Australian Government
Department of Agriculture, Water and the Environment

Magela Creek Monitoring data: 2021-2022

Supervising Scientist

© Commonwealth of Australia 2022

Ownership of intellectual property rights

Unless otherwise noted, copyright (and any other intellectual property rights) in this publication is owned by the Commonwealth of Australia (referred to as the Commonwealth).

Creative Commons licence

All material in this publication is licensed under a Creative Commons Attribution 4.0 International Licence except content supplied by third parties, logos and the Commonwealth Coat of Arms.

Inquiries about the licence and any use of this document should be emailed to copyright@awe.gov.au.

Cataloguing data

This publication (and any material sourced from it) should be attributed as: DAWE 2022, *Magela Creek monitoring Data*, Department of Agriculture, Water and the Environment, Canberra, March.

This publication is available at https://www.awe.gov.au/science-research/supervising-scientist/publications#monitoringdata

Department of Agriculture, Water and the Environment
GPO Box 858 Canberra ACT 2601
Telephone 1800 900 090
Web awe.gov.au

Disclaimer

The Australian Government acting through the Department of Agriculture, Water and the Environment has exercised due care and skill in preparing and compiling the information and data in this publication. Notwithstanding, the Department of Agriculture, Water and the Environment, its employees and advisers disclaim all liability, including liability for negligence and for any loss, damage, injury, expense or cost incurred by any person as a result of accessing, using or relying on any of the information or data in this publication to the maximum extent permitted by law.

Acknowledgements

The authors thank Jabiru Field station staff for the collection of water chemistry data that contributes to the results presented in this report.

Acknowledgement of Country

We acknowledge the Traditional Custodians of Australia and their continuing connection to land and sea, waters, environment and community. We pay our respects to the Traditional Custodians of the lands we live and work on, their culture, and their Elders past and present.

Contents

Tables

Figures

Summary

The *Environmental Requirements of the Commonwealth of Australia for the Operation of the Ranger Uranium Mine* (ERs) provide objectives to protect the environmental and cultural values of Kakadu National Park. These ERs include Water Quality Objectives (WQOs) that must be met by the mine operator Energy Resources of Australia (ERA) to minimise the environmental impacts of the mine. The Supervising Scientist is required to report on performance against water quality criteria (key water quality parameters and contaminants of potential concern).

Monitoring is undertaken at off-site locations upstream and downstream of the mine in Magela Creek (to the east of the mine lease) and Gulungul Creek (to the west of the mine lease). Water quality monitoring data collected by the Supervising Scientist shows all Water Quality Objectives have been met thus far in Magela Creek for the 2021-2022 wet season.

Introduction

The charts below compare measurements of key chemical indicators, collected during the **2021-2022** wet season, to the Water Quality Objectives (WQOs) for Magela Creek. The WQOs present a hierarchical set of trigger values for each indicator, enabling a tiered approach to the oversight and management of water quality in Magela Creek. The Focus and Action Trigger Values are used by ERA to manage surface water quality during mine activities. The Guideline and/or Limit Values are used to monitor compliance and ensure the protection of the downstream environment.

Focus Trigger Value - Values that are higher than the Focus level but lower than the Action level will result in a watching brief. A watching brief involves precautionary ongoing data assessment to verify whether a trend away from background is occurring, possibly including further sampling if required.

Action Trigger Value - Values that are higher than the Action level but lower than the Guideline/Limit will result in a data assessment. Where assessment of the data shows the value represents a trend away from background the company must undertake:

- An investigation into the cause of the exceedance; and
- Correction of the cause if it is deemed to be mining related.

Guideline Value - The company shall treat values that exceed the Guideline the same as a Limit exceedance except:

- When there is a corresponding increase at the upstream site; and
- For the Mn limit when the flow is less than five cumecs.

When one or more of the above exceptions occurs, a Guideline exceedance will be treated the same as an Action exceedance.

Limit Trigger Value - Values that are higher than the Limit will result in a full investigation, including:

- Determining the cause(s) of the exceedance
- Collecting further samples and data
- Undertaking immediate correction of the cause if it is deemed to be mining related.

The chemical and physical indicators are:

- Electrical Conductivity in Magela Creek
- Magnesium in Magela Creek
- Uranium in Magela Creek

- Manganese in Magela Creek
- Total Ammonia Nitrogen in Magela Creek
- Turbidity in Magela Creek
- Radium-226 in Magela Creek

The indicators listed above are interpreted in the context of rainfall and rainfall events. Flow commenced in Magela Creek on 7th December 2021. Total rainfall at Jabiru Airport (BOM) over the period of October 2021 to March 2022, was 1162 mm. Measured monthly rainfall and a comparison to the median for each month (calculated based on data from 1971-current) are listed in Table 1.

Table 1 Monthly and median monthly rainfall at Jabiru Airport (data from BOM)

Month	Rainfall	Median
Oct	26.4	25.6
Nov	142.2	120.1
Dec	415.2	200.4
Jan	196.0	329.6
Feb	302.8	316.5
March	79.4	277.4
Total	**1162.0**	**1269.6**

1 Electrical conductivity in Magela Creek

A set of Electrical Conductivity (EC) Trigger Values has been derived to indicate when magnesium (Mg) concentrations might be approaching levels that exceed the Mg Trigger Values. The EC Trigger Values are essentially the same as the Mg Trigger Values, converted to EC using a long-term EC-Mg relationship established for Magela Creek. An additional *Investigation Trigger* was derived for EC which prompts an assessment of estimated Mg concentrations using the long-term Mg/EC relationship or an event-specific relationship. The EC *Investigation Trigger* applies if conductivity exceeds 42 µS/cm for more than 6 hours, to prevent unnecessary action for short duration (<6 hours) pulses that go above 42 µS/cm but do not approach the Mg Guideline value.

Electrical Conductivity in Magela Creek has remained well below the Investigation trigger value and below the Action Trigger Value. Conductivity was at times, observed to be higher than the Focus trigger value.

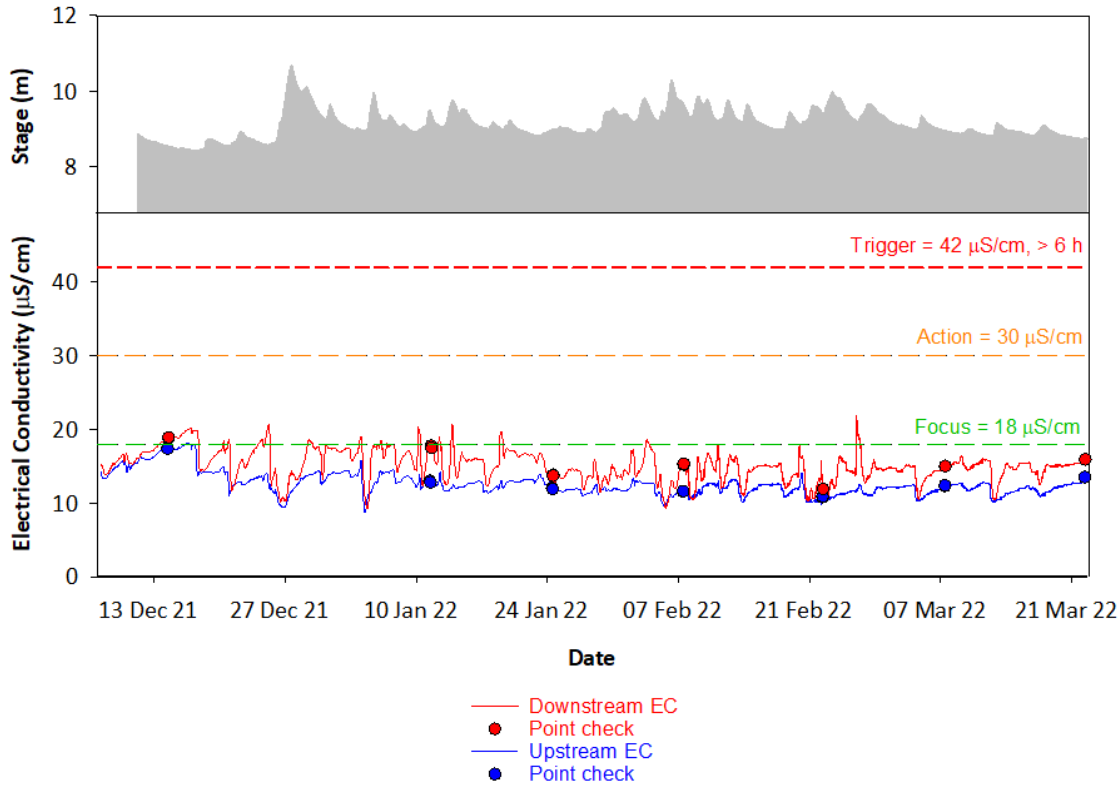

Figure 1 Continuous electrical conductivity and stage height (water level) in Magela Creek

2 Turbidity in Magela Creek

The turbidity Guideline Value of 26 NTU was determined statistically from continuous data collected from the upstream reference site between 2005-2015. This guideline may be exceeded occasionally due to natural events but should not be exceeded due to mining activities.

The turbidity values recorded in Magela Creek were below the guideline value. Peaks in turbidity throughout December-February were associated with first flow and rainfall events, with these detected at both upstream and downstream monitoring sites. These peaks do not reflect any unexpected increase in turbidity or mining-related effects at the downstream site.

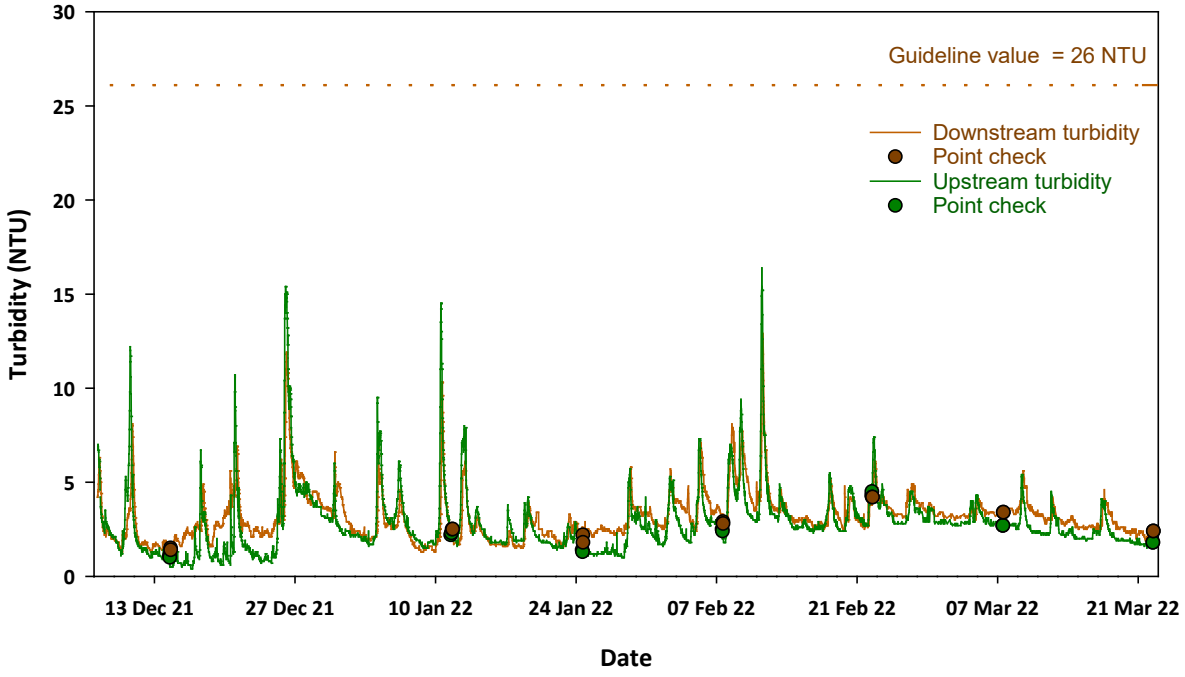

Figure 2 Continuous turbidity in Magela Creek

3 Magnesium in Magela Creek

The magnesium *Chronic Exposure Limit* of 3 mg/L has been derived using local ecotoxicological data and applies to exposures greater than 72 hours in duration. Based on the electrical conductivity (EC)-magnesium relationship developed for Magela Creek, this equates to an EC investigation trigger of 42 µS/cm for > 6 hours. The Supervising Scientist has also developed an interpretative framework for Mg exposures of less than 72 hours, which integrates the magnitude and the duration of any given pulse exposure. Details can be found in the Revised Ranger Mine Water Quality Objectives for Magela creek and Gulungul creek.

The EC trace thus far for the 2021-22 wet season (shown below) remains below the investigation trigger (42 µS/cm for > 6 h). Discrete samples collected from the downstream site in Magela Creek also demonstrate minimal increase in magnesium due to mining activity, with dissolved magnesium concentrations (< 0.45 µm filtered fraction) below the chronic exposure limit (green dashed line). Continuous EC data is shown for reference.

Plot showing magnesium concentrations from grab samples of Gulungul Creek. The data shows no exceedances of the 3 milligram per litre guideline value.

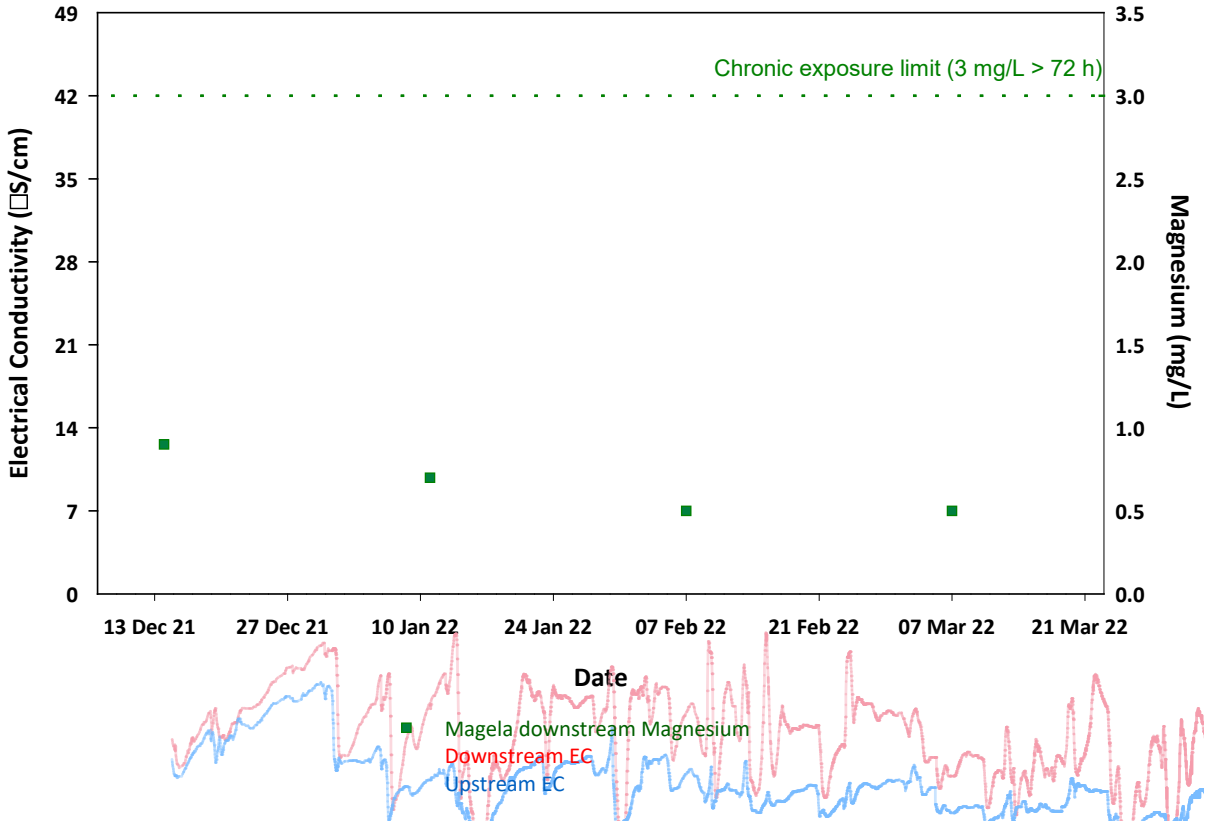

Figure 3 Magnesium (mg/L) in Magela Creek

4 Uranium in Magela Creek

The site-specific guideline value for uranium of 2.8 µg/L has been derived using local ecotoxicological data in accordance with the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2018)[1] to protect 99% of the species present.

Dissolved uranium concentrations (< 0.45 µm filtered fraction) in samples collected from the Magela Creek downstream site have remained below the guideline value. Continuous EC data shown for reference.

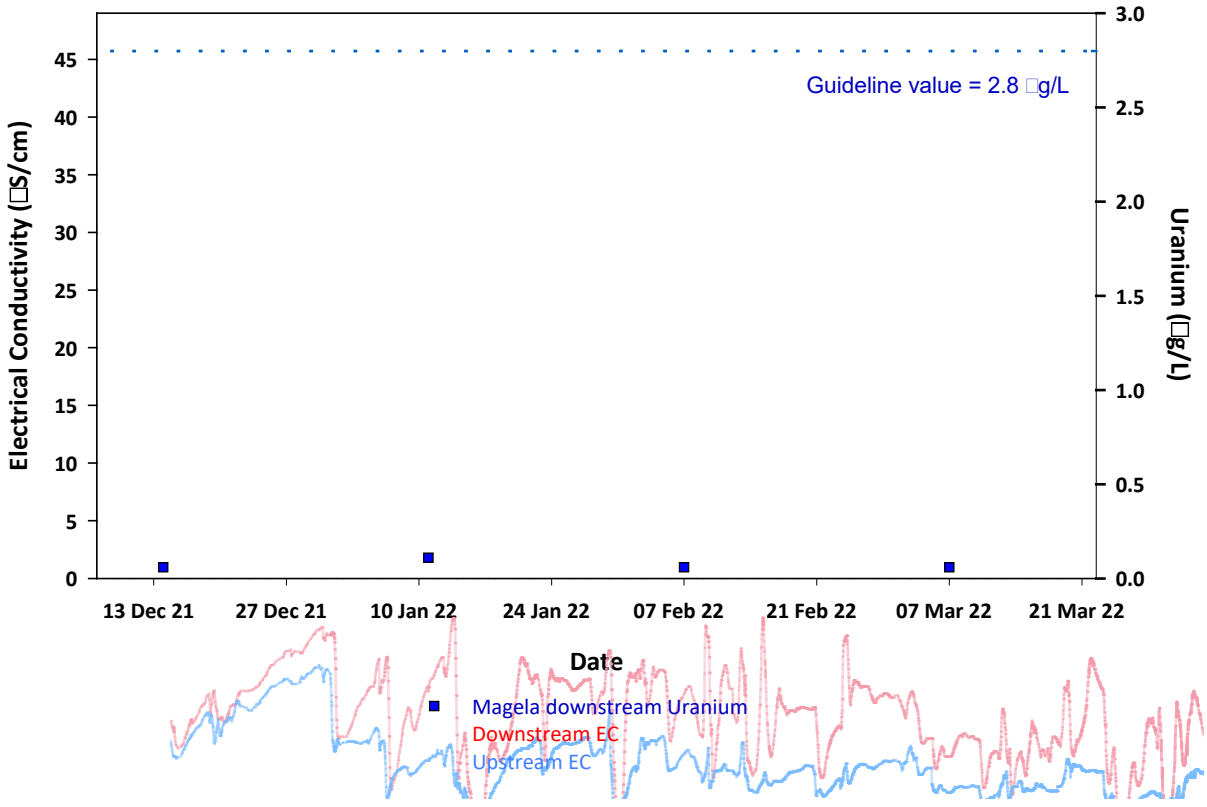

Figure 4 Uranium (µg/L) in Magela Creek

[1] www.waterquality.gov.au/anz-guidelines

5 Manganese in Magela Creek

The site-specific guideline value for manganese of 75 µg/L has been derived using local ecotoxicological data and applies to creek flows greater than 5 cumecs. Elevated manganese occurring in flows of less than 5 cumecs, is indicative of groundwater-dominated inputs, which are likely to be higher in manganese. This guideline may be exceeded occasionally due to natural events but should not be exceeded due to mining activities.

Dissolved manganese concentrations (< 0.45 µm filtered fraction) in samples collected at the Magela Creek downstream site have remained below the guideline value (continuous EC data shown for reference).

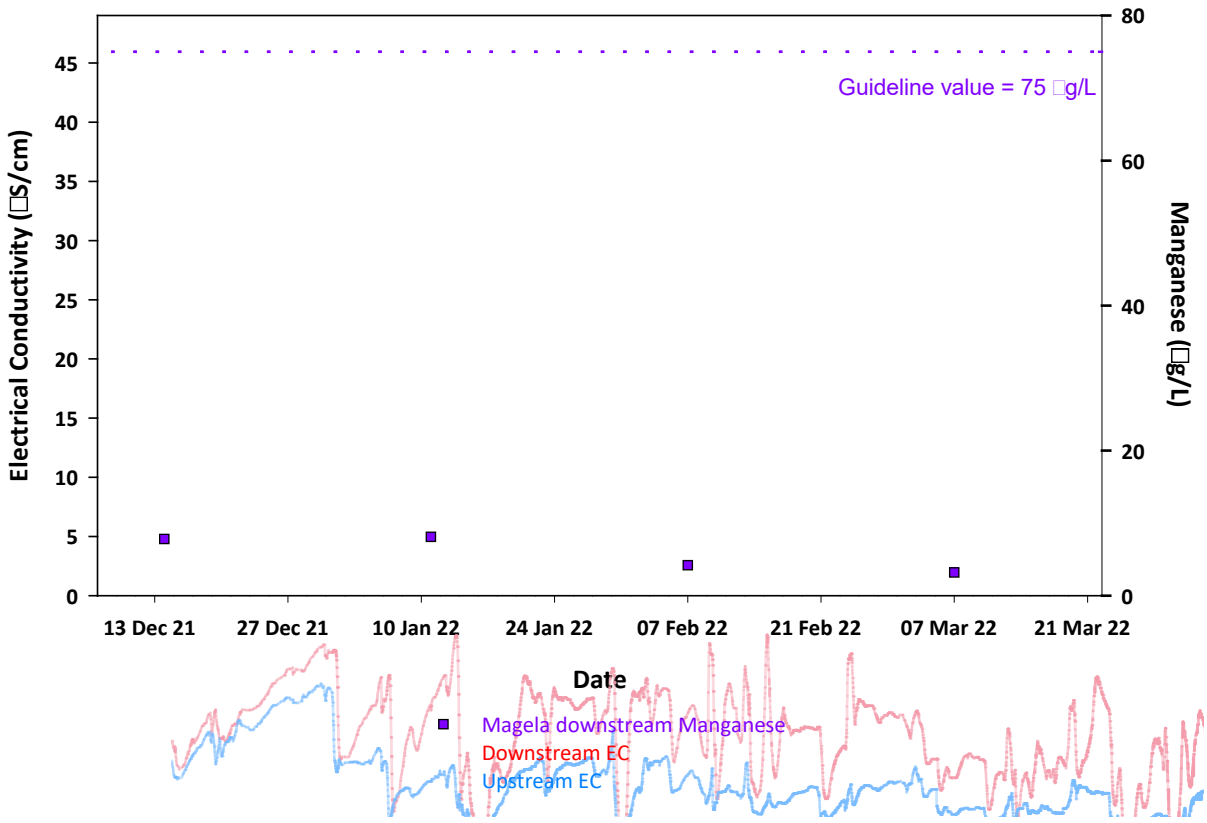

Figure 5 Manganese (µg/L) in Magela Creek

6 Total Ammonia Nitrogen in Magela Creek

The site-specific guideline value for total ammonia nitrogen of 0.4 mg/L has been derived using local ecotoxicological data in accordance with national guidance, to protect 99% of the species present.

Dissolved total ammonia nitrogen concentrations (< 0.45 µm filtered fraction) in samples collected at the Magela Creek downstream site have remained below the guideline value (continuous EC data shown for reference).

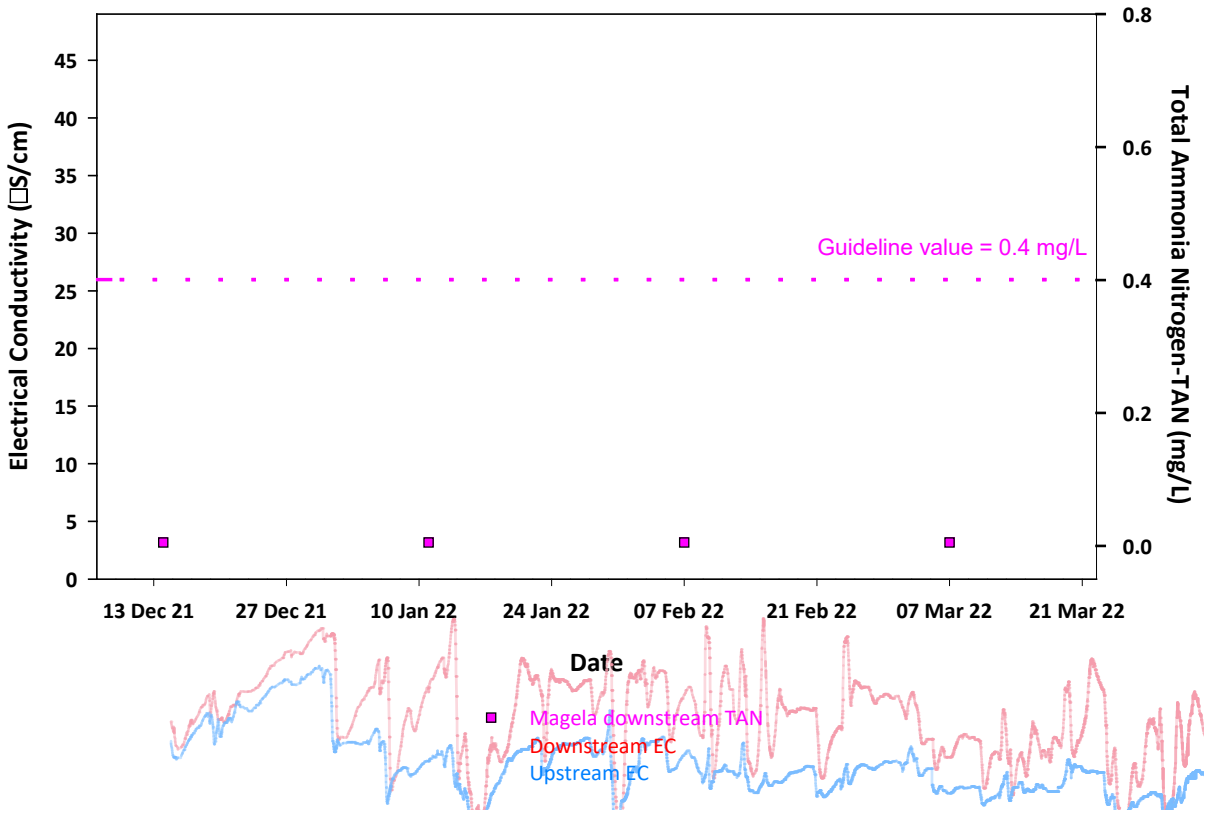

Figure 6 Total Ammonia Nitrogen (mg/L) in Magela Creek

7 Radium-226 in Magela Creek

The activity concentration limit for radium-226 was developed to ensure the radiation dose received by people who consume mussels from downstream waterways remains safe. The radium-226 *Limit Trigger Value* of less than 3 mBq/L is calculated as the geometric mean difference between the upstream and downstream values for the entire wet season.

For the three radium-226 samples collected this season, the activity of the downstream site was slightly higher than the upstream (by 0.19, 0.45 and 0.36 mBq/L, respectively). The total activity of the samples was within the historical range for both the upstream and downstream sites; 1-9 mBq/L and 0.5-4 mBq/L, respectively. A complete evaluation, including a graphical representation of the whole-of-season mean difference between the upstream and downstream site, will be provided at the end of the season.