Fe, Pb, Mn, Ni, Se, Zn                                                                                                                                                                                                 |
| Others                                                                                                                                                                                                                                                                                                                                     | <ul style="list-style-type: none"> <li>Filtered - Ca, K, Na, Mg, SO<sub>4</sub></li> <li>Hardness (CaCO<sub>3</sub>), total suspended solids (TSS) total dissolved solids (TDS)</li> <li>Total phosphorus (TP), total nitrogen (TN)</li> </ul> |
| EC = electrical conductivity, DO = dissolved oxygen, TSS = total suspended solids; Al = Aluminium, As = Arsenic, Cd = Cadmium, Co = Cobalt, Cr = Chromium, Cu = Copper, Fe = Iron, Pb = Lead, Mn = Manganese, Ni = Nickel, Se = Selenium, Zn = Zinc, Ca = Calcium, K = Potassium, Na = Sodium, Mg = Magnesium, SO <sub>4</sub> = Sulphate. |                                                                                                                                                                                                                                                |

<sup>1</sup> This recommendation was also followed for the 2021, 2022 and 2023 ecotoxicology programs.



## 2.9 Sample Sites and Dates

Samples were collected for chemistry and ecotoxicology testing at PCCK06 and PCCK16 (diluent) during the 2023/24 wet season on the 27 February 2024. The PCPWD sample was collected on 7 March 2024 for ecotoxicology and 5 March 2024 for chemical analysis.

**Table 2-3 Sample sites**

| Site   | Testing                          | Location                                                                                                                                                                                                           |
|--------|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PCCK16 | Ecotox diluent and chemistry     | Copperfield Creek – Upstream of PCPWD                                                                                                                                                                              |
| PCCK06 | Ecotox – screening and chemistry | Copperfield Creek - 100 m downstream of Copperfield Creek and Process Water Dam (PWD) spillway confluence – WDL 166-07 compliance point                                                                            |
| PCPWD  | Ecotox – screening and chemistry | The Pine Creek Process Water Dam (PCPWD) drains to the south via a constructed concrete spillway and wooden weir which then discharges to an unnamed tributary of Copperfield Creek approximately 2 km downstream. |

## 2.10 Ecotoxicology Program

The program conducted for the 2023/24 wet season for PCPA is shown in **Table 2-4** and is based on the revised Agnico Eagle (2022) ecotoxicology program which includes the rationale for testing during discharge.

**Table 2-4 Ecotoxicological sampling and testing program 2023/24 wet season**

| Site   | Bioassay   | Type                    | Rationale                                                                                                                    |
|--------|------------|-------------------------|------------------------------------------------------------------------------------------------------------------------------|
| PCPWD  | Cladoceran | DTA and chemistry       | Assess toxicity of the dam water prior to release using upstream PCCK16 water as diluent with the EC adjusted to ~100 µS/cm. |
| PCCK06 | Cladoceran | Screening and chemistry | Assess downstream toxicity during discharge at the WDL compliance point.                                                     |



## 3.0 Results

### 3.1 Sample Collection

Samples for PCCK 06 and PCCK16 were collected by NTMO on the 27 February 2024 and a sample from PCPWD was taken for ecotoxicology on 7 March 2024 and for chemistry on 5 March 2024. The samples were chilled and sent to ESA for ecotoxicology testing where they were received on 6 March 2024 and 8 March 2024, respectively<sup>2</sup>. All samples were kept chilled in eskies during storage and transport and the samples recorded 6 - 10°C upon receipt at ESA.

Water samples were submitted for chemistry analysis at the same time as samples for ecotoxicology testing. Chemistry samples were dispatched to Envirolab Group for analysis and the results supplied to SLR by NTMO.

**Table 3-1** shows the conditions at each site at the time of sampling.

**Table 3-1 Site conditions February 2024**

| Site   | Conditions                                                      |
|--------|-----------------------------------------------------------------|
| PCPWD  | Fast flow                                                       |
| PCCK06 | Steady flow and turbid                                          |
| PCCK16 | Blue-Winged kookaburra, spotted, algae, surface scum, fast flow |

### 3.2 PCPWD Discharge

PCPWD discharged 568.5 ML to Copperfield Creek during February 2024. **Table 3-2** shows the daily and average discharge rate during February 2024. PCPWD was discharging at the time of PCCK06 sampling.

**Table 3-2 PCPWD Discharge to Copperfield Creek February 2024**

| Date <sup>(1)</sup> | Discharge ML | Average discharge rate (L/S) |
|---------------------|--------------|------------------------------|
| 1/02/2024           | 0            | 0                            |
| 2/02/2024           | 12           | 139                          |
| 3/02/2024           | 8.2          | 95                           |
| 4/02/2024           | 9.2          | 106                          |
| 5/02/2024           | 7.9          | 91                           |
| 6/02/2024           | 8.1          | 94                           |
| 7/02/2024           | 9.5          | 110                          |
| 8/02/2024           | 7.3          | 84                           |
| 9/02/2024           | 6.1          | 71                           |
| 10/02/2024          | 14.5         | 168                          |
| 11/02/2024          | 10.7         | 124                          |

<sup>2</sup> See Appendix B ESA report



| Date <sup>(1)</sup>                 | Discharge<br>ML | Average discharge rate<br>(L/S) |
|-------------------------------------|-----------------|---------------------------------|
| 12/02/2024                          | 17.1            | 198                             |
| 13/02/2024                          | 58              | 671                             |
| 14/02/2024                          | 164.7           | 1906                            |
| 15/02/2024                          | 43.2            | 500                             |
| 16/02/2024                          | 0               | 0                               |
| 17/02/2024                          | 0               | 0                               |
| 18/02/2024                          | 18.8            | 217                             |
| 19/02/2024                          | 8.1             | 93                              |
| 20/02/2024                          | 16.9            | 196                             |
| 21/02/2024                          | 2.1             | 24                              |
| 22/02/2024                          | 14.7            | 170                             |
| 23/02/2024                          | 3               | 35                              |
| 24/02/2024                          | 15.8            | 183                             |
| 25/02/2024                          | 4.8             | 56                              |
| 26/02/2024                          | 14.3            | 165                             |
| 27/02/2024                          | 60.2            | 697                             |
| 28/02/2024                          | 29.5            | 341                             |
| 29/02/2024                          | 3.8             | 44                              |
| <sup>(1)</sup> Midnight to midnight |                 |                                 |

### 3.3 Water Chemistry Results

SLR has not independently verified the chemistry results supplied by NTMO; the results have been taken on face value in this report. A summary of water quality data provided to SLR by NTMO is shown in **Table 3-3**. Chemistry results as provided by NTMO are located in **Appendix A**.

**Table 3-3 February 2024 water chemistry results for ecotoxicity samples**

| Analyte                 | PCCK16            | PCCK06             | PCPWD <sup>(1)</sup> | SSTV <sup>(2)</sup><br>PCCK06 |
|-------------------------|-------------------|--------------------|----------------------|-------------------------------|
| <b>Field parameters</b> |                   |                    |                      |                               |
| EC (µS/cm)              | 31 <sup>(3)</sup> | 120 <sup>(4)</sup> | 662                  | 250                           |
| pH                      | 6.5               | 6.5                | 7.0                  | 6.0-8.0                       |
| DO (%)                  | 90                | 88                 | 79                   | 57-120                        |
| Temp (°C)               | 29                | 29                 | 28                   | -                             |
| Turbidity (NTU)         | 9.4               | 11                 | 14                   | 15                            |
| <b>Others (mg/L)</b>    |                   |                    |                      |                               |
| Calcium                 | 0.8               | 3                  | 22                   | -                             |
| Chloride                | 1                 | 2                  | 4                    | -                             |



| Analyte                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | PCCK16 | PCCK06 | PCPWD <sup>(1)</sup> | SSTV <sup>(2)</sup><br>PCCK06 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------|----------------------|-------------------------------|
| Magnesium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1      | 7.8    | 56                   | -                             |
| Potassium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 2      | 2      | 3                    | -                             |
| Sodium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 4      | 6.6    | 30                   | -                             |
| Sulphate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <1     | 42     | 350                  | -                             |
| Hardness                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 6.7    | 41     | 290                  | -                             |
| TSS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <10    | 19     | 20                   | 20                            |
| TDS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 20     | 78     | 429                  | -                             |
| TP (mg/L)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <0.01  | 0.01   | <0.01                | -                             |
| TN (µg/L)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <100   | 200    | 400                  | -                             |
| <b>Metals dissolved (µg/L)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |        |        |                      |                               |
| Aluminium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 20     | 10     | 330                  | 150                           |
| Arsenic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <1     | <1     | 5                    | 42                            |
| Cadmium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <0.1   | 1.3    | 17                   | 0.4                           |
| Chromium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <1     | <1     | <1                   | -                             |
| Cobalt                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <1     | 13     | 190                  | 1.4                           |
| Copper                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <1     | 1.5    | 40                   | 1.8                           |
| Iron                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 180    | 60     | 70                   | 830                           |
| Lead                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <1     | <1     | 7                    | 5.6                           |
| Manganese                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 5      | 480    | 4,600                | 2,500                         |
| Nickel                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <1     | 12     | 140                  | 13                            |
| Selenium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <1     | <1     | <1                   | -                             |
| Zinc                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 4      | 960    | 9,700                | 15                            |
| <sup>(1)</sup> PCPWD sampled 5 March 2024 for chemistry and 7 March 2024 for ecotoxicology.<br><sup>(2)</sup> SSTV from WDL 166-07.<br><sup>(3)</sup> EC adjusted by ESA to 102 µS/cm prior to ecotox testing.<br><sup>(4)</sup> EC incorrectly reported by ESA at 1,579 µS/cm for PCCK06 therefore the field data has been used for interpretation of the ecotox data.<br>TP = Total phosphorus, TN = Total nitrogen, TSS = Total suspended solids, SSTV = Site specific trigger value<br>Highlighted cells are above the WDL 166-07 SSTV for PCCK06 compliance point. |        |        |                      |                               |

## 3.4 Ecotoxicology Results

ESA provided a report on the NATA accredited bioassays titled 'Toxicity Assessment of Wastewater and Receiving Water Samples'. *Agnico Eagle Test Report March 2024*. This report is attached as **Appendix B**. The ecotoxicological assessment results are presented in **Table 3-4** and **Table 3-5**. All toxicity tests met the QA/QC criteria.

### 3.4.1 Screening tests

In accordance with the ecotoxicity testing program described in **Section 2.1**, a sample from PCCK06 was assessed with a screening bioassay using the cladoceran reproduction test. The results of the screening bioassay are shown in **Table 3-4**.



**Table 3-4 Screening cladoceran bioassay results (March 2024)**

| Site        | EC <sup>1</sup><br>(µS/cm) | Cladoceran                    |              |
|-------------|----------------------------|-------------------------------|--------------|
|             |                            | Reproduction (%) <sup>2</sup> | Survival (%) |
| Lab Control | 176                        | 100                           | 100          |
| PCCK06      | 120                        | 0                             | 0            |
| PCCK16      | 102                        | 102                           | 90           |

<sup>1</sup> ESA Laboratory data (Appendix B)  
<sup>2</sup> Reproduction is normalised with the control results as: [Number of young (treatment)/Number of young (control)] X100  
<sup>3</sup> An observation of >80% successful reproduction in the organisms tested when compared to controls indicates that the water quality of the tested sample shows no significant toxicity.

### 3.4.2 Dilution series results

The results for the full dilution series carried out on PCPWD are shown in **Table 3-5** using the PCCK16 diluent.

**Table 3-5 DTA results for PCPWD sample**

| Bioassay                            | Diluent | Endpoint     | EC10 (%) <sup>(1)</sup> | EC50 (%) <sup>(1)</sup> |
|-------------------------------------|---------|--------------|-------------------------|-------------------------|
| PCPWD (EC 801 µS/cm) <sup>(2)</sup> |         |              |                         |                         |
| Cladoceran                          | PCCK16  | Survival     | 0.8                     | 0.9                     |
|                                     | PCCK16  | Reproduction | 0.5                     | 0.9                     |

DTA = Direct Toxicity Assessment, EC = Electrical Conductivity, EC<sub>10(50)</sub> = Concentration (in %) resulting in a particular effect in 10 or 50% of test organisms.

<sup>(1)</sup> Results reported as % concentration of the test sample corresponding to the EC<sub>10</sub> or EC<sub>50</sub>. This was calculated by ESA using Toxcalc v5.0.23

<sup>(2)</sup>ESA incorrectly reported PCCK16 (Lab ID 11468 with EC 801 µS/cm) and PCPWD (Lab ID 11470 with EC 38 µS/cm). These samples were incorrectly labelled by ESA. An amended report has been requested from ESA.



## 4.0 Discussion

### 4.1 Screening Bioassay

The 2024 screening bioassay results for the upstream sample (EC adjusted to 102 µS/cm) and laboratory control showed no chronic or acute toxicity (**Table 3-4**). However, both acute and chronic toxicity was observed in the PCCK06 sample during PCPWD discharge with 100% mortalities (**Table 3-4**).

The chemistry data for the PCPA compliance point PCCK06 (**Table 3-3**) shows that cadmium, cobalt and zinc were above the SSTVs for the site. The acute toxicity observed in the PCCK06 sample can be attributed to the elevated zinc concentration which shows a toxic unit (TU) of 64 (**Table 4-1**). The zinc concentration at PCCK06 can be directly attributed to the PCPWD discharge.

**Table 4-1 Toxic Units in PCCK06**

| Metal (µg/L) | PCCK06 | SSTV | Toxic Unit <sup>(1)</sup> |
|--------------|--------|------|---------------------------|
| Cadmium      | 1.3    | 0.4  | 3.3                       |
| Cobalt       | 13     | 1.4  | 9.3                       |
| Zinc         | 960    | 15   | 64                        |

<sup>(1)</sup> TUs calculated from the PCCK06 sample concentrations (**Table 3-3**) as follows:  
Toxic Unit = Measured concentration ÷ SSTV.

A Toxic Unit less than 1 indicates that there is unlikely to be potential for toxicity.

A Toxic Unit greater than 1 indicates there is potential for toxicity. The higher the number, the greater potential for toxic effects.

The 2022/23 PCCK06 sample showed no acute toxicity with 100% survival, however, chronic toxicity was observed with a reduction in reproduction of 48% (SLR 2023). The chronic toxicity may have been related to a zinc concentration of 43 µg/L (2.8 TU) at the site. However, the PCPWD was not discharging at the time of sampling of the 2022/23 sample.

### 4.2 Dilution Series Bioassays

The 2023/24 ecotox assessment of the PCPWD water showed acute and chronic toxicity with 100% mortalities in 1.6% PCPWD water and 0% reproduction in 1.6% PCPWD water. The EC<sub>50</sub> result for both bioassays was 0.9%. Previous DTAs conducted on the PCPWD in 2021 (SLR 2021) and 2022 (SLR 2022) recorded EC<sub>10S</sub> and EC<sub>50S</sub> <6.3%. Toxicity in these samples was determined to be associated with elevated zinc concentrations.

**Table 3-3** shows that PCPWD recorded elevated concentrations of cadmium, cobalt, copper, nickel and zinc. To assess the potential source of toxicity in the sample, TUs were calculated using the SSTVs for the compliance point PCCK06. **Table 4-2** shows that, in the 0.9% dilution, the sample had a nominal concentration of zinc of 87.3 µg/L and a TU of 5.8. This indicates that zinc is the likely cause of the observed acute and chronic toxicity.



**Table 4-2 Estimated Toxic Units in PCPWD for Cladoceran Survival**

| Metal (µg/L)                                                                                                                                                                                                                                                                                                                                                                                          | PCPWD              |                                   | SSTV | Toxic Unit based on EC <sub>50</sub> <sup>(1)</sup> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-----------------------------------|------|-----------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                       | 100% (measured)    | EC <sub>50</sub> (0.9%) (nominal) |      |                                                     |
| Cadmium                                                                                                                                                                                                                                                                                                                                                                                               | 17                 | 0.153                             | 0.4  | 0.38                                                |
| Cobalt                                                                                                                                                                                                                                                                                                                                                                                                | 190                | 1.71                              | 1.4  | 1.2                                                 |
| Copper                                                                                                                                                                                                                                                                                                                                                                                                | 40                 | 0.36                              | 1.8  | 0.20                                                |
| Nickel                                                                                                                                                                                                                                                                                                                                                                                                | 140                | 1.26                              | 13   | 0.09                                                |
| Zinc                                                                                                                                                                                                                                                                                                                                                                                                  | 9,700              | 87.3                              | 15   | 5.8                                                 |
| EC                                                                                                                                                                                                                                                                                                                                                                                                    | 801 <sup>(2)</sup> | 109 (measured) <sup>(3)</sup>     | 250  | -                                                   |
| <p>PCPWD = Pine Creek Process Water Dam water. SSTV = Site Specific Trigger Value.</p> <p><sup>(1)</sup> TUs calculated from the nominal 0.9% treatment concentrations as follows:<br/>Toxic Unit = Measured concentration ÷ SSTV.</p> <p><sup>(2)</sup> Measured upon receipt by ESA</p> <p><sup>(3)</sup> EC results as measured by ESA in 0.8% tested dilution and shown in <b>Appendix B</b>.</p> |                    |                                   |      |                                                     |



## 5.0 Conclusions and Recommendations

### 5.1 Conclusions

An ecotoxicity program was implemented by NTMO to assess the environmental impact to Copperfield Creek from the discharge of mine affected dam water from the PCPWD. The program conducted included screening tests and DTA using a sensitive species to assess acute and chronic toxicity of samples representative of the receiving environment (PCCK06) and onsite dam water (PCPWD).

The results of the 2023/24 ecotox monitoring at PCPA show acute and chronic toxicity at PCCK06 related to the cadmium, cobalt and zinc concentrations, with the majority of the toxicity due to the zinc concentration of the water discharged from PCPWD. Zinc was also the major contributor to the toxicity observed in the PCPWD sample. However, any future treatment of the PCPWD water to reduce the metal concentrations will result in reduced toxicity.

In order to correctly interpret the integrated impact of the PCPWD, the results of the 2023/24 aquatic macroinvertebrate study will need to be assessed, taking into account the toxicity observed at PCCK06. Historical macroinvertebrate studies have shown that there are no significant differences between the upstream (reference) and downstream (impacted) Copperfield Creek sites after discharges from PCPWD. For example, the 2021 PCCK06 sample recorded a zinc concentration of 950 µg/L and did not result in long term adverse impacts to the ecology of the receiving environment in Copperfield Creek (Aquatic Ecology Services 2022).

### 5.2 Recommendations

The following items are recommended to be addressed in future ecotoxicity programs for the PCPA:

- Maintain the program as conducted in 2023/24 for the 2024/25 wet season.
- Ensure that there is discharge from PCPWD during sampling at PCCK06.
- Interpret the March 2024 results upon receipt of the aquatic macroinvertebrate 2023/24 wet season report.



## 6.0 References

- Agnico Eagle. 2022. Cosmo Howley Project Area Biological Monitoring Plan 2022 (Macroinvertebrate, Sediment and Ecotoxicity). October 2022.
- ANZG. 2018. Australia and New Zealand Guidelines for Freshwater and Marine Water Quality. <https://www.waterquality.gov.au/guidelines/anz-fresh-marine>
- Aquatic Ecology Services. 2022. Pine Creek Project Area Biological and Sediment Monitoring 2022. Final Report. July 2022.
- GHD. 2018. Kirkland Lake Gold Northern Territory Mining Operations CHPA Ecotoxicological Plan 2018/19. October 2018.
- SLR. 2021. Pine Creek Ecotox Report 2021. Prepared for Kirkland Lake Gold. April 2021
- SLR. 2022. Pine Creek Ecotox Report 2022. Prepared for Kirkland Lake Gold. April 2022
- SLR 2023. Pine Creek Ecotox Report 2023. Prepared for Agnico Eagle. June 2023
- US EPA. 2002. Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms. 4th Ed. United States Environmental Protection Agency, Office of Water, Washington DC.





## **Appendix A   Pine Creek Chemistry**

## **CERTIFICATE OF ANALYSIS 346036**

### **Client Details**

|                  |                              |
|------------------|------------------------------|
| <b>Client</b>    | NT Mining Operations Pty Ltd |
| <b>Attention</b> | AEM result                   |
| <b>Address</b>   | GPO 469, Darwin, NT, 0800    |

### **Sample Details**

|                                             |                             |
|---------------------------------------------|-----------------------------|
| <b>Your Reference</b>                       | <u>Pine Creek Mine Site</u> |
| <b>Number of Samples</b>                    | 5 Water                     |
| <b>Date samples received</b>                | 08/03/2024                  |
| <b>Date completed instructions received</b> | 08/03/2024                  |

### **Analysis Details**

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

**Please refer to the last page of this report for any comments relating to the results.**

### **Report Details**

|                                                                                                             |            |
|-------------------------------------------------------------------------------------------------------------|------------|
| <b>Date results requested by</b>                                                                            | 12/03/2024 |
| <b>Date of Issue</b>                                                                                        | 12/03/2024 |
| NATA Accreditation Number 2901. This document shall not be reproduced except in full.                       |            |
| Accredited for compliance with ISO/IEC 17025 - Testing. <b>Tests not covered by NATA are denoted with *</b> |            |

#### **Results Approved By**

Hannah Nguyen, Metals Supervisor  
Nick Sarlamis, Assistant Operation Manager

#### **Authorised By**

Nancy Zhang, Laboratory Manager

Client Reference: Pine Creek Mine Site

| HM in water - dissolved |       |            |            |            |            |            |
|-------------------------|-------|------------|------------|------------|------------|------------|
| Our Reference           |       | 346036-1   | 346036-2   | 346036-3   | 346036-4   | 346036-5   |
| Your Reference          | UNITS | PCCK22     | PCCK16     | PCCK06     | PCPWD      | PCWRDSE01  |
| InViron ID Croc Gold    |       | 564615     | 564616     | 564617     | 564618     | 564619     |
| Date Sampled            |       | 05/03/2024 | 05/03/2024 | 05/03/2024 | 05/03/2024 | 05/03/2024 |
| Type of sample          |       | Water      | Water      | Water      | Water      | Water      |
| Date prepared           | -     | 11/03/2024 | 11/03/2024 | 11/03/2024 | 11/03/2024 | 11/03/2024 |
| Date analysed           | -     | 11/03/2024 | 11/03/2024 | 11/03/2024 | 11/03/2024 | 11/03/2024 |
| Aluminium-Dissolved     | µg/L  | 30         | 20         | 30         | 330        | 30,000     |
| Arsenic-Dissolved       | µg/L  | <1         | <1         | 1          | 5          | 21         |
| Cadmium-Dissolved       | µg/L  | <0.1       | <0.1       | 3.4        | 17         | 230        |
| Cobalt-Dissolved        | µg/L  | <1         | <1         | 40         | 190        | 1,300      |
| Chromium-Dissolved      | µg/L  | <1         | <1         | <1         | <1         | 1          |
| Copper-Dissolved        | µg/L  | <1         | <1         | 6.1        | 40         | 890        |
| Iron-Dissolved          | µg/L  | 100        | 120        | 20         | 70         | 300        |
| Lead-Dissolved          | µg/L  | <1         | <1         | <1         | 7          | 69         |
| Manganese-Dissolved     | µg/L  | 16         | 6          | 1,100      | 4,600      | 25,000     |
| Nickel-Dissolved        | µg/L  | 1          | <1         | 33         | 140        | 1,100      |
| Selenium-Dissolved      | µg/L  | <1         | <1         | <1         | <1         | 1          |
| Zinc-Dissolved          | µg/L  | 61         | 2          | 2,200      | 9,700      | 100,000    |

Client Reference: Pine Creek Mine Site

| HM in water - total  |       |            |            |            |            |            |
|----------------------|-------|------------|------------|------------|------------|------------|
| Our Reference        | UNITS | 346036-1   | 346036-2   | 346036-3   | 346036-4   | 346036-5   |
| Your Reference       |       | PCCK22     | PCCK16     | PCCK06     | PCPWD      | PCWRDSE01  |
| InViron ID Croc Gold |       | 564615     | 564616     | 564617     | 564618     | 564619     |
| Date Sampled         |       | 05/03/2024 | 05/03/2024 | 05/03/2024 | 05/03/2024 | 05/03/2024 |
| Type of sample       |       | Water      | Water      | Water      | Water      | Water      |
| Date prepared        | -     | 11/03/2024 | 11/03/2024 | 11/03/2024 | 11/03/2024 | 11/03/2024 |
| Date analysed        | -     | 11/03/2024 | 11/03/2024 | 11/03/2024 | 11/03/2024 | 11/03/2024 |
| Aluminium-Total      | µg/L  | 920        | 190        | 330        | 620        | 37,000     |
| Arsenic-Total        | µg/L  | <1         | <1         | 2          | 9          | 19         |
| Cadmium-Total        | µg/L  | 0.1        | <0.1       | 3.6        | 17         | 230        |
| Cobalt-Total         | µg/L  | 1          | <1         | 38         | 180        | 1,600      |
| Chromium-Total       | µg/L  | 1          | <1         | <1         | <1         | 1          |
| Copper-Total         | µg/L  | 3          | <1         | 8          | 42         | 950        |
| Iron-Total           | µg/L  | 1,500      | 560        | 600        | 430        | 280        |
| Lead-Total           | µg/L  | 2          | <1         | 2          | 8          | 70         |
| Manganese-Total      | µg/L  | 44         | 7          | 1,100      | 5,100      | 29,000     |
| Nickel-Total         | µg/L  | 5          | 3          | 31         | 140        | 1,200      |
| Selenium-Total       | µg/L  | <1         | <1         | <1         | <1         | <1         |
| Zinc-Total           | µg/L  | 88         | 61         | 2,100      | 10,000     | 120,000    |

Client Reference: Pine Creek Mine Site

| Ion Balance                                                  |                        |            |            |            |            |            |
|--------------------------------------------------------------|------------------------|------------|------------|------------|------------|------------|
| Our Reference                                                |                        | 346036-1   | 346036-2   | 346036-3   | 346036-4   | 346036-5   |
| Your Reference                                               | UNITS                  | PCCK22     | PCCK16     | PCCK06     | PCPWD      | PCWRDSE01  |
| InViron ID Croc Gold                                         |                        | 564615     | 564616     | 564617     | 564618     | 564619     |
| Date Sampled                                                 |                        | 05/03/2024 | 05/03/2024 | 05/03/2024 | 05/03/2024 | 05/03/2024 |
| Type of sample                                               |                        | Water      | Water      | Water      | Water      | Water      |
| Date prepared                                                | -                      | 8/03/2024  | 8/03/2024  | 8/03/2024  | 8/03/2024  | 8/03/2024  |
| Date analysed                                                | -                      | 8/03/2024  | 8/03/2024  | 8/03/2024  | 8/03/2024  | 8/03/2024  |
| Calcium - Dissolved                                          | mg/L                   | 0.9        | <0.5       | 5.6        | 22         | 130        |
| Potassium - Dissolved                                        | mg/L                   | 1          | 1          | 2          | 3          | 7.4        |
| Sodium - Dissolved                                           | mg/L                   | 2          | 3          | 9.2        | 30         | 29         |
| Magnesium - Dissolved                                        | mg/L                   | 1          | 0.8        | 14         | 56         | 330        |
| Hydroxide Alkalinity (OH <sup>-</sup> ) as CaCO <sub>3</sub> | mg/L                   | <5         | <5         | <5         | <5         | <5         |
| Bicarbonate Alkalinity as CaCO <sub>3</sub>                  | mg/L                   | 9          | 15         | 11         | <5         | <5         |
| Carbonate Alkalinity as CaCO <sub>3</sub>                    | mg/L                   | <5         | <5         | <5         | <5         | <5         |
| Total Alkalinity as CaCO <sub>3</sub>                        | mg/L                   | 9          | 15         | 11         | <5         | <5         |
| Sulphate, SO <sub>4</sub>                                    | mg/L                   | 7          | <1         | 83         | 350        | 2,000      |
| Chloride, Cl                                                 | mg/L                   | <1         | <1         | 2          | 4          | 5          |
| Ionic Balance                                                | %                      | -4.0       | -11        | -4.0       | -2.0       | -9.0       |
| Hardness                                                     | mgCaCO <sub>3</sub> /L | 8.5        | 3.4        | 70         | 290        | 1,700      |

# Client Reference: Pine Creek Mine Site

| Miscellaneous Inorganics     |       |            |            |            |            |            |
|------------------------------|-------|------------|------------|------------|------------|------------|
| Our Reference                |       | 346036-1   | 346036-2   | 346036-3   | 346036-4   | 346036-5   |
| Your Reference               | UNITS | PCCK22     | PCCK16     | PCCK06     | PCPWD      | PCWRDSE01  |
| InViron ID Croc Gold         |       | 564615     | 564616     | 564617     | 564618     | 564619     |
| Date Sampled                 |       | 05/03/2024 | 05/03/2024 | 05/03/2024 | 05/03/2024 | 05/03/2024 |
| Type of sample               |       | Water      | Water      | Water      | Water      | Water      |
| Date prepared                | -     | 08/03/2024 | 08/03/2024 | 08/03/2024 | 08/03/2024 | 08/03/2024 |
| Date analysed                | -     | 08/03/2024 | 08/03/2024 | 08/03/2024 | 08/03/2024 | 08/03/2024 |
| Acidity as CaCO <sub>3</sub> | mg/L  | <5         | <5         | <5         | 27         | 400        |
| Total Suspended Solids       | mg/L  | 41         | <10        | 11         | 20         | <20        |
| Turbidity                    | NTU   | 67         | 9.1        | 8.6        | 14         | 0.6        |
| Total Nitrogen in water      | µg/L  | <100       | <100       | 100        | 400        | 500        |
| Ammonia as N in water        | mg/L  | <0.005     | <0.005     | 0.030      | 0.11       | 0.008      |
| NOx as N in water            | mg/L  | 0.03       | 0.03       | 0.08       | 0.2        | 0.96       |
| Total Organic Carbon         | mg/L  | 5          | 4          | 4          | 3          | 3          |
| Total Phosphorus             | mg/L  | <0.01      | 0.01       | <0.01      | <0.01      | <0.01      |

## Client Reference: Pine Creek Mine Site

| Method ID                | Methodology Summary                                                                                                                                                                                                                                                                                                             |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Inorg-005</b>         | Acidity - determined titrimetrically in accordance with APHA latest Edition, 2310-B.                                                                                                                                                                                                                                            |
| <b>Inorg-006</b>         | Alkalinity - determined titrimetrically in accordance with APHA latest edition, 2320-B.                                                                                                                                                                                                                                         |
| <b>Inorg-019</b>         | Suspended Solids - determined gravimetrically by filtration of the sample. The samples are dried at 104+/-5°C.                                                                                                                                                                                                                  |
| <b>Inorg-022</b>         | Turbidity - measured nephelometrically using a turbidimeter, in accordance with APHA latest edition, 2130-B.                                                                                                                                                                                                                    |
| <b>Inorg-040</b>         | The concentrations of the major ions (mg/L) are converted to milliequivalents and summed. The ionic balance should be within +/- 15% ie total anions = total cations +/-15%.                                                                                                                                                    |
| <b>Inorg-055</b>         | Nitrate - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.                                                                                                                                                                              |
| <b>Inorg-055/062/127</b> | Total Nitrogen - Calculation sum of TKN and oxidised Nitrogen. Alternatively analysed by combustion and chemiluminescence.                                                                                                                                                                                                      |
| <b>Inorg-057</b>         | Ammonia - determined colourimetrically, based on APHA latest edition 4500-NH3 F. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a KCl extraction.                                                                                                                                       |
| <b>Inorg-060</b>         | Total Phosphorus determined after persulphate digestion followed by colourimetric analysis.                                                                                                                                                                                                                                     |
| <b>Inorg-079</b>         | TOC determined using a TOC analyser using the combustion method. Dissolved requires filtering prior to determination. Analysis using APHA latest edition 5310B.                                                                                                                                                                 |
| <b>Inorg-081</b>         | Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis.<br>Alternatively determined by colourimetry/turbidity using Discrete Analyser.                                                                       |
| <b>Metals-020</b>        | Determination of various metals by ICP-AES.                                                                                                                                                                                                                                                                                     |
| <b>Metals-022</b>        | Determination of various metals by ICP-MS.<br><br>Please note for Bromine and Iodine, any forms of these elements that are present are included together in the one result reported for each of these two elements.<br><br>Salt forms (e.g. FeO, PbO, ZnO) are determined stoichiometrically from the base metal concentration. |

# Client Reference: Pine Creek Mine Site

| QUALITY CONTROL: HM in water - dissolved |       |     |            |            | Duplicate |            |            | Spike Recovery % |            |      |
|------------------------------------------|-------|-----|------------|------------|-----------|------------|------------|------------------|------------|------|
| Test Description                         | Units | PQL | Method     | Blank      | #         | Base       | Dup.       | RPD              | LCS-W1     | [NT] |
| Date prepared                            | -     |     |            | 11/03/2024 | 1         | 11/03/2024 | 11/03/2024 |                  | 11/03/2024 | [NT] |
| Date analysed                            | -     |     |            | 11/03/2024 | 1         | 11/03/2024 | 11/03/2024 |                  | 11/03/2024 | [NT] |
| Aluminium-Dissolved                      | µg/L  | 10  | Metals-022 | <10        | 1         | 30         | 30         | 0                | 95         | [NT] |
| Arsenic-Dissolved                        | µg/L  | 1   | Metals-022 | <1         | 1         | <1         | <1         | 0                | 90         | [NT] |
| Cadmium-Dissolved                        | µg/L  | 0.1 | Metals-022 | <0.1       | 1         | <0.1       | <0.1       | 0                | 98         | [NT] |
| Cobalt-Dissolved                         | µg/L  | 1   | Metals-022 | <1         | 1         | <1         | <1         | 0                | 112        | [NT] |
| Chromium-Dissolved                       | µg/L  | 1   | Metals-022 | <1         | 1         | <1         | <1         | 0                | 105        | [NT] |
| Copper-Dissolved                         | µg/L  | 1   | Metals-022 | <1         | 1         | <1         | <1         | 0                | 112        | [NT] |
| Iron-Dissolved                           | µg/L  | 10  | Metals-022 | <10        | 1         | 100        | 110        | 10               | 104        | [NT] |
| Lead-Dissolved                           | µg/L  | 1   | Metals-022 | <1         | 1         | <1         | <1         | 0                | 97         | [NT] |
| Manganese-Dissolved                      | µg/L  | 5   | Metals-022 | <5         | 1         | 16         | 17         | 6                | 108        | [NT] |
| Nickel-Dissolved                         | µg/L  | 1   | Metals-022 | <1         | 1         | 1          | 1          | 0                | 111        | [NT] |
| Selenium-Dissolved                       | µg/L  | 1   | Metals-022 | <1         | 1         | <1         | <1         | 0                | 99         | [NT] |
| Zinc-Dissolved                           | µg/L  | 1   | Metals-022 | <1         | 1         | 61         | 61         | 0                | 92         | [NT] |

Client Reference: Pine Creek Mine Site

| QUALITY CONTROL: HM in water - total |       |     |            |            | Duplicate |      |      | Spike Recovery % |            |      |
|--------------------------------------|-------|-----|------------|------------|-----------|------|------|------------------|------------|------|
| Test Description                     | Units | PQL | Method     | Blank      | #         | Base | Dup. | RPD              | LCS-W3     | [NT] |
| Date prepared                        | -     |     |            | 11/03/2024 | [NT]      | [NT] | [NT] | [NT]             | 11/03/2024 | [NT] |
| Date analysed                        | -     |     |            | 11/03/2024 | [NT]      | [NT] | [NT] | [NT]             | 11/03/2024 | [NT] |
| Aluminium-Total                      | µg/L  | 10  | Metals-022 | <10        | [NT]      | [NT] | [NT] | [NT]             | 94         | [NT] |
| Arsenic-Total                        | µg/L  | 1   | Metals-022 | <1         | [NT]      | [NT] | [NT] | [NT]             | 89         | [NT] |
| Cadmium-Total                        | µg/L  | 0.1 | Metals-022 | <0.1       | [NT]      | [NT] | [NT] | [NT]             | 95         | [NT] |
| Cobalt-Total                         | µg/L  | 1   | Metals-022 | <1         | [NT]      | [NT] | [NT] | [NT]             | 103        | [NT] |
| Chromium-Total                       | µg/L  | 1   | Metals-022 | <1         | [NT]      | [NT] | [NT] | [NT]             | 96         | [NT] |
| Copper-Total                         | µg/L  | 1   | Metals-022 | <1         | [NT]      | [NT] | [NT] | [NT]             | 103        | [NT] |
| Iron-Total                           | µg/L  | 10  | Metals-022 | <10        | [NT]      | [NT] | [NT] | [NT]             | 98         | [NT] |
| Lead-Total                           | µg/L  | 1   | Metals-022 | <1         | [NT]      | [NT] | [NT] | [NT]             | 95         | [NT] |
| Manganese-Total                      | µg/L  | 5   | Metals-022 | <5         | [NT]      | [NT] | [NT] | [NT]             | 102        | [NT] |
| Nickel-Total                         | µg/L  | 1   | Metals-022 | <1         | [NT]      | [NT] | [NT] | [NT]             | 102        | [NT] |
| Selenium-Total                       | µg/L  | 1   | Metals-022 | <1         | [NT]      | [NT] | [NT] | [NT]             | 99         | [NT] |
| Zinc-Total                           | µg/L  | 1   | Metals-022 | <1         | [NT]      | [NT] | [NT] | [NT]             | 86         | [NT] |

Client Reference: Pine Creek Mine Site

| QUALITY CONTROL: Ion Balance                                 |                        |     |            |            |   | Duplicate |           |     | Spike Recovery % |      |
|--------------------------------------------------------------|------------------------|-----|------------|------------|---|-----------|-----------|-----|------------------|------|
| Test Description                                             | Units                  | PQL | Method     | Blank      | # | Base      | Dup.      | RPD | LCS-W1           | [NT] |
| Date prepared                                                | -                      |     |            | 08/03/2024 | 2 | 8/03/2024 | 8/03/2024 |     | 08/03/2024       | [NT] |
| Date analysed                                                | -                      |     |            | 08/03/2024 | 2 | 8/03/2024 | 8/03/2024 |     | 08/03/2024       | [NT] |
| Calcium - Dissolved                                          | mg/L                   | 0.5 | Metals-020 | <0.5       | 2 | <0.5      | <0.5      | 0   | 89               | [NT] |
| Potassium - Dissolved                                        | mg/L                   | 0.5 | Metals-020 | <0.5       | 2 | 1         | 1         | 0   | 93               | [NT] |
| Sodium - Dissolved                                           | mg/L                   | 0.5 | Metals-020 | <0.5       | 2 | 3         | 3         | 0   | 97               | [NT] |
| Magnesium - Dissolved                                        | mg/L                   | 0.5 | Metals-020 | <0.5       | 2 | 0.8       | 0.8       | 0   | 87               | [NT] |
| Hydroxide Alkalinity (OH <sup>-</sup> ) as CaCO <sub>3</sub> | mg/L                   | 5   | Inorg-006  | <5         | 2 | <5        | [NT]      |     | [NT]             | [NT] |
| Bicarbonate Alkalinity as CaCO <sub>3</sub>                  | mg/L                   | 5   | Inorg-006  | <5         | 2 | 15        | [NT]      |     | [NT]             | [NT] |
| Carbonate Alkalinity as CaCO <sub>3</sub>                    | mg/L                   | 5   | Inorg-006  | <5         | 2 | <5        | [NT]      |     | [NT]             | [NT] |
| Total Alkalinity as CaCO <sub>3</sub>                        | mg/L                   | 5   | Inorg-006  | <5         | 2 | 15        | [NT]      |     | 100              | [NT] |
| Sulphate, SO4                                                | mg/L                   | 1   | Inorg-081  | <1         | 2 | <1        | [NT]      |     | 98               | [NT] |
| Chloride, Cl                                                 | mg/L                   | 1   | Inorg-081  | <1         | 2 | <1        | [NT]      |     | 89               | [NT] |
| Ionic Balance                                                | %                      |     | Inorg-040  | [NT]       | 2 | -11       | [NT]      |     | [NT]             | [NT] |
| Hardness                                                     | mgCaCO <sub>3</sub> /L | 3   | Metals-020 | [NT]       | 2 | 3.4       | [NT]      |     | [NT]             | [NT] |

Client Reference: Pine Creek Mine Site

| QUALITY CONTROL: Miscellaneous Inorganics |       |       |                   |            | Duplicate |      |      | Spike Recovery % |            |      |
|-------------------------------------------|-------|-------|-------------------|------------|-----------|------|------|------------------|------------|------|
| Test Description                          | Units | PQL   | Method            | Blank      | #         | Base | Dup. | RPD              | LCS-W1     | [NT] |
| Date prepared                             | -     |       |                   | 08/03/2024 | [NT]      | [NT] | [NT] | [NT]             | 08/03/2024 | [NT] |
| Date analysed                             | -     |       |                   | 08/03/2024 | [NT]      | [NT] | [NT] | [NT]             | 08/03/2024 | [NT] |
| Acidity as CaCO <sub>3</sub>              | mg/L  | 5     | Inorg-005         | <5         | [NT]      | [NT] | [NT] | [NT]             | 100        | [NT] |
| Total Suspended Solids                    | mg/L  | 5     | Inorg-019         | <5         | [NT]      | [NT] | [NT] | [NT]             | 91         | [NT] |
| Turbidity                                 | NTU   | 0.1   | Inorg-022         | <0.1       | [NT]      | [NT] | [NT] | [NT]             | 106        | [NT] |
| Total Nitrogen in water                   | µg/L  | 100   | Inorg-055/062/127 | <100       | [NT]      | [NT] | [NT] | [NT]             | 101        | [NT] |
| Ammonia as N in water                     | mg/L  | 0.005 | Inorg-057         | <0.005     | [NT]      | [NT] | [NT] | [NT]             | 98         | [NT] |
| NOx as N in water                         | mg/L  | 0.005 | Inorg-055         | <0.005     | [NT]      | [NT] | [NT] | [NT]             | 98         | [NT] |
| Total Organic Carbon                      | mg/L  | 1     | Inorg-079         | <1         | [NT]      | [NT] | [NT] | [NT]             | 101        | [NT] |
| Total Phosphorus                          | mg/L  | 0.01  | Inorg-060         | <0.01      | [NT]      | [NT] | [NT] | [NT]             | 115        | [NT] |

**Result Definitions**

|             |                                           |
|-------------|-------------------------------------------|
| <b>NT</b>   | Not tested                                |
| <b>NA</b>   | Test not required                         |
| <b>INS</b>  | Insufficient sample for this test         |
| <b>PQL</b>  | Practical Quantitation Limit              |
| <b>&lt;</b> | Less than                                 |
| <b>&gt;</b> | Greater than                              |
| <b>RPD</b>  | Relative Percent Difference               |
| <b>LCS</b>  | Laboratory Control Sample                 |
| <b>NS</b>   | Not specified                             |
| <b>NEPM</b> | National Environmental Protection Measure |
| <b>NR</b>   | Not Reported                              |

## Quality Control Definitions

|                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Blank</b>                                                                                                                                                                                                                                                   | This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.           |
| <b>Duplicate</b>                                                                                                                                                                                                                                               | This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.                                                 |
| <b>Matrix Spike</b>                                                                                                                                                                                                                                            | A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist. |
| <b>LCS (Laboratory Control Sample)</b>                                                                                                                                                                                                                         | This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.                                |
| <b>Surrogate Spike</b>                                                                                                                                                                                                                                         | Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.                          |
| Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.     |                                                                                                                                                                                                                                  |
| The recommended maximums for analytes in urine are taken from "2018 TLVs and BEIs", as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016. |                                                                                                                                                                                                                                  |
| Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2                                                                                                                         |                                                                                                                                                                                                                                  |

## Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

## Report Comments

MISC\_INORG:Turbidity/NOx as N in water:Samples were out of the recommended holding time for this analysis.

Total Suspended Solids: PQL has been raised due to the small volume of sample supplied.

## **CERTIFICATE OF ANALYSIS 345578**

### **Client Details**

|                  |                              |
|------------------|------------------------------|
| <b>Client</b>    | NT Mining Operations Pty Ltd |
| <b>Attention</b> | Emily Ordogh                 |
| <b>Address</b>   | GPO 469, Darwin, NT, 0800    |

### **Sample Details**

|                                             |                             |
|---------------------------------------------|-----------------------------|
| <b>Your Reference</b>                       | <u>Pine Creek Mine Site</u> |
| <b>Number of Samples</b>                    | 9 Water                     |
| <b>Date samples received</b>                | 05/03/2024                  |
| <b>Date completed instructions received</b> | 05/03/2024                  |

### **Analysis Details**

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

**Please refer to the last page of this report for any comments relating to the results.**

### **Report Details**

|                                                                                                             |            |
|-------------------------------------------------------------------------------------------------------------|------------|
| <b>Date results requested by</b>                                                                            | 07/03/2024 |
| <b>Date of Issue</b>                                                                                        | 07/03/2024 |
| NATA Accreditation Number 2901. This document shall not be reproduced except in full.                       |            |
| Accredited for compliance with ISO/IEC 17025 - Testing. <b>Tests not covered by NATA are denoted with *</b> |            |

#### **Results Approved By**

Loren Bardwell, Development Chemist  
 Priya Samarawickrama, Senior Chemist

#### **Authorised By**

Nancy Zhang, Laboratory Manager

Client Reference: Pine Creek Mine Site

| HM in water - dissolved |       |            |            |            |            |            |
|-------------------------|-------|------------|------------|------------|------------|------------|
| Our Reference           | UNITS | 345578-1   | 345578-2   | 345578-3   | 345578-4   | 345578-5   |
| Your Reference          |       | PCCK01     | PCCK03     | PCCK04     | PCCK06     | PCCK16     |
| InViron ID Croc Gold    |       | 564490     | 564492     | 564493     | 564494     | 564495     |
| Date Sampled            |       | 27/02/2024 | 27/02/2024 | 27/02/2024 | 27/02/2024 | 27/02/2024 |
| Type of sample          |       | Water      | Water      | Water      | Water      | Water      |
| Date prepared           | -     | 06/03/2024 | 06/03/2024 | 06/03/2024 | 06/03/2024 | 06/03/2024 |
| Date analysed           | -     | 06/03/2024 | 06/03/2024 | 06/03/2024 | 06/03/2024 | 06/03/2024 |
| Aluminium-Dissolved     | µg/L  | 50         | 20         | 30         | 10         | 20         |
| Arsenic-Dissolved       | µg/L  | 2          | 3          | 2          | <1         | <1         |
| Cadmium-Dissolved       | µg/L  | <0.1       | 0.2        | 0.7        | 1.3        | <0.1       |
| Cobalt-Dissolved        | µg/L  | <1         | 3          | 9          | 13         | <1         |
| Chromium-Dissolved      | µg/L  | <1         | <1         | <1         | <1         | <1         |
| Copper-Dissolved        | µg/L  | <1         | 1.4        | 3.3        | 1.5        | <1         |
| Iron-Dissolved          | µg/L  | 110        | 50         | 20         | 60         | 180        |
| Lead-Dissolved          | µg/L  | <1         | <1         | <1         | <1         | <1         |
| Manganese-Dissolved     | µg/L  | 7          | 110        | 260        | 480        | 5          |
| Nickel-Dissolved        | µg/L  | <1         | 3          | 8          | 12         | <1         |
| Selenium-Dissolved      | µg/L  | <1         | <1         | <1         | <1         | <1         |
| Zinc-Dissolved          | µg/L  | 3          | 80         | 390        | 960        | 4          |

| HM in water - dissolved |       |            |            |            |            |
|-------------------------|-------|------------|------------|------------|------------|
| Our Reference           | UNITS | 345578-6   | 345578-7   | 345578-8   | 345578-9   |
| Your Reference          |       | PCCK22     | PCCKWD     | PCWRDSE01  | PCCK02     |
| InViron ID Croc Gold    |       | 564496     | 564497     | 564498     | 564491     |
| Date Sampled            |       | 27/02/2024 | 27/02/2024 | 27/02/2024 | 27/02/2024 |
| Type of sample          |       | Water      | Water      | Water      | Water      |
| Date prepared           | -     | 06/03/2024 | 06/03/2024 | 06/03/2024 | 06/03/2024 |
| Date analysed           | -     | 06/03/2024 | 06/03/2024 | 06/03/2024 | 06/03/2024 |
| Aluminium-Dissolved     | µg/L  | 90         | 510        | 36,000     | 30         |
| Arsenic-Dissolved       | µg/L  | <1         | 5          | 27         | 2          |
| Cadmium-Dissolved       | µg/L  | <0.1       | 18         | 260        | 0.7        |
| Cobalt-Dissolved        | µg/L  | <1         | 190        | 1,800      | 9          |
| Chromium-Dissolved      | µg/L  | <1         | <1         | 1          | <1         |
| Copper-Dissolved        | µg/L  | <1         | 36         | 1,100      | 3.0        |
| Iron-Dissolved          | µg/L  | 140        | 60         | 270        | 30         |
| Lead-Dissolved          | µg/L  | <1         | 8          | 74         | <1         |
| Manganese-Dissolved     | µg/L  | 8          | 6,200      | 33,000     | 250        |
| Nickel-Dissolved        | µg/L  | <1         | 150        | 1,500      | 8          |
| Selenium-Dissolved      | µg/L  | <1         | <1         | 1          | <1         |
| Zinc-Dissolved          | µg/L  | 18         | 13,000     | 130,000    | 360        |

Client Reference: Pine Creek Mine Site

| HM in water - total  |       |            |            |            |            |            |
|----------------------|-------|------------|------------|------------|------------|------------|
| Our Reference        | UNITS | 345578-1   | 345578-2   | 345578-3   | 345578-4   | 345578-5   |
| Your Reference       |       | PCCK01     | PCCK03     | PCCK04     | PCCK06     | PCCK16     |
| InViron ID Croc Gold |       | 564490     | 564492     | 564493     | 564494     | 564495     |
| Date Sampled         |       | 27/02/2024 | 27/02/2024 | 27/02/2024 | 27/02/2024 | 27/02/2024 |
| Type of sample       |       | Water      | Water      | Water      | Water      | Water      |
| Date prepared        | -     | 06/03/2024 | 06/03/2024 | 06/03/2024 | 06/03/2024 | 06/03/2024 |
| Date analysed        | -     | 06/03/2024 | 06/03/2024 | 06/03/2024 | 06/03/2024 | 06/03/2024 |
| Aluminium-Total      | µg/L  | 200        | 950        | 800        | 800        | 440        |
| Arsenic-Total        | µg/L  | 3          | 5          | 4          | 1          | <1         |
| Cadmium-Total        | µg/L  | <0.1       | 0.2        | 0.8        | 1.3        | <0.1       |
| Cobalt-Total         | µg/L  | <1         | 4          | 10         | 13         | <1         |
| Chromium-Total       | µg/L  | <1         | <1         | <1         | <1         | <1         |
| Copper-Total         | µg/L  | <1         | 3          | 7          | 3          | <1         |
| Iron-Total           | µg/L  | 300        | 950        | 850        | 1,400      | 1,200      |
| Lead-Total           | µg/L  | <1         | 3          | 3          | 1          | <1         |
| Manganese-Total      | µg/L  | 11         | 120        | 270        | 470        | 11         |
| Nickel-Total         | µg/L  | <1         | 4          | 9          | 12         | <1         |
| Selenium-Total       | µg/L  | <1         | <1         | <1         | <1         | <1         |
| Zinc-Total           | µg/L  | 9          | 97         | 420        | 950        | 8          |

| HM in water - total  |       |            |            |            |            |
|----------------------|-------|------------|------------|------------|------------|
| Our Reference        | UNITS | 345578-6   | 345578-7   | 345578-8   | 345578-9   |
| Your Reference       |       | PCCK22     | PCCKWD     | PCWRDSE01  | PCCK02     |
| InViron ID Croc Gold |       | 564496     | 564497     | 564498     | 564491     |
| Date Sampled         |       | 27/02/2024 | 27/02/2024 | 27/02/2024 | 27/02/2024 |
| Type of sample       |       | Water      | Water      | Water      | Water      |
| Date prepared        | -     | 06/03/2024 | 06/03/2024 | 06/03/2024 | 06/03/2024 |
| Date analysed        | -     | 06/03/2024 | 06/03/2024 | 06/03/2024 | 06/03/2024 |
| Aluminium-Total      | µg/L  | 960        | 710        | 39,000     | 690        |
| Arsenic-Total        | µg/L  | <1         | 7          | 20         | 4          |
| Cadmium-Total        | µg/L  | <0.1       | 18         | 260        | 0.7        |
| Cobalt-Total         | µg/L  | <1         | 190        | 1,800      | 8          |
| Chromium-Total       | µg/L  | 1          | <1         | 1          | <1         |
| Copper-Total         | µg/L  | 2          | 38         | 1,200      | 6          |
| Iron-Total           | µg/L  | 1,200      | 130        | 280        | 720        |
| Lead-Total           | µg/L  | 2          | 8          | 73         | 3          |
| Manganese-Total      | µg/L  | 36         | 6,400      | 36,000     | 230        |
| Nickel-Total         | µg/L  | 1          | 150        | 1,500      | 8          |
| Selenium-Total       | µg/L  | <1         | <1         | 1          | <1         |
| Zinc-Total           | µg/L  | 40         | 12,000     | 140,000    | 350        |

Client Reference: Pine Creek Mine Site

| Ion Balance                                                  |                        |            |            |            |            |            |
|--------------------------------------------------------------|------------------------|------------|------------|------------|------------|------------|
| Our Reference                                                |                        | 345578-1   | 345578-2   | 345578-3   | 345578-4   | 345578-5   |
| Your Reference                                               | UNITS                  | PCCK01     | PCCK03     | PCCK04     | PCCK06     | PCCK16     |
| InViron ID Croc Gold                                         |                        | 564490     | 564492     | 564493     | 564494     | 564495     |
| Date Sampled                                                 |                        | 27/02/2024 | 27/02/2024 | 27/02/2024 | 27/02/2024 | 27/02/2024 |
| Type of sample                                               |                        | Water      | Water      | Water      | Water      | Water      |
| Date prepared                                                | -                      | 05/03/2024 | 05/03/2024 | 05/03/2024 | 05/03/2024 | 05/03/2024 |
| Date analysed                                                | -                      | 05/03/2024 | 05/03/2024 | 05/03/2024 | 05/03/2024 | 05/03/2024 |
| Calcium - Dissolved                                          | mg/L                   | <0.5       | 4          | 4          | 3          | 0.8        |
| Potassium - Dissolved                                        | mg/L                   | 0.7        | 1          | 2          | 2          | 2          |
| Sodium - Dissolved                                           | mg/L                   | 3          | 3          | 3          | 6.6        | 4          |
| Magnesium - Dissolved                                        | mg/L                   | <0.5       | 5          | 6.5        | 7.8        | 1          |
| Hydroxide Alkalinity (OH <sup>-</sup> ) as CaCO <sub>3</sub> | mg/L                   | <5         | <5         | <5         | <5         | <5         |
| Bicarbonate Alkalinity as CaCO <sub>3</sub>                  | mg/L                   | 7          | 12         | 9          | 18         | 18         |
| Carbonate Alkalinity as CaCO <sub>3</sub>                    | mg/L                   | <5         | <5         | <5         | <5         | <5         |
| Total Alkalinity as CaCO <sub>3</sub>                        | mg/L                   | 7          | 12         | 9          | 18         | 18         |
| Sulphate, SO <sub>4</sub>                                    | mg/L                   | <1         | 27         | 39         | 42         | <1         |
| Chloride, Cl                                                 | mg/L                   | <1         | 1          | 1          | 2          | 1          |
| Ionic Balance                                                | %                      | 0          | -6.0       | -5.0       | -5.0       | -8.0       |
| Hardness                                                     | mgCaCO <sub>3</sub> /L | <3         | 28         | 36         | 41         | 6.7        |

| Ion Balance                                                  |                        |            |            |            |            |
|--------------------------------------------------------------|------------------------|------------|------------|------------|------------|
| Our Reference                                                |                        | 345578-6   | 345578-7   | 345578-8   | 345578-9   |
| Your Reference                                               | UNITS                  | PCCK22     | PCCKWD     | PCWRDSE01  | PCCK02     |
| InViron ID Croc Gold                                         |                        | 564496     | 564497     | 564498     | 564491     |
| Date Sampled                                                 |                        | 27/02/2024 | 27/02/2024 | 27/02/2024 | 27/02/2024 |
| Type of sample                                               |                        | Water      | Water      | Water      | Water      |
| Date prepared                                                | -                      | 05/03/2024 | 05/03/2024 | 05/03/2024 | 05/03/2024 |
| Date analysed                                                | -                      | 05/03/2024 | 05/03/2024 | 05/03/2024 | 05/03/2024 |
| Calcium - Dissolved                                          | mg/L                   | 0.9        | 31         | 170        | 4          |
| Potassium - Dissolved                                        | mg/L                   | 1          | 4          | 10         | 2          |
| Sodium - Dissolved                                           | mg/L                   | 3          | 35         | 36         | 3          |
| Magnesium - Dissolved                                        | mg/L                   | 0.9        | 79         | 470        | 6.2        |
| Hydroxide Alkalinity (OH <sup>-</sup> ) as CaCO <sub>3</sub> | mg/L                   | <5         | <5         | <5         | <5         |
| Bicarbonate Alkalinity as CaCO <sub>3</sub>                  | mg/L                   | 13         | <5         | <5         | 14         |
| Carbonate Alkalinity as CaCO <sub>3</sub>                    | mg/L                   | <5         | <5         | <5         | <5         |
| Total Alkalinity as CaCO <sub>3</sub>                        | mg/L                   | 13         | <5         | <5         | 14         |
| Sulphate, SO <sub>4</sub>                                    | mg/L                   | 1          | 450        | 2,600      | 41         |
| Chloride, Cl                                                 | mg/L                   | <1         | 6          | 6          | 1          |
| Ionic Balance                                                | %                      | -4.0       | 1.0        | -5.0       | -14        |
| Hardness                                                     | mgCaCO <sub>3</sub> /L | 6.0        | 400        | 2,300      | 34         |

Client Reference: Pine Creek Mine Site

| Miscellaneous Inorganics     |       |            |            |            |            |            |
|------------------------------|-------|------------|------------|------------|------------|------------|
| Our Reference                | UNITS | 345578-1   | 345578-2   | 345578-3   | 345578-4   | 345578-5   |
| Your Reference               |       | PCCK01     | PCCK03     | PCCK04     | PCCK06     | PCCK16     |
| InViron ID Croc Gold         |       | 564490     | 564492     | 564493     | 564494     | 564495     |
| Date Sampled                 |       | 27/02/2024 | 27/02/2024 | 27/02/2024 | 27/02/2024 | 27/02/2024 |
| Type of sample               |       | Water      | Water      | Water      | Water      | Water      |
| Date prepared                | -     | 05/03/2024 | 05/03/2024 | 05/03/2024 | 05/03/2024 | 05/03/2024 |
| Date analysed                | -     | 05/03/2024 | 05/03/2024 | 05/03/2024 | 05/03/2024 | 05/03/2024 |
| Acidity as CaCO <sub>3</sub> | mg/L  | <5         | <5         | <5         | <5         | <5         |
| Total Suspended Solids       | mg/L  | <10        | 19         | 19         | 19         | <10        |
| Turbidity                    | NTU   | 3.6        | 28         | 8.8        | 11         | 9.4        |
| Total Nitrogen in water      | µg/L  | 100        | <100       | <100       | 200        | <100       |
| Ammonia as N in water        | mg/L  | 0.005      | 0.006      | <0.005     | <0.005     | <0.005     |
| NOx as N in water            | mg/L  | 0.03       | 0.03       | 0.06       | 0.03       | 0.02       |
| Total Organic Carbon         | mg/L  | 5          | 5          | 4          | 7          | 7          |
| Total Phosphorus             | mg/L  | 0.01       | 0.01       | <0.01      | 0.01       | <0.01      |

| Miscellaneous Inorganics     |       |            |            |            |            |
|------------------------------|-------|------------|------------|------------|------------|
| Our Reference                | UNITS | 345578-6   | 345578-7   | 345578-8   | 345578-9   |
| Your Reference               |       | PCCK22     | PCCKWD     | PCWRDSE01  | PCCK02     |
| InViron ID Croc Gold         |       | 564496     | 564497     | 564498     | 564491     |
| Date Sampled                 |       | 27/02/2024 | 27/02/2024 | 27/02/2024 | 27/02/2024 |
| Type of sample               |       | Water      | Water      | Water      | Water      |
| Date prepared                | -     | 05/03/2024 | 05/03/2024 | 05/03/2024 | 05/03/2024 |
| Date analysed                | -     | 05/03/2024 | 05/03/2024 | 05/03/2024 | 05/03/2024 |
| Acidity as CaCO <sub>3</sub> | mg/L  | <5         | 28         | 460        | <5         |
| Total Suspended Solids       | mg/L  | 40         | <10        | <10        | 16         |
| Turbidity                    | NTU   | 59         | 2.2        | 0.2        | 23         |
| Total Nitrogen in water      | µg/L  | 100        | 400        | 2,300      | <100       |
| Ammonia as N in water        | mg/L  | <0.005     | 0.13       | <0.005     | <0.005     |
| NOx as N in water            | mg/L  | 0.02       | 0.2        | 2.3        | 0.04       |
| Total Organic Carbon         | mg/L  | 6          | 3          | 5          | 4          |
| Total Phosphorus             | mg/L  | 0.01       | <0.01      | <0.01      | <0.01      |

## Client Reference: Pine Creek Mine Site

| Method ID                | Methodology Summary                                                                                                                                                                                                                                                                                                             |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Inorg-005</b>         | Acidity - determined titrimetrically in accordance with APHA latest Edition, 2310-B.                                                                                                                                                                                                                                            |
| <b>Inorg-006</b>         | Alkalinity - determined titrimetrically in accordance with APHA latest edition, 2320-B.                                                                                                                                                                                                                                         |
| <b>Inorg-019</b>         | Suspended Solids - determined gravimetrically by filtration of the sample. The samples are dried at 104+/-5°C.                                                                                                                                                                                                                  |
| <b>Inorg-022</b>         | Turbidity - measured nephelometrically using a turbidimeter, in accordance with APHA latest edition, 2130-B.                                                                                                                                                                                                                    |
| <b>Inorg-040</b>         | The concentrations of the major ions (mg/L) are converted to milliequivalents and summed. The ionic balance should be within +/- 15% ie total anions = total cations +/-15%.                                                                                                                                                    |
| <b>Inorg-055</b>         | Nitrate - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.                                                                                                                                                                              |
| <b>Inorg-055/062/127</b> | Total Nitrogen - Calculation sum of TKN and oxidised Nitrogen. Alternatively analysed by combustion and chemiluminescence.                                                                                                                                                                                                      |
| <b>Inorg-057</b>         | Ammonia - determined colourimetrically, based on APHA latest edition 4500-NH3 F. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a KCl extraction.                                                                                                                                       |
| <b>Inorg-060</b>         | Total Phosphorus determined after persulphate digestion followed by colourimetric analysis.                                                                                                                                                                                                                                     |
| <b>Inorg-079</b>         | TOC determined using a TOC analyser using the combustion method. Dissolved requires filtering prior to determination. Analysis using APHA latest edition 5310B.                                                                                                                                                                 |
| <b>Inorg-081</b>         | Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis.<br>Alternatively determined by colourimetry/turbidity using Discrete Analyser.                                                                       |
| <b>Metals-020</b>        | Determination of various metals by ICP-AES.                                                                                                                                                                                                                                                                                     |
| <b>Metals-022</b>        | Determination of various metals by ICP-MS.<br><br>Please note for Bromine and Iodine, any forms of these elements that are present are included together in the one result reported for each of these two elements.<br><br>Salt forms (e.g. FeO, PbO, ZnO) are determined stoichiometrically from the base metal concentration. |

Client Reference: Pine Creek Mine Site

| QUALITY CONTROL: HM in water - dissolved |       |     |            |            | Duplicate |            |            | Spike Recovery % |            |      |
|------------------------------------------|-------|-----|------------|------------|-----------|------------|------------|------------------|------------|------|
| Test Description                         | Units | PQL | Method     | Blank      | #         | Base       | Dup.       | RPD              | LCS-W2     | [NT] |
| Date prepared                            | -     |     |            | 06/03/2024 | 1         | 06/03/2024 | 06/03/2024 |                  | 06/03/2024 | [NT] |
| Date analysed                            | -     |     |            | 06/03/2024 | 1         | 06/03/2024 | 06/03/2024 |                  | 06/03/2024 | [NT] |
| Aluminium-Dissolved                      | µg/L  | 10  | Metals-022 | <10        | 1         | 50         | 50         | 0                | 97         | [NT] |
| Arsenic-Dissolved                        | µg/L  | 1   | Metals-022 | <1         | 1         | 2          | 3          | 40               | 90         | [NT] |
| Cadmium-Dissolved                        | µg/L  | 0.1 | Metals-022 | <0.1       | 1         | <0.1       | <0.1       | 0                | 94         | [NT] |
| Cobalt-Dissolved                         | µg/L  | 1   | Metals-022 | <1         | 1         | <1         | <1         | 0                | 101        | [NT] |
| Chromium-Dissolved                       | µg/L  | 1   | Metals-022 | <1         | 1         | <1         | <1         | 0                | 98         | [NT] |
| Copper-Dissolved                         | µg/L  | 1   | Metals-022 | <1         | 1         | <1         | <1         | 0                | 98         | [NT] |
| Iron-Dissolved                           | µg/L  | 10  | Metals-022 | <10        | 1         | 110        | 100        | 10               | 99         | [NT] |
| Lead-Dissolved                           | µg/L  | 1   | Metals-022 | <1         | 1         | <1         | <1         | 0                | 100        | [NT] |
| Manganese-Dissolved                      | µg/L  | 5   | Metals-022 | <5         | 1         | 7          | 7          | 0                | 102        | [NT] |
| Nickel-Dissolved                         | µg/L  | 1   | Metals-022 | <1         | 1         | <1         | <1         | 0                | 96         | [NT] |
| Selenium-Dissolved                       | µg/L  | 1   | Metals-022 | <1         | 1         | <1         | <1         | 0                | 91         | [NT] |
| Zinc-Dissolved                           | µg/L  | 1   | Metals-022 | <1         | 1         | 3          | 3          | 0                | 97         | [NT] |

Client Reference: Pine Creek Mine Site

| QUALITY CONTROL: HM in water - total |       |     |            |            | Duplicate |            |            | Spike Recovery % |            |            |
|--------------------------------------|-------|-----|------------|------------|-----------|------------|------------|------------------|------------|------------|
| Test Description                     | Units | PQL | Method     | Blank      | #         | Base       | Dup.       | RPD              | LCS-W3     | 345578-2   |
| Date prepared                        | -     |     |            | 06/03/2024 | 1         | 06/03/2024 | 06/03/2024 |                  | 06/03/2024 | 06/03/2024 |
| Date analysed                        | -     |     |            | 06/03/2024 | 1         | 06/03/2024 | 06/03/2024 |                  | 06/03/2024 | 06/03/2024 |
| Aluminium-Total                      | µg/L  | 10  | Metals-022 | <10        | 1         | 200        | 210        | 5                | 100        | #          |
| Arsenic-Total                        | µg/L  | 1   | Metals-022 | <1         | 1         | 3          | 3          | 0                | 90         | 93         |
| Cadmium-Total                        | µg/L  | 0.1 | Metals-022 | <0.1       | 1         | <0.1       | <0.1       | 0                | 91         | 95         |
| Cobalt-Total                         | µg/L  | 1   | Metals-022 | <1         | 1         | <1         | <1         | 0                | 95         | 96         |
| Chromium-Total                       | µg/L  | 1   | Metals-022 | <1         | 1         | <1         | <1         | 0                | 88         | 94         |
| Copper-Total                         | µg/L  | 1   | Metals-022 | <1         | 1         | <1         | <1         | 0                | 94         | 95         |
| Iron-Total                           | µg/L  | 10  | Metals-022 | <10        | 1         | 300        | 320        | 6                | 92         | #          |
| Lead-Total                           | µg/L  | 1   | Metals-022 | <1         | 1         | <1         | <1         | 0                | 100        | 94         |
| Manganese-Total                      | µg/L  | 5   | Metals-022 | <5         | 1         | 11         | 11         | 0                | 91         | 94         |
| Nickel-Total                         | µg/L  | 1   | Metals-022 | <1         | 1         | <1         | <1         | 0                | 90         | 98         |
| Selenium-Total                       | µg/L  | 1   | Metals-022 | <1         | 1         | <1         | <1         | 0                | 95         | 91         |
| Zinc-Total                           | µg/L  | 1   | Metals-022 | <1         | 1         | 9          | 10         | 11               | 93         | 96         |

Client Reference: Pine Creek Mine Site

| QUALITY CONTROL: Ion Balance                                 |                        |     |            |            |   | Duplicate  |            |     | Spike Recovery % |            |
|--------------------------------------------------------------|------------------------|-----|------------|------------|---|------------|------------|-----|------------------|------------|
| Test Description                                             | Units                  | PQL | Method     | Blank      | # | Base       | Dup.       | RPD | LCS-W1           | 345578-2   |
| Date prepared                                                | -                      |     |            | 05/03/2024 | 1 | 05/03/2024 | 05/03/2024 |     | 05/03/2024       | 05/03/2024 |
| Date analysed                                                | -                      |     |            | 05/03/2024 | 1 | 05/03/2024 | 05/03/2024 |     | 05/03/2024       | 05/03/2024 |
| Calcium - Dissolved                                          | mg/L                   | 0.5 | Metals-020 | <0.5       | 1 | <0.5       | <0.5       | 0   | 102              | 100        |
| Potassium - Dissolved                                        | mg/L                   | 0.5 | Metals-020 | <0.5       | 1 | 0.7        | 0.7        | 0   | 94               | 92         |
| Sodium - Dissolved                                           | mg/L                   | 0.5 | Metals-020 | <0.5       | 1 | 3          | 3          | 0   | 88               | 83         |
| Magnesium - Dissolved                                        | mg/L                   | 0.5 | Metals-020 | <0.5       | 1 | <0.5       | <0.5       | 0   | 99               | 97         |
| Hydroxide Alkalinity (OH <sup>-</sup> ) as CaCO <sub>3</sub> | mg/L                   | 5   | Inorg-006  | <5         | 1 | <5         | [NT]       |     | [NT]             | [NT]       |
| Bicarbonate Alkalinity as CaCO <sub>3</sub>                  | mg/L                   | 5   | Inorg-006  | <5         | 1 | 7          | [NT]       |     | [NT]             | [NT]       |
| Carbonate Alkalinity as CaCO <sub>3</sub>                    | mg/L                   | 5   | Inorg-006  | <5         | 1 | <5         | [NT]       |     | [NT]             | [NT]       |
| Total Alkalinity as CaCO <sub>3</sub>                        | mg/L                   | 5   | Inorg-006  | <5         | 1 | 7          | [NT]       |     | 102              | [NT]       |
| Sulphate, SO4                                                | mg/L                   | 1   | Inorg-081  | <1         | 1 | <1         | <1         | 0   | 103              | [NT]       |
| Chloride, Cl                                                 | mg/L                   | 1   | Inorg-081  | <1         | 1 | <1         | <1         | 0   | 95               | [NT]       |
| Ionic Balance                                                | %                      |     | Inorg-040  | [NT]       | 1 | 0          | [NT]       |     | [NT]             | [NT]       |
| Hardness                                                     | mgCaCO <sub>3</sub> /L | 3   | Metals-020 | [NT]       | 1 | <3         | <3         | 0   | [NT]             | [NT]       |

Client Reference: Pine Creek Mine Site

| QUALITY CONTROL: Miscellaneous Inorganics |       |       |                   |            | Duplicate |            |            | Spike Recovery % |            |            |
|-------------------------------------------|-------|-------|-------------------|------------|-----------|------------|------------|------------------|------------|------------|
| Test Description                          | Units | PQL   | Method            | Blank      | #         | Base       | Dup.       | RPD              | LCS-W1     | 345578-2   |
| Date prepared                             | -     |       |                   | 05/03/2024 | 1         | 05/03/2024 | 05/03/2024 |                  | 05/03/2024 | 05/03/2024 |
| Date analysed                             | -     |       |                   | 05/03/2024 | 1         | 05/03/2024 | 05/03/2024 |                  | 05/03/2024 | 05/03/2024 |
| Acidity as CaCO <sub>3</sub>              | mg/L  | 5     | Inorg-005         | <5         | 1         | <5         | [NT]       |                  | 99         | [NT]       |
| Total Suspended Solids                    | mg/L  | 5     | Inorg-019         | <5         | 1         | <10        | [NT]       |                  | 91         | [NT]       |
| Turbidity                                 | NTU   | 0.1   | Inorg-022         | <0.1       | 1         | 3.6        | 3.7        | 3                | 103        | [NT]       |
| Total Nitrogen in water                   | µg/L  | 100   | Inorg-055/062/127 | <100       | 1         | 100        | 100        | 0                | 92         | [NT]       |
| Ammonia as N in water                     | mg/L  | 0.005 | Inorg-057         | <0.005     | 1         | 0.005      | 0.006      | 18               | 100        | 96         |
| NOx as N in water                         | mg/L  | 0.005 | Inorg-055         | <0.005     | 1         | 0.03       | 0.03       | 0                | 97         | 94         |
| Total Organic Carbon                      | mg/L  | 1     | Inorg-079         | <1         | 1         | 5          | 5          | 0                | 110        | [NT]       |
| Total Phosphorus                          | mg/L  | 0.01  | Inorg-060         | <0.01      | 1         | 0.01       | <0.01      | 0                | 111        | 89         |

**Result Definitions**

|             |                                           |
|-------------|-------------------------------------------|
| <b>NT</b>   | Not tested                                |
| <b>NA</b>   | Test not required                         |
| <b>INS</b>  | Insufficient sample for this test         |
| <b>PQL</b>  | Practical Quantitation Limit              |
| <b>&lt;</b> | Less than                                 |
| <b>&gt;</b> | Greater than                              |
| <b>RPD</b>  | Relative Percent Difference               |
| <b>LCS</b>  | Laboratory Control Sample                 |
| <b>NS</b>   | Not specified                             |
| <b>NEPM</b> | National Environmental Protection Measure |
| <b>NR</b>   | Not Reported                              |

## Quality Control Definitions

|                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Blank</b>                                                                                                                                                                                                                                                   | This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.           |
| <b>Duplicate</b>                                                                                                                                                                                                                                               | This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.                                                 |
| <b>Matrix Spike</b>                                                                                                                                                                                                                                            | A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist. |
| <b>LCS (Laboratory Control Sample)</b>                                                                                                                                                                                                                         | This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.                                |
| <b>Surrogate Spike</b>                                                                                                                                                                                                                                         | Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.                          |
| Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.     |                                                                                                                                                                                                                                  |
| The recommended maximums for analytes in urine are taken from "2018 TLVs and BEIs", as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016. |                                                                                                                                                                                                                                  |
| Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2                                                                                                                         |                                                                                                                                                                                                                                  |

## Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

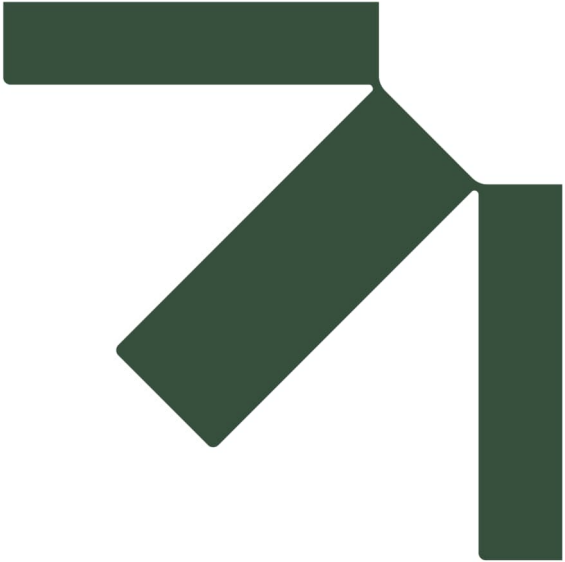
Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

## Report Comments

MISC\_INORG:Turbidity/NOx as N in water:Samples were out of the recommended holding time for this analysis.

Total Suspended Solids: PQL has been raised due to the small volume of sample supplied.

8 HM in water - total - # Percent recovery is not applicable due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.



# **Appendix B   Pine Creek Ecotoxicology Report**

# **Toxicity Assessment of Wastewater and Receiving Water Samples**

**Agnico Eagle**

**Test Report**

**March 2024**

## Toxicity Test Report: TR2218/1

(Page 1 of 2)

Accredited for compliance with ISO/IEC 17025

|                    |                                                           |                       |                      |
|--------------------|-----------------------------------------------------------|-----------------------|----------------------|
| <b>Client:</b>     | Agnico Eagle Australia<br>Dorat Rd<br>Hayes Creek NT 0822 | <b>ESA Job #:</b>     | PR2218               |
| <b>Attention:</b>  | Sam Yang                                                  | <b>Date Sampled:</b>  | 28 February 2024     |
| <b>Client Ref:</b> | PO 73001                                                  | <b>Date Received:</b> | 05 and 06 March 2024 |
|                    |                                                           | <b>Sampled By:</b>    | Client               |
|                    |                                                           | <b>ESA Quote #:</b>   | PL2218_q01           |

| Lab ID No.: | Sample Name: | Sample Description:                                                                                                             |
|-------------|--------------|---------------------------------------------------------------------------------------------------------------------------------|
| 11464       | CHCK06       | Aqueous sample, pH 7.6*, conductivity 364µS/cm*, total ammonia <2.0mg/L*. Sample received at 12°C* in apparent good condition.  |
| 11465       | CHCK04A      | Aqueous sample, pH 7.2*, conductivity 512µS/cm*, total ammonia <2.0mg/L*. Sample received at 12°C* in apparent good condition.  |
| 11466       | Cosmo PIT    | Aqueous sample, pH 7.6*, conductivity 3610µS/cm*, total ammonia <2.0mg/L*. Sample received at 12°C* in apparent good condition. |
| 11467       | Dam 3        | Aqueous sample, pH 6.6*, conductivity 1579µS/cm*, total ammonia <2.0mg/L*. Sample received at 12°C* in apparent good condition. |
| 11469       | PCCK06       | Aqueous sample, pH 7.1*, conductivity 1579µS/cm*, total ammonia <2.0mg/L*. Sample received at 12°C* in apparent good condition. |

\*NATA accreditation does not cover the performance of this service

|                                          |                                                                                            |
|------------------------------------------|--------------------------------------------------------------------------------------------|
| <b>Test Performed:</b>                   | Partial life-cycle toxicity test using the freshwater cladoceran <i>Ceriodaphnia dubia</i> |
| <b>Test Protocol:</b>                    | ESA SOP 102 (ESA 2016), based on USEPA (2002) and Bailey <i>et al.</i> (2000)              |
| <b>Test Temperature:</b>                 | The test was performed at 25±1°C.                                                          |
| <b>Deviations from Protocol:</b>         | Nil                                                                                        |
| <b>Comments on Solution Preparation:</b> | The samples were tested undiluted. A DMW control was tested concurrently with the samples. |
| <b>Source of Test Organisms:</b>         | ESA Laboratory culture                                                                     |
| <b>Test Initiated:</b>                   | 06 March 2024 at 1930h                                                                     |

| Sample      | % Unaffected at 7 days<br>(Mean ± SD) | Sample      | Number of Young<br>(Mean ± SD) |
|-------------|---------------------------------------|-------------|--------------------------------|
| DMW Control | 100 ± 0.0                             | DMW Control | 15.6 ± 1.5                     |
| CHCK06      | 0.0 ± 0.0                             | CHCK06      | 0.0 ± 0.0                      |
| CHCK04A     | 100 ± 0.0                             | CHCK04A     | 13.6 ± 2.9 *                   |
| Cosmo PIT   | 0.0 ± 0.0                             | Cosmo PIT   | 7.9 ± 4.4 *                    |
| Dam 3       | 0.0 ± 0.0                             | Dam 3       | 0.0 ± 0.0                      |
| PCCK06      | 0.0 ± 0.0                             | PCCK06      | 0.0 ± 0.0                      |

\*Significantly lower number of young compared with the DMW Control (Heteroscedastic t test, 1-tailed, P=0.05)

| QA/QC Parameter                                  | Criterion          | This Test    | Criterion met? |
|--------------------------------------------------|--------------------|--------------|----------------|
| Control mean % unaffected                        | ≥80.0%             | 100%         | Yes            |
| Control mean number of young per surviving adult | ≥15.0              | 15.6         | Yes            |
| Reference Toxicant within cusum chart limits     | 183.8-212.0mgKCl/L | 198.3mgKCl/L | Yes            |

## Toxicity Test Report: TR2218/1

(Page 2 of 2)

Test Report Authorised by: Dr Rick Krassoi, Director on 25 March 2024

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

**NATA Accredited Laboratory Number: 14709**

This document shall not be reproduced except in full.

### Citations:

Bailey, H.C., Krassoi, R., Elphick, J.R., Mulhall, A., Hunt, P., Tedmanson, L. and Lovell, A. (2000) Application of *Ceriodaphnia cf. dubia* for whole effluent toxicity tests in the Hawkesbury-Nepean watershed, New South Wales, Australia: method development and validation. *Environmental Toxicology and Chemistry* 19:88-93.

ESA (2016) ESA SOP 102 – *Acute Toxicity Test Using Ceriodaphnia dubia*. Issue No 11. Ecotox Services Australasia, Sydney, NSW.

USEPA (2002) *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms*. 4<sup>th</sup> Ed. United States Environmental Protection Agency, Office of Water, Washington DC.

## Toxicity Test Report: TR2218/2

(Page 1 of 2)

Accredited for compliance with ISO/IEC 17025

|                    |                                                           |                       |                      |
|--------------------|-----------------------------------------------------------|-----------------------|----------------------|
| <b>Client:</b>     | Agnico Eagle Australia<br>Dorat Rd<br>Hayes Creek NT 0822 | <b>ESA Job #:</b>     | PR2218               |
| <b>Attention:</b>  | Sam Yang                                                  | <b>Date Sampled:</b>  | 28 February 2024     |
| <b>Client Ref:</b> | PO 73001                                                  | <b>Date Received:</b> | 06 and 08 March 2024 |
|                    |                                                           | <b>Sampled By:</b>    | Client               |
|                    |                                                           | <b>ESA Quote #:</b>   | PL2218_q01           |

|                    |                     |                                                                                                                               |
|--------------------|---------------------|-------------------------------------------------------------------------------------------------------------------------------|
| <b>Lab ID No.:</b> | <b>Sample Name:</b> | <b>Sample Description:</b>                                                                                                    |
| 11468              | PCCK16              | Aqueous sample, pH 6.5*, conductivity 801µS/cm*, total ammonia <2.0mg/L*. Sample received at 8°C* in apparent good condition. |
| 11470              | PCPWD               | Aqueous sample, pH 7.8*, conductivity 38µS/cm*, total ammonia <2.0mg/L*. Sample received at 8°C* in apparent good condition.  |

\*NATA accreditation does not cover the performance of this service

|                                          |                                                                                                                                                                                                                                                                                                         |
|------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Test Performed:</b>                   | Partial life-cycle toxicity test using the freshwater cladoceran <i>Ceriodaphnia dubia</i>                                                                                                                                                                                                              |
| <b>Test Protocol:</b>                    | ESA SOP 102 (ESA 2016), based on USEPA (2002) and Bailey <i>et al.</i> (2000)                                                                                                                                                                                                                           |
| <b>Test Temperature:</b>                 | The test was performed at 25±1°C.                                                                                                                                                                                                                                                                       |
| <b>Deviations from Protocol:</b>         | Nil                                                                                                                                                                                                                                                                                                     |
| <b>Comments on Solution Preparation:</b> | The conductivity of sample PCCK16 (Lab ID '11468') to be used as diluent was raised to 100µS/cm using GP2 salts. Sample PCPWD (Lab ID '11470') was serially diluted with sample PCCK16 (Lab ID '11468'). A DMW control and a Diluent Control (sample PCCK16) were tested concurrently with the samples. |
| <b>Source of Test Organisms:</b>         | ESA Laboratory culture                                                                                                                                                                                                                                                                                  |
| <b>Test Initiated:</b>                   | 11 March 2024 at 1930h                                                                                                                                                                                                                                                                                  |

| Sample 11470: PCPWD                        |                                    | Sample 11470: PCPWD                          |                             |
|--------------------------------------------|------------------------------------|----------------------------------------------|-----------------------------|
| Concentration (%)                          | % Unaffected at 7 days (Mean ± SD) | Concentration (%)                            | Number of Young (Mean ± SD) |
| DMW Control                                | 100 ± 0.0                          | DMW Control                                  | 15.4 ± 1.0                  |
| Diluent Control                            | 90.0 ± 31.6                        | Diluent Control                              | 15.7 ± 2.5                  |
| 0.4                                        | 100 ± 0.0                          | 0.4                                          | 16.0 ± 2.4                  |
| 0.8                                        | 90.0 ± 31.6                        | 0.8                                          | 9.2 ± 5.1 *                 |
| 1.6                                        | 0.0 ± 0.0                          | 1.6                                          | 0.0 ± 0.0                   |
| 3.1                                        | 0.0 ± 0.0                          | 3.1                                          | 0.0 ± 0.0                   |
| 6.3                                        | 0.0 ± 0.0                          | 6.3                                          | 0.0 ± 0.0                   |
| 7 day EC10 (unaffected) = 0.8 (0.61-1.07)% |                                    | 7 day IC10 (reproduction) = 0.5 (0.30-0.57)% |                             |
| 7 day EC50 (unaffected) = 0.9 (0.86-1.16)% |                                    | 7 day IC50 (reproduction) = 0.9 (0.73-1.07)% |                             |
| NOEC = 0.8%                                |                                    | NOEC = 0.4%                                  |                             |
| LOEC = 1.6%                                |                                    | LOEC = 0.8%                                  |                             |

\*Significantly lower number of young compared with the Diluent Control (Steel's Many-One Rank, 1-tailed, P=0.05)

| QA/QC Parameter                                  | Criterion          | This Test    | Criterion met? |
|--------------------------------------------------|--------------------|--------------|----------------|
| Control mean % unaffected                        | ≥80.0%             | 100%         | Yes            |
| Control mean number of young per surviving adult | ≥15.0              | 15.4         | Yes            |
| Reference Toxicant within cusum chart limits     | 184.0-212.6mgKCl/L | 202.1mgKCl/L | Yes            |

## Toxicity Test Report: TR2218/2

(Page 2 of 2)

Test Report Authorised by: Dr Rick Krassoi, Director on 25 March 2024

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

**NATA Accredited Laboratory Number: 14709**

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### Citations:

Bailey, H.C., Krassoi, R., Elphick, J.R., Mulhall, A., Hunt, P., Tedmanson, L. and Lovell, A. (2000) Application of *Ceriodaphnia cf. dubia* for whole effluent toxicity tests in the Hawkesbury-Nepean watershed, New South Wales, Australia: method development and validation. *Environmental Toxicology and Chemistry* 19:88-93.

ESA (2016) ESA SOP 102 – *Acute Toxicity Test Using Ceriodaphnia dubia*. Issue No 11. Ecotox Services Australasia, Sydney, NSW.

USEPA (2002) *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms*. 4<sup>th</sup> Ed. United States Environmental Protection Agency, Office of Water, Washington DC.



# Sample Receipt Notification

**Attention** : Sam Yang

**Client** : Agnico Eagle Australia  
Dorat Rd  
Hayes Creek NT 0822

**Email** : sam.yang@agnicoeagle.com  
**Telephone** : 08 8978 1737  
**Facsimile** :

**Date** : 11/03/2024

**Re** : Receipt of Samples

**Pages** : 2

**ESA Project** : PR2218

☒ For Review

☐ Additional Documentation Required - Please Respond

---

## Sample Delivery Details

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

**Date samples received** : 5/03/2024  
**Time samples received** : 16:00  
**No. of samples received** : 4  
**Sample matrix** : Aqueous  
**Sample temperature** : 6-10°C

**Comments** : 1 x 5L of each sample received at 8 degrees C in apparent good condition

---

## Contact Details

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

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

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

---

## Ecotox Services Australia

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

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



# Chain-of-Custody / Service Request Form

Datasheet ID: 601.1  
Last Revised: 20 September 2018

Customer: Agnico Eagle Ship To: Ecotox Services Aust.  
Contact Name: Sam Yang Attention:  
Phone: (please provide an email address for sample receipt notification)  
Email:  
Sampled by:

| Sample Date<br>(day/month/year) | Sample Time | Sample Name<br>(exactly as written on the sample vessel) | Sample Method<br>(eg. Grab, composite etc.) | Number and Volume of Containers<br>(eg 2 x 1L) | Tests Requested<br>(See reverse for guidance) |                        | Comments / Instructions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|---------------------------------|-------------|----------------------------------------------------------|---------------------------------------------|------------------------------------------------|-----------------------------------------------|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                 |             |                                                          |                                             |                                                | Chronic Cerio Screening                       | Chronic Cerio Dilution |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 27/02/24                        | 11:43       | PGCK16                                                   | X                                           | 1x 5L                                          |                                               |                        | <b>Note that testing will be delayed if an incomplete chain of custody is received</b> <ul style="list-style-type: none"><li>• Additional treatment of samples (i.e. spiking)</li><li>• Sub-contracted services (i.e. chemical analyses)</li><li>• Dilutions required (if different than 100% down to 6.25%)</li><li>• Sample holding time restriction (if applicable)</li><li>• Sample used for litigation (if applicable)</li></ul> <b>Note: An MSDS must be attached if Available</b><br><b>ESA Project Number: PR 2218</b><br>Used as diluent |
| 28/02/24                        | 10:00       | CHCK06                                                   | ✓                                           | 1x 5L                                          | X                                             |                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 28/02/24                        | 11:28       | CHCK04A                                                  | ✓                                           | 1x 5L                                          | X                                             |                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 28/02/24                        | 14:51       | Cosmo Pit                                                | ✓                                           | 1x 5L                                          | X                                             |                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 28/02/24                        | 14:09       | Dam 3                                                    | ✓                                           | 1x 5L                                          | X                                             |                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 27/02/24                        | 11:16       | PCCK06                                                   | X                                           | 1x 5L                                          | X                                             |                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 7/03/24                         | 9:30        | PCPWD                                                    | X                                           | 1x 5L                                          | X                                             |                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|                                 |             |                                                          |                                             |                                                |                                               |                        | PCC16 used as diluent with EC increased to 100 uS/cm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

|                 |       |                 |       |                 |       |                 |       |
|-----------------|-------|-----------------|-------|-----------------|-------|-----------------|-------|
| 1) Released By: | Date: | 2) Received By: | Date: | 3) Released By: | Date: | 4) Received By: | Date: |
| Of:             | Time: | Of:             | Time: | Of:             | Time: | Of:             | Time: |

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



# Sample Receipt Notification

**Attention** : Sam Yang

**Client** : Agnico Eagle Australia  
Dorat Rd  
Hayes Creek NT 0822

**Email** : sam.yang@agnicoeagle.com  
**Telephone** : 08 8978 1737  
**Facsimile** :

**Date** : 11/03/2024

**Re** : Receipt of Samples

**Pages** : 2

**ESA Project** : PR2218

☒ For Review

☐ Additional Documentation Required - Please Respond

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## Sample Delivery Details

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

**Date samples received** : 6/03/2024  
**Time samples received** : 11:30  
**No. of samples received** : 2  
**Sample matrix** : Aqueous  
**Sample temperature** : 0-5°C

**Comments** : 2 x 5L of PCCK16 and 1 x 5L of PCCK06 received at 5 degrees C in apparent good condition

---

## Contact Details

**Projects Manager** : Dr Rick Krasso  
**Telephone** : 61 2 9420 9481  
**Facsimile** : 61 2 9420 9484  
**Email** : rkrasso@ecotox.com.au

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

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

---

## Ecotox Services Australia

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

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

# Chain-of-Custody / Service Request Form

Datasheet ID: 601.1  
Last Revised: 20 September 2018

Customer: Agnico Eagle  
Contact Name: Sam Yang  
Phone: \_\_\_\_\_  
Email: \_\_\_\_\_  
Ship To: Ecotox Services Aust.  
Attention: \_\_\_\_\_  
(please provide an email address for sample receipt notification)

| Sample Date<br>(day/month/year)                              | Sample Time | Sample Name<br>(exactly as written on the sample vessel) | Sample Method<br>(eg. Grab, composite etc.) | Number and Volume of Containers<br>(eg 2 x 1L) | Tests Requested<br>(See reverse for guidance) | Comments / Instructions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------------------------------------------------------------|-------------|----------------------------------------------------------|---------------------------------------------|------------------------------------------------|-----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 27/02/24                                                     | 11:43       | PCCK16                                                   |                                             | 1x 5L 2x 5L                                    | Chronic Cerio Screening                       | <p><b>Note that testing will be delayed if an incomplete chain of custody is received</b></p> <ul style="list-style-type: none"> <li>Additional treatment of samples (i.e. spiking)</li> <li>Sub-contracted services (i.e. chemical analyses)</li> <li>Dilutions required (if different than 100% down to 6.25%)</li> <li>Sample holding time restriction (if applicable)</li> <li>Sample used for litigation (if applicable)</li> </ul> <p>Note: An MSDS must be attached if Available</p> <p>ESA Project Number: PR 2218</p> <p>Used as diluent</p> |
| 28/02/24                                                     | 10:00       | CHCK06                                                   |                                             | 1x 5L                                          | X                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 28/02/24                                                     | 11:28       | CHCK04A                                                  |                                             | 1x 5L                                          | X                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 28/02/24                                                     | 14:51       | Cosmo Pit                                                |                                             | 1x 5L                                          | X                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 28/02/24                                                     | 14:09       | Dam-3                                                    |                                             | 1x 5L                                          | X                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 27/02/24                                                     | 11:16       | PCCK06                                                   |                                             | 1x 5L                                          | X                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 7/03/24                                                      | 9:30        | PCPWD                                                    |                                             | 1x 5L                                          | X                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <p>PCCK16 used as diluent with EC increased to 100 uS/cm</p> |             |                                                          |                                             |                                                |                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

|                       |             |                       |              |                       |             |                       |             |
|-----------------------|-------------|-----------------------|--------------|-----------------------|-------------|-----------------------|-------------|
| 1) Released By: _____ | Date: _____ | 2) Received By: _____ | Date: 6/3/24 | 3) Released By: _____ | Date: _____ | 4) Received By: _____ | Date: _____ |
| Of: _____             | Time: _____ | Of: _____             | Time: 1130   | Of: _____             | Time: _____ | Of: _____             | Time: _____ |

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



# Sample Receipt Notification

**Attention** : Sam Yang

**Client** : Agnico Eagle Australia  
Dorat Rd  
Hayes Creek NT 0822

**Email** : sam.yang@agnicoeagle.com  
**Telephone** : 08 8978 1737  
**Facsimile** :

**Date** : 11/03/2024

**Re** : Receipt of Samples

**Pages** : 2

**ESA Project** : PR2218

☒ For Review

☐ Additional Documentation Required - Please Respond

---

## Sample Delivery Details

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

**Date samples received** : 8/03/2024  
**Time samples received** : 14:00  
**No. of samples received** : 1  
**Sample matrix** : Aqueous  
**Sample temperature** : 6-10°C

**Comments** : 1 x 5L of sample received at 9 degrees C in apparent good condition

---

## Contact Details

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

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

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

---

## Ecotox Services Australia

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

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

# Chain-of-Custody / Service Request Form

Datasheet ID: 601.1  
Last Revised: 20 September 2018

Customer: Agnico Eagle  
Contact Name: Sam Yang  
Phone: \_\_\_\_\_  
Email: \_\_\_\_\_  
Ship To: Ecotox Services Aust  
Attention: \_\_\_\_\_  
Sampled by: \_\_\_\_\_  
(please provide an email address for sample receipt notification)

| Sample Date<br>(day/month/year) | Sample Time | Sample Name<br>(exactly as written on the sample vessel) | Sample Method<br>(eg. Grab, composite etc.) | Number and Volume of Containers<br>(eg 2 x 1L) | Tests Requested<br>(See reverse for guidance) |                        | Comments / Instructions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------------------|-------------|----------------------------------------------------------|---------------------------------------------|------------------------------------------------|-----------------------------------------------|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                 |             |                                                          |                                             |                                                | Chronic Cerio Screening                       | Chronic Cerio Dilution |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 27/02/24                        | 11:43       | PCCK16-                                                  |                                             | 1x 5L                                          |                                               |                        | <p><b>Note that testing will be delayed if an incomplete chain of custody is received</b></p> <ul style="list-style-type: none"> <li>• Additional treatment of samples (i.e. spiking)</li> <li>• Sub-contracted services (i.e. chemical analyses)</li> <li>• Dilutions required (if different than 100% down to 6.25%)</li> <li>• Sample holding time restriction (if applicable)</li> <li>• Sample used for litigation (if applicable)</li> </ul> <p>Note: An MSDS must be attached if Available</p> <p>ESA Project Number: PR 2218</p> |
| 28/02/24                        | 10:00       | CHCK06-                                                  |                                             | 1x 5L                                          | X                                             |                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 28/02/24                        | 11:28       | CHCK04A-                                                 |                                             | 1x 5L                                          | X                                             |                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 28/02/24                        | 14:51       | Cosmo Pit                                                |                                             | 1x 5L                                          | X                                             |                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 28/02/24                        | 14:09       | Dam 3-                                                   |                                             | 1x 5L                                          | X                                             |                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 27/02/24                        | 11:16       | PCCK06-                                                  |                                             | 1x 5L                                          | X                                             |                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 7/03/24                         | 9:30        | PCPWD                                                    |                                             | 1x 5L                                          |                                               | X                      | PCCK16 used as diluent with EC increased to 100 uS/cm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

|                       |             |                            |                     |                       |             |                       |             |
|-----------------------|-------------|----------------------------|---------------------|-----------------------|-------------|-----------------------|-------------|
| 1) Released By: _____ | Date: _____ | 2) Received By: <u>ESA</u> | Date: <u>8/3/24</u> | 3) Released By: _____ | Date: _____ | 4) Received By: _____ | Date: _____ |
| Of: _____             | Time: _____ | Of: <u>ESA</u>             | Time: <u>1400</u>   | Of: _____             | Time: _____ | Of: _____             | Time: _____ |

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

**Statistical Printouts for the 3-  
brood Partial Life Cycle Test with  
*Ceriodaphnia dubia***

### Ceriodaphnia Partial Life-Cycle Test-Reproduction

|                              |                    |                                     |
|------------------------------|--------------------|-------------------------------------|
| Start Date: 11/03/2024 19:30 | Test ID: PR2218/04 | Sample ID: PCPWD                    |
| End Date: 18/03/2024 19:30   | Lab ID: 11470      | Sample Type: AQ-Aqueous             |
| Sample Date:                 | Protocol: ESA 102  | Test Species: CD-Ceriodaphnia dubia |
| Comments:                    |                    |                                     |

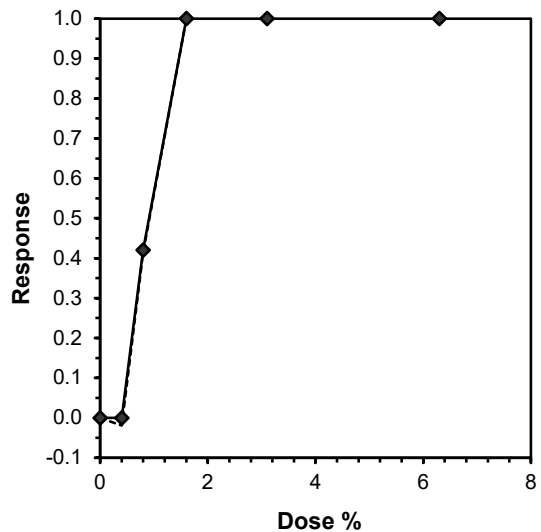
| Conc-%          | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9      | 10     |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| DMW Control     | 16.000 | 16.000 | 14.000 | 16.000 | 16.000 | 17.000 | 14.000 | 15.000 | 15.000 | 15.000 |
| Diluent Control | 14.000 | 15.000 | 17.000 | 17.000 | 14.000 | 14.000 | 15.000 | 15.000 | 22.000 | 14.000 |
| 0.4             | 12.000 | 14.000 | 15.000 | 17.000 | 21.000 | 17.000 | 17.000 | 16.000 | 15.000 | 16.000 |
| 0.8             | 11.000 | 13.000 | 10.000 | 12.000 | 0.000  | 15.000 | 9.000  | 0.000  | 12.000 | 10.000 |
| 1.6             | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  |
| 3.1             | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  |
| 6.3             | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  |

| Conc-%          | Transform: Untransformed |        |        |        |        |        |    | Rank Sum | 1-Tailed Critical | Isotonic |        |
|-----------------|--------------------------|--------|--------|--------|--------|--------|----|----------|-------------------|----------|--------|
|                 | Mean                     | N-Mean | Mean   | Min    | Max    | CV%    | N  |          |                   | Mean     | N-Mean |
| DMW Control     | 15.400                   | 0.9809 | 15.400 | 14.000 | 17.000 | 6.273  | 10 |          |                   |          |        |
| Diluent Control | 15.700                   | 1.0000 | 15.700 | 14.000 | 22.000 | 15.902 | 10 | *        |                   | 15.850   | 1.0000 |
| 0.4             | 16.000                   | 1.0191 | 16.000 | 12.000 | 21.000 | 14.731 | 10 | 115.00   | 79.00             | 15.850   | 1.0000 |
| *0.8            | 9.200                    | 0.5860 | 9.200  | 0.000  | 15.000 | 55.849 | 10 | 60.50    | 79.00             | 9.200    | 0.5804 |
| 1.6             | 0.000                    | 0.0000 | 0.000  | 0.000  | 0.000  | 0.000  | 10 |          |                   | 0.000    | 0.0000 |
| 3.1             | 0.000                    | 0.0000 | 0.000  | 0.000  | 0.000  | 0.000  | 10 |          |                   | 0.000    | 0.0000 |
| 6.3             | 0.000                    | 0.0000 | 0.000  | 0.000  | 0.000  | 0.000  | 10 |          |                   | 0.000    | 0.0000 |

| Auxiliary Tests                                                         | Statistic | Critical | Skew     | Kurt    |
|-------------------------------------------------------------------------|-----------|----------|----------|---------|
| Shapiro-Wilk's Test indicates non-normal distribution ( $p \leq 0.05$ ) | 0.90434   | 0.927    | -0.87733 | 2.19507 |
| Bartlett's Test indicates equal variances ( $p = 0.03$ )                | 6.97887   | 9.21034  |          |         |
| The control means are not significantly different ( $p = 0.73$ )        | 0.35437   | 2.10092  |          |         |
| Hypothesis Test (1-tail, 0.05)                                          | NOEC      | LOEC     | ChV      | TU      |
| Steel's Many-One Rank Test                                              | 0.4       | 0.8      | 0.56569  | 250     |
| Treatments vs Diluent Control                                           |           |          |          |         |

#### Linear Interpolation (200 Resamples)

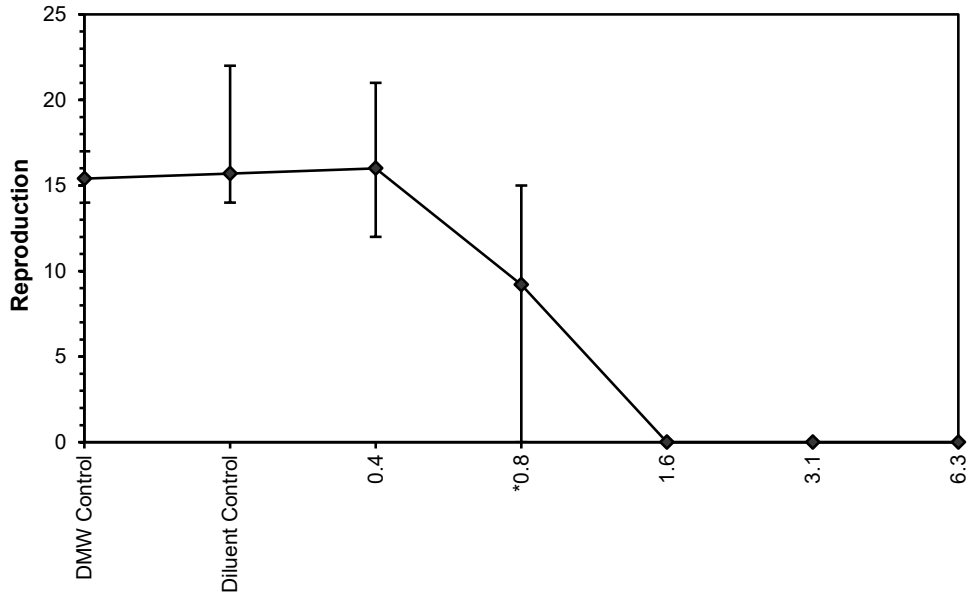
| Point | %      | SD     | 95% CL |        | Skew    |
|-------|--------|--------|--------|--------|---------|
| IC05  | 0.4477 | 0.0779 | 0.1500 | 0.4836 | -2.4014 |
| IC10  | 0.4953 | 0.0522 | 0.3000 | 0.5672 | -2.0095 |
| IC15  | 0.5430 | 0.0516 | 0.4370 | 0.6508 | -0.1421 |
| IC20  | 0.5907 | 0.0593 | 0.4937 | 0.7344 | 0.7276  |
| IC25  | 0.6383 | 0.0672 | 0.5414 | 0.8114 | 0.8359  |
| IC40  | 0.7814 | 0.0851 | 0.6584 | 0.9691 | 0.3880  |
| IC50  | 0.9109 | 0.0960 | 0.7258 | 1.0743 | -0.1454 |



### Ceriodaphnia Partial Life-Cycle Test-Reproduction

|              |                  |           |           |               |                       |
|--------------|------------------|-----------|-----------|---------------|-----------------------|
| Start Date:  | 11/03/2024 19:30 | Test ID:  | PR2218/04 | Sample ID:    | PCPWD                 |
| End Date:    | 18/03/2024 19:30 | Lab ID:   | 11470     | Sample Type:  | AQ-Aqueous            |
| Sample Date: |                  | Protocol: | ESA 102   | Test Species: | CD-Ceriodaphnia dubia |
| Comments:    |                  |           |           |               |                       |

Dose-Response Plot



**Ceriodaphnia Partial Life-Cycle Test-Reproduction**

|              |                  |           |           |               |                       |
|--------------|------------------|-----------|-----------|---------------|-----------------------|
| Start Date:  | 11/03/2024 19:30 | Test ID:  | PR2218/04 | Sample ID:    | PCPWD                 |
| End Date:    | 18/03/2024 19:30 | Lab ID:   | 11470     | Sample Type:  | AQ-Aqueous            |
| Sample Date: |                  | Protocol: | ESA 102   | Test Species: | CD-Ceriodaphnia dubia |
| Comments:    |                  |           |           |               |                       |

|                 |              | Auxiliary Data Summary |        |        |       |       |    |
|-----------------|--------------|------------------------|--------|--------|-------|-------|----|
| Conc-%          | Parameter    | Mean                   | Min    | Max    | SD    | CV%   | N  |
| DMW Control     | No of Young  | 15.40                  | 14.00  | 17.00  | 0.97  | 6.38  | 10 |
| Diluent Control |              | 15.70                  | 14.00  | 22.00  | 2.50  | 10.06 | 10 |
| 0.4             |              | 16.00                  | 12.00  | 21.00  | 2.36  | 9.60  | 10 |
| 0.8             |              | 9.20                   | 0.00   | 15.00  | 5.14  | 24.64 | 10 |
| 1.6             |              | 0.00                   | 0.00   | 0.00   | 0.00  |       | 10 |
| 3.1             |              | 0.00                   | 0.00   | 0.00   | 0.00  |       | 10 |
| 6.3             |              | 0.00                   | 0.00   | 0.00   | 0.00  |       | 10 |
| DMW Control     | % unaffected | 100.00                 | 100.00 | 100.00 | 0.00  | 0.00  | 10 |
| Diluent Control |              | 90.00                  | 0.00   | 100.00 | 31.62 | 6.25  | 10 |
| 0.4             |              | 100.00                 | 100.00 | 100.00 | 0.00  | 0.00  | 10 |
| 0.8             |              | 90.00                  | 0.00   | 100.00 | 31.62 | 6.25  | 10 |
| 1.6             |              | 0.00                   | 0.00   | 0.00   | 0.00  |       | 10 |
| 3.1             |              | 0.00                   | 0.00   | 0.00   | 0.00  |       | 10 |
| 6.3             |              | 0.00                   | 0.00   | 0.00   | 0.00  |       | 10 |
| DMW Control     | pH           | 8.10                   | 8.10   | 8.10   | 0.00  | 0.00  | 1  |
| Diluent Control |              | 7.40                   | 7.40   | 7.40   | 0.00  | 0.00  | 1  |
| 0.4             |              | 7.40                   | 7.40   | 7.40   | 0.00  | 0.00  | 1  |
| 0.8             |              | 7.40                   | 7.40   | 7.40   | 0.00  | 0.00  | 1  |
| 1.6             |              | 7.30                   | 7.30   | 7.30   | 0.00  | 0.00  | 1  |
| 3.1             |              | 7.20                   | 7.20   | 7.20   | 0.00  | 0.00  | 1  |
| 6.3             |              | 7.10                   | 7.10   | 7.10   | 0.00  | 0.00  | 1  |
| DMW Control     | DO %         | 99.60                  | 99.60  | 99.60  | 0.00  | 0.00  | 1  |
| Diluent Control |              | 102.00                 | 102.00 | 102.00 | 0.00  | 0.00  | 1  |
| 0.4             |              | 103.10                 | 103.10 | 103.10 | 0.00  | 0.00  | 1  |
| 0.8             |              | 104.20                 | 104.20 | 104.20 | 0.00  | 0.00  | 1  |
| 1.6             |              | 105.20                 | 105.20 | 105.20 | 0.00  | 0.00  | 1  |
| 3.1             |              | 105.10                 | 105.10 | 105.10 | 0.00  | 0.00  | 1  |
| 6.3             |              | 105.30                 | 105.30 | 105.30 | 0.00  | 0.00  | 1  |
| DMW Control     | Cond uS/cm   | 178.00                 | 178.00 | 178.00 | 0.00  | 0.00  | 1  |
| Diluent Control |              | 102.00                 | 102.00 | 102.00 | 0.00  | 0.00  | 1  |
| 0.4             |              | 107.00                 | 107.00 | 107.00 | 0.00  | 0.00  | 1  |
| 0.8             |              | 109.00                 | 109.00 | 109.00 | 0.00  | 0.00  | 1  |
| 1.6             |              | 116.00                 | 116.00 | 116.00 | 0.00  | 0.00  | 1  |
| 3.1             |              | 130.00                 | 130.00 | 130.00 | 0.00  | 0.00  | 1  |
| 6.3             |              | 156.00                 | 156.00 | 156.00 | 0.00  | 0.00  | 1  |

### Ceriodaphnia Partial Life-Cycle Test-7 Day Unaffected

|              |                  |           |           |               |                       |
|--------------|------------------|-----------|-----------|---------------|-----------------------|
| Start Date:  | 11/03/2024 19:30 | Test ID:  | PR2218/04 | Sample ID:    | PCPWD                 |
| End Date:    | 18/03/2024 19:30 | Lab ID:   | 11470     | Sample Type:  | AQ-Aqueous            |
| Sample Date: |                  | Protocol: | ESA 102   | Test Species: | CD-Ceriodaphnia dubia |
| Comments:    |                  |           |           |               |                       |

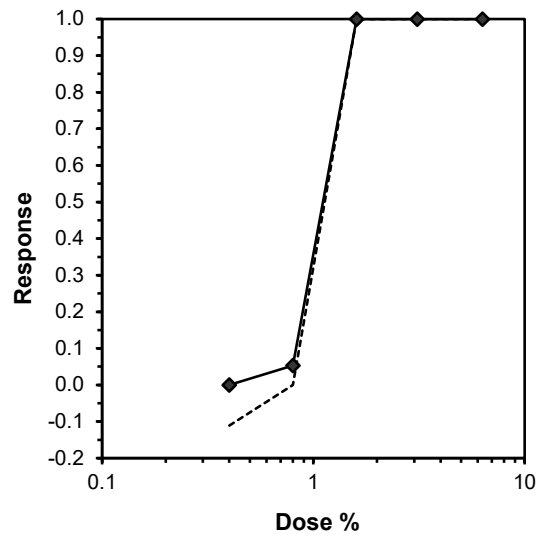
| Conc-%          | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9      | 10     |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| DMW Control     | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| Diluent Control | 0.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 0.4             | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 0.8             | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.0000 |
| 1.6             | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 3.1             | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 6.3             | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

| Conc-%          | Mean   | N-Mean | Resp | Not Resp | Total | N  | Fisher's Exact P | 1-Tailed Critical | Isotonic Mean | N-Mean |
|-----------------|--------|--------|------|----------|-------|----|------------------|-------------------|---------------|--------|
| DMW Control     | 1.0000 | 1.1111 | 0    | 10       | 10    | 10 | 0.5619           |                   |               |        |
| Diluent Control | 0.9000 | 1.0000 | 1    | 9        | 10    | 10 | *                |                   | 0.9500        | 1.0000 |
| 0.4             | 1.0000 | 1.1111 | 0    | 10       | 10    | 10 | 0.5000           | 0.0500            | 0.9500        | 1.0000 |
| 0.8             | 0.9000 | 1.0000 | 1    | 9        | 10    | 10 | 0.7632           | 0.0500            | 0.9000        | 0.9474 |
| 1.6             | 0.0000 | 0.0000 | 10   | 0        | 10    | 10 |                  |                   | 0.0000        | 0.0000 |
| 3.1             | 0.0000 | 0.0000 | 10   | 0        | 10    | 10 |                  |                   | 0.0000        | 0.0000 |
| 6.3             | 0.0000 | 0.0000 | 10   | 0        | 10    | 10 |                  |                   | 0.0000        | 0.0000 |

| Hypothesis Test (1-tail, 0.05) | NOEC | LOEC | ChV     | TU  |
|--------------------------------|------|------|---------|-----|
| Fisher's Exact Test            | 0.8  | 1.6  | 1.13137 | 125 |
| Treatments vs Diluent Control  |      |      |         |     |

#### Log-Logit Interpolation (200 Resamples)

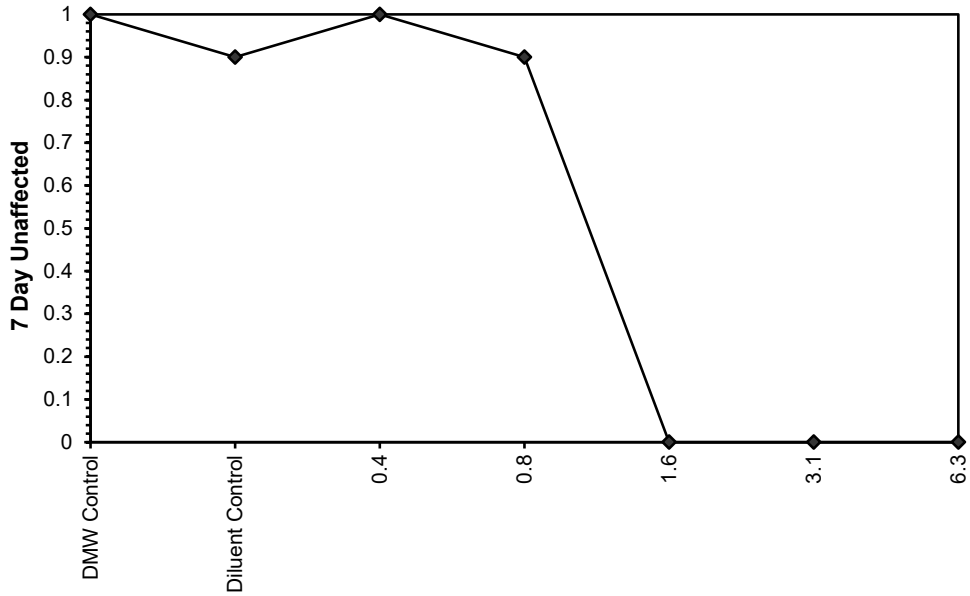
| Point | %      | SD     | 95% CL | Skew   |
|-------|--------|--------|--------|--------|
| IC05  | 0.7831 | 0.1295 | 0.5260 | 1.0398 |
| IC10  | 0.8247 | 0.1095 | 0.6107 | 1.0705 |
| IC15  | 0.8448 | 0.0982 | 0.6915 | 1.0897 |
| IC20  | 0.8616 | 0.0938 | 0.7499 | 1.1043 |
| IC25  | 0.8764 | 0.0911 | 0.7870 | 1.1164 |
| IC40  | 0.9146 | 0.0865 | 0.8374 | 1.1459 |
| IC50  | 0.9384 | 0.0838 | 0.8633 | 1.1633 |



### Ceriodaphnia Partial Life-Cycle Test-7 Day Unaffected

|              |                  |           |           |               |                       |
|--------------|------------------|-----------|-----------|---------------|-----------------------|
| Start Date:  | 11/03/2024 19:30 | Test ID:  | PR2218/04 | Sample ID:    | PCPWD                 |
| End Date:    | 18/03/2024 19:30 | Lab ID:   | 11470     | Sample Type:  | AQ-Aqueous            |
| Sample Date: |                  | Protocol: | ESA 102   | Test Species: | CD-Ceriodaphnia dubia |
| Comments:    |                  |           |           |               |                       |

Dose-Response Plot



**Ceriodaphnia Partial Life-Cycle Test-7 Day Unaffected**

|              |                  |           |           |               |                       |
|--------------|------------------|-----------|-----------|---------------|-----------------------|
| Start Date:  | 11/03/2024 19:30 | Test ID:  | PR2218/04 | Sample ID:    | PCPWD                 |
| End Date:    | 18/03/2024 19:30 | Lab ID:   | 11470     | Sample Type:  | AQ-Aqueous            |
| Sample Date: |                  | Protocol: | ESA 102   | Test Species: | CD-Ceriodaphnia dubia |
| Comments:    |                  |           |           |               |                       |

**Auxiliary Data Summary**

| Conc-%          | Parameter    | Mean   | Min    | Max    | SD    | CV%   | N  |
|-----------------|--------------|--------|--------|--------|-------|-------|----|
| DMW Control     | No of Young  | 15.40  | 14.00  | 17.00  | 0.97  | 6.38  | 10 |
| Diluent Control |              | 15.70  | 14.00  | 22.00  | 2.50  | 10.06 | 10 |
| 0.4             |              | 16.00  | 12.00  | 21.00  | 2.36  | 9.60  | 10 |
| 0.8             |              | 9.20   | 0.00   | 15.00  | 5.14  | 24.64 | 10 |
| 1.6             |              | 0.00   | 0.00   | 0.00   | 0.00  |       | 10 |
| 3.1             |              | 0.00   | 0.00   | 0.00   | 0.00  |       | 10 |
| 6.3             |              | 0.00   | 0.00   | 0.00   | 0.00  |       | 10 |
| DMW Control     | % unaffected | 100.00 | 100.00 | 100.00 | 0.00  | 0.00  | 10 |
| Diluent Control |              | 90.00  | 0.00   | 100.00 | 31.62 | 6.25  | 10 |
| 0.4             |              | 100.00 | 100.00 | 100.00 | 0.00  | 0.00  | 10 |
| 0.8             |              | 90.00  | 0.00   | 100.00 | 31.62 | 6.25  | 10 |
| 1.6             |              | 0.00   | 0.00   | 0.00   | 0.00  |       | 10 |
| 3.1             |              | 0.00   | 0.00   | 0.00   | 0.00  |       | 10 |
| 6.3             |              | 0.00   | 0.00   | 0.00   | 0.00  |       | 10 |
| DMW Control     | pH           | 8.10   | 8.10   | 8.10   | 0.00  | 0.00  | 1  |
| Diluent Control |              | 7.40   | 7.40   | 7.40   | 0.00  | 0.00  | 1  |
| 0.4             |              | 7.40   | 7.40   | 7.40   | 0.00  | 0.00  | 1  |
| 0.8             |              | 7.40   | 7.40   | 7.40   | 0.00  | 0.00  | 1  |
| 1.6             |              | 7.30   | 7.30   | 7.30   | 0.00  | 0.00  | 1  |
| 3.1             |              | 7.20   | 7.20   | 7.20   | 0.00  | 0.00  | 1  |
| 6.3             |              | 7.10   | 7.10   | 7.10   | 0.00  | 0.00  | 1  |
| DMW Control     | DO %         | 99.60  | 99.60  | 99.60  | 0.00  | 0.00  | 1  |
| Diluent Control |              | 102.00 | 102.00 | 102.00 | 0.00  | 0.00  | 1  |
| 0.4             |              | 103.10 | 103.10 | 103.10 | 0.00  | 0.00  | 1  |
| 0.8             |              | 104.20 | 104.20 | 104.20 | 0.00  | 0.00  | 1  |
| 1.6             |              | 105.20 | 105.20 | 105.20 | 0.00  | 0.00  | 1  |
| 3.1             |              | 105.10 | 105.10 | 105.10 | 0.00  | 0.00  | 1  |
| 6.3             |              | 105.30 | 105.30 | 105.30 | 0.00  | 0.00  | 1  |
| DMW Control     | Cond uS/cm   | 178.00 | 178.00 | 178.00 | 0.00  | 0.00  | 1  |
| Diluent Control |              | 102.00 | 102.00 | 102.00 | 0.00  | 0.00  | 1  |
| 0.4             |              | 107.00 | 107.00 | 107.00 | 0.00  | 0.00  | 1  |
| 0.8             |              | 109.00 | 109.00 | 109.00 | 0.00  | 0.00  | 1  |
| 1.6             |              | 116.00 | 116.00 | 116.00 | 0.00  | 0.00  | 1  |
| 3.1             |              | 130.00 | 130.00 | 130.00 | 0.00  | 0.00  | 1  |
| 6.3             |              | 156.00 | 156.00 | 156.00 | 0.00  | 0.00  | 1  |

### Ceriodaphnia Partial Life-Cycle Test-Reproduction

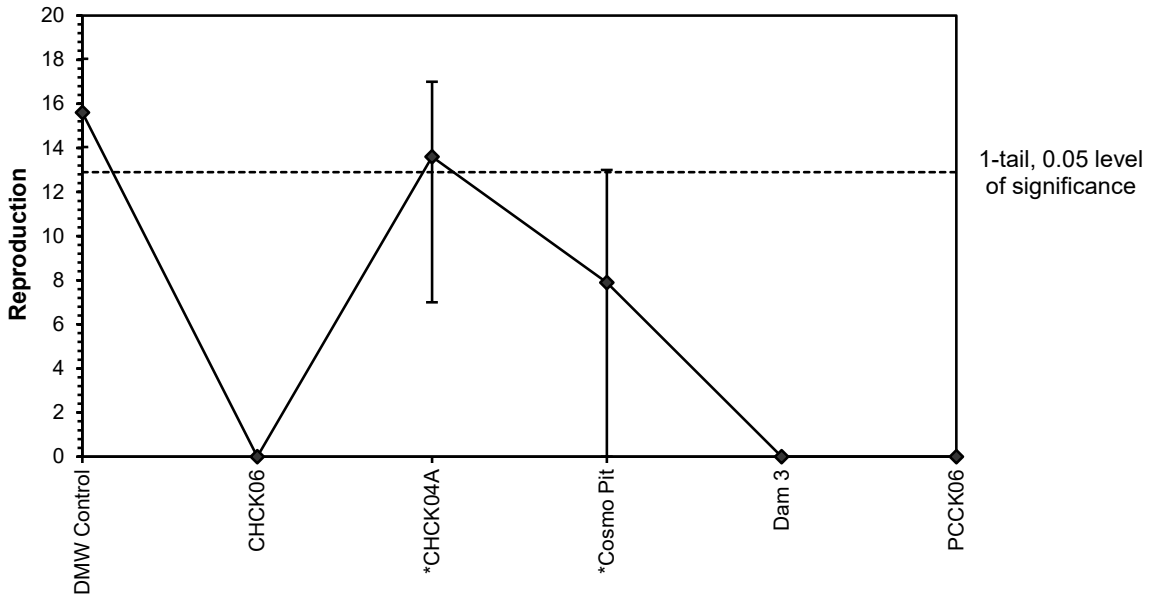
|              |                  |           |           |               |                       |
|--------------|------------------|-----------|-----------|---------------|-----------------------|
| Start Date:  | 6/03/2024 19:30  | Test ID:  | PR2218/01 | Sample ID:    | Various Screens       |
| End Date:    | 13/03/2024 19:30 | Lab ID:   | Various   | Sample Type:  | AQ-Aqueous            |
| Sample Date: |                  | Protocol: | ESA 102   | Test Species: | CD-Ceriodaphnia dubia |
| Comments:    |                  |           |           |               |                       |

| Conc-%      | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9      | 10     |
|-------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| DMW Control | 15.000 | 14.000 | 18.000 | 14.000 | 15.000 | 15.000 | 16.000 | 15.000 | 18.000 |        |
| CHCK06      | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  |
| CHCK04A     | 13.000 | 12.000 | 15.000 | 17.000 | 14.000 | 7.000  | 12.000 | 17.000 | 15.000 | 14.000 |
| Cosmo Pit   | 2.000  | 4.000  | 0.000  | 11.000 | 13.000 | 10.000 | 11.000 | 10.000 | 10.000 | 8.000  |
| Dam 3       | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  |
| PCCK06      | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  |

| Conc-%      | Mean   | N-Mean | Transform: Untransformed |        |        |        |    | t-Stat | 1-Tailed Critical | MSD   |
|-------------|--------|--------|--------------------------|--------|--------|--------|----|--------|-------------------|-------|
|             |        |        | Mean                     | Min    | Max    | CV%    | N  |        |                   |       |
| DMW Control | 15.556 | 1.0000 | 15.556                   | 14.000 | 18.000 | 9.702  | 9  |        |                   |       |
| CHCK06      | 0.000  | 0.0000 | 0.000                    | 0.000  | 0.000  | 0.000  | 10 |        |                   |       |
| *CHCK04A    | 13.600 | 0.8743 | 13.600                   | 7.000  | 17.000 | 21.423 | 10 | 1.863  | 1.771             | 1.859 |
| *Cosmo Pit  | 7.900  | 0.5079 | 7.900                    | 0.000  | 13.000 | 55.160 | 10 | 5.219  | 1.796             | 2.634 |
| Dam 3       | 0.000  | 0.0000 | 0.000                    | 0.000  | 0.000  | 0.000  | 10 |        |                   |       |
| PCCK06      | 0.000  | 0.0000 | 0.000                    | 0.000  | 0.000  | 0.000  | 10 |        |                   |       |

| Auxiliary Tests                                                   | Statistic | Critical | Skew     | Kurt    |         |       |
|-------------------------------------------------------------------|-----------|----------|----------|---------|---------|-------|
| Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05) | 0.92194   | 0.926    | -0.95671 | 0.84649 |         |       |
| Equality of variance cannot be confirmed                          |           |          |          |         |         |       |
| Hypothesis Test (1-tail, 0.05)                                    | MSDu      | MSDp     | MSB      | MSE     | F-Prob  | df    |
| Heteroscedastic t Test indicates significant differences          | 2.63449   | 0.16936  | 152.894  | 10.2124 | 4.7E-05 | 2, 26 |
| Treatments vs DMW Control                                         |           |          |          |         |         |       |

**Dose-Response Plot**



**Ceriodaphnia Partial Life-Cycle Test-Reproduction**

|              |                  |           |           |               |                       |
|--------------|------------------|-----------|-----------|---------------|-----------------------|
| Start Date:  | 6/03/2024 19:30  | Test ID:  | PR2218/01 | Sample ID:    | Various Screens       |
| End Date:    | 13/03/2024 19:30 | Lab ID:   | Various   | Sample Type:  | AQ-Aqueous            |
| Sample Date: |                  | Protocol: | ESA 102   | Test Species: | CD-Ceriodaphnia dubia |
| Comments:    |                  |           |           |               |                       |

|             |              | Auxiliary Data Summary |         |         |      |       |    |
|-------------|--------------|------------------------|---------|---------|------|-------|----|
| Conc-%      | Parameter    | Mean                   | Min     | Max     | SD   | CV%   | N  |
| DMW Control | No of Young  | 15.56                  | 14.00   | 18.00   | 1.51 | 7.90  | 9  |
| CHCK06      |              | 0.00                   | 0.00    | 0.00    | 0.00 |       | 10 |
| CHCK04A     |              | 13.60                  | 7.00    | 17.00   | 2.91 | 12.55 | 10 |
| Cosmo Pit   |              | 7.90                   | 0.00    | 13.00   | 4.36 | 26.42 | 10 |
| Dam 3       |              | 0.00                   | 0.00    | 0.00    | 0.00 |       | 10 |
| PCCK06      |              | 0.00                   | 0.00    | 0.00    | 0.00 |       | 10 |
| DMW Control | % unaffected | 100.00                 | 100.00  | 100.00  | 0.00 | 0.00  | 10 |
| CHCK06      |              | 0.00                   | 0.00    | 0.00    | 0.00 |       | 10 |
| CHCK04A     |              | 100.00                 | 100.00  | 100.00  | 0.00 | 0.00  | 10 |
| Cosmo Pit   |              | 0.00                   | 0.00    | 0.00    | 0.00 |       | 10 |
| Dam 3       |              | 0.00                   | 0.00    | 0.00    | 0.00 |       | 10 |
| PCCK06      |              | 0.00                   | 0.00    | 0.00    | 0.00 |       | 10 |
| DMW Control | pH           | 8.10                   | 8.10    | 8.10    | 0.00 | 0.00  | 1  |
| CHCK06      |              | 7.60                   | 7.60    | 7.60    | 0.00 | 0.00  | 1  |
| CHCK04A     |              | 7.20                   | 7.20    | 7.20    | 0.00 | 0.00  | 1  |
| Cosmo Pit   |              | 7.60                   | 7.60    | 7.60    | 0.00 | 0.00  | 1  |
| Dam 3       |              | 6.60                   | 6.60    | 6.60    | 0.00 | 0.00  | 1  |
| PCCK06      |              | 7.10                   | 7.10    | 7.10    | 0.00 | 0.00  | 1  |
| DMW Control | DO %         | 94.00                  | 94.00   | 94.00   | 0.00 | 0.00  | 1  |
| CHCK06      |              | 91.60                  | 91.60   | 91.60   | 0.00 | 0.00  | 1  |
| CHCK04A     |              | 93.20                  | 93.20   | 93.20   | 0.00 | 0.00  | 1  |
| Cosmo Pit   |              | 90.70                  | 90.70   | 90.70   | 0.00 | 0.00  | 1  |
| Dam 3       |              | 90.70                  | 90.70   | 90.70   | 0.00 | 0.00  | 1  |
| PCCK06      |              | 93.80                  | 93.80   | 93.80   | 0.00 | 0.00  | 1  |
| DMW Control | Cond uS/cm   | 176.00                 | 176.00  | 176.00  | 0.00 | 0.00  | 1  |
| CHCK06      |              | 364.00                 | 364.00  | 364.00  | 0.00 | 0.00  | 1  |
| CHCK04A     |              | 512.00                 | 512.00  | 512.00  | 0.00 | 0.00  | 1  |
| Cosmo Pit   |              | 3660.00                | 3660.00 | 3660.00 | 0.00 | 0.00  | 1  |
| Dam 3       |              | 1579.00                | 1579.00 | 1579.00 | 0.00 | 0.00  | 1  |
| PCCK06      |              | 1579.00                | 1579.00 | 1579.00 | 0.00 | 0.00  | 1  |

### Ceriodaphnia Partial Life-Cycle Test-7 Day Unaffected

|                             |                    |                                     |
|-----------------------------|--------------------|-------------------------------------|
| Start Date: 6/03/2024 19:30 | Test ID: PR2218/01 | Sample ID: Various Screens          |
| End Date: 13/03/2024 19:30  | Lab ID: Various    | Sample Type: AQ-Aqueous             |
| Sample Date:                | Protocol: ESA 102  | Test Species: CD-Ceriodaphnia dubia |
| Comments:                   |                    |                                     |

| Conc-%      | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9      | 10     |
|-------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| DMW Control | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| CHCK06      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| CHCK04A     | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| Cosmo Pit   | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Dam 3       | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| PCCK06      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

### Transform: Arcsin Square Root

| Conc-%      | Mean   | N-Mean | Mean   | Min    | Max    | CV%   | N  |
|-------------|--------|--------|--------|--------|--------|-------|----|
| DMW Control | 1.0000 | 1.0000 | 1.0472 | 1.0472 | 1.0472 | 0.000 | 10 |
| CHCK06      | 0.0000 | 0.0000 | 0.5236 | 0.5236 | 0.5236 | 0.000 | 10 |
| CHCK04A     | 1.0000 | 1.0000 | 1.0472 | 1.0472 | 1.0472 | 0.000 | 10 |
| Cosmo Pit   | 0.0000 | 0.0000 | 0.5236 | 0.5236 | 0.5236 | 0.000 | 10 |
| Dam 3       | 0.0000 | 0.0000 | 0.5236 | 0.5236 | 0.5236 | 0.000 | 10 |
| PCCK06      | 0.0000 | 0.0000 | 0.5236 | 0.5236 | 0.5236 | 0.000 | 10 |

### Auxiliary Tests

Shapiro-Wilk's Test indicates normal distribution ( $p > 0.05$ )  
 Equality of variance cannot be confirmed

Statistic

1

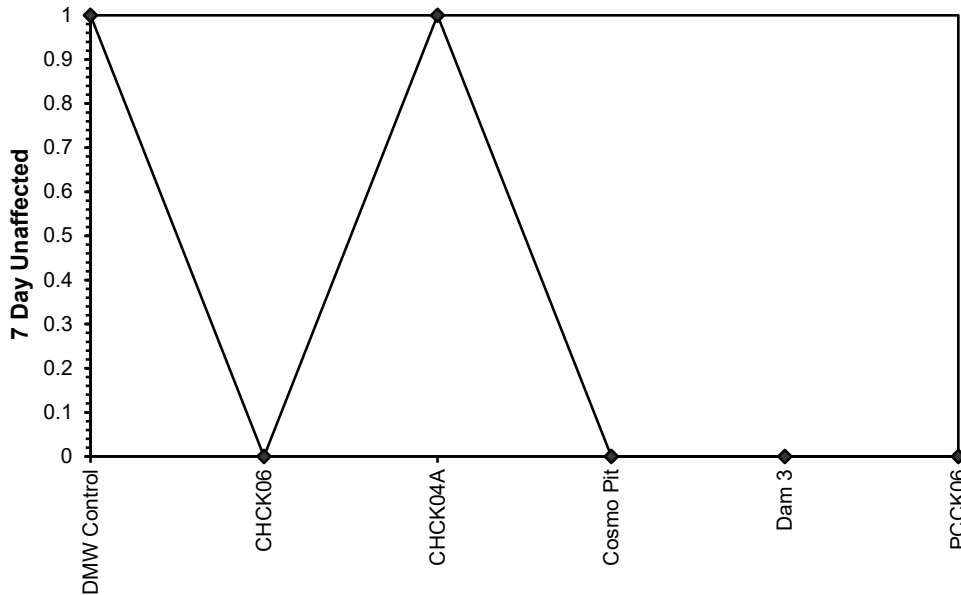
Critical

0.905

Skew

Kurt

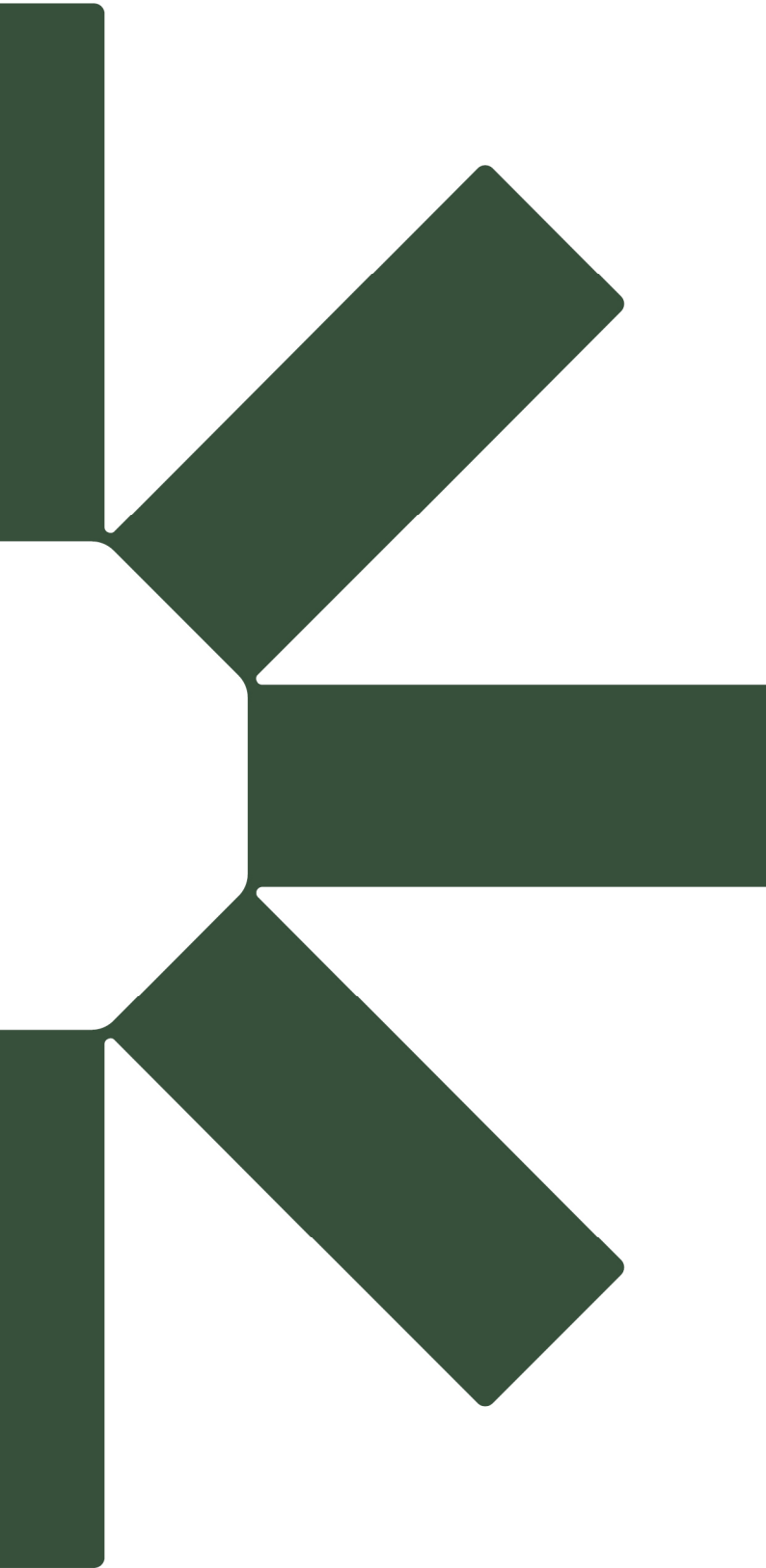
### Dose-Response Plot



**Ceriodaphnia Partial Life-Cycle Test-7 Day Unaffected**

|              |                  |           |           |               |                       |
|--------------|------------------|-----------|-----------|---------------|-----------------------|
| Start Date:  | 6/03/2024 19:30  | Test ID:  | PR2218/01 | Sample ID:    | Various Screens       |
| End Date:    | 13/03/2024 19:30 | Lab ID:   | Various   | Sample Type:  | AQ-Aqueous            |
| Sample Date: |                  | Protocol: | ESA 102   | Test Species: | CD-Ceriodaphnia dubia |
| Comments:    |                  |           |           |               |                       |

|             |              | Auxiliary Data Summary |         |         |      |       |    |
|-------------|--------------|------------------------|---------|---------|------|-------|----|
| Conc-%      | Parameter    | Mean                   | Min     | Max     | SD   | CV%   | N  |
| DMW Control | No of Young  | 15.56                  | 14.00   | 18.00   | 1.51 | 7.90  | 9  |
| CHCK06      |              | 0.00                   | 0.00    | 0.00    | 0.00 |       | 10 |
| CHCK04A     |              | 13.60                  | 7.00    | 17.00   | 2.91 | 12.55 | 10 |
| Cosmo Pit   |              | 7.90                   | 0.00    | 13.00   | 4.36 | 26.42 | 10 |
| Dam 3       |              | 0.00                   | 0.00    | 0.00    | 0.00 |       | 10 |
| PCCK06      |              | 0.00                   | 0.00    | 0.00    | 0.00 |       | 10 |
| DMW Control | % unaffected | 100.00                 | 100.00  | 100.00  | 0.00 | 0.00  | 10 |
| CHCK06      |              | 0.00                   | 0.00    | 0.00    | 0.00 |       | 10 |
| CHCK04A     |              | 100.00                 | 100.00  | 100.00  | 0.00 | 0.00  | 10 |
| Cosmo Pit   |              | 0.00                   | 0.00    | 0.00    | 0.00 |       | 10 |
| Dam 3       |              | 0.00                   | 0.00    | 0.00    | 0.00 |       | 10 |
| PCCK06      |              | 0.00                   | 0.00    | 0.00    | 0.00 |       | 10 |
| DMW Control | pH           | 8.10                   | 8.10    | 8.10    | 0.00 | 0.00  | 1  |
| CHCK06      |              | 7.60                   | 7.60    | 7.60    | 0.00 | 0.00  | 1  |
| CHCK04A     |              | 7.20                   | 7.20    | 7.20    | 0.00 | 0.00  | 1  |
| Cosmo Pit   |              | 7.60                   | 7.60    | 7.60    | 0.00 | 0.00  | 1  |
| Dam 3       |              | 6.60                   | 6.60    | 6.60    | 0.00 | 0.00  | 1  |
| PCCK06      |              | 7.10                   | 7.10    | 7.10    | 0.00 | 0.00  | 1  |
| DMW Control | DO %         | 94.00                  | 94.00   | 94.00   | 0.00 | 0.00  | 1  |
| CHCK06      |              | 91.60                  | 91.60   | 91.60   | 0.00 | 0.00  | 1  |
| CHCK04A     |              | 93.20                  | 93.20   | 93.20   | 0.00 | 0.00  | 1  |
| Cosmo Pit   |              | 90.70                  | 90.70   | 90.70   | 0.00 | 0.00  | 1  |
| Dam 3       |              | 90.70                  | 90.70   | 90.70   | 0.00 | 0.00  | 1  |
| PCCK06      |              | 93.80                  | 93.80   | 93.80   | 0.00 | 0.00  | 1  |
| DMW Control | Cond uS/cm   | 176.00                 | 176.00  | 176.00  | 0.00 | 0.00  | 1  |
| CHCK06      |              | 364.00                 | 364.00  | 364.00  | 0.00 | 0.00  | 1  |
| CHCK04A     |              | 512.00                 | 512.00  | 512.00  | 0.00 | 0.00  | 1  |
| Cosmo Pit   |              | 3660.00                | 3660.00 | 3660.00 | 0.00 | 0.00  | 1  |
| Dam 3       |              | 1579.00                | 1579.00 | 1579.00 | 0.00 | 0.00  | 1  |
| PCCK06      |              | 1579.00                | 1579.00 | 1579.00 | 0.00 | 0.00  | 1  |



Making Sustainability Happen

Waste Discharge Licence 166-07  
Monitoring Report  
Pine Creek Project Area

Appendix D – Pine Creek  
Macroinvertebrate and Sediment  
Report



**AGNICO EAGLE**

# Pine Creek Project Area

*Biological and Sediment Monitoring 2024*

*Final Report*



*This report has been prepared for NT Mining Operations as a technical document to inform the Waste Discharge Licence Report.*

*The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. As a result, not all relevant site features and conditions may have been identified in this report.*

*Sediment quality data and rainfall data were obtained from NTMO. Aquatic Ecology Services has made the assumption that all data has been validated and is correct.*

| Version   | Prepared by | Reviewed by | Review Date |
|-----------|-------------|-------------|-------------|
| Draft 1.0 | T Steele    | E. McGowan  | 29/10/2024  |
| Final 2.0 | T Steele    |             |             |
|           |             |             |             |
|           |             |             |             |
|           |             |             |             |



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# 1. Background

## 1.1 Catchment

The Pine Creek Project Area (PCPA) lies within the Daly River catchment. The local sub-catchment systems are the ephemeral Pine Creek and Copperfield Creek which drain from the Project Area. Both streams flow into the Cullen River, a large tributary of the Douglas-Daly Catchment. The Daly River flows into the ocean, approximately 200 km west of the Project Area.

Pine Creek Process Water Dam (PCPWD) drains to the south via a constructed concrete spillway and wooden weir which then discharges to an unnamed tributary of Copperfield Creek approximately 2 km downstream.

## 1.2 Monitoring Program

The release of this waste water from the Process Water Dam (PCPWD) to Copperfield Creek has historically been controlled by the Waste Discharge License (WDL) 166-03 pursuant to S74 of the Water Act. In 2019/2020, NT Mining Operations (NTMO) did not seek the renewal of the WDL. Irrespective of this change, biological monitoring was conducted to understand if any passive discharges from the PCPA were influencing the aquatic ecosystems of the receiving environment. In 2020, NTMO applied for and was granted a WDL (166-06) and released water to Copperfield Creek during the 2020/2021 wet season as a result, which remains in place in 2022.

Biological monitoring has occurred in the PCPA since 2010. In addition to biological monitoring, sediment quality monitoring results assist with interpretation of macroinvertebrate community data. By monitoring both macroinvertebrates and sediment, an integrated assessment of long-term impacts from exposure to treated mine water can be determined should it be required.

## 1.3 Scope

Aquatic Ecology Services was engaged by NTMO to undertake biological and sediment monitoring at the PCPA, following the 2023-2024 wet season. This report presents the data collected during monitoring undertaken in the post-wet season of 2024.

## 2. Study Design

### 2.1 Sampling sites

Seven sampling sites were visited during sampling in 2024 (Table 1). This included one upstream site and three downstream sites on Pine Creek, as well as one upstream and two downstream sites on Copperfield Creek.

Sites on Pine Creek are located upstream and downstream of passive discharges from the PCPA, and sites on Copperfield Creek are downstream of active discharges from PCPWD. Site PCCK06 on Copperfield Creek is downstream of the PCPWD and is the compliance point for the PCPA (WDL 166-03).

*Table 1 – Sampling sites at the PCPA*

| Site Code | Site type  | Description                                                                                                | Easting | Northing |
|-----------|------------|------------------------------------------------------------------------------------------------------------|---------|----------|
| PCCK01    | Upstream   | Pine Creek upstream of Green Valley Road                                                                   | 803839  | 8470765  |
| PCCK04    | Downstream | Downstream of PCPA within Pine Creek on tenement boundary                                                  | 805619  | 8470439  |
| PCCK02    | Downstream | Pine Creek captures water from AD PCCK04. In PC township                                                   | 806079  | 8470548  |
| PCCK03    | Downstream | 1 km further downstream from PCCK02 at Railway line culvert, Pine Creek                                    | 806926  | 8471010  |
| PCCK16    | Upstream   | Copperfield Creek at Jindare/Umbrawarra Road Crossing                                                      | 804801  | 8465732  |
| PCCK06    | Downstream | 100 metres downstream of the confluence of Copperfield Creek with the process water dam spillway tributary | 806230  | 8465696  |
| PCCK22    | Downstream | Copperfield Creek ~21km downstream of the PCPA                                                             | 815136  | 8449095  |

### 2.2 Timing

Sampling has routinely been conducted in the post-wet season during the recessional flow period, to capture the potential effects of mine site runoff during the preceding wet season. The timing of sampling has generally been undertaken in late April to mid-May. In 2024, sampling was undertaken in late April to target adequate water availability at all sites.



## 3. Methods

### 3.1 Habitat assessment

At each site, descriptions of habitat characteristics were recorded following the criteria listed in the Northern Territory AUSRIVAS "Darwin-Daly Region Model" field sheets (Lamche, 2007). Habitat assessments were undertaken in consideration of the whole reach sampled, including:

- Site description
- Water quality
- Instream physical characteristics (flow velocity and depth, instream habitat characteristics, bank height, riparian zone width)
- Riparian vegetation characteristics (types, %cover, exotic species, erosion, land use)
- Water quality observations (clarity, odour, oils, foam/scum, plumes etc.)
- Sketches of the site, including a cross - section of the reach

The information recorded was used to assist interpretation of biological data and to provide input data for the Northern Territory AUSRIVAS model. Data recorded is also used in conjunction with the biological community information as the basis of the overall health assessment.

Photos were taken of upstream and downstream portions of the reach sampled, as well as bank habitat and other key habitat features. This further characterises the habitat conditions at each site, serving as a pictorial record of site conditions that can be tracked over time using photos taken from the same photo points.

### 3.2 Water quality

The physico-chemical parameters of the water at each site were measured using a calibrated multi-parameter water quality meter. The following parameters were recorded:

- Water temperature (°C)
- Dissolved oxygen (DO) concentrations (mg/L and % saturation)
- pH
- Electrical conductivity (EC) (µS/cm)
- Turbidity

### 3.3 Sediment quality

Sediment sampling methods utilised at each site were in accordance with those outlined in ANZECC (2000) and Simpson and Batley (2016) and involved:

- The collection of multiple sub-samples using a spade of inert material.
- Compositing the sub-samples into a receptacle (also composed of inert material) and mixing the contents.
- The collection of one QA/QC duplicate sample per project area to validate results.
- Collecting a sub-sample from the mixture and placing it into a laboratory-supplied container, labelled with site and sample details.
- Keeping samples in chilled eskies for onward delivery to a NATA accredited laboratory for testing.

Bioavailable metals data (from 1M HCl dilute acid digestion analysis) were analysed for the parameters shown in Table 2. Within each project area, comparisons were made between results from upstream and downstream of release points.

*Table 2 – Testing parameters for sediments collected at URPA*

| Group                                     | Analytes                           |
|-------------------------------------------|------------------------------------|
| Metals: 1 M HCl acid digest, total metals | Al, As, Cd, Co, Cu, Fe, Mn, Ni, Zn |
| Ions                                      | Total sulphur, sulfate,            |
| Others                                    | PSD, saturated pH, TOC             |

### 3.4 Macroinvertebrates

#### 3.4.1 Field sampling

Macroinvertebrate sampling and processing followed procedures outlined in the Northern Territory AUSRIVAS Manual for the Darwin-Daly Region (Lamche, 2007). Sampling involved scraping the bank and sweeping a dip net through the water column downstream of the edge habitat, to collect the dislodged animals. Areas of riffle or fast flowing habitat, Pandanus roots and severe bank undercuts were avoided when collecting edge habitat samples.

Once collected, the samples were washed through 10 mm and 250 µm mesh sieves. The course mesh sieve was examined for large, conspicuous taxa, and these were placed in the labelled sample container. The sample collected in the fine mesh sieve was also placed in the labelled sample container and filled with 70% ethanol. All samples were sent to the macroinvertebrate laboratory for further processing and identification.

#### 3.4.2 Laboratory processing

Samples were washed through a series of sieves (10 mm, 500 µm and 250 µm mesh sizes). Any large, conspicuous taxa identified in the 10 mm mesh sieve were added to the contents of the large mesh fraction

retained in the field. The contents of the 500 µm mesh sieve were retained for macroinvertebrate identification and enumeration, while the 250 µm fraction was retained as sample residue for quality assurance purposes. The contents of the 500 µm mesh fraction was poured into a Marchant sub-sampler (Marchant, 1989) and extractions made randomly from cells (aliquots) in this apparatus. These extractions were placed under a microscope and the taxa identified and counted. This process continued until either all aliquots were examined, or a total of 200 individuals had been counted and identified. The number of aliquots required to be processed to obtain a minimum 200 individual sub-sample was recorded in order to be able to calculate abundance. A Leica stereo-dissection microscope was used to examine specimens.

Taxa were identified to genus level where possible, with the exception of key taxa identified in Lamche (2007), requiring identification to order level (e.g., Conchostraca). Quality assurance processes were followed as per Lamche (2007). Five percent of samples were sent to an external laboratory and checked for correct identification by an AUSRIVAS accredited Senior Taxonomist.

### **3.5 Data analysis**

A number of indices can be used to assess and/or quantify the influence of anthropogenic activities on macroinvertebrate communities. Responses to contaminants or changes in flow can result in anything from changes in abundance and diversity through to changes in community composition through the loss or reduction of sensitive taxa. As such, a multiple lines of evidence approach has been adopted with regards to interpreting macroinvertebrate community data. Where possible, data from 2024 was compared against historical data collected by NTMO, as well as Crocodile Gold macroinvertebrate monitoring data from 2010 and 2012.

In previous years, macroinvertebrate data was assessed using the NT AUSRIVAS Darwin-Daly Early (dry season) Family level Edge habitat model. New guidance on the use of these models in the NT to understand impacts of point source pollution have been published (ANZG 2021). The updated guidance states that the models are not useful in understanding aquatic ecosystem health outside of the large rivers where macroinvertebrates have been collected, and therefore the use of AUSRIVAS modelling has been discontinued.

Macroinvertebrate community indices were calculated for each sample at each site. Long - term medians were be calculated using historical data. The use of median values allows for consideration of the overall performance of metrics at a particular site over previous years. Metrics and their long-term median values were compared between sites to understand the temporal and spatial differences of sites within the catchment. A one-way ANOVA was performed, comparing metric results from each treatment (upstream or downstream). Analyses were conducted in Statistica v12.

A summary of the univariate macroinvertebrate indices assessed as part of this study are provided below:

- Relative abundance – Total number of individual taxa collected at a site. This information is calculated based on processing requirements in the laboratory (% of sample processed).
- Taxa richness (Family) – Total number of taxa present at the site used as a measure of diversity of families (used for long-term data analysis).

- Taxa Richness (Genus) - Total number of taxa present at the site used as a measure of diversity of genera.
- PET richness (Family) – total number of families from orders Plecoptera, Ephemeroptera and Trichoptera. PET taxa are generally more sensitive to disturbance.
- PET richness (Genus) – total number of genera from orders Plecoptera, Ephemeroptera and Trichoptera.
- SIGNAL-2 – a biotic index that allocates a value to each macroinvertebrate family based on their sensitivity to pollution. The metric is calculated by averaging the index of all families collected. Lamche (2007) cautions against the use of the SIGNAL-2 index for assessing the status of Northern Territory macroinvertebrate communities. This measure is however, considered appropriate for this study as the number of pollution-sensitive versus pollution-tolerant families does provide some insight to the level of stress that the macroinvertebrate community is experiencing.

In addition to univariate analysis of metrics, an assessment of differences in the macroinvertebrate community composition will be undertaken. NMDS Ordination provides a representation of the relative similarity of entities (i.e., samples) based on their attributes (i.e., macroinvertebrate community composition) within a reduced dimensional space. The more similar sites are to each other, the closer they are located in the NMDS ordination space. In this study, NMDS plots were used to display the similarity between site types (Impacted and Control) and Years (sampling events). A similarity matrix for all pairs of samples based on the Bray-Curtis similarity coefficient was calculated. Stress, which is a measure of the distortion produced by compressing multi-dimensional data into a reduced set of dimensions, was used to gauge how reliable the patterns presented in two-dimensional NMDS plots are. Stress levels above 0.20 indicate a poor representation of inter-sample similarity and, as such, the NMDS results with stress values of this order require interpretation with caution (Clarke *et al.* 2014).

The ANOSIM (ANalysis Of SIMilarity) routine was applied on the similarity matrix for each ordination analysis to determine if the differences between sites observed within the ordination plots were significantly different. This analysis provides a measure of the dissimilarity of groups of samples (years) in the form of an R-statistic that typically lies between 0 and 1; values close to 1 imply that these groups are very dissimilar and those approaching 0 are very similar. A p-value is calculated to determine the statistical significance of the site groupings. The interpretation of group separation is not wholly based upon the p-value, but rather the R-statistic, as the numbers of replicates within the groups being compared does not unduly affect the R value. Where significant differences were seen in community composition, a similarity percentages (SIMPER) analysis was performed to understand which taxa had the greatest influence on differences in site types.

## 4. Results and Discussion

### 4.1 Site conditions

#### 4.1.1 Rainfall and flow

Rainfall recorded at Union Reefs Mine, approximately 13km north of the PCPA is presented below in Figure 2. A total of 1642mm of rain was recorded in the 2023-2024 wet season, the majority of that rain fell between January and March. Active discharge to Copperfield Creek occurred from PCPWD and passive discharge from seepage points across the PCPA was observed during the wet season (Emer McGowan, KLG *pers comm*). The end of the wet season was likely to see the majority of discharge from the PCPWD during the months when rainfall occurred and would have continued into April when rainfall ceased.

Continuous rainfall records are only available from 2020, and so no comparisons to long-term rainfall data were undertaken. The 2022-2023 wet season experienced 300mm more rainfall compared with the 2022-2023 wet season (AES 2023).

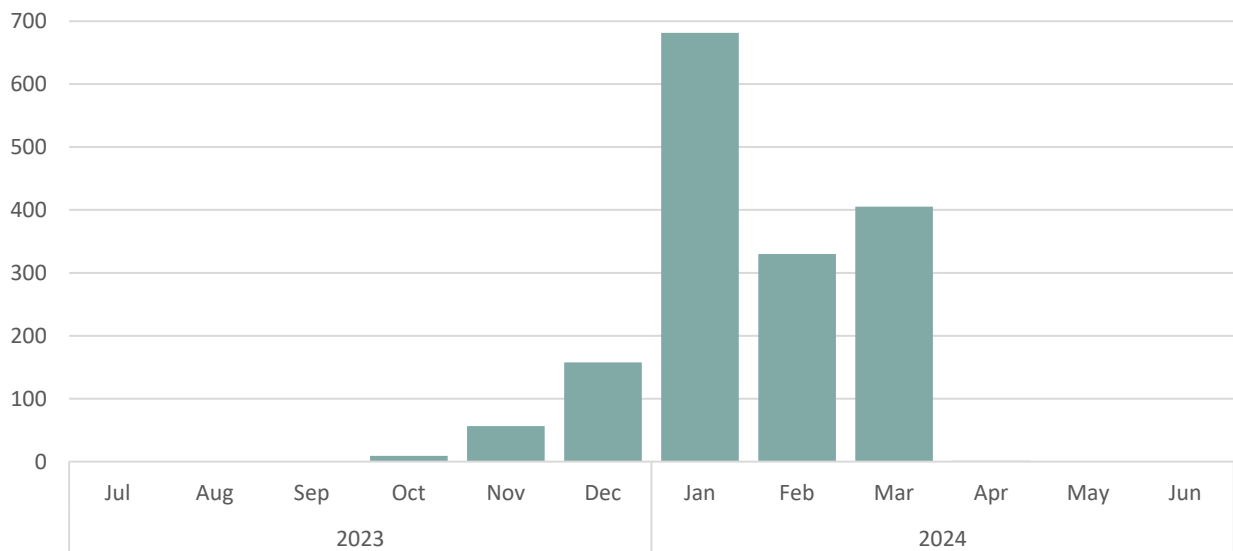


Figure 2 – Monthly Rainfall recorded at Union Reefs Mine July 2023-June 2024

#### 4.1.2 Habitat characteristics

Habitat characteristics of each site are detailed below in Table 3. All sites were flowing at the time of sampling. Sufficient water was present for replicate sampling to take place at each site, and sample timing was considered appropriate.

Table 3 – BMP site descriptions, April 2024

| Site description                                                                                                                                                                                                                                                                                                                                                                                                                             | Site photo                                                                           |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| <p><b>PCCK01 – Upstream</b></p> <p>The site is intersected by Tabletop Road and was characterised by a series of deep pools., connected by shallow runs. The riparian zone was narrow and discontinuous and dominated by pandanus, paperbarks and native grasses. The substrate of pools was dominated by sand and clay covered by fine detritus.. Water was turbid and shading was moderate.</p>                                            |    |
| <p><b>PCCK04 – Downstream</b></p> <p>The site was a long, shallow pool, connected to a run at the downstream end. The substrate was a mixture of bedrock, cobbles and sand, and the riparian vegetation was a majority pasture grass and pandanus lining the banks. Flow was present at the time of sampling and fish were present.</p>                                                                                                      |   |
| <p><b>PCCK02 – Downstream</b></p> <p>The site was located in the township of Pine Creek, downstream of the culvert/road crossing of Main Terrace. The site was a long pool with a cleared riparian zone, besides a number of large trees that provided shade. There were emergent and floating macrophytes present throughout the site in shallow areas. At the end of the pool was a long run that flowed under a historic rail bridge.</p> |  |
| <p><b>PCCK03 – Downstream</b></p> <p>The site was located at a railway bridge. The site consisted of a large pool around 150m long and 10m wide, connected downstream to a number of smaller pools by shallow runs. Bed material was a mixture of cobbles sand and clay. Declared weed <i>Hymenachne amplexicaulis</i> was observed growing upstream at the site.</p>                                                                        |  |

| Site description                                                                                                                                                                                                                                                                                                                                                                                                                                             | Site photo                                                                           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| <p><b>PCCK16 – Upstream</b></p> <p>The site is located at the crossing of Umbawarra Road. The substrate of the site was a mixture of sand, silt and cobbles. Native grasses and Pandanus lined the pool and trailed in the water. Sparse native trees were present and provided dappled shade. Water was flowing slowly at the time of sampling and leaf packs were present in deeper pools.</p>                                                             |    |
| <p><b>PCCK06 – Downstream</b></p> <p>The site was located just upstream of a low-level weir. The stream bed was predominantly sand, gravel and cobbles. Edge habitat consisted of grasses, exposed roots and overhanging vegetation, while instream habitat was mainly made up of snags, sticks and leaf packs. Riparian vegetation at the site was discontinuous due to a power line intersecting the site.</p>                                             |   |
| <p><b>PCCK22 – Downstream</b></p> <p>The site is located downstream of the crossing of Dorisvale Road. A large, deep isolated pool was upstream, and a run/pool downstream. The banks were mostly vertical, with continuous vegetation lining the banks. The vegetation was made up of melaleucas and some pandanus. Available habitat was mostly exposed roots and detritus. Shading was high, and substrate was a mixture of sand, gravel and cobbles.</p> |  |

## 4.2 Water quality

*In situ* water quality data collected at sampling sites is presented below in Table 4. The following observations can be made about water physico-chemical parameters at sites associated with the PCPA:

- Water temperatures were similar at all sites, with the warmest temperatures recorded during the middle of the day. Warmer temperatures at sites corresponded with higher dissolved oxygen. .
- Conductivity readings were higher at sites on Pine Creek downstream of the PCPA compared with the upstream site, indicating some influence from passive discharges. EC decreased slightly with distance downstream on Pine Creek. Comparatively, EC readings were much lower on Copperfield Creek, and although they increase downstream of PCPWD, there was very little difference between any site in the catchment, regardless of their position relative to the PCPA.
- pH results were similar for sites in each watercourse. pH values at sites and were circumneutral.
- Turbidity was highest at PCCK01, but all readings reflected the clarity of water at all sites.

*Table 4 – In situ water quality results from sites visited in April 2024*

| Site Code | Time  | Temp (°C) | pH   | DO (%) | DO (mg/L) | EC (µS/cm) | Turbidity (NTU) |
|-----------|-------|-----------|------|--------|-----------|------------|-----------------|
| PCCK01    | 10:30 | 24.34     | 6.25 | 83.13  | 7.62      | 22.75      | 64.05           |
| PCCK04    | 8:35  | 25.16     | 6.52 | 88.71  | 7.16      | 112.1      | 7.22            |
| PCCK02    | 12:30 | 27.7      | 6.36 | 90.33  | 6.95      | 129.84     | 10.82           |
| PCCK03    | 14:40 | 28.98     | 6.66 | 90.26  | 6.76      | 104.87     | 6.22            |
| PCCK16    | 8:15  | 27.36     | 6.84 | 81.44  | 6.31      | 35.14      | 4.17            |
| PCCK06    | 10:00 | 26.93     | 6.96 | 86.83  | 6.79      | 44.04      | 8.33            |
| PCCK22    | 12:50 | 27.97     | 7.55 | 101.44 | 7.82      | 67.66      | 15.67           |

## 4.3 Sediment

The results of laboratory analysis of sediments are presented in Table 5 along with long-term medians. The following observations were made relating to sediment quality:

- Although slightly elevated downstream, there were no exceedances of the SQGVs at any site in Copperfield Creek, and most acid-extractible metal concentrations were below long-term medians.
- Site PCCK06 returned a result for acid-extractible zinc approaching the SQGV and showed a more than two-fold increase from the value in 2023. Historical results for the site are presented in Figure 3. Zinc concentrations were reduced to below detection downstream at PCCK22.
- Besides PCCK02, there were no exceedances of the SQGV for any parameter at any site.
- There was an increase in most acid-extractible metals downstream of the PCPA on Pine Creek, but most metals reduced in concentration downstream at PCCK03.

- Both arsenic and zinc were recorded above the SQGV-high at PCCK02, with a reduction below the SQGV downstream at PCCK03.
- Proportions of total organic carbon (TOC) in samples were variable. Overall, the proportion of TOC in each sample was low (It is unlikely that these quantities of TOC would ameliorate the bioavailability of metals in sediments of Pine or Copperfield Creeks (ANZG 2018)).

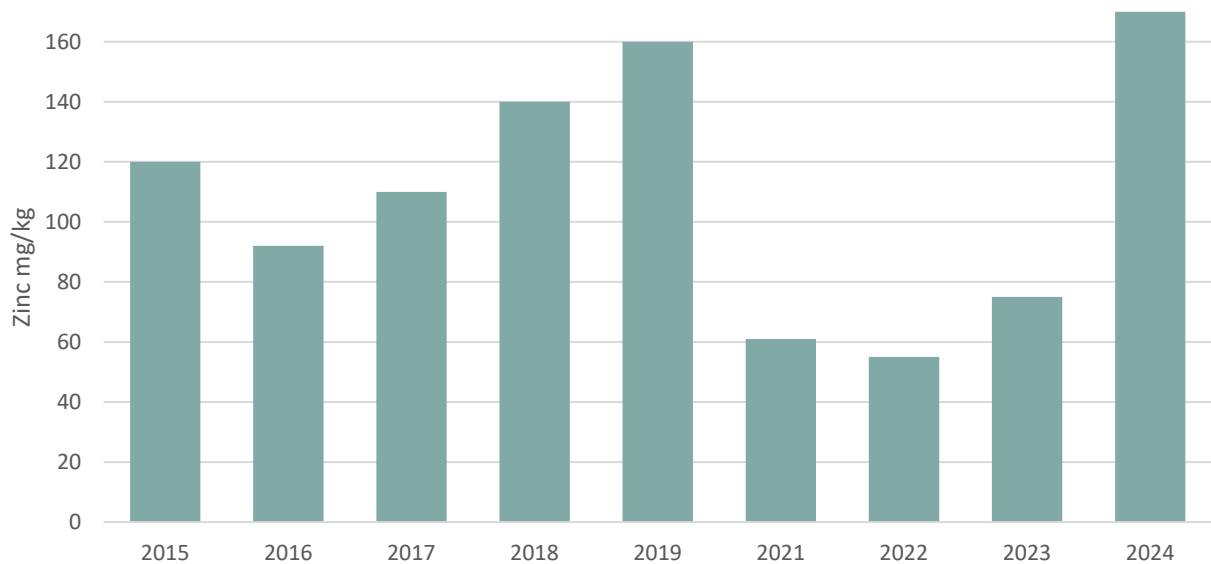


Figure 3 – Historical zinc concentrations at PCCK06, 2015 - 2024

Table 5 – Analysis results of sediment parameters from 2024, compared with long-term medians. All values are presented in mg/kg

| Catchment position | Site   | TOC   | Aluminium | Arsenic | Cadmium | Chromium | Cobalt | Copper | Iron  | Lead | Manganese | Nickel | Zinc  |
|--------------------|--------|-------|-----------|---------|---------|----------|--------|--------|-------|------|-----------|--------|-------|
| Low                |        |       |           | 20      | 1.5     |          |        | 65     |       | 50   |           | 21     | 200   |
| High               |        |       |           | 70      | 10      |          |        | 270    |       | 220  |           | 52     | 410   |
| Upstream           | PCCK01 | 800   | 110       | 15      | <0.5    | <1       | <1     | 30     | 740   | 5    | 4         | <1     | 1     |
|                    | Median | 7700  | 350       | 13.5    | 0.5     | 0.5      | 1.15   | 21.5   | 1750  | 8.5  | 33        | 1      | 2.5   |
|                    | PCCK16 | 600   | 84        | <4      | <0.5    | <1       | <1     | <1     | 370   | 2    | 27        | <1     | <1    |
|                    | Median | 3,550 | 395       | 17      | <0.5    | 2        | 2      | 2      | 2,200 | 4    | 110       | 2      | 2     |
| Downstream         | PCCK04 | 3700  | 380       | 9       | <0.5    | <1       | 5.5    | 6      | 880   | 19   | 86        | 2      | 81    |
|                    | Median | 6000  | 790       | 15      | 0.55    | <1       | 20     | 9      | 2600  | 20   | 450       | 7      | 200   |
|                    | PCCK02 | 33000 | 40000     | 82      | <0.5    | 3        | 13     | 150    | 20000 | 130  | 170       | 5      | 620   |
|                    | Median | 18000 | 20065     | 82      | <0.5    | 3        | 13     | 150    | 10550 | 66   | 107       | 5      | 310.5 |
|                    | PCCK03 | 4400  | 430       | 5       | <0.5    | <1       | 9.4    | 6      | 1200  | 87   | 170       | 3      | 110   |
|                    | Median | 4400  | 520       | 8       | 0.6     | <1       | 13     | 5      | 1700  | 44   | 260       | 3      | 110   |
|                    | PCCK06 | 500   | 160       | <4      | <0.5    | <1       | 2.5    | 4      | 540   | 3    | 65        | 2      | 170   |
|                    | Median | 1700  | 250       | 4       | 0.5     | 8.8      | 1      | 4      | 890   | 4    | 170       | 2      | 110   |
|                    | PCCK22 | 200   | 2         | <4      | <0.5    | <1       | <1     | <1     | 1     | <1   | <1        | <1     | <1    |
|                    | Median | 2000  | 120       | 0       | <0.5    | <1       | 2.2    | 4      | 520   | 3.5  | 60.5      | 1      | 31    |

## 4.4 Macroinvertebrates

The following sections summarise the findings of results from 2024, including historical comparisons of aquatic ecosystem health where available. Raw data is available in Appendix C.

### 4.4.1 Relative abundance

The relative abundance of macroinvertebrates collected at the PCPA in 2024 is presented in Figure 4. The highest relative abundances were observed at sites furthest downstream on both creeks. There was no significant difference ( $p > 0.05$ ) between site types in the either catchment (Appendix A, Table 9 and Table 10).

The relative abundance of samples collected upstream on Pine creek were above the long-term median, with an increase in numbers with distance downstream. Alternatively, results downstream were below the long-term median on Copperfield Creek, and were slightly below in two of three samples upstream.

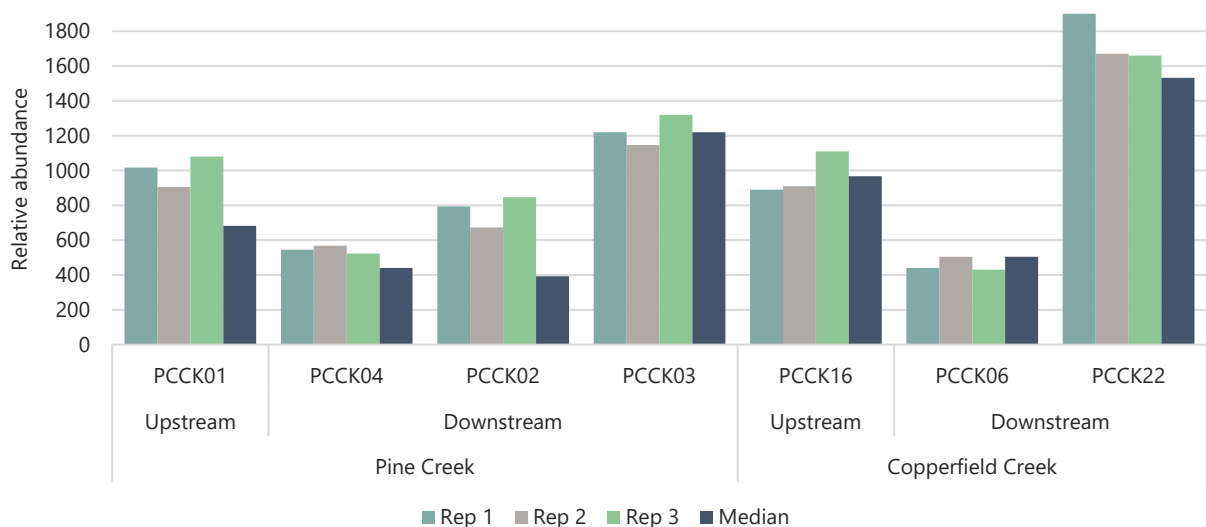


Figure 4 – Relative abundance of samples collected in 2024 compared to long-term medians

### 4.4.2 Taxa richness (Family)

The family taxa richness for samples collected in 2024 are presented in Figure 5. The highest taxa richness was recorded at PCKK06, and results at PCKK22 was similar to the upstream site on Copperfield Creek. Results were more variable on Pine Creek, where almost all samples collected were either equal or above the long-term median. The majority of samples contained less diversity than the long term median on Copperfield Creek, regardless of their position in the catchment. The lowest number of families were collected furthest downstream at PCKK22

Despite any variations from long-term medians, there were no significant differences ( $p > 0.05$ ) in family taxa richness between sites upstream and downstream of the PCPA in both catchments (Appendix A, Table 11 and Table 12)

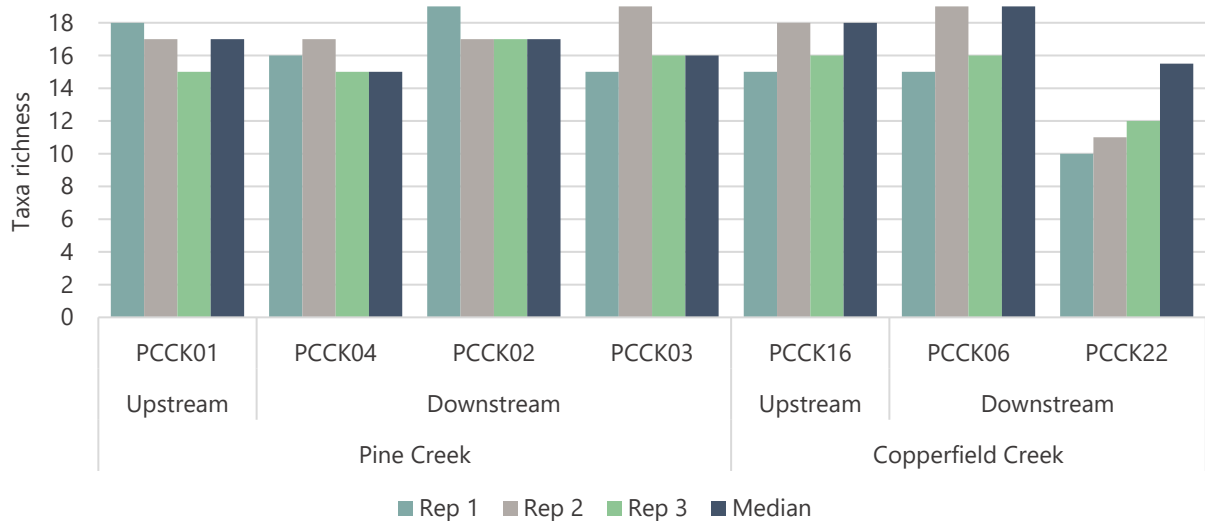


Figure 5 -Family taxa richness from sites at the PCPA sampled in 2024 compared to long-term medians

#### 4.4.3 Taxa richness (Genus)

The results of genus-level data collected in 2024 is presented in Figure 6. Contrary to family richness results in Copperfield Creek, values were higher at PCCK22 than PCCK16. This inverse relationship led to a significant difference ( $p = 0.002691$ ) between site types (Table 6), this is demonstrated in Figure 7, showing that higher values were recorded downstream.

There was very little variability in taxa richness between samples at each site on Pine Creek, which meant there was no significant differences were found between site types in Pine Creek ( $p > 0.05$ , Appendix A, Table 13).

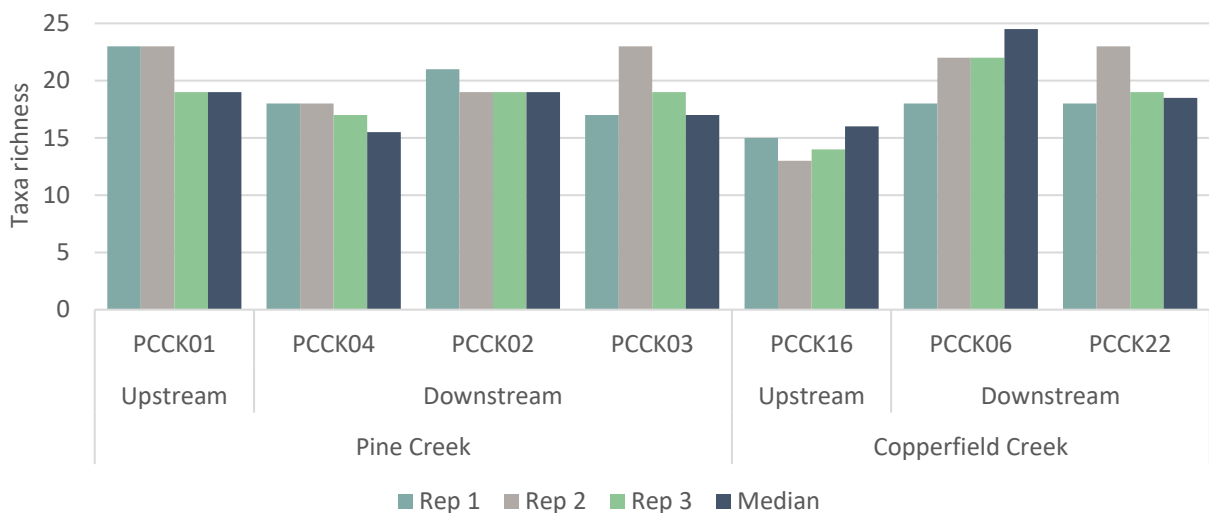


Figure 6 – Genus taxa richness at sites collected at the PCPA in 2024

Table 6 – One-way ANOVA results of genus-level taxa richness – Copperfield Creek

| Effect                  | df | SS       | MS      | F       | <i>p</i> |
|-------------------------|----|----------|---------|---------|----------|
| Groups (between groups) | 1  | 80.2222  | 80.2222 | 20.5447 | 0.002691 |
| Error (within groups)   | 7  | 27.3333  | 3.9048  |         |          |
| Total                   | 8  | 107.5556 | 13.4444 |         |          |



Figure 7 – Box and whisker plot of genus level taxa richness results from Copperfield Creek in 2024

#### 4.4.4 PET richness

PET richness results for samples collected in 2024 are presented in Figure 8. Results were variable on Pine Creek, with no trend observed based on position of sites in the catchment. There was no significant difference ( $p > 0.05$ ) between upstream and downstream results on Pine Creek (Appendix A, Table 14).

The number of PET taxa reduced with distance downstream on Copperfield Creek. there was a pronounced reduction in PET richness from the long-term median furthest downstream at PCCK22. The decrease in PET taxa downstream resulted in a significant difference ( $p = 0.009628$ ) between site types (Figure 9)

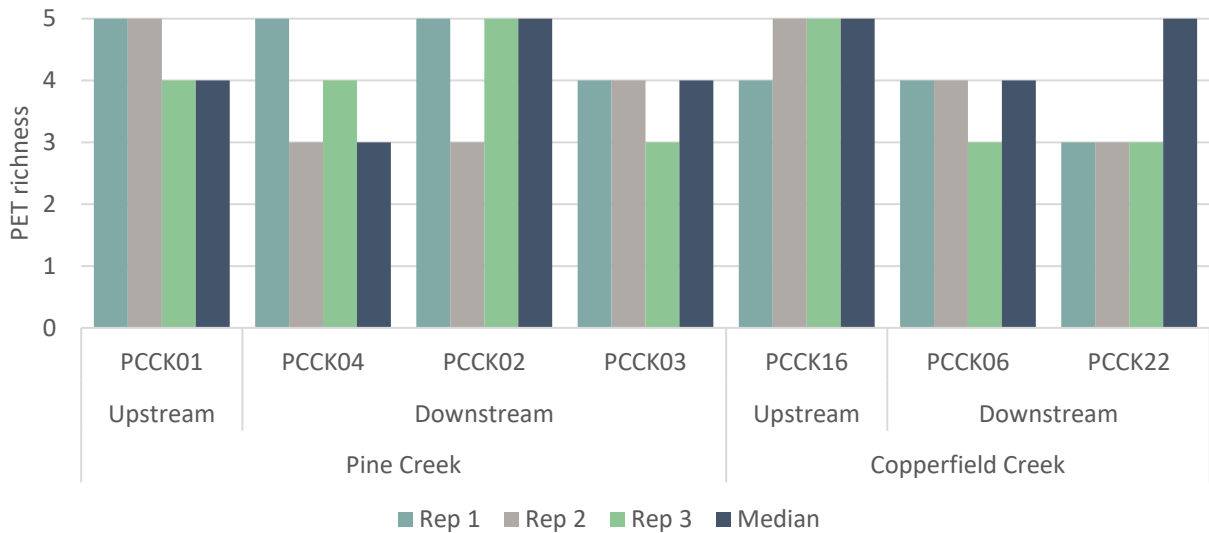


Figure 8 – PET richness from sites at the PCPA sampled in 2024 compared to long-term medians

Table 7 – Results of one-way ANOVA performed on PET Richness – Copperfield Creek

| Effect                  | df | SS     | MS     | F       | <i>p</i> |
|-------------------------|----|--------|--------|---------|----------|
| Groups (between groups) | 1  | 3.5556 | 3.5556 | 12.4445 | 0.009628 |
| Error (within groups)   | 7  | 2      | 0.2857 |         |          |
| Total                   | 8  | 5.5556 | 0.6944 |         |          |

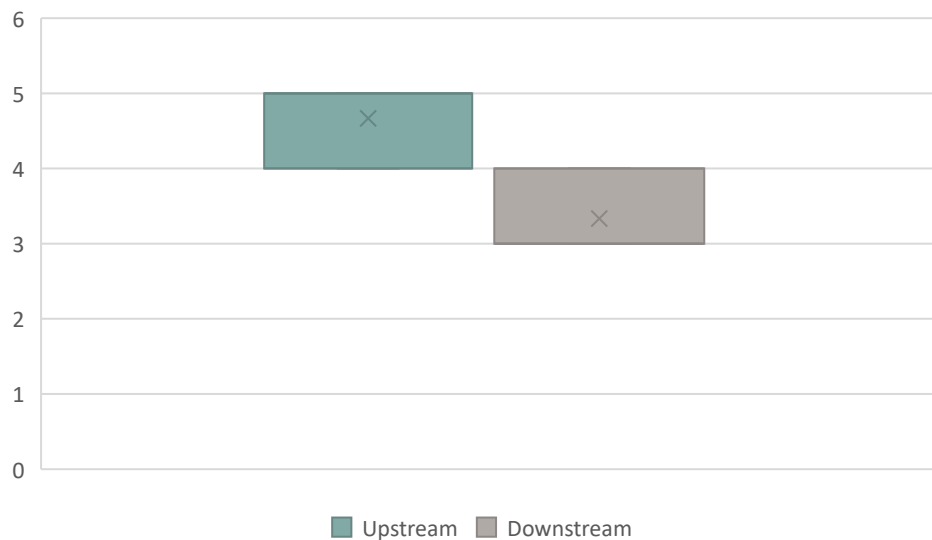


Figure 9 – Box and whisker plot demonstrating differences in PET richness between site types on Copperfield Creek

#### 4.4.5 SIGNAL-2

SIGNAL-2 scores calculated for samples collected in 2024 are presented in Figure 10. A high amount of similarity in SIGNAL-2 scores was observed. SIGNAL-2 scores from sites on Copperfield and Pine Creek are indicative of a pollution tolerant community, which does not appear to be related to position in either catchment. Scores were slightly higher than the long-term median at sites on Pine Creek and variable on

Copperfield Creek. There was no significant difference ( $p > 0.05$ ) between sites upstream and downstream of the PCPA in 2024 in both catchments (Appendix A, Table 15 and Table 16).

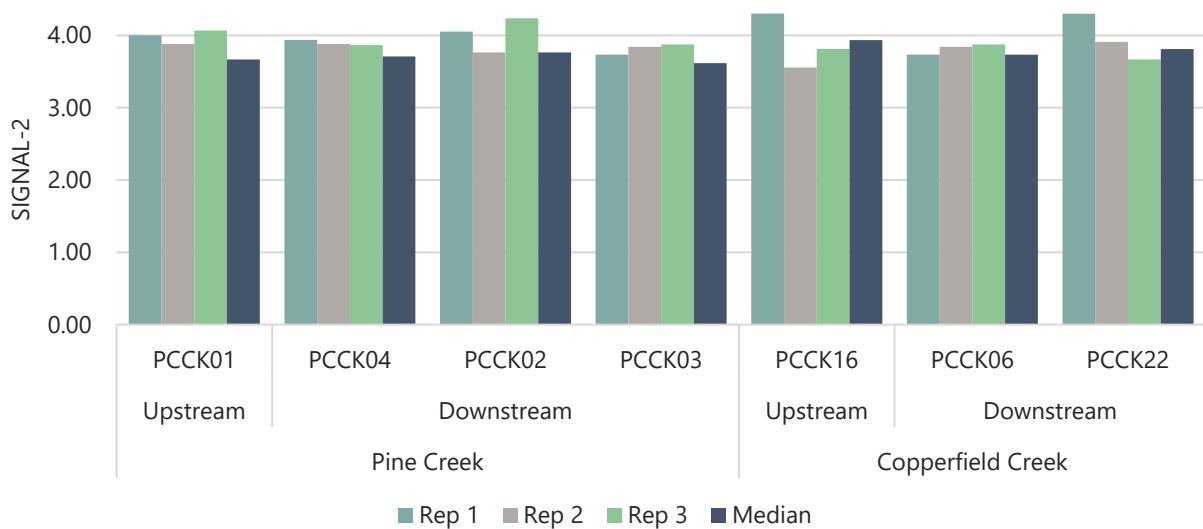


Figure 10 – SIGNAL-2 scores for samples collected at the PCPA in 2024

#### 4.4.6 Community composition

Genus-level data was used to analyse community composition of 2024 data. The NMDS plots show that samples from each site were generally more similar to each other than to those of any other site in both catchments. The similarities between samples at sites, rather than grouping by site type demonstrates that habitat characteristics at each site are likely to be a stronger driver of macroinvertebrate community composition than position within the catchment (relative to influences of the PCPA).

Samples collected on Pine creek showed some variability based on site type, but there was at least 65% similarity between samples collected upstream and furthest downstream (PCCK01 and PCCK03). These similarities were reflected in the results of ANOSIM, which showed no significant difference between site types ( $p = 0.414$ , Global R = 0.018).

Samples on Copperfield Creek were grouped most strongly by site (Figure 12), and the upstream site PCCK16 and downstream site PCCK06 were at least 60% similar in community composition. Despite this similarity between the two sites, the results of ANOSIM demonstrated a significant difference between site types on Copperfield Creek (Global R = 0.463,  $p = 0.024$ ). The results of SIMPER analysis (Table 8) showed that an absence of Mayfly (genus: *Cloen*) from the upstream site along with the absence of two genera of beetles (*Hydraena* and *Hydrochus*) from the downstream sites. Complete SIMPER results are available in Appendix B.

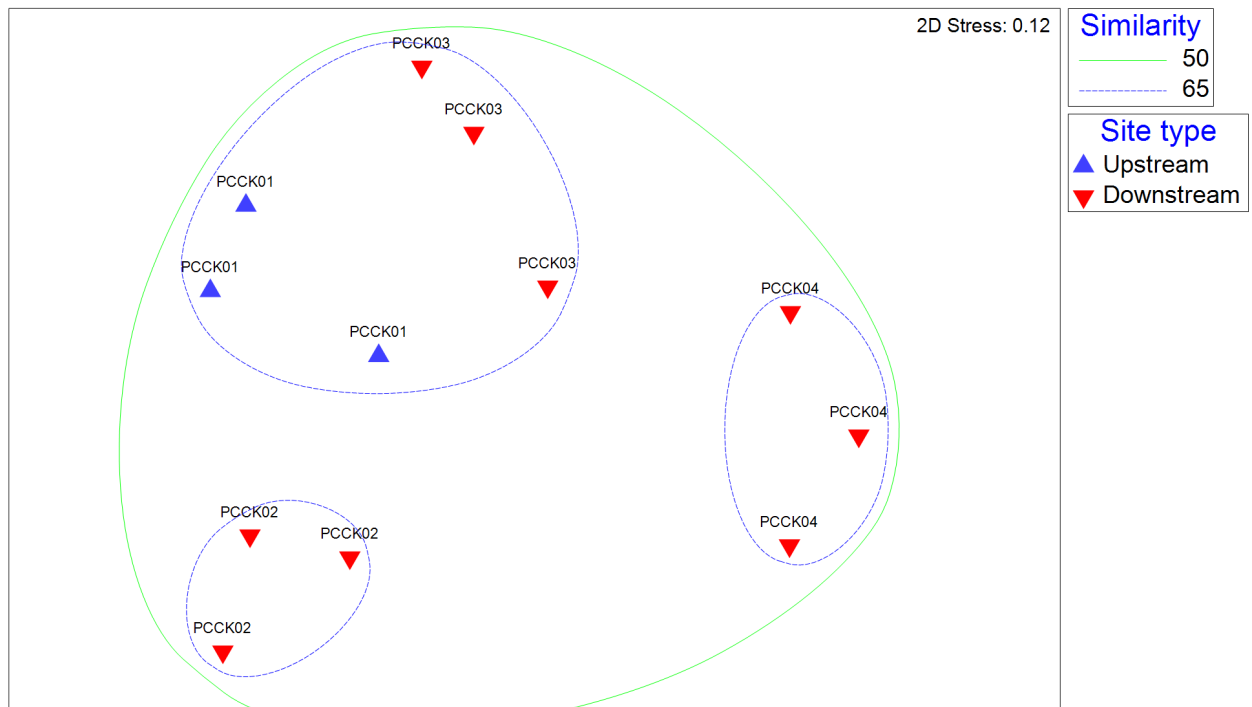


Figure 11 - NMDS plot showing variation in community composition between sites and site types on Pine Creek in 2024

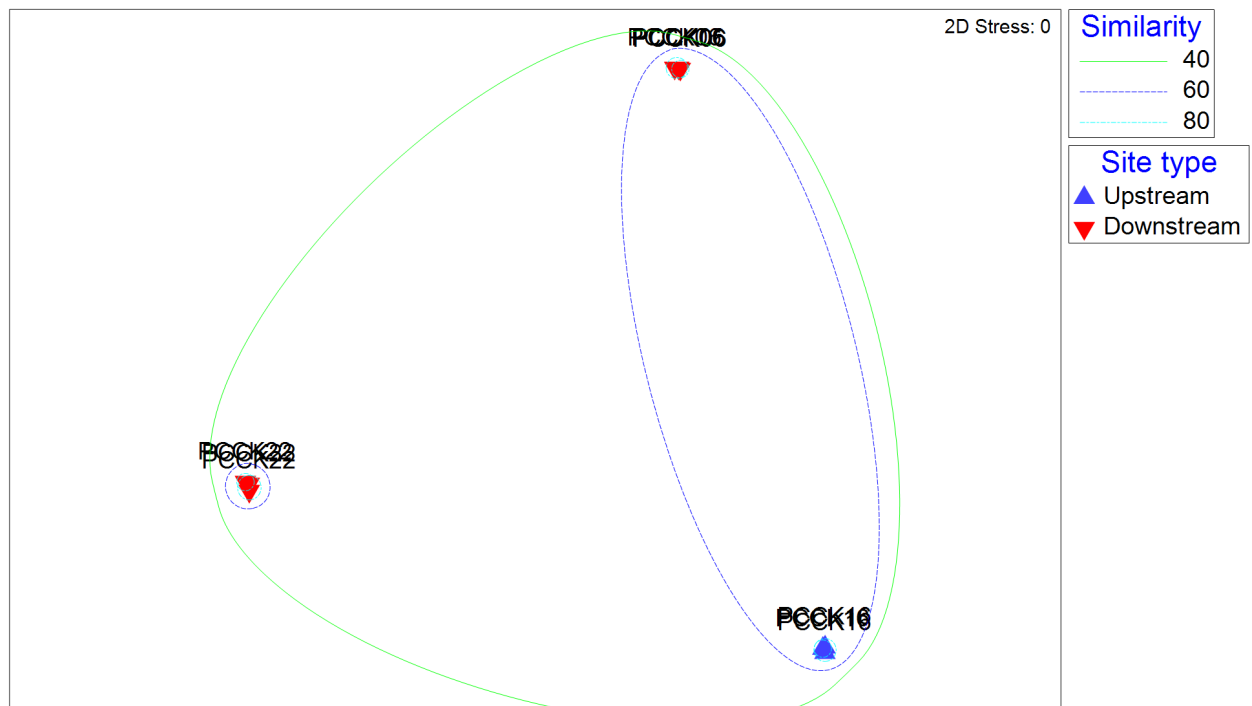


Figure 12 - NMDS plot showing variation in community composition between sites and site types on Copperfield Creek in 2024

Table 8 – SIMPER results of taxa contributing most to differences between site types

| Genus        | Average Abundance |            | Average Dissimilarity | Contribution (%) | Cumulative (%) |
|--------------|-------------------|------------|-----------------------|------------------|----------------|
|              | Upstream          | Downstream |                       |                  |                |
| Cloeon       | 0.00              | 2.54       | 3.37                  | 4.41             | 8.19           |
| Hydraena     | 1.78              | 0.00       | 2.33                  | 10.35            | 5.67           |
| Hydrochus    | 2.11              | 0.67       | 1.83                  | 2.41             | 4.44           |
| Austrolimnus | 0.00              | 1.43       | 1.80                  | 1.34             | 4.38           |
| Thralus      | 0.00              | 1.35       | 1.73                  | 2.12             | 4.22           |
| Micronecta   | 0.78              | 1.44       | 1.67                  | 1.76             | 4.06           |
| Orhothrichia | 1.19              | 1.56       | 1.65                  | 1.54             | 4.02           |

## 4.5 Discussion

Weak-acid extraction of metals showed that bioavailability of most metals was higher at sites on Pine Creek downstream of the PCPA compared with upstream sediments, including downstream of the Pine Creek Township. The concentration of metals was below the long-term median for each site except for two exceedances of the SQGVs recorded at PCCK02. As 2024 represented just the third sediment sampling event for site PCCK02, there is little understanding at this stage of the trend in concentrations at the site. Exceedances of two metal upper guideline values at PCCK02 (arsenic and zinc) is cause for some concern, but as the waters at the site were close to neutral, there was no risk to aquatic ecosystems at the time of sampling. A reduction in concentrations of both metals in sediments downstream at PCCK03 showed that any potential impact of passive discharge is spatially limited. This was reflected in macroinvertebrate results, which showed no divergence from the long-term medians for the site and no impact on pollution sensitivity of taxa. There were no significant differences or trends in macroinvertebrate metrics between sites upstream and downstream of the PCPA on Pine Creek. The same results were found for macroinvertebrate community composition. Despite the elevated metals results at PCCK02, there is no indication of an impact on aquatic ecosystem health as a result of passive discharge from the PCPA.

In reviewing results from Copperfield Creek, elevated metal concentrations were found in sediments at PCCK06 compared with the upstream site, PCCK16. Despite the elevated values, there were no exceedances of guideline values and water was pH neutral at all sites. Zinc concentrations at the site were the highest recorded at the site to date, and results of historical values do suggest a trend towards ecotoxic concentrations. Furthest downstream at PCCK22 there were no exceedances of sediment guideline values, and most metals had lowered to concentrations similar to the upstream site, indicating recover and sediment dilution over the 22km to the site from the PCPA boundary. Macroinvertebrate health metrics and community composition results did not reflect a scenario where the increases in sediment metal concentrations were impacting on aquatic ecosystems. The macroinvertebrate community on Copperfield Creek showed variable results, which in turn created significant differences between metrics upstream and downstream of the PCPA. These differences were not always caused by decreases in health metrics downstream, e.g. genus-level taxa richness results were higher downstream compared with the upstream site. Conversely, less PET taxa were found downstream.

A significant difference was also found in community composition between site types on Copperfield Creek. This was likewise due to variability in presence/absence of certain genera at upstream or downstream sites. There was the greatest similarity between samples at each site, demonstrating that habitat is likely a strong driver of community composition than discharges from the PCPA. In saying this, there was more similarity found between PCCK16 and PCCK06 sampled communities, giving further confirmation that the changes in sediment quality are not impacting aquatic ecosystems. The lower macroinvertebrate metric results at PCCK22 is the first time that such a pronounced drop from median values have been seen at the site. although the result appears anomalous, future results and health trends at the site should be closely observed.

#### **4.6 Conclusions and Recommendations**

- There were no exceedances of sediment guideline values at any site on Copperfield Creek in 2024. Although some values were higher downstream of the PCPA compared to upstream sites, circumneutral pH at sites downstream of the PCPA, metal concentrations in sediments pose a low risk of adversely affecting aquatic biota.
- Exceedances of SQGVs for arsenic and zinc in sediments at one site downstream of the PCPA on Pine Creek were recorded in 2024, but at this stage are no cause for concern. More data over the coming years is required from sampling at the site to understand if there is an increasing trend of metal accumulation in sediments.
- There were no significant differences in the macroinvertebrate community between sites upstream and downstream of the PCPA in Pine Creek. The similarities in the composition of taxa between the upstream site and furthest downstream site show recovery in the community over a short distance downstream of the PCPA.
- There were differences in the macroinvertebrate community observed on Copperfield Creek that did not align well with sediment quality results. Differences are more likely to be related to habitat availability upstream compared with downstream sites. It is likely that zinc will continue to accumulate in sediments should the source of dissolved zinc from the PCPA continue to be present.
- The distance between sites downstream of the PCPWD is vast, and the distance between the compliance point at PCPWD very short. A mid-catchment site that allows for a more robust assessment of any impacts would allow site PCCK22 to be utilised as a recovery site. although locating a site that is accessible may be difficult, sampling at site PCCK06B should be considered.

## 5. References

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## Appendix A. Macroinvertebrate Univariate Results

Table 9 – One-way ANOVA results of relative abundance data – Pine Creek

| Effect                  | df | SS          | MS         | F      | <i>p</i> |
|-------------------------|----|-------------|------------|--------|----------|
| Groups (between groups) | 1  | 52364.6947  | 52364.6947 | 0.6752 | 0.4304   |
| Error (within groups)   | 10 | 775574.2202 | 77557.422  |        |          |
| Total                   | 11 | 827938.9149 | 75267.1741 |        |          |

Table 10 – One-way ANOVA results of relative abundance data – Copperfield Creek

| Effect                  | df | SS          | MS          | F       | <i>p</i> |
|-------------------------|----|-------------|-------------|---------|----------|
| Groups (between groups) | 1  | 36001.3891  | 36001.3891  | 0.09772 | 0.7637   |
| Error (within groups)   | 7  | 2578920.832 | 368417.2618 |         |          |
| Total                   | 8  | 2614922.221 | 326865.2777 |         |          |

Table 11 – One-way ANOVA results of family-level taxa richness – Pine Creek

| Effect                  | df | SS      | MS      | F      | <i>p</i> |
|-------------------------|----|---------|---------|--------|----------|
| Groups (between groups) | 1  | 0.02778 | 0.02778 | 0.0125 | 0.9132   |
| Error (within groups)   | 10 | 22.2222 | 2.2222  |        |          |
| Total                   | 11 | 22.25   | 2.0227  |        |          |

Table 12 – One-way ANOVA results of family-level taxa richness – Copperfield Creek

| Effect                  | df | SS   | MS     | F     | <i>p</i> |
|-------------------------|----|------|--------|-------|----------|
| Groups (between groups) | 1  | 12.5 | 12.5   | 1.378 | 0.2788   |
| Error (within groups)   | 7  | 63.5 | 9.0714 |       |          |
| Total                   | 8  | 76   | 9.5    |       |          |

Table 13 – Results of one-way ANOVA performed on genus-level taxa richness – Pine Creek

| Effect                  | df | SS      | MS     | F      | <i>p</i> |
|-------------------------|----|---------|--------|--------|----------|
| Groups (between groups) | 1  | 16      | 16     | 3.9344 | 0.07543  |
| Error (within groups)   | 10 | 40.6667 | 4.0667 |        |          |
| Total                   | 11 | 56.6667 | 5.1515 |        |          |

Table 14 – Results of one-way ANOVA performed on PET Richness – Pine Creek

| Effect                  | df | SS     | MS     | F   | <i>p</i> |
|-------------------------|----|--------|--------|-----|----------|
| Groups (between groups) | 1  | 1      | 1      | 1.5 | 0.2487   |
| Error (within groups)   | 10 | 6.6667 | 0.6667 |     |          |
| Total                   | 11 | 7.6667 | 0.697  |     |          |

Table 15 – Results of one-way ANOVA performed on SIGNAL-2 data – Pine Creek

| Effect                  | df | SS     | MS      | F      | <i>p</i> |
|-------------------------|----|--------|---------|--------|----------|
| Groups (between groups) | 1  | 0.0121 | 0.0121  | 0.5733 | 0.4664   |
| Error (within groups)   | 10 | 0.2111 | 0.02111 |        |          |
| Total                   | 11 | 0.2232 | 0.02029 |        |          |

Table 16 – Results of one-way ANOVA performed on SIGNAL-2 data – Copperfield Creek

| Effect                  | df | SS        | MS        | F        | <i>p</i> |
|-------------------------|----|-----------|-----------|----------|----------|
| Groups (between groups) | 1  | 0.0002722 | 0.0002722 | 0.003442 | 0.9549   |
| Error (within groups)   | 7  | 0.5537    | 0.0791    |          |          |
| Total                   | 8  | 0.554     | 0.06924   |          |          |

## Appendix B. SIMPER Results

| Species          | Average Abundance |            | Average<br>Dissimilarity | Diss/SD | Contribution<br>(%) | Cumulative<br>(%) |
|------------------|-------------------|------------|--------------------------|---------|---------------------|-------------------|
|                  | Upstream          | Downstream |                          |         |                     |                   |
| Cloeon           | 0.00              | 2.54       | 3.37                     | 4.41    | 8.19                | 8.19              |
| Hydraena         | 1.78              | 0.00       | 2.33                     | 10.35   | 5.67                | 13.86             |
| Hydrochus        | 2.11              | 0.67       | 1.83                     | 2.41    | 4.44                | 18.31             |
| Auistrolimnus    | 0.00              | 1.43       | 1.80                     | 1.34    | 4.38                | 22.69             |
| Thralus          | 0.00              | 1.35       | 1.73                     | 2.12    | 4.22                | 26.91             |
| Micronecta       | 0.78              | 1.44       | 1.67                     | 1.76    | 4.06                | 30.97             |
| Orhothrichia     | 1.19              | 1.56       | 1.65                     | 1.54    | 4.02                | 34.99             |
| Tipulidae        | 0.00              | 1.21       | 1.47                     | 0.95    | 3.57                | 38.56             |
| Berosus          | 0.00              | 1.14       | 1.46                     | 1.37    | 3.55                | 42.11             |
| Oligochaeta      | 0.59              | 1.41       | 1.44                     | 1.38    | 3.50                | 45.62             |
| Ecnomus          | 0.00              | 1.15       | 1.43                     | 1.33    | 3.47                | 49.09             |
| Liodessus        | 0.00              | 1.05       | 1.36                     | 1.37    | 3.31                | 52.40             |
| Austroepigomphus | 0.59              | 1.03       | 1.24                     | 1.23    | 3.01                | 55.41             |
| Hellyethira      | 0.59              | 1.01       | 1.20                     | 1.21    | 2.93                | 58.34             |
| Orthocladinae    | 2.65              | 2.23       | 1.19                     | 1.37    | 2.89                | 61.23             |
| Tanypodinae      | 4.23              | 3.70       | 1.17                     | 1.42    | 2.86                | 64.09             |
| Wundacaenis      | 0.70              | 0.59       | 1.15                     | 0.91    | 2.80                | 66.89             |
| Coenagrionidae   | 0.59              | 0.73       | 1.12                     | 1.09    | 2.73                | 69.62             |
| Chironominae     | 4.31              | 4.37       | 1.11                     | 6.84    | 2.71                | 72.33             |

Appendix C. Raw Macroinvertebrate Data

| Order-Suborder | Family           | Lowest Taxon    | PCCCK01_1 | PCCCK01_2 | PCCCK01_3 | PCCCK02_1 | PCCCK02_2 | PCCCK02_3 | PCCCK04_1 | PCCCK04_2 | PCCCK04_3 | PCCCK03_1 | PCCCK03_2 | PCCCK03_3 | PCCCK16_1 | PCCCK16_2 | PCCCK16_3 | PCCCK06_1 | PCCCK06_2 | PCCCK06_3 | PCCCK22_1 | PCCCK22_2 | PCCCK22_3 |
|----------------|------------------|-----------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Acarina        | Acarina          | Hydracarina     | 6         | 0         | 7         | 7         | 7         | 7         | 0         | 9         | 0         | 7         | 7         | 7         | 10        | 10        | 10        | 5         | 3         | 0         | 10        | 0         | 10        |
| Coleoptera     | Dytiscidae       | Copelatus       | 0         | 0         | 0         | 0         | 0         | 0         | 9         | 5         | 9         | 0         | 7         | 20        | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Coleoptera     | Dytiscidae       | Liodessus       | 0         | 0         | 0         | 7         | 7         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 3         | 0         | 5         | 10        | 10        | 0         |
| Coleoptera     | Dytiscidae       | Neobidessodes   | 6         | 6         | 7         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 10        | 0         | 0         | 3         | 3         | 0         | 0         | 0         |
| Coleoptera     | Elmidae          | Auistrolimnus   | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 7         | 7         | 0         | 0         | 0         | 8         | 0         | 0         | 10        | 50        | 40        |
| Coleoptera     | Hydraenidae      | Hydraena        | 0         | 0         | 0         | 7         | 7         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 10        | 10        | 10        | 0         | 0         | 0         | 0         | 0         | 0         |
| Coleoptera     | Hydrochidae      | Hydrochus       | 11        | 11        | 27        | 13        | 0         | 0         | 14        | 5         | 5         | 33        | 13        | 20        | 20        | 20        | 20        | 3         | 5         | 3         | 0         | 0         | 0         |
| Coleoptera     | Hydrophilidae    | Berosus         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 8         | 8         | 0         | 10        | 10        |
| Coleoptera     | Hydrophilidae    | Enochrus        | 6         | 6         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Coleoptera     | Hydrophilidae    | Helochares      | 0         | 6         | 7         | 0         | 7         | 7         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 10        | 10        | 0         |
| Coleoptera     | Hydrophilidae    | Paracymus       | 11        | 28        | 20        | 0         | 0         | 0         | 5         | 0         | 0         | 7         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Coleoptera     | Hydrophilidae    | Regimbartia     | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 5         | 0         | 0         | 0         | 0         | 0         | 0         | 10        | 0         | 5         | 5         | 0         | 0         | 0         |
| Coleoptera     | Noteridae        | Neohydrocoptus  | 0         | 0         | 0         | 7         | 0         | 7         | 0         | 0         | 0         | 0         | 7         | 7         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Coleoptera     | Sperchidae       | Spercheus       | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Decapoda       | Palaemonidae     | Macrobrachium   | 67        | 44        | 53        | 40        | 7         | 20        | 36        | 36        | 50        | 27        | 40        | 53        | 40        | 70        | 50        | 5         | 5         | 10        | 50        | 40        | 10        |
| Decapoda       | Parathelphusidae | Austrothelphusa | 6         | 6         | 0         | 0         | 0         | 0         | 5         | 5         | 5         | 7         | 13        | 7         | 0         | 10        | 0         | 3         | 3         | 3         | 0         | 0         | 0         |
| Diptera        | Ceratopogonidae  | Ceratopogoninae | 11        | 22        | 27        | 60        | 47        | 60        | 23        | 32        | 23        | 40        | 53        | 47        | 10        | 20        | 10        | 30        | 33        | 30        | 0         | 40        | 10        |
| Diptera        | Ceratopogonidae  | Dasyheleinae    | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 10        | 0         | 0         | 0         | 0         | 0         | 0         | 10        | 0         |
| Diptera        | Chironomidae     | Chironominae    | 433       | 383       | 367       | 220       | 180       | 360       | 100       | 200       | 164       | 520       | 560       | 373       | 330       | 360       | 350       | 138       | 170       | 153       | 800       | 690       | 740       |
| Diptera        | Chironomidae     | Orthocladinae   | 6         | 33        | 40        | 0         | 0         | 0         | 5         | 0         | 5         | 0         | 7         | 7         | 20        | 100       | 50        | 3         | 3         | 8         | 90        | 90        | 90        |
| Diptera        | Chironomidae     | Tanypodinae     | 244       | 183       | 273       | 180       | 207       | 147       | 264       | 200       | 177       | 233       | 160       | 520       | 310       | 230       | 450       | 73        | 103       | 50        | 550       | 290       | 410       |
| Diptera        | Culicidae        | Culicinae       | 6         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 5         | 0         | 0         | 0         | 0         |
| Diptera        | Tipulidae        | Tipulidae       | 6         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 50        | 20        | 40        |
| Ephemeroptera  | Baetidae         | Cloeon          | 44        | 72        | 80        | 33        | 60        | 47        | 9         | 9         | 23        | 53        | 27        | 27        | 0         | 0         | 0         | 78        | 50        | 50        | 50        | 10        | 40        |
| Ephemeroptera  | Caenidae         | Tasmanocoenis   | 50        | 22        | 60        | 40        | 27        | 40        | 9         | 0         | 0         | 133       | 80        | 127       | 50        | 30        | 50        | 68        | 73        | 65        | 90        | 140       | 60        |
| Ephemeroptera  | Caenidae         | Wundacaenis     | 0         | 6         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 7         | 7         | 7         | 20        | 0         | 0         | 0         | 0         | 0         | 10        | 10        | 0         |
| Ephemeroptera  | Leptophlebiidae  | Thralus         | 6         | 6         | 7         | 7         | 0         | 7         | 5         | 5         | 5         | 0         | 0         | 0         | 0         | 0         | 0         | 5         | 0         | 3         | 10        | 10        | 10        |
| Hemiptera      | Gerridae         | Limnogonus      | 11        | 6         | 7         | 27        | 7         | 13        | 5         | 0         | 0         | 7         | 13        | 7         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Hemiptera      | Mesovelidae      | Mesovelia       | 0         | 6         | 0         | 40        | 27        | 27        | 0         | 5         | 5         | 0         | 7         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Hemiptera      | Micronectidae    | Micronecta      | 28        | 17        | 60        | 47        | 20        | 33        | 0         | 0         | 0         | 93        | 80        | 67        | 0         | 0         | 30        | 5         | 10        | 5         | 10        | 0         | 20        |
| Hemiptera      | Nepidae          | Ranatra         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 5         | 5         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Hemiptera      | Pleidae          | Paraplea        | 0         | 0         | 7         | 0         | 0         | 0         | 5         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 10        | 10        |

| Order-Suborder | Family          | Lowest Taxon     | PCCCK01_1 | PCCCK01_2 | PCCCK01_3 | PCCCK02_1 | PCCCK02_2 | PCCCK02_3 | PCCCK04_1 | PCCCK04_2 | PCCCK04_3 | PCCCK03_1 | PCCCK03_2 | PCCCK03_3 | PCCCK16_1 | PCCCK16_2 | PCCCK16_3 | PCCCK06_1 | PCCCK06_2 | PCCCK06_3 | PCCCK22_1 | PCCCK22_2 | PCCCK22_3 |
|----------------|-----------------|------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Hemiptera      | Veliidae        | Microvelia       | 0         | 0         | 0         | 0         | 0         | 0         | 9         | 5         | 5         | 7         | 13        | 0         | 0         | 0         | 0         | 0         | 3         | 3         | 0         | 0         | 0         |
| Lepidoptera    | Crambidae       | Crambidae        | 0         | 0         | 0         | 7         | 7         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Odonata        | Coenagrionidae  | Coenagrionidae   | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 5         | 5         | 20        | 13        | 7         | 0         | 0         | 10        | 3         | 8         | 5         | 0         | 0         | 0         |
| Odonata        | Gomphidae       | Austroepigomphus | 0         | 6         | 0         | 7         | 7         | 13        | 14        | 9         | 5         | 0         | 0         | 0         | 10        | 0         | 0         | 3         | 8         | 5         | 0         | 10        | 0         |
| Odonata        | Hemicorduliidae | Hemicordulia     | 17        | 0         | 7         | 0         | 20        | 20        | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Odonata        | Libellulidae    | Nannophlebia     | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Odonata        | Libellulidae    | Orthetrum        | 0         | 11        | 0         | 7         | 13        | 7         | 0         | 14        | 0         | 0         | 7         | 7         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         |
| Oligochaeta    | Oligochaeta     | Oligochaeta      | 17        | 17        | 7         | 13        | 7         | 7         | 0         | 0         | 0         | 0         | 0         | 0         | 10        | 0         | 0         | 8         | 3         | 8         | 0         | 20        | 10        |
| Trichoptera    | Ecnomidae       | Ecnomus          | 0         | 0         | 0         | 20        | 0         | 13        | 9         | 0         | 27        | 0         | 7         | 0         | 0         | 0         | 0         | 0         | 3         | 0         | 20        | 10        | 10        |
| Trichoptera    | Hydroptilidae   | Hellyethira      | 6         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 7         | 0         | 7         | 10        | 0         | 0         | 0         | 3         | 3         | 0         | 10        | 10        |
| Trichoptera    | Hydroptilidae   | Orhothrichia     | 0         | 6         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 10        | 10        | 0         | 0         | 3         | 50        | 60        | 50        |
| Trichoptera    | Leptoceridae    | Oecetis          | 6         | 6         | 0         | 7         | 13        | 0         | 23        | 0         | 9         | 0         | 7         | 0         | 30        | 30        | 50        | 5         | 5         | 8         | 90        | 110       | 80        |
| Trichoptera    | Leptoceridae    | Triplectides     | 17        | 0         | 20        | 0         | 0         | 13        | 0         | 18        | 0         | 20        | 13        | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 10        | 10        | 0         |



*Good science at a fair price*

Waste Discharge Licence 166-07  
Monitoring Report  
Pine Creek Project Area

Appendix E – Pine Creek Performance  
Improvement Report



**AGNICO EAGLE**



Pine Creek Project Area  
Performance Improvement Report

2023/24



**AGNICO EAGLE**

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# 1 Introduction

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This Performance Improvement Report outlines proposed initiatives scheduled for completion by the beginning of the 2025 wet season at the Pine Creek Project Area. These initiatives include improving the water quality at the compliance monitoring location PCCK06.

Implementation of WDL Signage, a Sluice Gate, Dual Dosing, the reconstruction of a Low Flow Channel, the removal of Cofferdam edge and a clean up of the Spillway is expected to contribute to the long-term improvements in PCCK06's water quality. Through continuous monitoring and adaptation of our environmental management strategies, we strive to uphold our commitment to environmental protection.

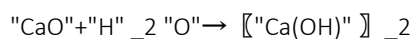
## 2 Process Water Dam

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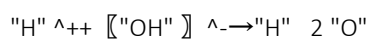
### 2.1 Milk of Lime In-situ treatment

The Process Water Dam (PCPWD) was designed in 1984 and constructed in 1990. The dam is the primary catchment for low quality site waters, capturing much of the rainfall that flows over the southern section of the PCPA, including drainage from the TSF and the Main WRD. Process Water Dam was such that this dam would easily fill during an average wet season and, once full, excess water would discharge into Copperfield Creek. Water treatment will start in January 2025, NTMO proposes to employ a triple trailer system to transport pre-mixed liquid calcium hydroxide ( $\text{Ca}(\text{OH})_2$ ) derived from quicklime. This solution will be directly pumped into the Process Water Dam via pipeline diffusers to increase the pH and precipitate toxic metals. This will be repeated three times a week until March. This will improve the quality of the water as it will be targeting the whole pollutant source before its running into the surrounding creeks. The pH needs to be constantly controlled and monitored for the project to be successful, the key to success is consistency.

Milk of Lime to neutralise and control Acid Metalliferous Drainage has been widely used for the mining industry. When quicklime is added to acidic water, it undergoes a chemical reaction that increases the water's pH level. The primary reaction involves the conversion of calcium oxide to calcium hydroxide:



This reaction releases hydroxide ions ( $\text{OH}^-$ ), which neutralize the hydrogen ions ( $\text{H}^+$ ).



This methodology represents a strategic approach to addressing water acidity and toxic metal contamination by:

#### Efficiency in pH Adjustment and Metal Precipitation

Calcium hydroxide is highly effective in increasing the pH of water. The direct pumping of this solution into the dam via pipeline diffusers ensures a rapid and uniform distribution, leading to immediate pH adjustment. The increase in pH facilitates the precipitation of toxic metals, especially to reduce Zinc and Cobalt level of Process Water Dam.

The use of a triple trailer system for transporting pre-mixed liquid calcium hydroxide allows for flexible and scalable deployment. This mobility ensures that the treatment can be applied in terms of varies rainfall patterns within Process Water Dam catchment, ensuring contamination loading is managed precisely for consistent results.

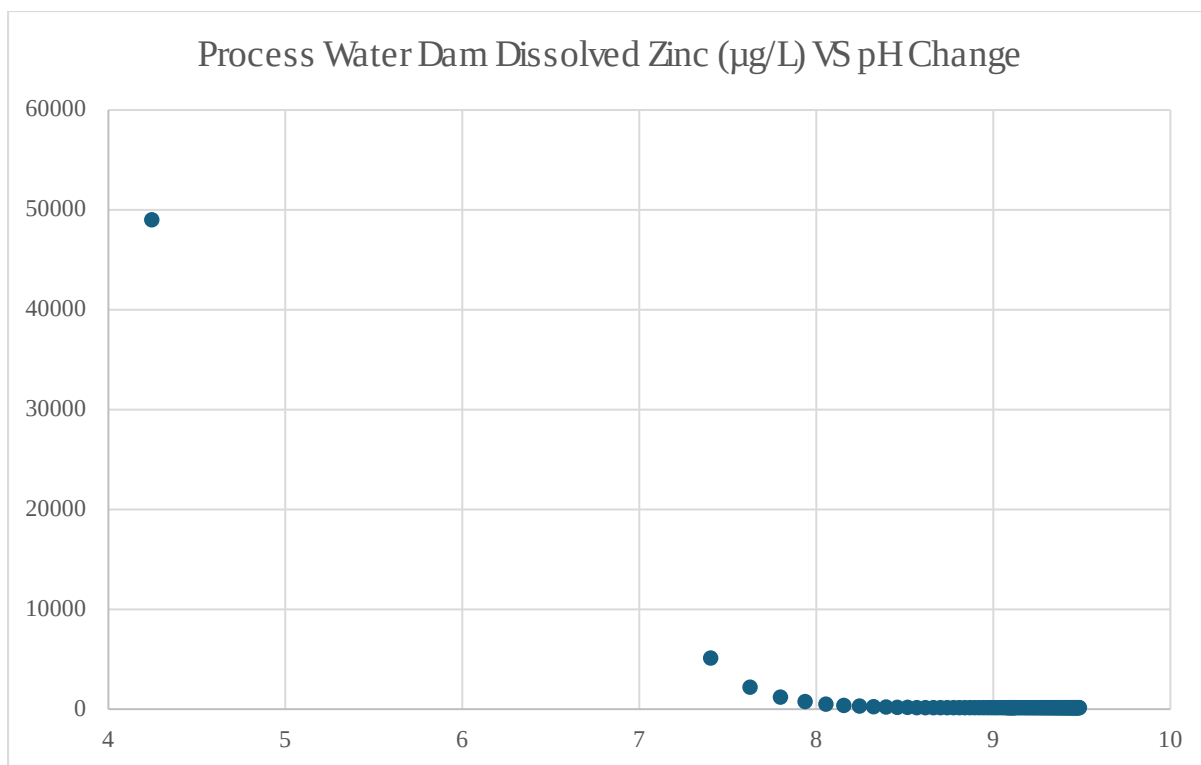


Figure 1 Process Water Dam Dissolved Zinc ( $\mu\text{g/L}$ ) VS pH Change

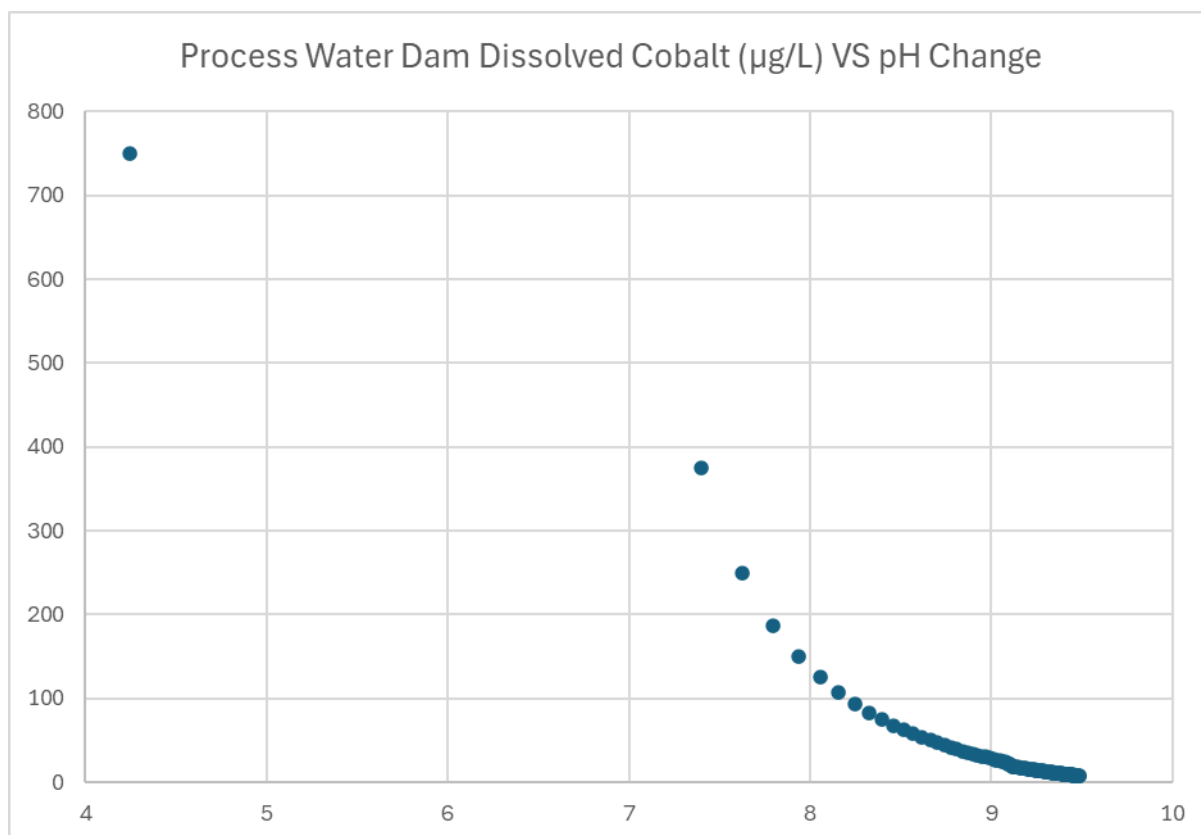


Figure 2 Process Water Dam Dissolved Cobalt ( $\mu\text{g/L}$ ) VS pH Change

## 2.2 Clean up Spillway

Cleaning up the spillway will prevent erosion along the bank of the dam and surface runoff. By reducing the amount of captured sediment and runoff contents it prevents some metal contaminants flowing into our water ways. When interacting with the site, it will be a safer and clearer space to operate on and around, when completing the routine surface water sampling. Machinery within proximity to the water's edge can pose a risk to the process. This process will be completed by the start of the 2024/2025 Wet Season.



Figure 3 PCPWD Spillway Post Clean up

## 2.3 Install Sluice Gate

Installing a Sluice Gate contributes more control of water flow in and out of the Process Water Dam (PCPWD), to help regulate the water levels in the Dam. The more rainfall we get the greater dilution of metals there is, so by allowing the water to flow when the metal levels are lower means there are fewer risks of contamination. Whereas when there are high metal concentrations in the dam, the contamination can be isolated and stopped from flowing into surrounding creek beds. The sluice gate will help stop the flow of large solids and sediment flowing through into surrounding creeks. It will also prevent surrounding creeks from exposure to high metal concentrations. Capturing seepage into the dam will help the control of flow and contaminants of that seepage flowing into other creek beds. There are no risks associated with implementing these measures, however over time the sluice gate may become weakened overtime after many wet seasons of higher-than-normal rainfall periods. NTMO has implemented the sluice gate.



Figure 4 Installation of Sluice Gate

## 2.4 Reconstruction of the Low Flow channel

The Low flow channel has been cleaned up in preparation for the Wet Season, this means the flow of the surface water will be controlled further. It will be extended by 40 meters. There are no risks involved in this improvement. By adding another control will make it less likely that debris will be captured, and less surrounding vegetation will be disturbed by fast flowing water.

## 2.5 Cofferd Dam Decommission

The Cofferd Dam is decommissioned and has been replaced with rock armory in the water channel, the removal of this will mean the water flow is more consistent and controlled.



Figure 5 Installation of Weir Concrete Footing (Rock Armory)

## 3 Pine Creek Project Area

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### 3.1 WDL Signage

Upon a site visit from the NTEPA we were advised to add the WDL signage at every site. This is to help advertise the location of each site. This change will assist with the location of each monitoring location, especially for those visiting site. The signage of each site also helps officialize each water body included in the WDL. There is no risk implementing these measures, this will only benefit the monitoring program, with the routine sampling of the WDL sites. Installation of signage is to occur before the start of the 2024/2025 wet season.