

IRON BRIDGE: SURFACE WATER MONITORING & AQUATIC ECOLOGY BASELINE REPORT LATE WET 2019 TO LATE DRY 2022

FMG IRON BRIDGE (AUST) PTY LTD



VERSION 1.7

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GLOSSARY OF ACRONYMS

Acronym	Definition
ANZG	Australian and New Zealand Guidelines for fresh and marine water quality
BRUV	Baited Remote Underwater Video- a sampling method for fish
DO	Dissolved oxygen
DOC	Dissolved organic carbon
DSIAR	Diatom Species Index for Australian Rivers
EC	Electrical Conductivity
EPT	Ephemeroptera, Plecoptera, Trichoptera: three macroinvertebrate orders that comprise a biotic index
FMGIB	FMG Iron Bridge (Aust) Pty Ltd
N	Nitrogen
NTU	Nephelometric Turbidity Units
P	Phosphorous
QA/QC	Quality Assurance/Quality Control
SO4	Sulphate
SPC	Specific Conductivity (conductivity normalized to 25°C)
TDS	Total Dissolved Solids
TIC	Total Inorganic Carbon
TN	Total Nitrogen
TP	Total Phosphorus
TOC	Total Organic Carbon
TSS	Total Suspended Solids

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EXECUTIVE SUMMARY

This report summarises the results of the aquatic ecology baseline surveys conducted by Hydrobiology WA Pty Ltd (Hydrobiology) in each wet and dry season between 2019 and 2022 on selected surface water pools and waterways of the Iron Bridge Magnetite Project in the Pilbara region of Western Australia on behalf of FMG Iron Bridge (Aust) Pty Ltd. The baseline data collected are critical components of the approvals required in expanding the developments of the North Star Magnetite Project and Glacier Valley Project, as well as the implementation of a Surface Water Management Plan (SWMP).

The aquatic ecology survey was conducted at nine surface water pools at Iron Bridge within the Turner and Strelley/Shaw River catchments that contain the development footprint of both the North Star Magnetite and Glacier Valley projects. The proposed development of a waste rock landform for the North Star Project is upstream of Site 12 Pool, that has considerable environmental and cultural value, and as such proposed operations must comply with Condition 12 in Ministerial Statement 993. In response, the Site 12 Pool Water Quality and Quantity Management Plan is included within the SWMP for Iron Bridge, with aquatic ecology surveys conducted by Hydrobiology providing a baseline to effectively assess possible future changes.

To understand the aquatic ecology of the seven monitored surface pools within the project areas, Hydrobiology used multiple lines of evidence approach as informed by ANZG (2018) and the associated Temporary Waters Guidance. At each site, the baseline aquatic ecology surveys included sampling for water quality, sediment quality, hydrology (water level) and, biodiversity indicators (fish, macroinvertebrates, diatoms, phytoplankton and macrophytes). These indicators of ecological value were assessed against water quality triggers and provide the baseline to which the SWMP can be

assessed. The biannual surveys were conducted in order to capture the seasonal variability in the aquatic ecology as well as meeting the requirements of approvals compliance.

The main findings of the Late Dry 2022 aquatic ecology baseline surveys were:

- As Site 12 Pool was dry in the Late Dry 2022, the results reported in this document relate to the small remanent pool just downstream of the usual sampling location.
- Central Creek, GV Pool and NJA21-006-US were dry for the Late Dry 2022 survey and no samples were collected.
- Total nitrogen (TN), nitrate/nitrite exceeded the ANZG 2018 Default Guideline Values (DGVs) for Site 12 (downstream remnant), Mundagoora and Cow Spring, with TN for Site 12 being the highest recorded over the seven seasons and TP concentration higher than the site mean value. Site 12 also recorded reactive phosphorus and nitrite exceeding the DGVs. Both Mundagoora and Cow Spring had nitrate levels that exceeded the DGVs. Fig Pool's major ion concentrations were stable over seven water sampling events, with aluminium and zinc the only dissolved metals to exceed DGVs.
- Cow Spring pools' mean ammonium and zinc levels were above the DGVs.
- No sediment samples were collected for Site 12 due to main pool being dry. Arsenic and cadmium concentration exceeded the DGVs for Fig Pool, chromium concentrations exceeded the DGVs for Fig Pool and Mundagoora pool, and nickel exceeded the DGVs for both Mundagoora and Cow Spring.
- No fish were collected at Site 12 due to pool being dry however, in a remanent pool downstream *M.australis* and *N.hyrtlii* were observed in the refuge of the small pool with generally lower counts. As per previous seasons, no fish were collected or observed at Fig Pool although frog calls were heard and identified as *Litoria rubella*, a common species in the area.
- Mundagoora Pool experienced a slight decline in fish abundance since the Late Wet 2022, with only large size classes of *L.unicolor* captured. Abundance of *M.australis* increased significantly across all size ranges from the previous season.
- Macroinvertebrate abundance decreased over all sites. The SIGNAL2 score for Site 12 and Fig Pool both increased from previous seasons, with Site 12 having the highest score for all seasons since 2020. Fig Pool taxonomic richness was lower than all previous seasons aside from the Late Wet 2022. Mundagoora Pool was dominated by Baetidae (mayflies) which were recorded at record numbers for this season.
- Site 12 recorded 6 new species of diatoms, Fig Pool recorded diatoms for the first time since surveying of the pool commenced. All pools surveyed had a significantly lower DSIAR score compared to previous seasons indicating more stress tolerant species. This is associated with lower levels of stream flow and reduced water quality during the Late Wet and Late Dry 2022 seasons.
- Phytoplankton abundance and diversity decreased across all pools due to a relatively dry wet season and a very dry season.
- There was no noticeable change in the fringing, emergent or submerged macrophytes in any of the pools except where pools were dry and submerged macrophytes were no longer present.

The results of the sampling in the pools in the Iron Bridge Magnetite Project area over the Late Dry 2022 were significantly affected by the low wet season rainfall and flows. Lower fish and macroinvertebrate abundances coincided with higher nutrient levels due to evaporative concentration effects. These results were considered to be due to natural variability and not attributable to mine operations.

1. INTRODUCTION

This report presents the findings of the baseline aquatic ecology monitoring program of surface water pools at the Iron Bridge Project between December 2019 and November 2022.

1.1 BACKGROUND

Hydrobiology WA Pty Ltd (Hydrobiology) conducted an aquatic ecology baseline monitoring program of surface water pools to support the baseline development and approvals of the Iron Bridge Magnetite Project (the Project) in the Pilbara region of Western Australia on behalf of FMG Iron Bridge (Aust) Pty Ltd (FMGIB). The managing entity for the Project is IB Operations Pty Ltd (Iron Bridge), a joint venture company between FMGIB and Formosa Steel IB Pty Ltd.

1.2 OBJECTIVES

The objectives of the aquatic ecology survey are the following:

- Establish baseline aquatic ecology conditions at selected surface water pools, which will support future assessments of impacts potentially resulting from the Project.
- Characterise environmental value of surface water pools.
- Implementation of the Iron Bridge Surface Water Management Plan (FMG, 2020).
- Inform the Site 12 Pool Water Quality and Hydrological Regime Investigation (Hydrobiology, 2020) and provide technical input to the Site 12 Pool Water Quality and Quantity Management Plan (FMG, 2020).

2. METHODOLOGY

2.1 SITE LOCATIONS

The Project is located 110 km south of Port Hedland in the Pilbara region and incorporates the North Star and Glacier Valley Magnetite ore bodies. The aquatic ecology survey was conducted at seven surface water pools at Iron Bridge within the Turner and Strelley/Shaw River catchments (Figure 2-1) and is situated within the Chichester IBRA bioregion and the Grassland climate class. Hydrological data was additionally collected from surface water creeks at Iron Bridge. A map of the survey sites for aquatic ecology is provided in Figure 2-2, including catchment areas for each site. Study site catchment areas and coordinates are provided in Table 2-1.

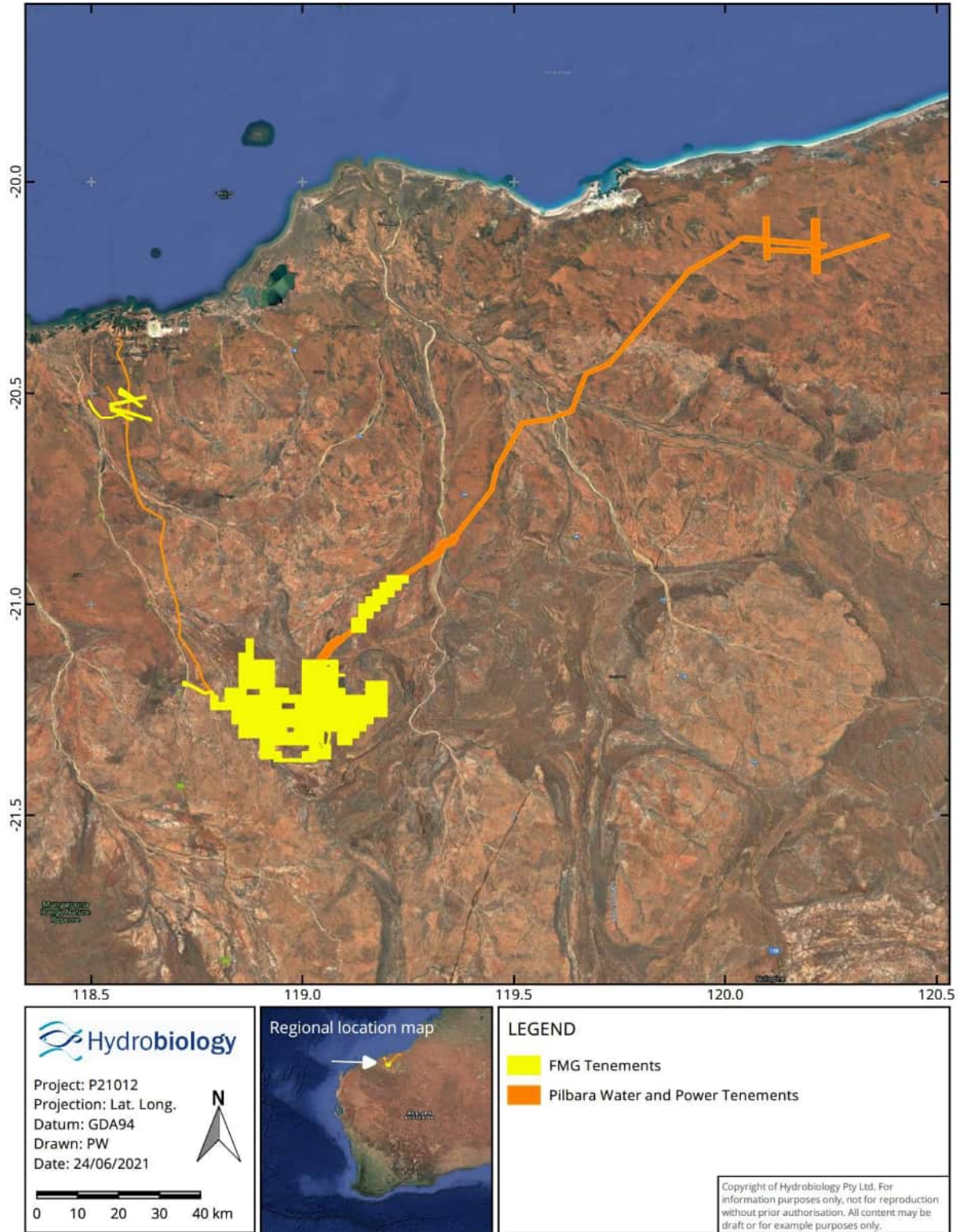


Figure 2-1 Regional study location area map showing project tenements

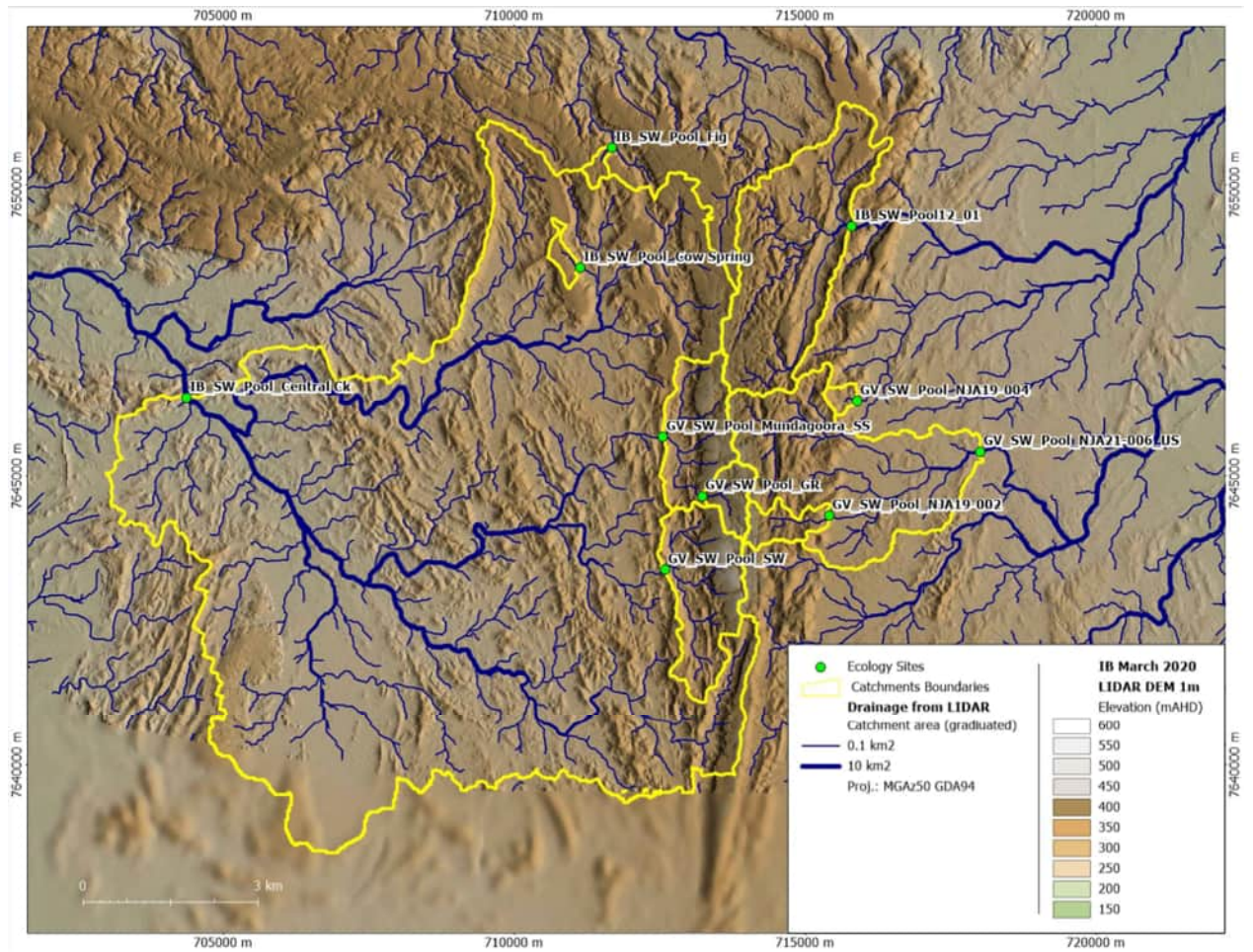


Figure 2-2 Study site catchments and drainage lines

Table 2-1. Summary of study sites included in the aquatic ecology and surface water monitoring survey for the late wet and Late Wet 2020, Late Dry 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022 and Late Dry 2022 seasons including catchment areas and coordinates (GDA94, UTM 50K)

Site Name	Site Code	Catchment area (km ²)	Easting	Northing
Fig Pool	IB_SW_Pool_Fig	0.18	711668	7650632
Mundagoora Pool¹	GV_SW_Pool_Mundagoora_SS	3.2	712558	7645667
Site 12 Pool	IB_SW_Pool12_01	7.4	716248	7649263
Cow Spring	IB_SW_Pool_Cow Spring	0.26	711103	7648587
Central Creek Pool	IB_SW_Pool_Central Ck	82.6	704385	7646299
GV Pool²	GV_SW_Pool_SW	3.3	712580	7643386
NJA21-006-US Pool³	NJA21-006-US Pool	8.8	717973	7645416
GV_SW_POOL_GR⁴	GV_SW_POOL_GR	0.72	713224	7644659
GV_SW_POOL_NJA19_002⁵	GV_SW_POOL_NJA19_002	0.74	715410	7644323
GV_SW_POOL_NJA19_004⁵	GV_SW_POOL_NJA19_004	0.20	715887	7646286

¹ Mundagoora Pool was previously named South Star Pool

² GV Pool was first sampled in the late wet season 2021. GV Pool is also known as GVSU or SWGV pool.

³ NJA21-006-US Pool was first sampled in June 2022.

⁴ GV_SW_POOL_GR was added to the ecology program for the upcoming late wet 2023 survey, only preliminary information is provided here.

⁵ GV_SW_POOL_NJA19_002 and GV_SW_POOL_NJA19_004 were added to the surface water monitoring program in the late dry 2021. Only preliminary ecology observations are available at these sites due to their impermanence.

2.2 MONITORING TIMING

Surface water level logger installations, water sampling and initial inspections of several sites were completed in December 2019 (Late Dry 2019). Aquatic ecology sampling for five pools (Fig Pool, Mundagoora Pool, Site 12 Pool, Cow Spring and Central Creek) was first initiated in May 2020 (Late Wet 2020). Subsequent surveys were completed at these sites in December 2020 (Late Dry 2020) and May-June 2021 (Late Wet 2021). An additional site, SW_GV Pool, was added in December 2020 (Late Dry 2020) with a site inspection and the installation of a water level and conductivity logger. This site (GV_SW Pool) was first surveyed for aquatic ecology in May-June 2021 (Late Wet 2021). The NJA21-006-US Pool was first surveyed in June 2022 (Late Wet 2022) for aquatic ecology. Pool GR (site GV_SW_POOL_GR) was added to the monitoring program for the Late Wet 2023 surveys (June 2023) though is currently un-impacted and so preliminary data has been provided here as part of the baseline reporting. Some Late Wet 2023 data has been included for selected other sites including GV_SW_Pool_NJA21-006_US and GV_SW_Pool_NJA19_004,

where the additional data was required to support the characterisation of these sites. These will be fully reported on in the Late Wet 2023 monitoring report.

The late wet season baseline conditions are expected to show greater species diversity and abundance relative to dry season conditions when stressors (such as high temperature and salinity) are typically greater and result in declining ecosystem health. Capturing the seasonal variability is expected to allow for a more accurate assessment of baseline conditions and variability, which will inform surface water management.

The late wet season baseline aquatic ecology surveys are typically conducted between May and June. Collecting baseline data during this period captures conditions when the aquatic food web is established, and early life stages of some aquatic organisms are present, which enables effective characterisation of the ecosystem health. The late dry season sampling typically occurs between September and December each year, and represents the period when aquatic ecosystems are at their poorest health. The timing of baseline data collection aims to align with the water quality sampling periods for the assessment period, being the wet and drying season.

Table 2-2 provides the key dates and seasons for the aquatic ecology and surface monitoring survey.

Table 2-2 Summary of the key sampling dates and seasons for the aquatic ecology and surface water monitoring surveys

Season	Year	Dates	Sites
Late Dry	2019	Trip 1: 17 – 19 Dec	Installation of loggers, water sampling and site inspections. No Aquatic Ecology sampling.
Late Wet	2020	Trip 1: 29 May – 2 Jun Trip 2: 24 – 29 Jun	Fig Pool, Mundagoora Pool, Site 12 Pool, Cow Spring, Central Creek
Late Dry	2020	Trip 1: 8 – 13 Dec	Fig Pool, Mundagoora Pool, Site 12 Pool, Cow Spring, Central Creek
Late Wet	2021	Trip 1: 21 – 28 May Trip 2: 14 – 18 Jun	Fig Pool, Mundagoora, Site 12 Pool, Cow Spring, Central Creek, GV Pool
Late Dry	2021	Trip 1: 4 – 9 Oct Trip 2: 6 – 11 Dec	Fig Pool, Mundagoora, Site 12 Pool, Cow Spring, Central Creek, GV Pool
Late Wet	2022	Trip 1: 21 – 25 June Trip 2: 17 – 24 Aug	Fig Pool, Mundagoora, Site 12 Pool, Cow Spring, Central Creek, GV Pool, NJA21-006-US
Late Dry	2022	Trip 1: 21 – 25 Oct Trip 2: 22 – 26 Nov	Mundagoora, Site 12 Pool, Cow Spring, Central Creek, GV Pool, NJA21-006-US Fig Pool

2.3 WATER QUALITY AND HYDROLOGICAL MONITORING

2.3.1 IN-SITU SAMPLING

Water level, temperature and conductivity loggers were installed in each pool to continuously monitor the effects of rainfall, the rate of drying, and evapo-concentration effects. In situ AquaTROLL CTD data loggers were installed in Site 12 Pool, Fig Pool and Mundagoora Pool from December 2019 and currently remain in situ. Further In situ data loggers were installed in Cow Spring Pool (LevelTROLL) and Central Creek Pool (AquaTROLL CTD) in May 2020 and currently remain in situ. An additional logger was installed in GV_SW Pool in December 2020 and remains active. In December 2021 an additional AquaTROLL logger was installed at NJA21-006-US. All loggers were downloaded during each survey, including most recently in November 2022.

In addition to the permanently deployed loggers, a calibrated YSI DSS Pro water quality sonde was used to collect in situ measurements from all sites where sufficient water was present during field surveys. Measurements were collected following the 'Field sampling guidelines: A guideline for field sampling for surface water quality monitoring programs' procedure for physical parameter sampling (Department of Water, 2009 pg. 13). In-situ measurements were collected before all other activities to ensure that no disturbance to water quality was caused by sampler activity. The following field parameters were collected; temperature (°C), pH, oxidation reduction potential (mV), dissolved oxygen, specific conductivity ($\mu\text{s}/\text{cm}$), salinity (ppt) and turbidity (NTU).

An EXO2 Sonde was installed at Mundagoora pool in November 2022 to replace a faulty turbidity logger, however the EXO2 also measures depth, dissolved oxygen, conductivity and temperature.

2.3.2 SURFACE WATER QUALITY

Water samples were collected following the 'Field sampling guidelines: A guideline for field sampling for surface water quality monitoring programs' (Department of Water, 2009) procedure for direct sampling. Water samples were collected by submerging the sample containers in the water at the waters' edge with the sampler on the bank to minimise disturbance. Powder-free nitrile gloves and laboratory prepared bottles were used to avoid potential sources of contamination. Unpreserved sample containers were rinsed three times with sample water before retaining a representative sample, and preserved bottles were filled from a pre-rinsed syringe. Samples for dissolved metals analysis were syringe filtered within 1 minute of collection through 0.45 μm membrane filters using 50 mL polyethylene disposable syringes.

Upon collection, samples were immediately placed on ice in a dedicated esky and then transferred to a fridge at the earliest convenience. For delivery to ALS Australia, samples were packed in clean coolers with ice bricks. All bottles and filtering equipment were prepared by NATA-accredited ALS, Perth. Samples were sent to a NATA accredited laboratory for analysis for parameters which allowed for a broad characterisation of the examined environments. The parameters are identified in Appendix A.

Water quality samples were also delivered to the Stable Isotope Laboratory, West Australian Biogeochemistry Centre, University of Western Australia for isotope analysis. Samples were analysed for $\delta^2\text{H}$ and $\delta^{18}\text{O}$, using an Isotopic Liquid Water and Continuous Water Vapour Analyser Picarro 2130i and followed the procedure of Skrzypek and Ford (2014).

2.3.3 SEDIMENT QUALITY

Sediment samples were collected following the 'Handbook for Sediment Quality Assessment' procedures for the collection of surface sediment (Simpson *et al.*, 2005). Surface sediment was collected from the top 5 cm of sediment and homogenised in a bowl before transferring to sterile jars. Powder-free nitrile gloves and laboratory prepared jars were used to avoid potential sources of contamination. Samples were stored

on ice in a dedicated esky and transferred to a fridge at the earliest convenience. For delivery to ALS Australia, samples were packed in clean coolers with ice bricks. Samples were sent to a NATA accredited laboratory to analyse parameters, including total metals, major ions, total organic carbon, total nitrogen and total phosphorous. The specific parameters are identified in Appendix B.

2.4 AQUATIC ECOLOGY MONITORING

2.4.1 MONITORING PARAMETERS

Aquatic ecology monitoring parameters were selected following the ANZG process (ANZG, 2018) for selecting relevant ecological indicators of water quality through establishing environmental values and identifying conceptual impact mechanisms. These indicators are algal (diatom/phytoplankton) communities, macrophyte communities, macroinvertebrate communities and fish communities. The selection of these four communities provides multiple lines of evidence and spans multiple trophic levels and phyla, which is recommended by ANZG (2019) in order to capture the variable impact of ecosystems stressors and detect, for example, impacts of bioaccumulation and biomagnification. Algae, macroinvertebrates, fish and macrophytes typically underpin the food web in pools, providing habitat and/or food sources for a diversity of native species including terrestrial or semi-aquatic organisms that may use the pools such as reptiles (e.g. Pilbara olive python), avian fauna and amphibians (Halse et al. 2001).

2.4.2 FISH AND DECAPOD CRUSTACEANS

2.4.2.1 SAMPLING

Fish and decapod communities were sampled to collect data on higher-order organisms with relatively long life spans, which is useful for assessing bioaccumulation and biomagnification effects, interannual survivability and reproduction. Evidence of reproduction was sought (i.e., presence of juveniles) to detect sub-lethal effects impacting reproduction or vulnerable size classes.

Fish and decapod crustaceans were sampled using fyke nets and traps. Two trap types, box traps and bait traps, were used to collect a more representative sample of size classes present at a site (Osawa et al. 2015). Fyke nets were 4 m long, 1 m diameter, 4 m wings, with a 4 mm mesh size and 150 cm diameter entry hole. Bait traps were 0.4 m long, 0.25 m wide and 0.25 m high, with a 5 mm mesh size and 30 mm diameter entry holes. Box traps were 0.6 m long, 0.45 m wide and 0.2 m high, with a 10 mm mesh size. Traps were baited with a 50/50 ratio of cat food biscuits and whiting based burley. At each pool, one fyke net, two bait traps, and two box traps were set for overnight an average of 12 hours (maximum 19 hours). Traps were set along the length of the pools, predominantly in bank habitats with high structural complexity (e.g., macrophytes, woody debris, root masses), where abundance was likely to be highest.

After two rounds of sampling (Late Wet 2020 and Late Dry 2020) it was decided that the box traps were not providing useful data as they rarely caught fish and those that were caught were not representative of the counts in the fyke nets, or fish abundance observable within the pools. The use of traps was discontinued for future surveys, and fyke nets are used as the primary measure of fish abundance and diversity for this program.

Following capture, the first 30 individuals of each species were randomly selected for subsampling to reduce handling stress on the entire catch. Subsampled individuals were counted and measured (total length and standard length). The remaining individuals were counted and allocated to one of four length classes based on standard length (SL) (i.e. <30 mm, 30 – 60 mm, 60 – 90 mm and >90 mm). All fish were kept in aerated tubs immediately after capture, prior to being measured and were immediately released near the collection point after processing.

As a secondary measure of fish abundance and species presence at each site, Hydrobiology utilised baited remote underwater video traps (BRUVS). Baited underwater GoPro 5 cameras were deployed in suitable habitats at each site, and the video was set to record for 10 minutes.

2.4.2.2 ANALYSIS

Fish abundance at each site was compared for each season. Catch per unit effort (CPUE) was used as a measure of abundance and was defined as the species total catch divided by the soak time in hours. Fish were grouped into standard length classes, and length frequency (%) figures were constructed for each species at each site across the three seasons. Juvenile presence was defined as the presence of smaller size classes that are below the size at sexual maturity described in the relevant literature (based on wild populations).

Where standard length was recorded for subsampled fish, length distribution box and whisker plots were constructed for each species at each site across the three seasons. Independent t-tests and analysis of variance (ANOVA) were used to assess any significant differences in the mean standard length for each species at all sites across the three seasons.

Fish abundance on BRUV footage was recorded using a common metric MaxN, the maximum number of fish per species on a single video frame.

2.4.3 MACROINVERTEBRATES

2.4.3.1 SAMPLING

Macroinvertebrates are a commonly used bioindicator for assessing a variety of environmental issues. ANZG (2019) recommends macroinvertebrate monitoring to assess changes in biodiversity and changes in ecosystem processes of water bodies due to contaminant inputs. The taxonomic groups sensitive or tolerant to declines in water quality are well known and the presence and abundance of these taxa are used to score the water condition of surface water pools.

Macroinvertebrate sampling followed the procedures of 'Western Australia AUSRIVAS sampling and processing manual' (van Looij, 2009). Samples were collected using a 250 µm mesh pond net, 35 cm by 25 cm opening, a 30 cm depth (tail) and a 150 cm handle. The net was rinsed and checked for holes between each site. Two samples were collected from each pool. Due to the pool's small size, two replicates from the same habitat (i.e., macrophyte, pool) was not possible for all pools without risking re-sweeping the extent of the previous sweep. Therefore, samples were obtained from different habitats for most pools. Sites were sampled by sweeping the net starting at the downstream end of the 10 m sampling area and moving upstream while collecting the sample, aiming to sample all the different sub-components of the habitat and at different depths. The contents of the net were then rinsed into labelled sterile containers using 70% ethanol for preservation. Samples were transported to Stream Macroinvertebrate Identification for identification and enumeration.

Specimens in each sample were laboratory picked following the AusRivAS methods. Samples were identified to family level, where possible. A 10% error margin is allowed for the identifications and enumerations of macroinvertebrates (as required for AusRivAS macroinvertebrate identification accreditation). Any taxa that could not be identified (usually due to their immature stage or deterioration/damage) were recorded at a higher taxonomic level (i.e., Order). Taxa were recorded as present if the head was present in the sample (provided it appeared to be alive at the time of collection). This is common with Ephemeroptera, Zygoptera and Oligochaeta, which are often damaged at the time of collection and only part of the specimen is retained in the sample. Empty (dead) Gastropoda shells are not recorded as being present. Specimens were preserved in a solution of 70% methylated spirits, 5% Glycerol and 25% water and retained for QA/QC purposes at Hydrobiology Perth.

2.4.3.2 ANALYSIS

Several indices were derived from the macroinvertebrate data and are described below as per Negus *et al.* (2013) and Chessman (2003). Each of these indices was qualitatively assessed for changes in values among sampling occasions.

Total abundance – The number of individual macroinvertebrates collected in a sample, which can provide insights into the biological productivity, population health or carrying capacity of an ecosystem.

SIGNAL 2 Index – The SIGNAL index (Stream Invertebrate Grade Number – Average Level) was developed for the bioassessment of water quality in rivers in Australia. It is calculated by grading each macroinvertebrate family based upon the level of its sensitivity to various pollutants. The grades applied range from 1 (tolerant) to 10 (sensitive; Chessman, 2003) and a weight is applied to each taxa depending on its abundance. The SIGNAL 2 score for a sample is calculated by averaging the weighted sensitivity grades of the macroinvertebrate families collected. The version applied here is SIGNAL version 2.iv, SIGNAL 2 Scores suit both family and order-class-phylum identification (Chessman, 2003).

EPT taxa richness – The number of aquatic macroinvertebrate families collected from three orders of aquatic insects: Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies). Macroinvertebrates belonging to these three orders are considered sensitive to changes in their environment and therefore EPT is often used to assess water body conditions. Sensitivity would generally be indicated by a decrease in EPT in the presence of changed environmental conditions; however, increases can occur depending on the nature of the impacts that are present.

Taxa richness – The number of aquatic macroinvertebrate taxa collected in a sample. This index is used as a common measure in many monitoring programs. The use of taxa richness is based on the premise that with changes in the condition of a site, the taxa richness will increase or decrease from the baseline condition. Increases or decreases will depend on the nature of the threats that are influencing the ecosystem.

Additionally, the taxonomic composition of the community was also assessed to see how abundances of individual taxa vary among sampling events. Note that the taxonomic classification level of taxa (e.g., genus, family, order) varies as the taxa are identified to the lowest practical level, with some groups harder to identify to lower levels than others (e.g., Ostracoda).

2.4.4 DIATOMS AND PHYTOPLANKTON

2.4.4.1 SAMPLING

Diatoms (single-celled algae with siliceous cell walls) are effective indicators for ecological change in freshwater systems (Gale, 2015). Diatoms are an important component of the riverine algae community and are commonly used for assessing water quality based on the tolerance of species present to pollution (Oeding and Taffs, 2017). Artificial substrates called periphytometers were used to collect living diatoms over a specified time. Two periphytometers each containing 10 microscope slides were deployed at each of the pools. The substrates were left immersed for an average of four weeks to enable diatom communities to establish, reflecting the ambient water quality. On retrieval, the 10 slides from each artificial substrate were scraped into a small, labelled sample container and preserved with 70% ethanol. They were then submitted to the laboratory for taxonomic identification to species level and enumeration. Dr John Tibby of the University of Adelaide was engaged as the sub-consultant for the taxonomic identification and enumeration.

Water samples were taken from the survey sites and submitted to Dalcon Environmental to analyse a full count phytoplankton profile for each pool. Following the Dalcon Environmental recommended sampling protocol, 1.25 L of water was collected from each site from the mid-water column. Phytoplankton samples were preserved with Lugol's Iodine and chilled on ice for the duration of transport.

2.4.4.2 ANALYSIS

The most widely used biotic indices in Australia, DSIAR score (Diatom Species Index for Australian Rivers score), was derived to quantify diatom ecology at the pools. The DSIAR score estimates water quality by the relative abundance of diatom species sensitive to water quality stressors, where a higher DSIAR score represents higher water quality (Chessman *et al.*, 2007). Total count per sample for each species of planktonic phytoplankton and diatoms is also presented.

2.4.5 MACROPHYTES

Macrophytes (aquatic plants) are sensitive indicators of ecosystem health and can be used to assess when physico-chemical thresholds are reached (e.g. turbidity blocking photosynthesis of submerged macrophytes or impacts of sedimentation) (Barko *et al.*, 1982) and the abundance and spatial distribution of heavy metals in aquatic environments (Cardwell *et al.*, 2002). They play a fundamental role in aquatic systems by, for example, reducing erosion of stream banks, increasing dissolved oxygen levels, providing a food source and mediating food web dynamics by providing habitat structural complexity (Warfe and Barmuta, 2006).

Macrophyte sampling followed the AusRivAS guidance (van Looij, 2009). Macrophyte surface area coverage of emergent, submerged and floating macrophytes (Figure 2-3) was visually estimated across the pool habitat and defined as isolated, scattered, in beds or choking the stream as per the 'Field Sampling and Habitat Assessment Sheet 2006 v.14'. Macrophytes included those which were out of the water but in the active channel. Specimens were photographed and samples collected and preserved in 70% ethanol for subsequent confirmation of taxonomic identification and retained. Macrophytes were identified to the species level where possible.

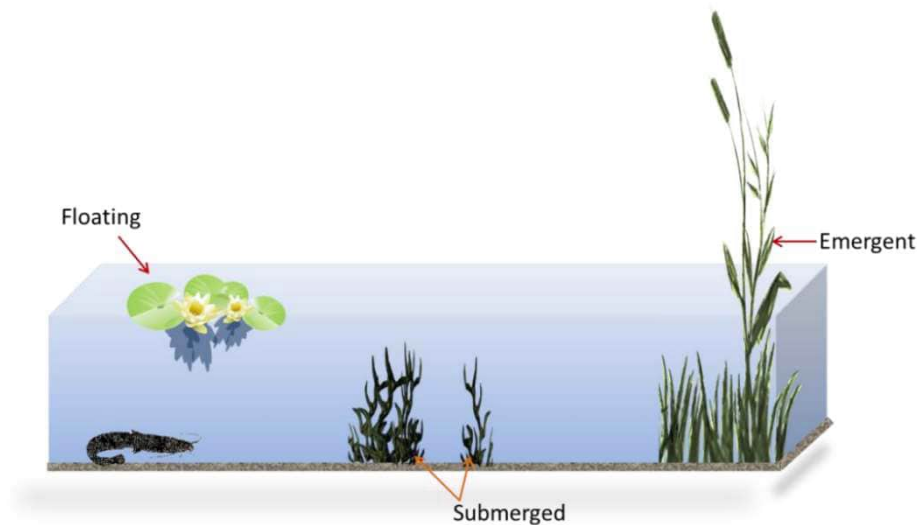


Figure 2-3 Schematic of floating, submerged and emergent macrophytes (DES, 2018)

3. RESULTS

This section presents the findings of the hydrology and aquatic ecology surveys conducted between December 2019 (Late Wet 2019) to December 2022 (Late Dry 2022). The results are presented as distinct chapters for each site to reflect that the pools should not be directly assessed relative to other pools but rather to the temporal patterns of the individual pool. For example, each pool has different hydrology, size and habitats, and the methods used are not spatially uniform (i.e., macroinvertebrate sampling of different habitat types between pools).

3.1 SITE 12 POOL (IB_SW_POOL12_01)

Site 12 Pool is part of a series of shallow pools that lie to the east of the Project on a small tributary to the upper Six Mile Creek (Figure 3-1). It is connected to both surface water and groundwater sources over the hydrologic cycle, typically sustained by groundwater until the local groundwater level drops below the pool base level over the late dry season. The pool is frequently perennial, though has been known to dry out following small wet seasons. During the late wet season sampling it is a fresh-brackish, predominantly bedrock habitat that supports fish, macroinvertebrates, algal communities, macrophytes and riparian vegetation (Figure 3-2 and Figure 3-3).



Figure 3-1 Site 12 Pool looking downstream toward the monitoring area

3.1.1 SITE SPECIFIC TRIGGER VALUES

To meet the management goal, this report followed the current ANZG (2018a) guidance for developing site-specific water quality guidelines and applies the Temporary Waters Guidance (ANZG 2018b). The formulation of site-specific guideline values using a multiple lines of evidence approach is considered most appropriate for the protection of aquatic ecosystems, above applying generic principles and default guidelines (ANZG 2018a).

To date the collection of data over the three wet and four dry cycles, will be sufficient to develop site specific triggers for water quality as outlined in the Site 12 Pool Water Quality Monitoring and Management Plan. However, in developing site specific triggers for select parameters and analytes the results for the most recent survey having come from a remnant pool downstream of the usual sampling location will be excluded if ongoing compliance monitoring is confined to the series of main pools at the site.

For the most parameters and analytes the default guidelines (ANZG 2018a) will provide sufficient trigger values. However, site specific triggers should be developed for pH, SPC, TDS, TN, and TP which will lead to the investigation when the long-term rolling median values exceed the 80th percentile of the baseline data collected up to this point. This will accommodate the high temporal variability anticipated in Site 12 Pool over the hydrological cycle, with the data not indicating the need for specific triggers over the wet or dry season phases. In addition to the long-term 80th percentile median trigger, an instant value of exceedances over the 95th percentile median value could trigger investigation. For example; the long term median concentration values for TN and TP are above the ANZG (2018a) default guideline values and new site specific trigger values will reduce redundant investigations.

In terms of ecological triggers, the highly variable data indicates that for fish, macroinvertebrates, diatoms and phytoplankton a presence/absence trigger may be the most appropriate. This highly variable data is to be expected in ephemeral pools, with the hydrological cycle having the greatest influence on ecological functioning of the pool habitat. The loss of significant proportions of permanent riparian vegetation would also be a trigger for investigation.

3.1.2 WATER QUALITY AND HYDROLOGY

Water quality sampling included physico-chemical parameters, metals analysis and major ions to characterise the surface water system. Stable isotope analysis at Site 12 Pool and bore NS-0664 was also conducted to inform the connectivity of surface water and groundwater. A logger recorded conductivity, temperature and water level on a 3-hourly basis at Site 12 Pool between December 2019 and November 2022.

Site 12 Pool is a shallow bedrock supported natural habitat with a 7.4 km² catchment area (Figure 3-5) with typically low rainfall and infrequent high rainfall events largely driven by storm and cyclonic activity. The water quality experiences high seasonal variability due to the climatic conditions of the region, with the greatest variability recorded following rainfall events.

The water quality was predominantly clear (mean turbidity = 1.2 NTU), and a magnesium-bicarbonate (Ca/Mg-HCO₃) dominated water type with low sulphates (SO₄) (Table 3-1; Figure 3-6). While the pool water is slightly alkaline (mean pH = 8.) in the Late Dry 2022 it was neutral (pH = 7.01) (Figure 3-6). However, it is expected that during surface water flow events the turbidity temporarily increases. Similarly, during rainfall events, the typically slightly brackish pool (1,090-1,833 µS/cm) would become temporarily extremely fresh (<100 µS/cm), as recorded in the continuous logger measurements (Figure 3-7).



Figure 3-2 Aerial (drone) image of Site 12 Pool and downstream reach (May 2019)

Figure 3-7 displays a high-resolution water level, salinity (conductivity) and temperature logger record from Site 12 Pool for December 2019 to November 2022. The rapid change in conductivity after rainfall events is evident with one minor inflow at the start of the 2019-20 wet season that partially flushed and filled the pool as well as four major inflows that displayed flooding peaks and complete pool flushing. A similar pattern of four flushing events was also observed in the 2020-21 wet season (Figure 3-7). The conductivity sensor was not functioning properly from June 2021 to June 2022 and has been removed from the dataset.

This preliminary baseline data indicates that the pool is sustained by groundwater (until the local groundwater level drops below the pool level) and is periodically flushed with fresh surface water flows after rainfall events. It takes approximately 2 – 3 weeks for the groundwater to displace the surface water flows once a flushing event has occurred. Comparison of the nearby groundwater levels at the Site 12 Groundwater monitoring bore (NS-0664) with the rainfall and flow in the Site 12 Pool is provided in Figure 3-8. This data suggests that the groundwater level recedes at around 3 cm per week over the dry season, reaching the level below which groundwater no longer maintains the Site 12 Pool towards the end of the dry season. While a groundwater level at NS-0664 below 284.44 mAHD indicated that surface water levels at the IB_SW_Pool12_01 site would start receding, it is important to note that this is a periodic natural occurrence, particularly in the late dry season. Site 12 Pool has periodically dried out, or become almost dry, on several occasions over the monitoring period.



Figure 3-3 Photographs of Site 12 Pool during the late dry season (Nov-Dec) and late wet seasons (May-June)

Site 12 Pool is a larger habitat area relative to other North Star pools, comprising a series of isolated pools spanning approximately a 650 m reach and 1266 m², and likely has greater downstream

connectivity relative to other pools in the Iron Bridge area. Most pools are shallow, with the deepest being approximately 2.5 m. The total volume of the pools is estimated to be 2,532 m³ based on an average depth of 2 m. This is a small volume relative to the inflow volume; for example, the 1EY post-development estimated inflow is substantially higher (54,198 m³) (FMG, 2020).

Recorded water levels were a maximum of ~0.6 m above the pool overflow levels during high-flow events, which typically lasted less than 24 hours before flows receded. The rapid falling stage after large flow events indicates there is little retention capacity in the system beyond the pool spill point. The depth response to rainfall and flow events in February and to a greater extent May 2022 (Figure 3-7) is anomalous with regards to the previous hydrograph response in the pool. The longer receding depth tail in the hydrograph after the May 2022 rainfall events may indicate groundwater recharge in the catchment to a greater extent than the preceding period of January to March 2022 (Figure 3-7).

The presence of a significant riparian vegetation habitat immediately upstream of Site 12 pool acts as both a filter for sediments and a moderator of flows. The pool contains very little sediment and is characterised by solid rock substrate with some boulders present in deeper sections. As this pool is supported by groundwater levels within the local fractured rock and upstream alluvium, flushing events are not likely to be a significant factor in the longer-term ecology of this system.

Note that the conductivity (E.C.) logger recording at Site 12 Pool failed on 11th June 2021 and so there is no E.C. record for this period to June 2022 (Figure 3-7). However, water depth (pressure) readings at Site 12 Pool appear to be of reasonable quality over this period.

Analysis of the stable isotopes $\delta^{18}\text{O}$ and $\delta^2\text{H}$ in Site 12 Pool and bore NS-0664 indicated that the isotope ratios for the surface water within Site 12 Pool and the upstream monitoring bore (NS-0664) were consistently different, with the groundwater being substantially more depleted, particularly for the late dry season (Dec 2019 and Oct 2021) sampling events. It is likely that some degree of evaporation along the groundwater inflow to the pool, and within the pool system itself, is creating an enriched signature relative to the deeper groundwater (NS-0664) which is more representative of large rainfall event recharge. The December 2019 and Oct 2021 isotope enrichment in the Site 12 Pool is evidence that at this stage “fresh” or deep groundwater recharge was at a minimum and evaporative isotopic enrichment was a dominant process. The most depleted isotopic ratio of the dataset was observed at the Site 12 groundwater monitoring bore (NS-0664) following the large 2020/21 wet season. This may indicate that the source of the groundwater at the site was relatively recent rainfall during this period. There are preliminary indications that the groundwater at the Site 12 Pool monitoring bore is more similar to a rainwater isotopic composition after the wet season, moving towards the evaporation line in the late dry. The significant difference in the Late Dry 2022 stable isotopes $\delta^{18}\text{O}$ and $\delta^2\text{H}$ between the remnant pool and the bore NS-0664 may be due to the increased temperature and evaporation of the remnant pool waters.

Although the pool is sustained by groundwater for the majority of the dry season, it has been recorded as completely dry in recent years (2015, 2016, 2020 and 2022 dry seasons) following low rainfall and groundwater recharge wet seasons (BOM 2020). The pool did not completely dry out in 2019 (Plate 1.). The pool naturally drying out or experiencing substantially lower water levels would be expected to impact significantly on the ecological health of Site 12 Pool due to evapo-concentration increasing environmental stressors (e.g., salinity and temperature) and lower water levels reducing available habitat. It is noted that visual observations in the late dry 2019 indicated there were no fish in the pool. However, after a drying event in mid-November 2020 (late dry), the pool retained all three fish species within several weeks of re-wetting in December 2020. This indicated that the pool ecological response to drying is variable depending on antecedent conditions. It is unknown if the larger pools downstream of the monitoring location dry out at the same frequency as the monitoring location though the largest pool (~100m downstream of Site 12 Pool) was found to be dry in December 2021. These downstream pools are not accessed regularly due to heritage restrictions.

Over the seven seasons sampled the mean concentrations for total nitrogen (TN), total phosphorus (TP), reactive phosphorus and nitrite (NO²⁻) exceeded the ANZG 2018 Default Guideline Values (DGVs). TN in the Late Dry 2022 the highest recorded over the seven seasons and TP concentrations were higher than the site mean value. This is likely due to the evapo-concentration of the remnant pool. Of the dissolved metals, Zinc and Copper were the only metals to exceed the the ANZG (2018) 95% species protection levels as a maximum value. Copper that exceeds the guideline values can cause a decrease in algal growth and lethal concentrations can lead to detrimental effects on freshwater adult fish, leading to disruption of lifecycle and recruitment in those species (ANZECC & ARMCANZ, 2000).

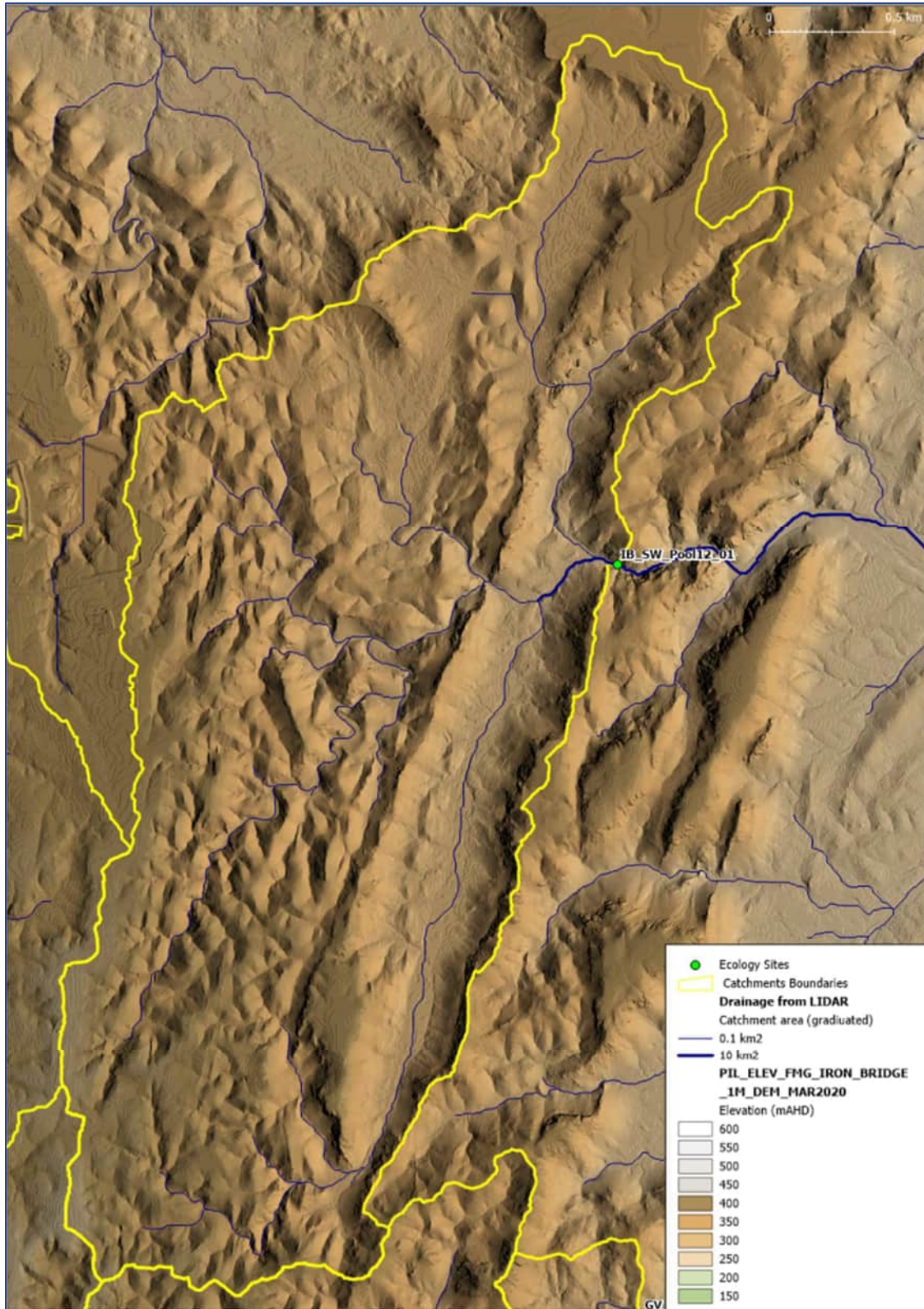


Figure 3-5 Site 12 Pool catchment area

Table 3-1. Summary of water quality analytical results for Site 12 Pool. Concentration for each analyte and analyte group described for Late Wet season 2020, Late Dry season 2020, Late Wet season 2021, Late Dry season 2021, Late Wet 2022 and Late Dry 2022. Only dissolved metals with Default Guideline Values (DGV) were included in this table. Bolded values denote results above the 95% species protection levels ANZG (2018) DGVs. Range refers to the difference in Max and Min values and Standard Error (SE) is the standard error of the mean (sampling error).

Analyte/Water Quality Parameter	Mean	Median	Max	Min	Range	SE	95% Protection/DGV
Temp (°C)	24.64	24.85	30.3	13.9	16.4	2.80	
DO (%)	98.24	119.25	162	61.7	100.3	15.23	
DO (mg/L)	8.14	9.735	12.3	4.74	7.56	1.16	
SPC (uS/cm)	1399.29	1224	1833	1090	743	121.09	
TDS (mg/L)	867.00	796.5	1192	728	464	80.76	
pH	8.20	8.38	8.63	8.18	0.45	0.09	6.0-7.5
Turbidity (NTU)	1.23	1.025	12.29	-11.55	23.84	3.39	
Total Alkalinity as	608.38	592	685	478	207	27.42	
Ammonium as N	0.005	0.005	0.005	0.005	0	-	0.9
Nitrite as N (mg/L)	0.005	0.005	0.005	0.005	0	-	0.006
Nitrate as N (mg/L)	0.005	0.005	0.005	0.005	0	-	0.03
Nitrite + Nitrate as N	0.0114	0.005	0.05	0.005	0.045	0.01	0.03
Total Nitrogen as N	0.2813	0.2	0.3	0.05	0.25	0.04	0.15
Total Phosphorus as	0.020	0.015	0.04	0.005	0.035	0.01	0.01
Reactive Phosphorus	0.005	0.005	0.005	0.005	0	0	0.005
Dissolved Organic	6.33	5	10	2	8	1	
<i>Dissolved Metals</i>							
Aluminium (mg/L)	0.00	0.0025	0.0025	0.0025	0	0	0.055
Arsenic (mg/L)	0.00	0.001	0.002	0.0005	0.0015	0.0002	0.024(AsII),
Boron (mg/L)	0.28	0.275	0.34	0.2	0.14	0.02	0.94
Cadmium (mg/L)	0.00	0.00005	0.00005	0.000025	0.000025	0	0.0002
Chromium (mg/L)	0.00	0.0005	0.0005	0.0001	0.0004	0	0.001
Copper (mg/L)	0.0013	0.0005	0.0076	0.00025	0.00735	0.0011	0.0014
Lead (mg/L)	0.00	0.0005	0.0005	0.00005	0.00045	0.0001	0.0034
Manganese (mg/L)	0.01	0.01	0.017	0.004	0.013	0	1.9
Mercury (mg/L)	0.00	0.00005	0.00005	0.00002	0.00003	0.00001	0.00006
Nickel (mg/L)	0.00	0.0005	0.001	0.00025	0.00075	0	0.011
Selenium (mg/L)	0.00	0.005	0.005	0.0001	0.0049	0.001	0.011
Zinc (mg/L)	0.0058	0.0025	0.009	0.0005	0.0085	0.001	0.008

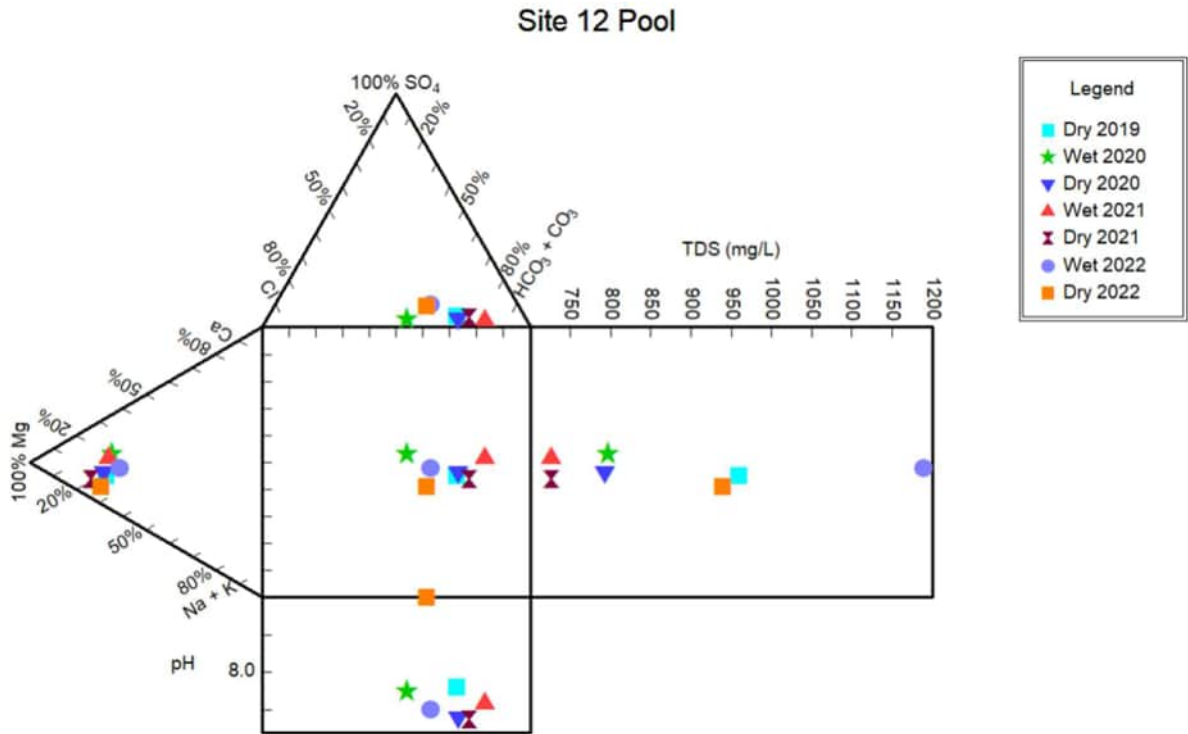


Figure 3-6 Durov diagram illustrates Site 12 Pool is a calcium/magnesium-bicarbonate (Ca/Mg-HCO₃) dominated water type. It is fresh-brackish, alkaline (481 mg/kg CaCO₃) with low sodium, chloride and sulphate (SO₄).

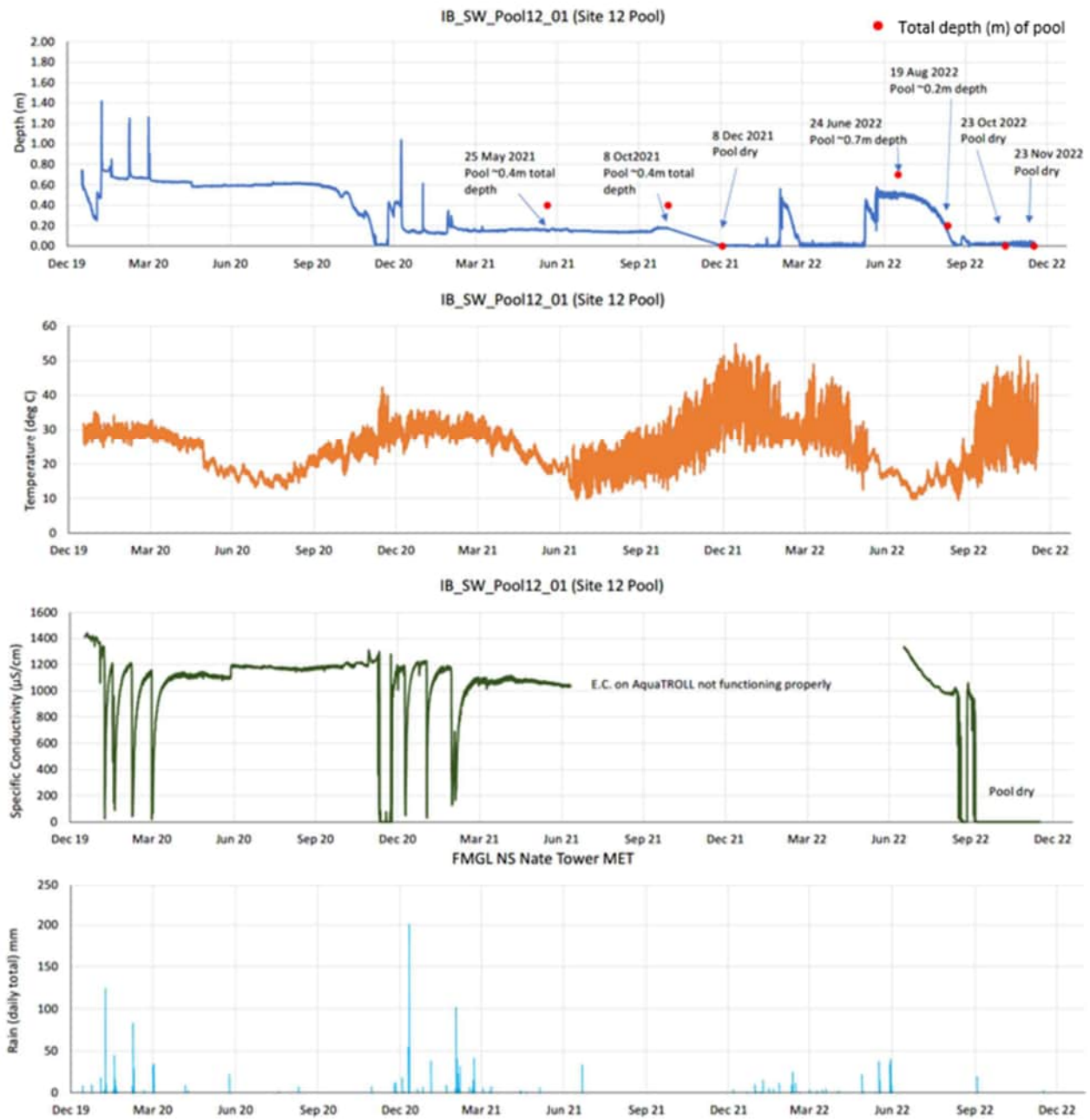


Figure 3-7 Site 12 Pool logger record from 19/12/2019 to 24/11/2022 for pool water depth (m), water temperature (°C), Specific conductivity (µS/cm), and daily rainfall at FMG LNS Nate Tower MET. Sensor depth is approximately 30cm above bottom of pool therefore total depth is 30cm above recorded level indicated by the red dots.

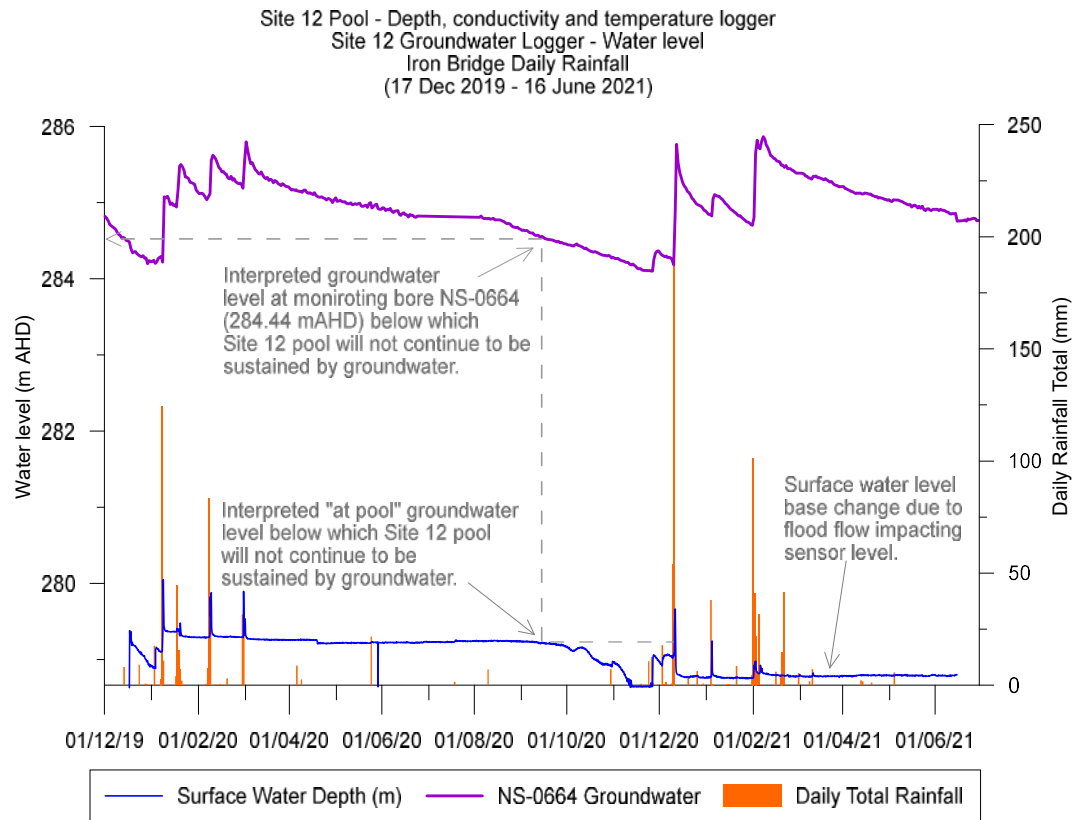


Figure 3-8 Comparison of surface water levels in Site 12 Pool and groundwater levels within the upgradient monitoring bore (NS-0664).

The presence of a significant riparian vegetation habitat immediately upstream of Site 12 pool acts as both a filter for sediments and a moderator of flows. The pool contains very little sediment and is characterised by solid rock substrate with some boulders present in deeper sections. As this pool is supported by groundwater levels within the local fractured rock and upstream alluvium, flushing events are not likely to be a significant factor in the longer term ecology of this system. Connectivity to pools through ongoing groundwater discharge and flow-through is an important factor for this ecology of this system. Much of the ecology of the pool is developed during periods of little or no flow. Maintaining groundwater levels is likely to be more important than flow velocities or short duration flushing events.



Plate 1 Site 12 Pool hydrological characteristics including; a) high flows over a steeper gradient of bedrock habitat b) confined creek line supporting riparian vegetation and c) sustained groundwater flow

3.1.3 SEDIMENT QUALITY

Table 3-162 provides the surface sediment quality at Site 12 Pool during the Late Wet 2020, Late Dry 2020, Late Wet 2021, Late Dry 2021 and Late Wet 2022. No sediment samples were collected for the Late Dry 2022 due to the site being dry.

Table 3-2 Summary of sediment quality analytical results for Site 12 Pool. Concentration for each analyte and analyte group described for the Late Wet 2020, Late Dry 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022 and Late Dry 2022. No analysis recorded for late dry season (2022) due to the site being dry. Bolded values denote results above the ANZG.

Analyte grouping/Analyte	Unit	ANZG value	Late Wet 2020	Late Dry 2020	Late Wet 2021	Late Dry 2021	Late Wet 2022
Total Soluble Salts	mg/kg	-	408	-	402	1870	688
Moisture Content (Dried @ 105-110°C)	%	-	28.6	20.9	25	39.2	30.2
Total Alkalinity as CaCO₃	mg/kg	-	71	329	253	722	60
Bicarbonate Alkalinity as CaCO₃	mg/kg	-	67	265	26	521	452
Carbonate Alkalinity as CaCO₃	mg/kg	-	4	65	26	722	512
Acidity	mg/kg	-	4	<5	<5	<5	<5
Sulfate as SO₄ 2- (soluble sulfate by ICPAES)	mg/kg	-	20	<10	<10	130	20
Chloride (by Discrete Analyser)	mg/kg	-	30	30	20	290	80
Calcium	mg/kg	-	50	40	30	30	50
Magnesium	mg/kg	-	60	90	60	410	110
Sodium	mg/kg	-	40	40	6	340	80
Potassium	mg/kg	-	<10	<10	<10	10	<10
Mercury (FIMS)	mg/kg	-	<0.1	-	<0.1	<0.1	<0.1
Nitrite + Nitrate as N (Sol.)	mg/kg	-	<0.1	<0.1	<0.1	<0.1	<0.1
Total Kjeldahl Nitrogen as N	mg/kg	-	520	200	80	660	440
Total Nitrogen as N	mg/kg	-	520	200	80	660	440

Analyte grouping/Analyte	Unit	ANZG value	Late Wet 2020	Late Dry 2020	Late Wet 2021	Late Dry 2021	Late Wet 2022
Total Phosphorus as P	mg/kg	-	73	61	56	106	111
Reactive Phosphorus as P	mg/kg	-	<0.1	<0.1	<0.1	0.1	<0.1
Total Organic Carbon	%	-	0.18	0.29	0.2	1.13	0.16
<i>Total Metals by ICP-AES</i>							
Arsenic	mg/kg	20	<5	-	6	<5	<5
Barium	mg/kg	-	50	-	70	40	60
Beryllium	mg/kg	-	<1	-	<1	<1	<1
Boron	mg/kg	-	<50	-	<50	<50	<50
Cadmium	mg/kg	1.5	<1	-	<1	<1	<1
Chromium	mg/kg	80	384	-	492	244	301
Cobalt	mg/kg	-	23	-	36	16	22
Copper	mg/kg	65	23	-	37	19	17
Iron	mg/kg	-	32,800	41,200	49,400	29,600	28,000
Lead	mg/kg	50	<5	-	<5	<5	<5
Manganese	mg/kg	-	561	-	894	504	667
Nickel	mg/kg	21	179	-	246	115	128
Selenium	mg/kg	-	<5	-	<5	<5	<5
Vanadium	mg/kg	-	48	-	65	40	30
Zinc	mg/kg	200	26	-	44	22	18

3.1.4 FISH

Fish, decapods and non-fish vertebrates were sampled with a combination of nets/traps and underwater video (BRUVs). Table 3-3 and Figure 3-10 to Figure 3-15 present the fish species, abundance, and size distribution.

Three native omnivorous fish species were observed in Site 12 Pool across the five seasons: *Melanotaenia australis* (Western Rainbowfish), *Leiopotherapon unicolor* (Spangled Perch) and *Neosilurus hyrtlii* (Hyrtl's Catfish).

There were no fish present at Site 12 Pool due to the pool being dry in the Late Dry 2022. However, in a remnant pool downstream *M. australis* and *N. hyrtlii* were observed in the refuge of the small pool (Figure 3-16). The generally lower counts of all three species in the Late Wet 2022 compared to that observed in previous seasons may be a result of the lower flows and water levels experienced in the 2022 wet season.

M. australis was the dominant species in all four seasons prior to the Late Wet 2022, where *L. unicolor* was more abundant (Table 3-3). Figure 3-13 demonstrates the frequency of each length class for *M. australis* for the five seasons. The frequency and size class of *M. australis* in the Late Wet 2022 was very similar to that observed in the Late Wet 2020, where there were no fish in the smaller size class (<30 mm) and slightly more fish in the 60-90 mm size class than the 30-60 mm size class. However, the total abundance of *M. australis* was noticeably reduced in abundance from the previous season, down from 48 fish in the Late Dry 2021 to 7 in in the Late Wet 2022) (Table 3-3). This reduction in abundance may be correlated with the lower water levels recorded over the 2022 wet season.

The larger size distribution of *L. unicolor* and *N. hyrtlii*, ranging from juveniles to adults over a year old, more clearly indicates interannual survival of these species and demonstrating evidence of successful wet season or post-wet season reproduction. However, these species may aestivate (*L. unicolor*) or persist in downstream environments rather than at Site 12 Pool throughout the drier months and migrate upstream to the pool during wet season connective flows. The lower water levels in the 2022 wet season may explain the absence of *Neosilurus hyrtlii* in Site 12 Pool, with lower water levels preventing upstream migration. These reduced wet season flows may also not have been conducive to reproduction by *L. unicolor* which may explain the absence of the smallest size class (<30 mm). These lower water levels and the impediment to upstream migration may explain the absence of fish over 100 mm as seen in all other seasons (Figure *L. unicolor* box plot). However, the continued presence *L. unicolor* in the larger size classes to the previous season indicates that the fish population is stable and resilient within the pool even without recruitment from further downstream.

Further surveys will clarify the role of environmental stress and connectivity in determining fish presence. For example, whether extended dry season conditions result in decreased fish, or low wet seasons restrict connectivity and therefore fish movement.

Burrowing Toadlets (*Uperoleia* sp.), a genus that typically inhabits rocky creeks, were observed in the tadpole phase during December 2019 though were not observed during wet season sampling in 2022. This finding may be due to the breeding season occurring earlier and only the semi-aquatic adult stage being present at the time of sampling, which was not targeted by sampling methods. No further amphibian observations were recorded over the following seasons.

Table 3-3. Summary of fish species observed at Site 12 Pool with number of fish for each size class sampled in the Late Wet 2020, Late Dry 2020, Late Wet 2021 Late Dry 2021 and Late Wet 2022. CPUE (catch per unit effort) calculated for each species and sampling date.

Species	Size class (mm)	Late Wet (2020)		Late Dry (2020)		Late Wet (2021)		Late Dry (2021)		Late Wet (2022)	
		Fish Count	CPUE ¹	Fish Count	CPUE ¹	Fish Count	CPUE ¹	Fish Count	CPUE ¹	Fish Count	CPUE ¹
<i>Melanotaenia australis</i>		196	12.6	111	7.1	25	1.6	48	3.1	7	0.5
	0 – 30	0		7		6		0		0	
	30 – 60	84		18		16		43		3	
	60 – 90	112		86		3		5		4	
<i>Neosilurus hyrtlilii</i>		37	2.4	50	3.2	10	0.6	26	1.6	0	0
	60 – 90	16		4		4		11		0	
	>90	21		46		6		15		0	
<i>Leiopotherapon unicolor</i>		24	1.5	52	3.3	20	1.3	21	1.4	16	1.0
	0 – 30	0		0		2		0		0	
	30 – 60	7		5		12		5		2	
	60 – 90	10		32		5		12		12	
	> 90	7		15		1		4		2	
Total		257	16.6	213	13.7	55	3.5	95	6.1	23	1.5

¹ CPUE is catch per unit effort, a measure of relative abundance. Effort is fyke net set for 15.5 hours.

No fish data collected in the Late Dry 2022 due to pool being dry at the time of sampling.

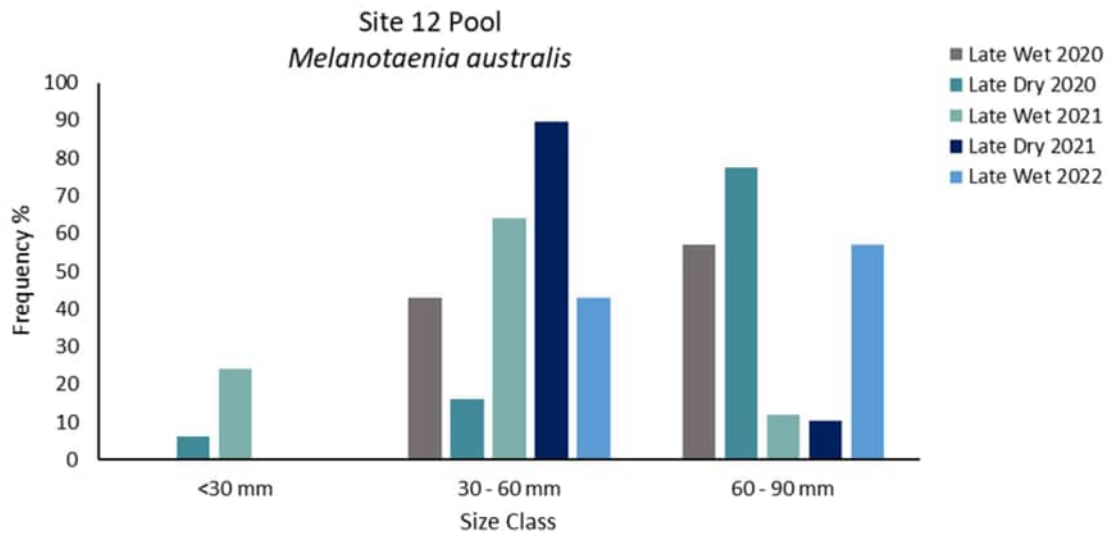


Figure 3-10 Frequency (%) of occurrence for each length class (SL, mm) of *Melanotaenia australis* sampled in Site 12 Pool in the Late Wet 2020, Late Dry 2020, Late Wet 2021 and Late Wet 2022. No fish data collected in the Late Dry 2022 due to pool being dry at the time of sampling.

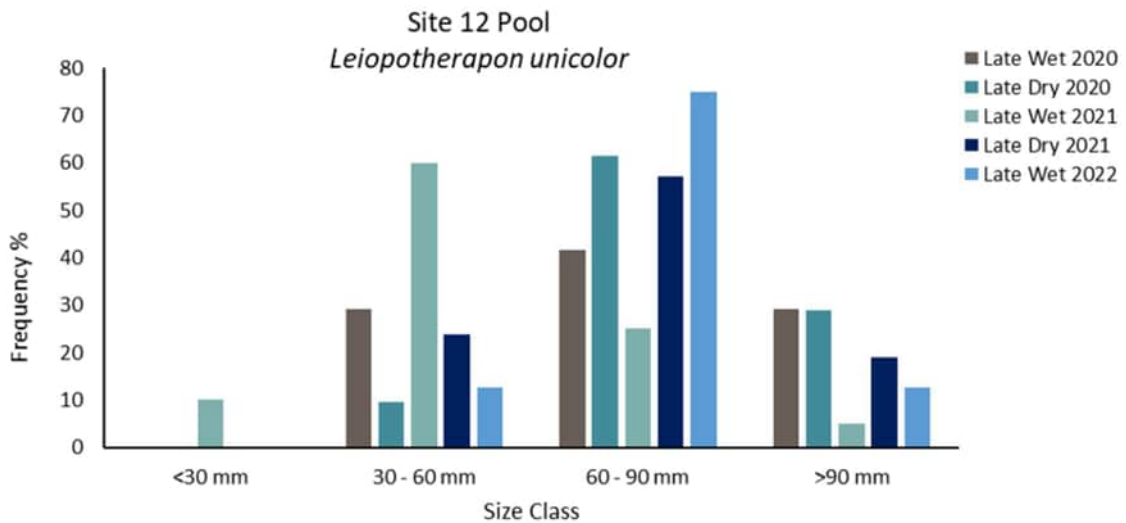


Figure 3-11. Frequency (%) of occurrence for each standard length class (SL, mm) of *Leiopotherapon unicolor* sampled in Site 12 Pool in the Late Wet 2020, Late Dry 2020, Late Wet 2021 and Late Wet 2022. No fish data collected in the Late Dry 2022 due to pool being dry at the time of sampling.

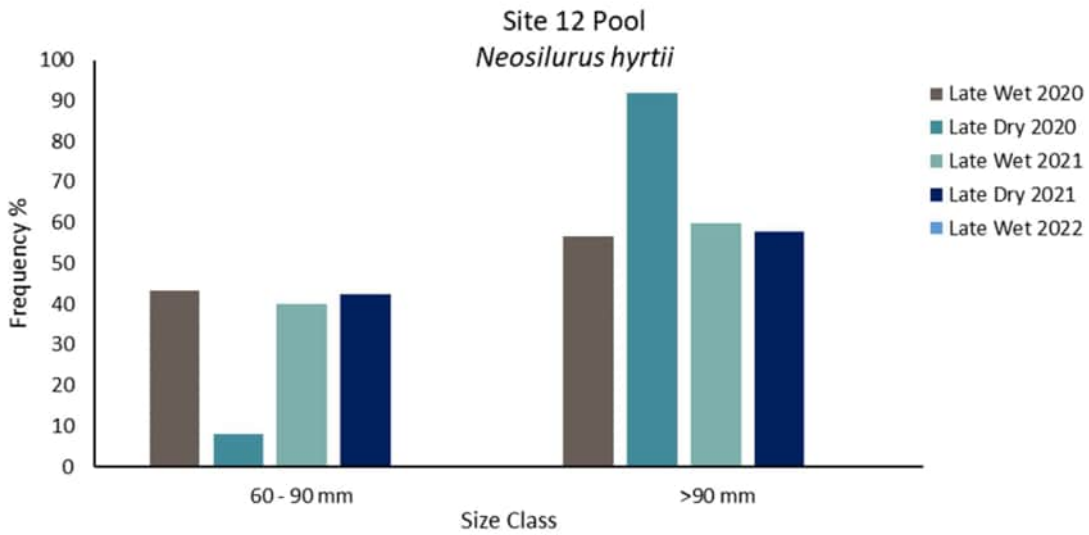


Figure 3-12. Frequency (%) of occurrence for each length class (SL, mm) of *Neosilurus hyrtii* sampled in Site 12 Pool in the Late Wet 2020, Late Dry 2020, Late Wet 2021, Late Dry 2021 and Late Wet 2022. No fish data collected in the Late Dry 2022 due to pool being dry at the time of sampling.

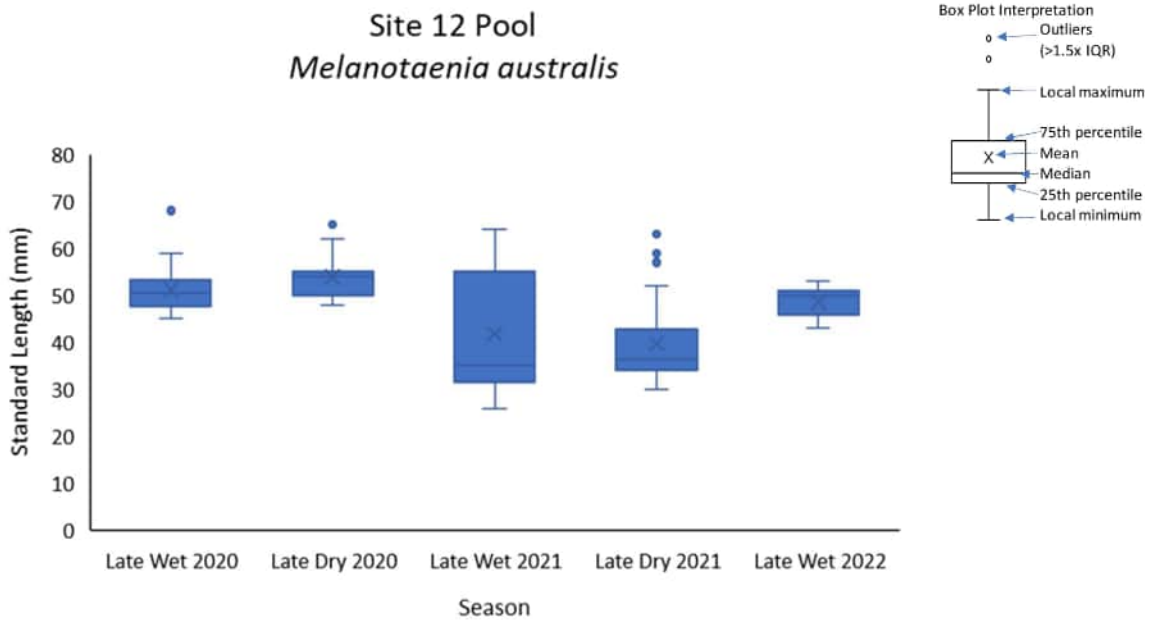


Figure 3-13. Distribution of standard length (SL, mm) of *Melanotaenia australis* sampled in Site 12 Pool in the Late Wet 2020, Late Dry 2020, Late Wet 2021, Late Dry 2021 and Late Wet 2022. No fish data collected in the Late Dry 2022 due to pool being dry at the time of sampling.

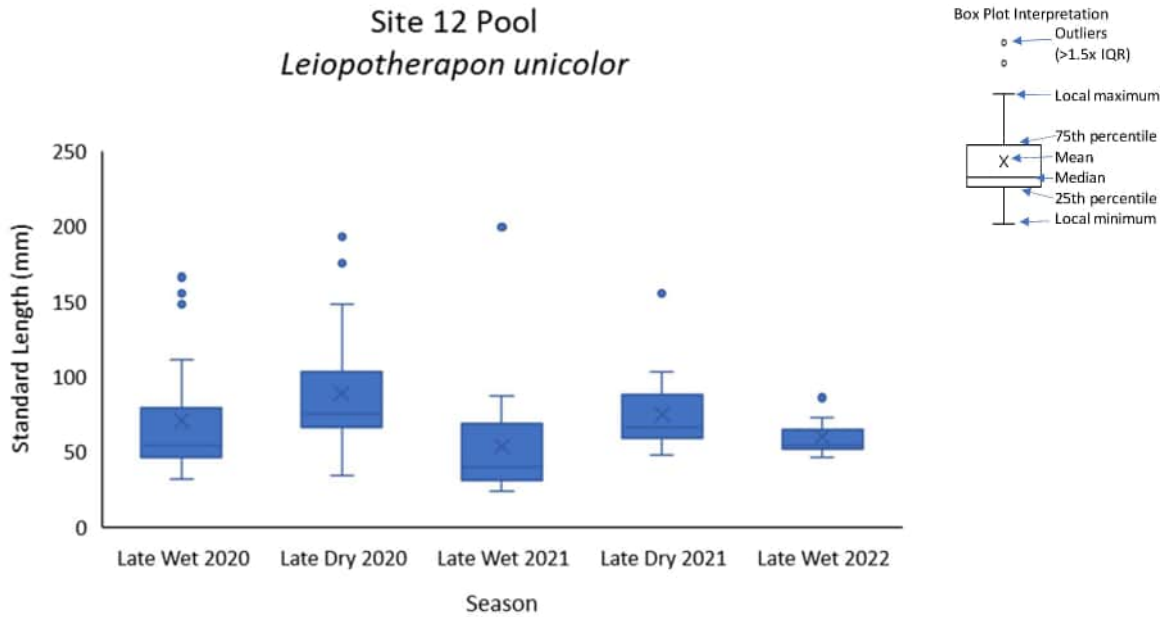


Figure 3-14 Distribution of standard length (SL, mm) of *Leiopotherapon unicolor* sampled in Site 12 Pool in the Late Wet 2020, Late Dry 2020, Late Wet 2021, Late Dry 2021 and Late Wet 2022. No fish data collected in the Late Dry 2022 due to pool being dry at the time of sampling.

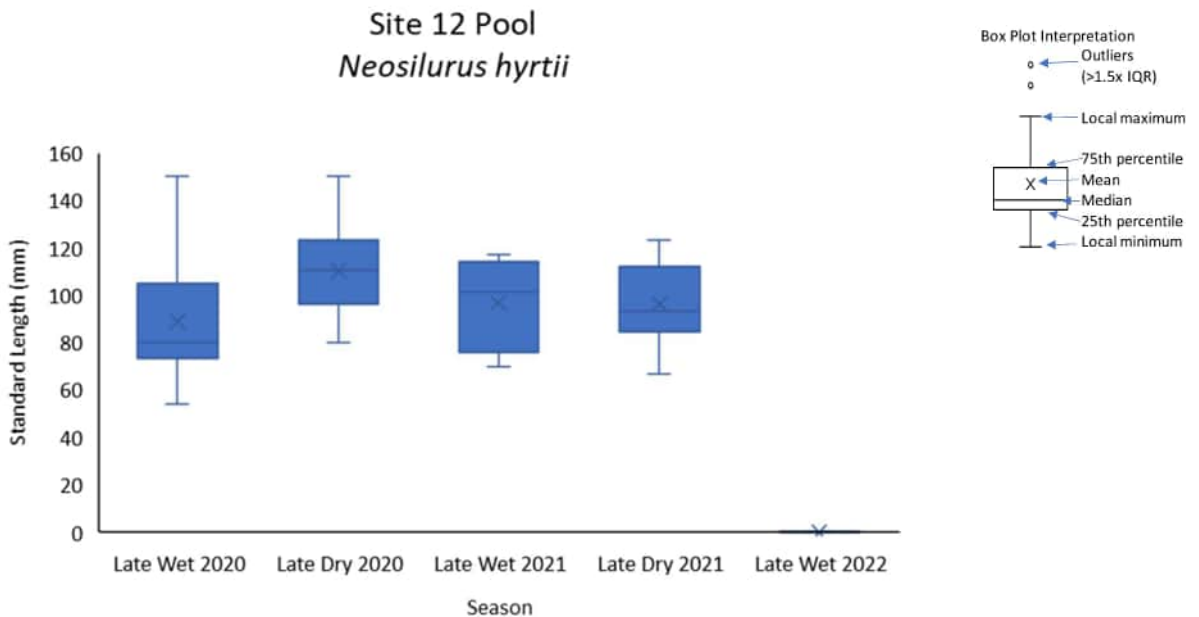


Figure 3-15 Distribution of standard length (SL, mm) of *Neosilurus hyrtii* sampled in Site 12 Pool in the Late Wet 2020, Late Dry 2020, Late Wet 2021, Late Dry 2021 and Late Wet 2022. No fish data collected in the Late Dry 2022 due to pool being dry at the time of sampling.



Figure 3-16 *Neosilurus hyrtlii* (Hyrtl's Catfish) in downstream remnant near Site 12 pool.

3.1.5 AQUATIC MACROINVERTEBRATES

Figure 3-17 presents the total abundance, taxa richness, EPT richness and SIGNAL2 scores for Site 12 Pool in the late wet seasons of 2020, 2021 and 2022, and the late dry seasons of 2020 and 2021. Macroinvertebrates samples were collected in the Late Dry 2022 from a downstream remnant pool as the main pool was dry. The key findings were as follows:

- Average macroinvertebrate abundance and taxonomic richness in the Late Dry 2022 were similar to the previous dry season (Figure 3-17a,b).
- In the Late Dry 2022, some taxa belonging to the sensitive Ephemeroptera, Plecoptera and Trichoptera (EPT) orders was recorded (EPT richness = 1) (Figure 3-17c). This is a slight increase from the previous Late Dry 2021 season but still lower than the Late Dry 2020 season (EPT richness = 0.5 and 2, respectively).

- The SIGNAL2 score (4.21) for Late Dry 2022 was the highest score for all seasons since 2020 (Figure 3-17d) indicating the community is becoming dominated by macroinvertebrate families that are sensitive to pollution.

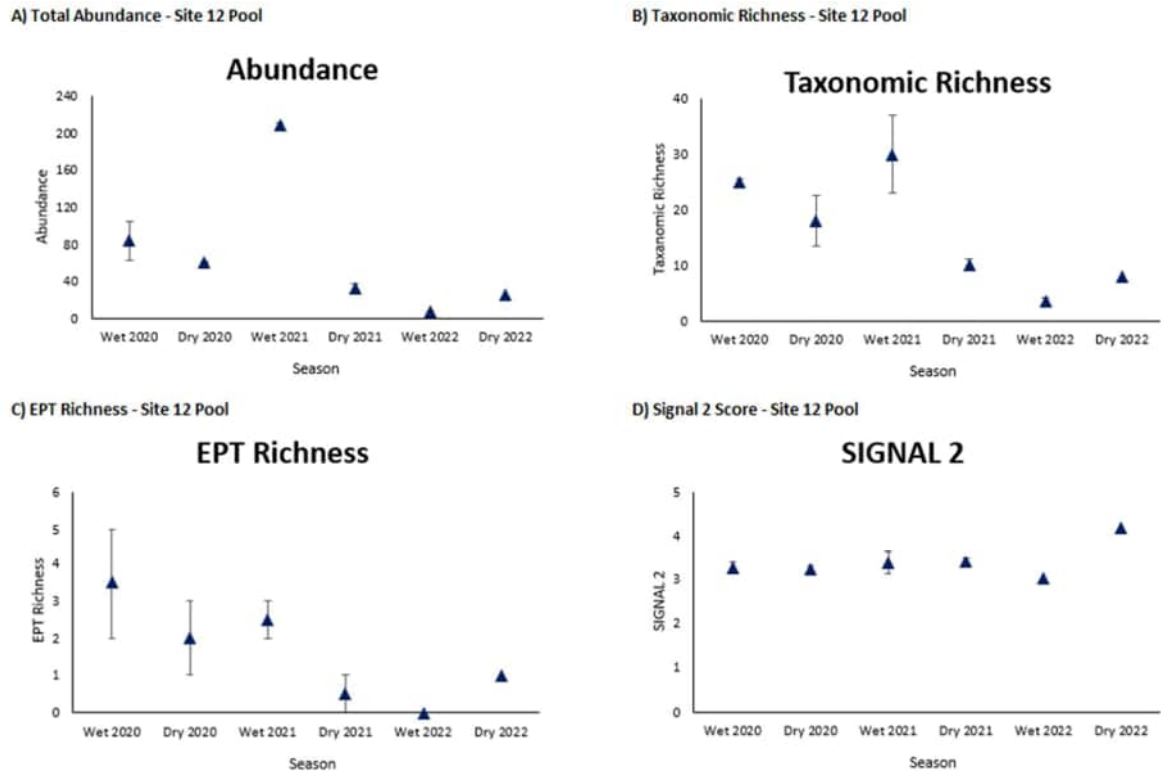


Figure 3-17 Macroinvertebrate indices for Site 12 Pool – Late Wet 2020, Late Dry 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022 and Late Dry 2022 seasons.

The abundance of taxa for the six seasonal surveys is provided in Figure 3-18 and shows taxa ranging from the most abundant (left) to the least abundant (right) along the x-axis. The abundance of taxa in the Late Dry 2022 was similar to previous dry seasons with few macroinvertebrates sampled and were dominated by mites and ticks belonging to the Acarina subclass. Oligochaete worms, Stratiomyidae (soldier flies), Gomphidae (dragonflies) and Hydraenidae (aquatic beetles) were more abundant in the 2022 dry season than the previous 2021 dry season. The non-biting midge Chironominae was similarly abundant in all sampling events apart from the 2021 dry, 2022 wet and dry seasons.

No macroinvertebrate species of conservation significance were found at Site 12 Pool.

Site 12 Pool

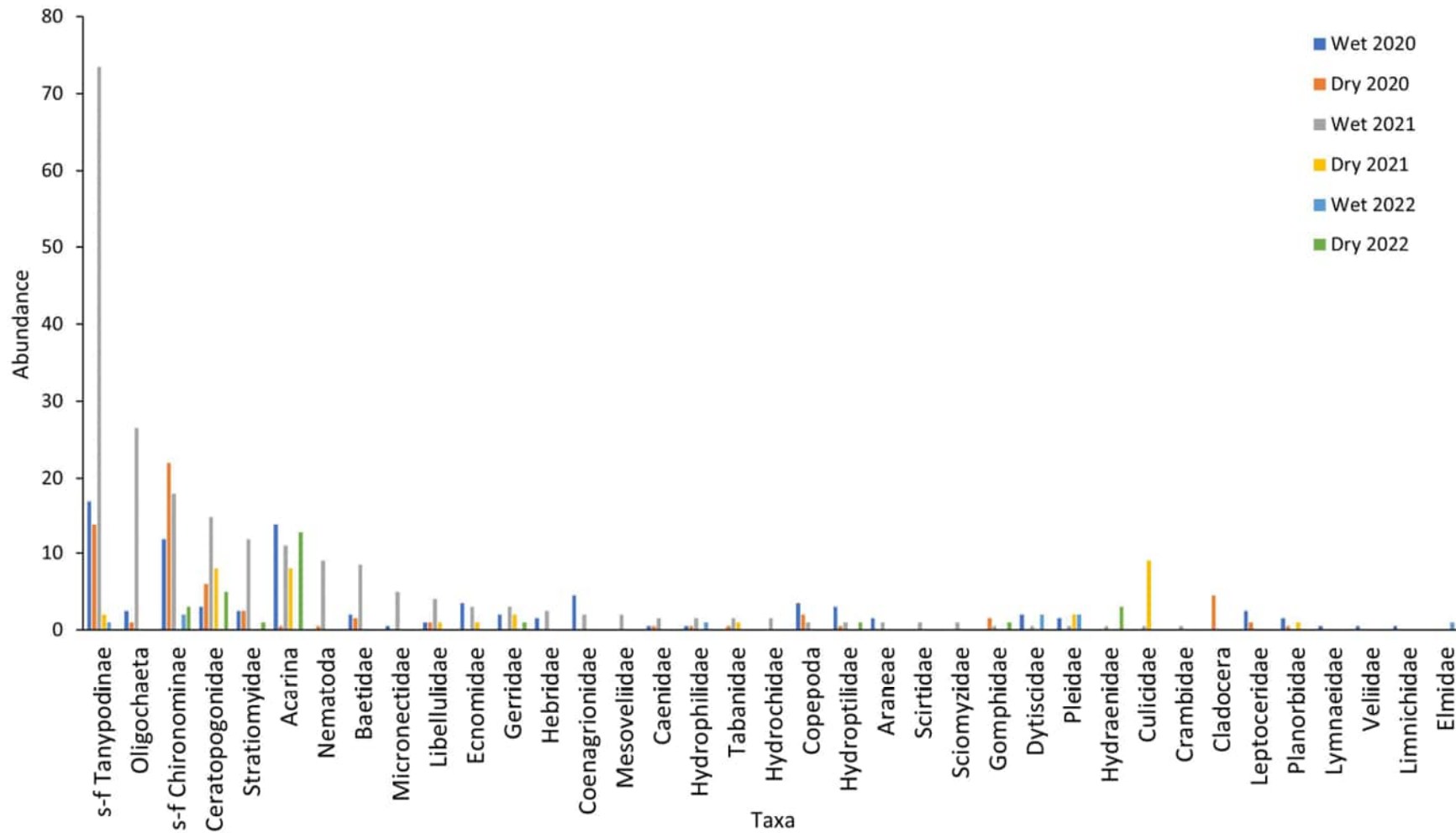


Figure 3-18 Average abundances of all macroinvertebrate taxa at Site 12 Pool in the Late Wet 2020, Late Dry 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022 and Late Dry 2022 seasons, with taxa arranged from most abundant (left) to least abundant (right) along the x-axis.

3.1.6 DIATOMS AND PHYTOPLANKTON

3.1.6.1 DIATOMS

The Late Wet 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022 and Late Dry 2022 results are presented. The Late Dry 2020 diatom samples were not analysed as there was a major flow event during the four-week sampler deployment time and, therefore, the samples were not considered representative or useful.

The two replicates of diatom samples were collected from a downstream remnant pool at Site 12 and species, abundance and biotic indices were recorded. Overall, a total of 77 diatom species were recorded (Table 3-4) across the two replicates and five seasonal sampling rounds. 6 new species were found during the Late Dry 2022 season, *Encyonopsis perborealis*, *Cymbella gracilis*, *Craticula halophila*, *Cyclotella meneghiniana*, *Encyonema silesiacum* and *Brachysira stryiaca*. The most abundant species in the Late Dry 2022 was *Mastogloia elliptica* (average count = 209; Table 3-4) followed by *Mastogloia smithii* (average count = 21; Table 3-4).

The Late Dry 2022 species richness (17) and DSIAR score (16.2) was lower than all previous seasons. This could be due to the relatively dry 2022 wet season and a dry 2022 dry season, with reduced rainfall and flow events. The tolerance to environmental stress for Site 12 Pool is high as reflected in low DSIAR scores for the Late Dry 2022 season which is a significant change from the moderate sensitivity from previous seasons (48 to 55 across the replicates and seasonal surveys of Late Dry 2020 and 2021 and Late Wet 2021 and 2022).

Table 3-4 Summary of Site 12 Pool diatom average count per species, total abundance, species richness and DSIAR score in Late Wet 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022 and Late Dry 2022.

Taxon name	Dry 2020	Wet 2021	Dry 2021	Wet 2022	Dry 2022
<i>Mastogloia elliptica</i>	0	6	0	5	209
<i>Mastogloia smithii</i>	0	174	186	37	21
<i>Encyonopsis perborealis</i>	0	0	0	0	18
<i>Navicymbula pusilla</i>	0	0	37	24	15
<i>Nitzschia palea</i>	0	0	1	90	15
<i>Fragilaria acus</i>	0	11	6	0	14
<i>Achnantheidium minutissimum</i>	0	34	0	6	13
<i>Brachysira vitrea</i>	0	2	0	0	7
<i>Ulnaria ulna</i>	0	26	12	1	6
<i>Cymbella gracilis</i>	0	0	0	0	6
<i>Navicula aff. Bryophila</i>	0	0	9	0	6
<i>Craticula halophila</i>	0	0	0	0	4
<i>Cyclotella meneghiniana</i>	0	0	0	0	3
<i>Gomphonema affine</i>	0	0	0	2	3
<i>Encyonema silesiacum</i>	0	0	0	0	2
<i>Nitzschia microcephala</i>	0	0	7	38	1
<i>Brachysira stryiaca</i>	0	0	0	0	1

Taxon name	Dry 2020	Wet 2021	Dry 2021	Wet 2022	Dry 2022
<i>Achnanthes brevipes</i>	77	0	0	0	0
<i>Achnanthes exigua</i>	0	0	0	2	0
<i>Achnanthes impexa</i>	14	0	0	0	0
<i>Achnanthes subexigua</i>	9	0	0	0	0
<i>Achnantheidium exiguum</i>	6	0	0	0	0
<i>Achnantheidium kryophila</i>	3	0	0	0	0
<i>Achnantheidium lineare</i>	2	0	0	0	0
<i>Achnantheidium minutissimum var affine</i>	1	0	0	0	0
<i>Adlafia spp.</i>	0	0	0	5	0
<i>Caloneis clevei</i>	0	0	0	2	0
<i>Cymbella spp</i>	0	1	1	0	0
<i>Diploneis ovalis</i>	0	0	0	3	0
<i>Diploneis parma</i>	0	2	0	0	0
<i>Encyonema minutum</i>	0	0	0	1	0
<i>Encyonopsis microcephala</i>	0	0	15	0	0
<i>Epithemia gibba</i>	0	4	0	0	0
<i>Eunotia arcus</i>	0	6	0	0	0
<i>Eunotia bilunaris</i>	0	9	2	0	0
<i>Eunotia incisa</i>	0	0	2	0	0
<i>Eunotia tenera</i>	0	2	0	0	0
<i>Fragilaria capucina var gracilis</i>	0	1	0	0	0
<i>Gomphonema angustum</i>	0	0	0	3	0
<i>Gomphonema sp.</i>	0	0	0	1	0
<i>Navicula cincta</i>	0	0	2	0	0
<i>Navicula gregaria</i>	0	1	1	0	0
<i>Navicula lanceolata</i>	0	1	0	0	0
<i>Navicula leptostriata</i>	0	0	4	0	0
<i>Navicula menisculus</i>	0	0	4	0	0
<i>Navicula tenelloides</i>	0	0	0	2	0
<i>Nitzschia acicularis</i>	0	0	1	0	0
<i>Nitzschia agnita</i>	0	0	0	3	0
<i>Nitzschia filiformis</i>	0	1	0	0	0
<i>Nitzschia fonticola</i>	0	0	2	0	0
<i>Nitzschia frustulum</i>	0	2	0	4	0

Taxon name	Dry 2020	Wet 2021	Dry 2021	Wet 2022	Dry 2022
<i>Nitzschia girdle</i>	0	0	0	3	0
<i>Nitzschia graciliformis</i>	0	0	1	0	0
<i>Nitzschia gracilis</i>	0	0	0	15	0
<i>Nitzschia inconspicua</i>	0	0	2	1	0
<i>Nitzschia intermedia</i>	0	0	2	0	0
<i>Nitzschia linearis</i>	0	0	4	1	0
<i>Nitzschia palea var debilis</i>	0	0	0	6	0
<i>Nitzschia perminuta</i>	0	0	1	8	0
<i>Nitzschia pumilla</i>	0	1	0	0	0
<i>Nitzschia pura</i>	0	0	0	10	0
<i>Nitzschia reversa</i>	0	0	2	0	0
<i>Nitzschia solita</i>	0	0	1	0	0
<i>Nitzschia sp.</i>	0	0	0	3	0
<i>Nitzschia subacicularis</i>	0	0	0	5	0
<i>Pinnularia borealis</i>	0	0	1	0	0
<i>Pinnularia gibba</i>	0	0	0	1	0
<i>Pinnularia legumen</i>	0	0	1	0	0
<i>Pinnularia spp.</i>	0	1	0	0	0
<i>Planothidium delicatulum</i>	0	0	0	1	0
<i>Planothidium frequentissimum</i>	0	2	0	0	0
<i>Stauroneis pachycephala</i>	0	0	1	0	0
<i>Surirella brebissonii</i>	0	0	2	0	0
<i>Surirella elegans</i>	0	1	0	0	0
<i>Tryblionella calida</i>	0	1	0	0	0
<i>Ulnaria acus</i>	0	0	0	23	0
<i>Ulnaria girdle</i>	0	0	0	1	0
Total Count	112	289	310	302	342
Species Richness	7	22	28	31	17
DSIAR Score	54.5	52.5	49.5	51	16.2

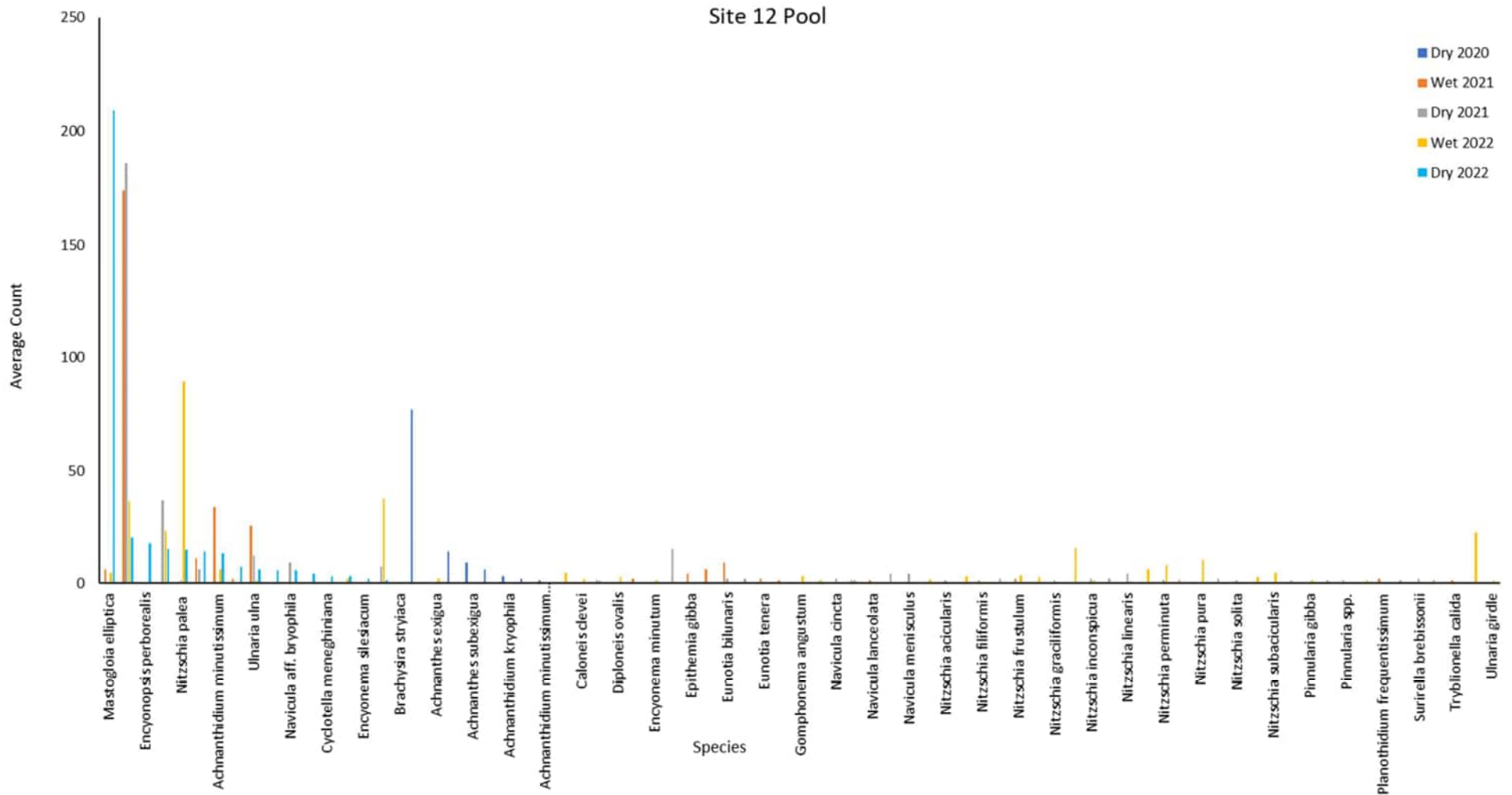


Figure 3-19 Average species abundance (diatom count per replicate) for diatoms sampled at Site 12 Pool in the Late Wet 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022 and Late Dry 2022. Arranged most abundant Late Dry 2022 left to right.

3.1.6.2 PHYTOPLANKTON

As noted in Section 3.1.6.1, in the Late Dry 2020 sampling, the Diatom samplers (periphytometers) did not record meaningful data, as such, water samples were taken from the site to analyse a full phytoplankton profile for the site. This was repeated in the Late Dry 2021 survey for completeness and comparison of results.

As Site 12 Pool was dry during the Late Dry 2022 survey all samples were collected from a small pool located downstream and the phytoplankton composition is reported here. Six classes of phytoplankton recorded in the Late Dry 2022 sampling (Table 3-5), with Cyanobacteria contributing the largest percentage of taxa. As there was only one class (Prasinophyceae) recorded during Late Wet 2022, this indicates that during the Late Dry 2022, the development of water column algal populations has been able to occur due to less water movement. This is consistent with the phytoplankton in Late Dry 2022 being sampled from a remanent pool. Prasinophyceae is only present in a small percentage which indicates with less water movement, other classes dominate the water column during the dry season. In contrast to previous dry season sampling in Site 12 Pool there were no Dinophyceae in the remanent pool.

Table 3-5 Summary of phytoplankton analytical results for Site 12 Pool sampled in Late Dry 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022 and Late Dry 2022, abundance (cells L⁻¹) and percentage contribution (%), limit of reporting 10 cell L⁻¹.

Taxon	Late Dry 2020		Late Wet 2021		Late Dry 2021		Late Wet 2022		Late Dry 2022	
	Abundance	%	Abundance	%	Abundance	%	Abundance	%	Abundance	%
Bacillariophyceae	5200	2.27	20	100	0	0	0	0	2220	9.44
<i>Amphora spp</i>	400	0.28	0	0	0	0	0	0	280	1.19
<i>Navicula spp.</i>	1200	0.85	20000	100	0	0	0	0	470	2
<i>Mastogloia spp.</i>	0	0	0	0	0	0	0	0	1140	4.85
<i>Nitzschia spp.</i>	1200	0.85	0	0	0	0	0	0	0	0
<i>Synedra spp.</i>	400	0.28	0	0	0	0	0	0	330	1.4
Chlorophyceae	3200	2.27	0	0	70000	4.09	0	0	3570	15.18
<i>Closterium spp.</i>	1200	0.85	0	0	0	0	0	0	0	0
<i>Cosmarium spp.</i>	2000	1.42	0	0	0	0	0	0	160	0.68
<i>Dicosphaerium spp. (O)</i>	0	0	0	0	0	0	0	0	80	0.34
<i>Monoraphidium contorta</i>	0	0	0	0	0	0	0	0	420	1.79
<i>Monoraphidium spp</i>	0	0	0	0	20000	1.17	0	0	0	0
<i>Mougeotia spp.</i>	0	0	0	0	0	0	0	0	1900	8.08

Taxon	Late Dry 2020		Late Wet 2021		Late Dry 2021		Late Wet 2022		Late Dry 2022	
<i>Oocystis spp</i>	0	0	0	0	50000	2.92	0	0	380	1.62
<i>Tetraedon spp.</i>	0	0	0	0	0	0	0	0	10	0.04
Cryptophyceae	24000	17	0	0	30000	1.75	0	0	870	3.7
<i>Chroomonas spp.</i>	2400	1.7	0	0	0	0	0	0	550	2.34
<i>Cryptomonas spp.</i>	21600	15.3	0	0	30000	1.75	0	0	320	1.36
Cyanobacteria	8000	5.67	0	0	720000	42.11	0	0	16420	69.81
<i>Beaded Cyanobacteria Filaments</i>	0	0	0	0	0	0	0	0	240	1.02
<i>Chroococcus spp.</i>	1600	1.13	0	0	40000	2.34	0	0	0	0
<i>Merismopedia spp.</i>	0	0	0	0	0	0	0	0	320	1.36
<i>Microcystis spp (O) (PT)</i>	0	0	0	0	0	0	0	0	5440	23.13
<i>Phormidium spp (O) (PT)</i>	0	0	0	0	0	0	0	0	2240	9.52
<i>Planktolyngbya spp.</i>	6400	4.53	0	0	0	0	0	0	380	1.62
<i>Pseudanabaena spp</i>	0	0	0	0	30000	1.74	0	0	1360	5.78
<i>Synechococcus spp.</i>	0	0	0	0	0	0	0	0	6440	27.38
<i>Aphanothece spp</i>	0	0	0	0	650000	38.01	0	0	0	0
Dinophyceae	102800	72.8	0	0	40000	2.34	0	0	0	0
<i>Gonyaulax spp.</i>	42800	30.31	0	0	0	0	0	0	0	0

Taxon	Late Dry 2020		Late Wet 2021		Late Dry 2021		Late Wet 2022		Late Dry 2022	
<i>Peridinium spp.</i>	60000	42.49	0	0	40000	2.32	0	0	0	0
Euglenophyceae	0	0	0	0	0	0	0	0	70	0.3
<i>Euglena spp. (O)</i>	0	0	0	0	0	0	0	0	10	0.04
<i>Phacus spp.</i>	0	0	0	0	0	0	0	0	40	0.17
<i>Trachelomonas spp.</i>	0	0	0	0	0	0	0	0	20	0.09
Prasinophyceae	0	0	0	0	850000	49.71	50000	100	370	1.57
<i>Prasinophytes (unknown)</i>	0	0	0	0	850000	49.71	50000	100	370	1.57

3.1.7 MACROPHYTES

A diverse range of native flora was observed within Site 12 Pool. These comprised aquatic species and groundwater-dependent species. These species are likely not surface water inflow dependent, as the pool refills with groundwater within 2 – 3 weeks following flushing events.

During all surveys (Late Wet 2020, Late Dry 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022 and Late Dry 2022), a total of seven common macrophyte species were observed belonging to five families (Table 3-6). Macrophytes observed at Site 12 Pool included Bulrush reeds (*Typha sp.*), sedges (*Cyperus sp.*), two charophytes (*Nitella sp.* And *Chara sp.*), as well as two submerged macrophytes (*Vallisneria sp.* And *Myriophyllum sp.*) (Figure 3-20). Table 3-6 summarises the macrophyte species observed at Site 12 Pool.

No substantial changes in macrophyte composition were observed at the Site 12 Pool over the seven surveys. Some senescence of sedges in the Late Wet 2022 was noted, though no changes were substantial enough to alter the categorical abundance classification.

The types and species of macrophytes present in a system are indicators of water quality and ecological health. The abundance and diversity of macrophytes at Site 12 Pool plays a key role in nutrient dynamics, indicates that water quality parameters (e.g., turbidity, salinity) have not reached levels that interfere with macrophyte growth and development and provides habitat structure and refuges to organisms. For example, the macrophyte habitat and its' structural complexity likely provide refuge to the *M. australis* (western rainbowfish) from predation by adult *L. unicolor* (spangled perch).

Table 3-6. Summary of macrophyte species abundance, with family name and common name observed at Site 12 Pool during sampling in the Late Wet 2020, Late Dry 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022 and Late Dry 2022.

Common name	Species name	Late Wet 2020 Abundance ¹	Late Dry 2020 Abundance ¹	Late Wet 2021 Abundance ¹	Late Dry 2021 Abundance ¹	Late Wet 2022 Abundance ¹	Late Dry 2022 Abundance ¹
Ribbon weed	<i>Vallisneria sp.</i>	Isolated	Isolated	Isolated	Isolated	Isolated	Isolated
Charophytes	<i>Nitella sp.</i> , <i>Chara sp.</i>	Isolated	Isolated	Isolated	Isolated	Isolated	Isolated
Clubrush	<i>Schoenoplectus sp.</i>	Isolated	Isolated	Isolated	Isolated	Isolated	Isolated
Sedges	Cyperaceae	Isolated	Isolated	Isolated	Isolated	Isolated	Isolated
Bulrush	<i>Typha sp.</i>	Isolated	Isolated	Isolated	Isolated	Isolated	Isolated

¹ Abundance based on *Western Australia AUSRIVAS field sampling and habitat assessment sheet* (DoW, 2009).

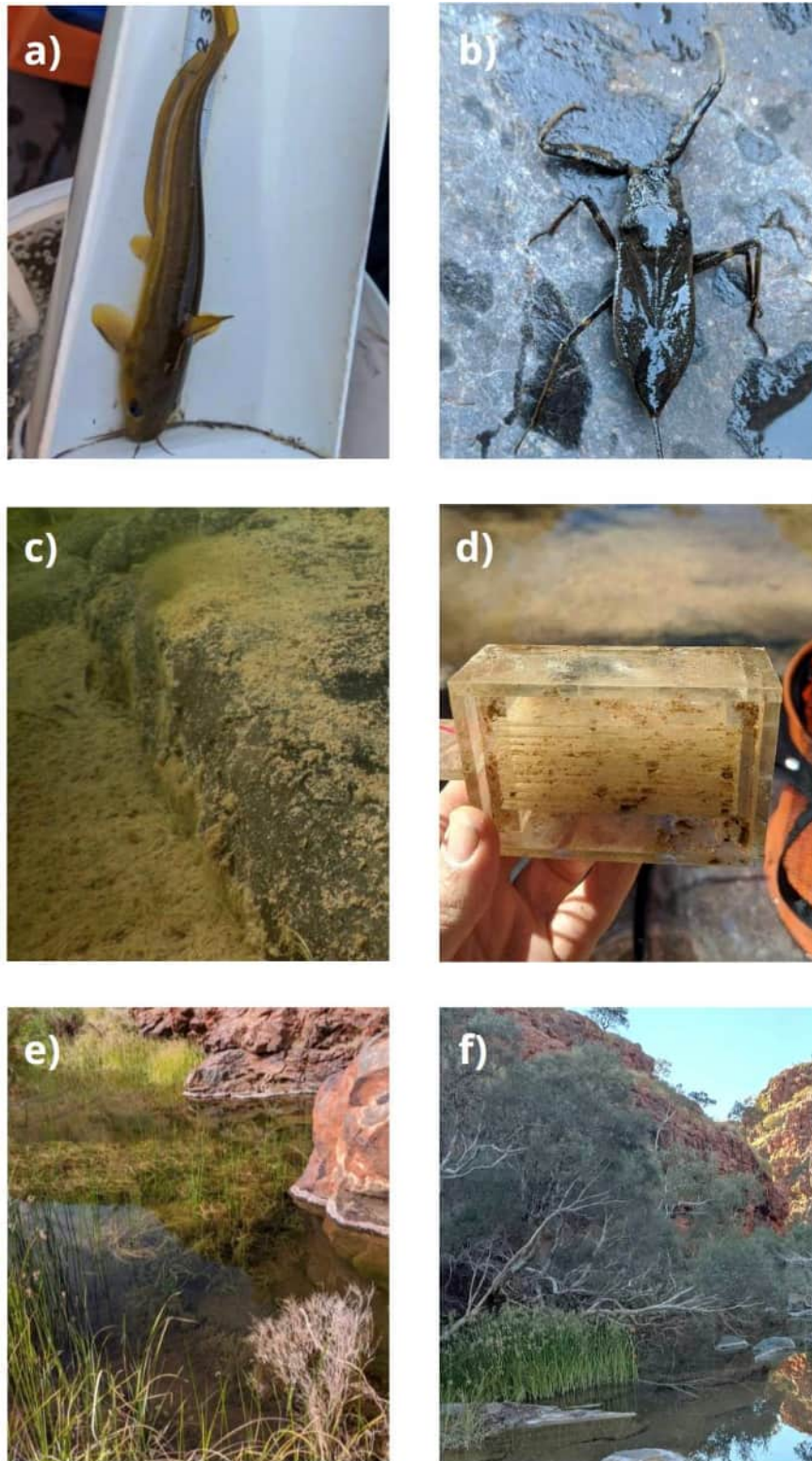


Figure 3-20 Site 12 Pool aquatic ecology. A) *Neosilurus hyrtlil* found at Site 12 Pool and no other surveyed pools; b) *Belostomatidae*, a giant water bug that typically hunts amongst macrophytes; c) bedrock covered in benthic algae; d) periphytometer used to sample diatoms shows benthic algae growth; e) and f) submerged and emergent macrophytes

3.1.8 ENVIRONMENTAL VALUE

The Site 12 Pool area provides a habitat to a diverse range of fauna and flora including the EPBC Act (1999) listed Pilbara Olive Python (*Liasis olivaceus barroni*) (vulnerable), Northern Quoll (*Dasyurus hallucatus*) (endangered) and the Pilbara Leaf-nosed Bat (*Rhinonictis aurantia*) (vulnerable). As such the series of pools that constitute this site are considered to have significant environmental value and are subject to its own Water Quality and Quantity Monitoring Plan (WQQMP) under Condition 12 of Ministerial Statement (MS) 993. The ephemeral nature of the pool is dependent on groundwater levels being sufficiently high to be expressed at the surface and periodic freshwater flushing after rainfall events, indicating that significant alterations to catchment hydrology could adversely affect the vulnerable species that utilise the pools. In addition, the Dinner-plate Turtle (*Chelodina steindachneri*), a species endemic to Western Australia and one of the least known Australian turtles, as well as Burrowing Toadlets (*Uperoleia* sp.), which are widespread throughout Australia, have also been sighted at the pool, though neither are listed threatened or conservation significant species.

The abundance of three native fish species Western Rainbowfish (*Melanotaenia australis*), Spangled Perch (*Leiopotherapon unicolor*) and Hyrtl's Catfish (*Neosilurus hyrtlii*) in various life stages indicates that Site 12 Pool plays an important habitat for the exploitation of these fish species, often through upstream migration. As this pool has naturally slightly elevated copper content it is likely the freshwater fish found here have adapted to these conditions. However, it should be noted that sub-lethal to lethal concentrations of copper can lead to detrimental effects of freshwater adult fish, leading to lifecycle and recruitment disruption in those species (ANZECC & ARMCANZ, 2000).

Connectivity to pools through ongoing groundwater discharge and flow-through is an important factor for this ecology of this system. Maintaining periods of elevated groundwater levels is likely to be more important than flow velocities or short duration flushing events. This pool is of conservation significance as a habitat for the Pilbara Olive Python, which has been sighted at the pool previously. The site is also notable as it provides a habitat for the Dinner-Plate Turtle, which is not only endemic to Western Australia, but is one of the least studied turtles in Australia. Site 12 Pool is the only location the Dinner-Plate Turtle and the Hyrtl's Catfish have been observed at Iron Bridge.

3.2 FIG POOL (IB_SW_POOL_Fig)

Fig Pool is an isolated small pool that lies at the base of a rockface (Figure 3-21) with a small catchment area of 0.16 km² (Figure 3-22). It is characterised by stable water levels maintained by fresh groundwater. A relatively low abundance and diversity of aquatic flora and fauna inhabit the pool, likely due to it being naturally acidic. For example, fish and macrophytes are absent in the pool. It is a bedrock dominated habitat with the primary structural complexity provided by the roots of *Melaleuca leucadendra* (paperbark tree).



Figure 3-21 Fig Pool is a small, acidic pool that lies below a rockface and is surrounded by *Melaleuca leucadendra* (paper bark tree) of which the roots are a dominant feature.

3.2.1 SITE SPECIFIC TRIGGER VALUES

For most parameters and analytes the default guidelines (ANZG 2018a) will provide sufficient trigger values. However, site specific triggers should be developed for SPC, TDS and pH which will lead to the investigation when the long-term rolling median values exceed the 80th percentile of the baseline data collected up to this point. As dissolved zinc exceeded the default guidelines (ANZG 2018a) trigger values in three of the four surveyed dry seasons a site-specific trigger value for the dry season can be implemented, with the wet season retaining the generalised DGV (ANZG 2018a). In addition to the long-term 80th

percentile median trigger, an instant value of exceedances over the 95th percentile median value could trigger investigation.

In terms of ecological triggers, the low pH of the pool has a limiting effect on ecological functioning, with no fish species being recorded, depauperate in terms of diatom and phytoplankton species and only recent indications of frog habitation. Any increases in these ecological measures may indicate changing water quality and should trigger investigation.

3.2.2 WATER QUALITY AND HYDROLOGY

Water quality sampling results, including physio-chemical parameters, metals analysis, major ions, and stable isotope analysis to characterise the surface water system and its connectivity to groundwater are presented in Appendix A. Figure 3-23 displays a high-resolution water level, salinity (conductivity) and temperature logger record from Fig Pool for the wet seasons of 2019/2020 and 2020/2021 respectively, as well as late dry seasons 2020 and 2021. The data for the 2021/2022 wet season through to August 2022 was unable to be retrieved from the logger due to malfunction. Data was retrieved for the pool between August and November 2022.

Fig Pool is a small (~20 m³), shallow pool with water quality that varies minimally between seasons. The pool is largely sustained by groundwater and was periodically flushed with fresh surface water flows after rainfall events. It takes approximately 1 week for the groundwater to displace the surface water flows once a flushing event has occurred. Conductivity was typically fresh (~200 µS/cm) except during a surface water flow event when it would become extremely fresh (<20 µS/cm). Water levels were a maximum of ~0.06 m above the pool overflow levels during high-flow events, which typically lasted less than 24 hours before flows receded. The minimal change in water level indicates the pool remained approximately at its spill point level throughout the logging period. Due to the small catchment area (0.18 km²) and the gradient of Fig Pool's upstream and downstream environment, it is likely the pool has very limited connectivity to surface drainage.

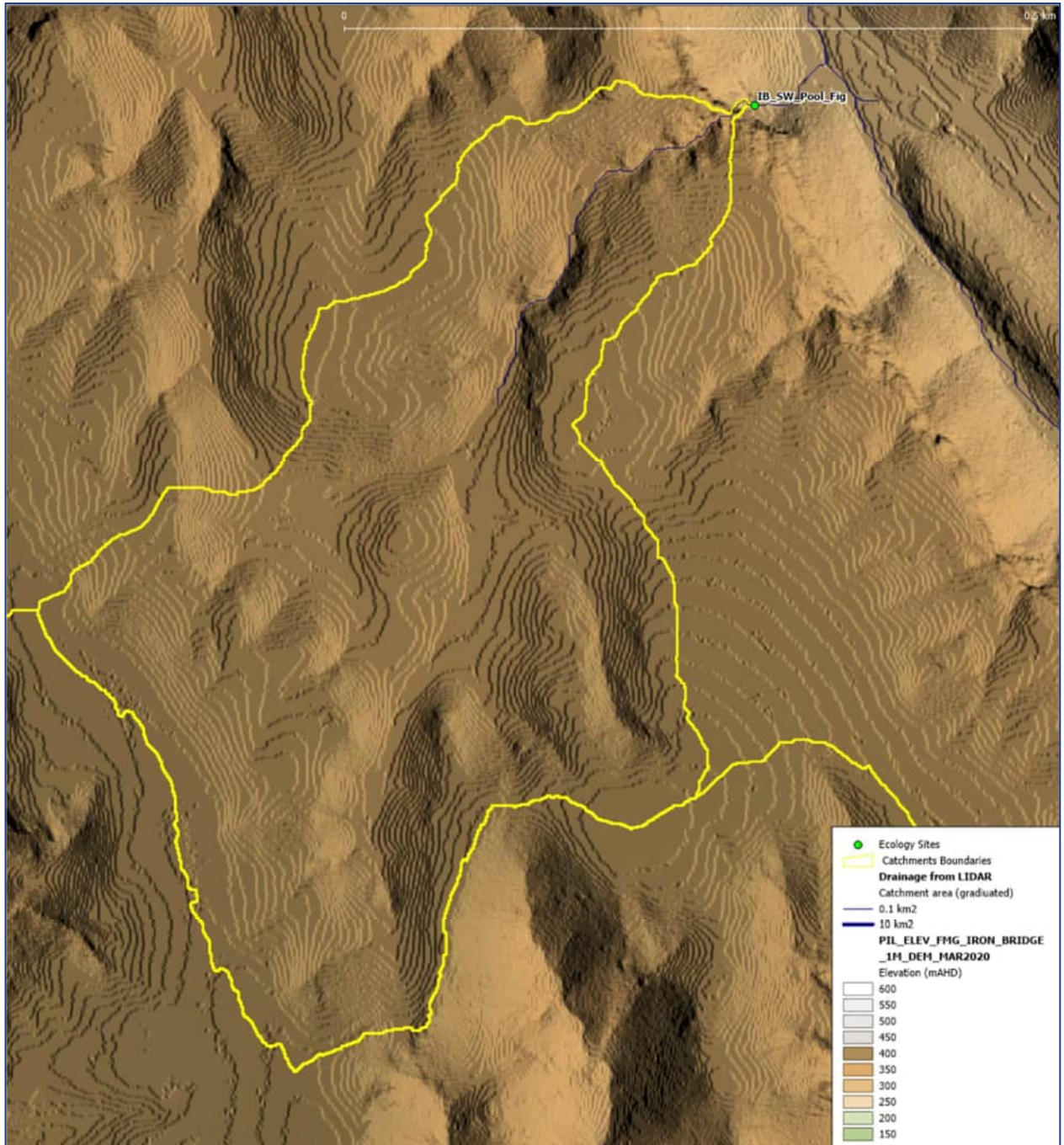


Figure 3-22 Fig Pool catchment area (0.18 km²)

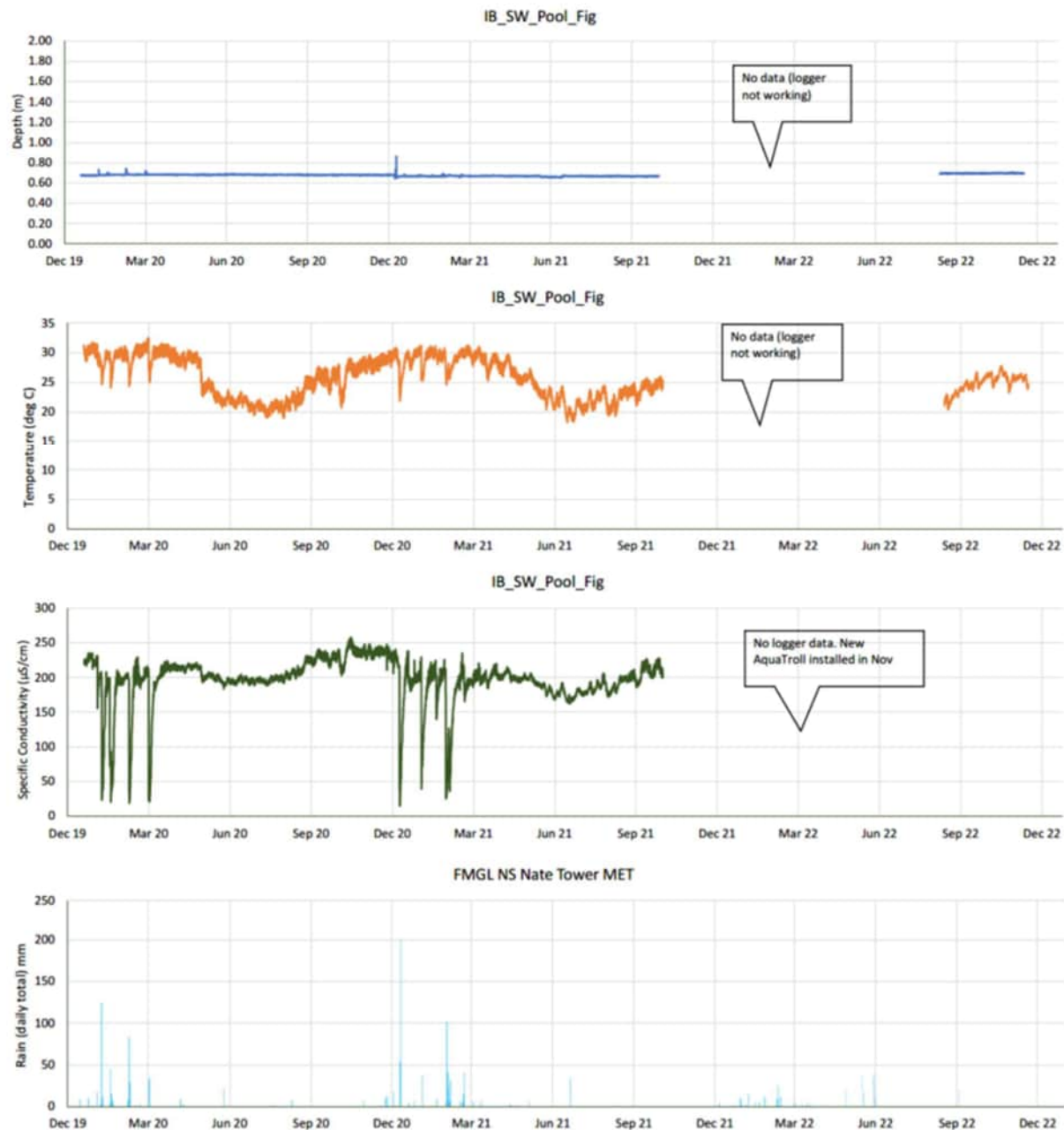


Figure 3-23 Fig Pool logger record from 19/12/2019 to 24/11/2022 for pool water depth (m), water temperature ($^{\circ}\text{C}$), Specific conductivity ($\mu\text{S}/\text{cm}$), and daily rainfall at FMG LNS Nate Tower MET. Data from October 2021 to August 2022 not able to be retrieved from faulty logger.

The major ion balance at Fig Pool was remarkably stable over the seven water sampling events (Late Dry 2019, Late Wet 2020, Late Dry 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022, and Late Dry 2022). The water quality was clear (turbidity = <1 NTU), acidic (pH = 4.03) and a sodium sulphate dominated water type (Table 3-7; Figure 3-24). Although the pH at this site is low, the mean acidity levels are only moderate

to low (14.75 mg/L as CaCO₃). The concentrations of Aluminium and Zinc were the only dissolved metals that exceeded the ANZG (2018) 95% species protection levels.

Table 3-6. Summary of water quality analytical results for Fig Pool. Concentration for each analyte and analyte group described for Late Wet season 2020, Late Dry season 2020, Late Wet season 2021, Late Dry season 2021, Late Wet 2022, Late Dry 2022. Only dissolved metals with Default Guideline Values (DGV) were included in this table. Bolded values denote results above the 95% species protection levels ANZG (2018) DGVs.

Analyte/Water Quality Parameter	Mean	Median	Max	Min	Range	SE	95% Protection/DGV
Temp (°C)	25.3	23.75	29.2	22.4	6.8	1.35	
DO (%)	62.12	64.7	87.46	35.6	51.86	8.46	90
DO (mg/L)	5.04	5.285	7.21	2.73	4.48	0.73	
SPC (uS/cm)	190.53	196.2	202.8	172	30.8	5.34	
TDS (mg/L)	125.17	125	132	123	9	2.22	
pH	4.04	3.96	5.19	3.33	1.86	0.27	6.0-7.5
Turbidity (NTU)	-0.72	0.53	2.62	-9.62	12.24	2.45	15
Total Alkalinity as CaCO ₃	0.86	0.5	3	0.5	2.5	0.46	
Ammonium as N (mg/L)	0.005	0.005	0.005	0.005	0	-	0.006
Nitrite as N (mg/L)	0.005	0.005	0.005	0.005	0	-	0.03
Nitrate as N (mg/L)	0.005	0.005	0.005	0.005	0	-	0.03
Nitrite + Nitrate as N	0.011	0.005	0.03	0.005	0.025	0.005	0.03
Total Nitrogen as N	0.114	0.05	0.5	0.05	0.45	0.082	0.15
Total Phosphorus as P	0.0085	0.0075	0.02	0.005	0.015	0.003	0.01
Reactive Phosphorus as P	0.005	0.005	0.005	0.005	0	0	0.005
Dissolved Organic	1.08	0.5	4	0.5	3.5	0.78	
<i>Dissolved Metals</i>							
Aluminium (mg/L)	0.178	0.178	0.198	0.158	0.04	0.02	0.055
Arsenic (mg/L)	0.0003	0.0005	0.0005	0.0001	0.0004	0.00009	0.024(AsII),
Boron (mg/L)	0.069	0.078	0.09	0.025	0.065	0.013	0.94
Cadmium (mg/L)	0.00004	0.00005	0.00005	0.000025	0.000025	0.000005	0.0002
Chromium (mg/L)	0.0003	0.0005	0.0005	0.0001	0.0004	0.00009	0.001
Copper (mg/L)	0.0004	0.0005	0.0005	0.00025	0.00025	0.00005	0.0014
Lead (mg/L)	0.0004	0.0005	0.0005	0.0005	0	0	0.0034
Manganese (mg/L)	0.350	0.354	0.383	0.328	0.055	0.008	1.9
Nickel (mg/L)	0.009	0.0094	0.0105	0.008	0.0025	0.0004	0.011
Selenium (mg/L)	0.003	0.005	0.005	0.0001	0.0049	0.001	0.011
Zinc (mg/L)	0.015	0.00525	0.03	0.002	0.028	0.001	0.008

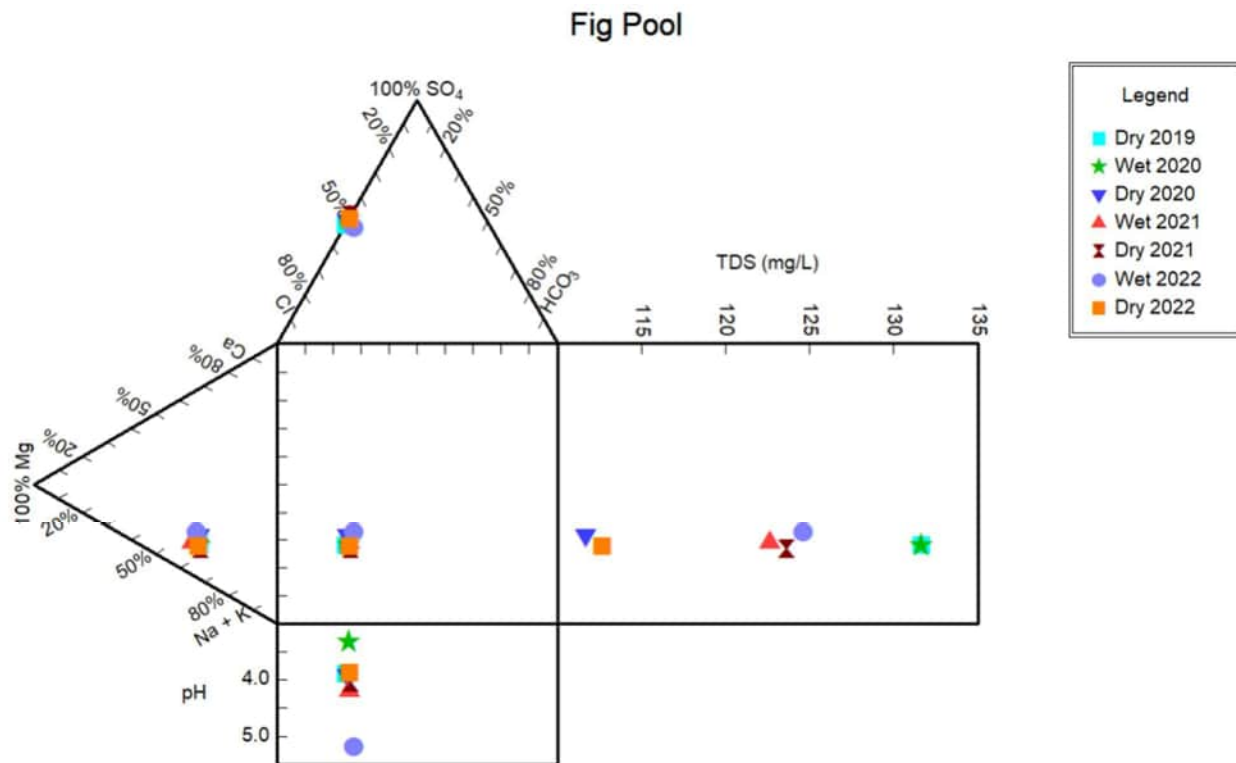


Figure 3-24 Durov diagram illustrates Fig Pool is a sodium-sulphate dominated water type. It is fresh, highly acidic pool with low total dissolved solids (TDS).

3.2.3 SEDIMENT QUALITY

Table 3-7 provides the surface sediment quality at Fig Pool during the Late Wet 2020, Late Dry 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022 and Late Dry 2022 surveys. Metal and metalloid concentrations were assessed against the ANZG (2018) DGVs. Arsenic concentrations exceeded the DGV (20 mg/kg) in the Late Dry 2022, however were below the GV-high (70 mg/kg). Cadmium concentrations exceeded the DGV (1.5 mg/kg) however were below the GV-high (10 mg/kg). As in previous seasons chromium concentrations exceeded the DGV (80 mg/kg) in the Late Dry 2022. Chromium naturally occurs at high concentrations across the Project area and were similarly above DGVs at most other surveyed surface water pools in the Project area. Dissolved iron concentrations increased in Late Dry 2022 as also seen in previous seasons.

Table 3-7. Summary of sediment analysis at Fig Pool sampled in Late Wet 2020, Late Dry 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022 and Late Dry 2022. Bolded values denote results above the ANZG (2018) DGVs.

4	Unit	ANZG value	Late Wet 2020	Late Dry 2020	Late Wet 2021	Late Dry 2021	Late Wet 2022	Late Dry 2022
Total Soluble Salts	mg/kg	-	248	-	384	278	393	785
Moisture Content (Dried @ 105-110°C)	%	-	-	38.3	37	52.6	66.4	92.6
Total Alkalinity as CaCO₃	mg/kg	-	2	<5	<5	<5	<5	6
Bicarbonate Alkalinity as CaCO₃	mg/kg	-	2	<5	<5	<5	11	6
Carbonate Alkalinity as CaCO₃	mg/kg	-	<1	<5	<5	<5	11	<5
Acidity	mg/kg	-	14	166	1000	753	452	1190
Sulfate as SO₄ 2- (soluble sulfate by ICPAES)	mg/kg	-	120	160	150	120	300	5330
Chloride (by Discrete Analyser)	mg/kg	-	<10	40	60	40	200	470
Calcium	mg/kg	-	30	<10	<10	<10	10	130
Magnesium	mg/kg	-	<10	10	10	20	20	120
Sodium	mg/kg	-	10	40	12	30	140	210
Potassium	mg/kg	-	10	30	10	40	110	180
Mercury (FIMS)	mg/kg	-	<0.1	-	0.2	0.1	0.2	<0.2
Nitrite + Nitrate as N (Sol.)	mg/kg	-	<0.1	<0.1	0.2	<0.1	0.2	<0.5
Total Kjeldahl Nitrogen as N	mg/kg	-	1110	1670	3030	1820	4930	4290
Total Nitrogen as N	mg/kg	-	1110	1670	3030	1820	4930	4290
Total Phosphorus as P	mg/kg	-	60	223	310	238	301	572
Reactive Phosphorus as P	mg/kg	-	<0.1	<0.1	<0.1	<0.1	<0.1	<5.0
Total Organic Carbon	%	-	0.30	3.60	3.08	3.26	12.8	13.0

4	Unit	ANZG value	Late Wet 2020	Late Dry 2020	Late Wet 2021	Late Dry 2021	Late Wet 2022	Late Dry 2022
	Total Metals by ICP-AES							
Arsenic	mg/kg	20	<5	-	12	10	11	25
Barium	mg/kg	-	10	-	40	20	90	<50
Beryllium	mg/kg	-	<1	-	<1	<1	<1	<5
Boron	mg/kg	-	<50	-	<50	<50	<50	70
Cadmium	mg/kg	1.5	<1	-	<1	<1	<1	<2
Chromium	mg/kg	80	143	-	127	258	238	114
Cobalt	mg/kg	-	<2	-	2	3	7	16
Copper	mg/kg	65	8	-	24	15	15	19
Iron	mg/kg	-	58500	90200	64600	92700	142000	291000
Lead	mg/kg	50	<5	-	<5	<5	8	<5
Manganese	mg/kg	-	94	-	39	81	1340	1680
Nickel	mg/kg	21	6	-	12	14	18	19
Selenium	mg/kg	-	<5	-	<5	<5	<5	<5
Vanadium	mg/kg	-	27	-	53	61	52	61
Zinc	mg/kg	200	5	-	8	8	9	17

3.2.4 FISH

Fish, decapods, and non-fish vertebrates were sampled with a combination of nets/traps and BRUVs over the six surveys (Late Wet 2020, Late Dry 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022 and Late Dry 2022). No fish were collected by fyke nets, traps or BRUVs and no fish have been observed to inhabit the pool across the six seasons.

Tadpoles were caught for the first time in the Late Wet 2022 (Figure 3-25) and as all were released no positive identification was made though it was likely the Desert Tree Frog (*Litoria sp.*). The presence for the tadpoles is surprising considering the usually low pH of this pool (pH 3-4), however in Late Wet 2022 the pH increased to 5.19 possibly becoming suitable for this species of frog. No tadpoles were observed in the Late Dry 2022, however frog calls at the pool were identified using the FrogID app (Rowley, J.J.L., *et al.* 2019) as *Litoria rubella* which is a species commonly found in the region.



Figure 3-25 Fig Pool tadpole caught in Late Wet 2022.

3.2.5 AQUATIC MACROINVERTEBRATES

Figure 3-26 presents the total abundance, taxa richness and SIGNAL2 scores for Fig Pool in the Late Wet seasons of 2020, 2021 and 2022, and the Late Dry seasons of 2020, 2021 and 2022. The key findings were as follows:

- Total mean abundance decreased from 2021 to 2022 (Figure 3-26a), reducing from mean taxa abundance of 138 over both the wet and dry seasons in 2021 to only 25 taxa in the Late Dry 2022.
- The taxonomic richness in the Late Dry 2022 (7) was lower than all previous seasons besides the Late Wet 2022 (5), following a reduction from the 2021 wet (15) to the 2021 dry (9) seasons (Figure 3-26b).

- No families belonging to the pollution sensitive Ephemeroptera, Plecoptera or Trichoptera order were sampled in Late Dry 2022 or any other season (EPT richness ≤ 1 ; not plotted).
- In contrast to the other indices the Late Dry 2022 (3.48) SIGNAL2 score increased, being slightly greater than that recorded in the Late Wet 2022 (3.37) (Figure 3-26c). This slight increase in the SIGNAL2 score with the reduction in mean abundance is indicative of stress tolerant taxa being present in the pool.

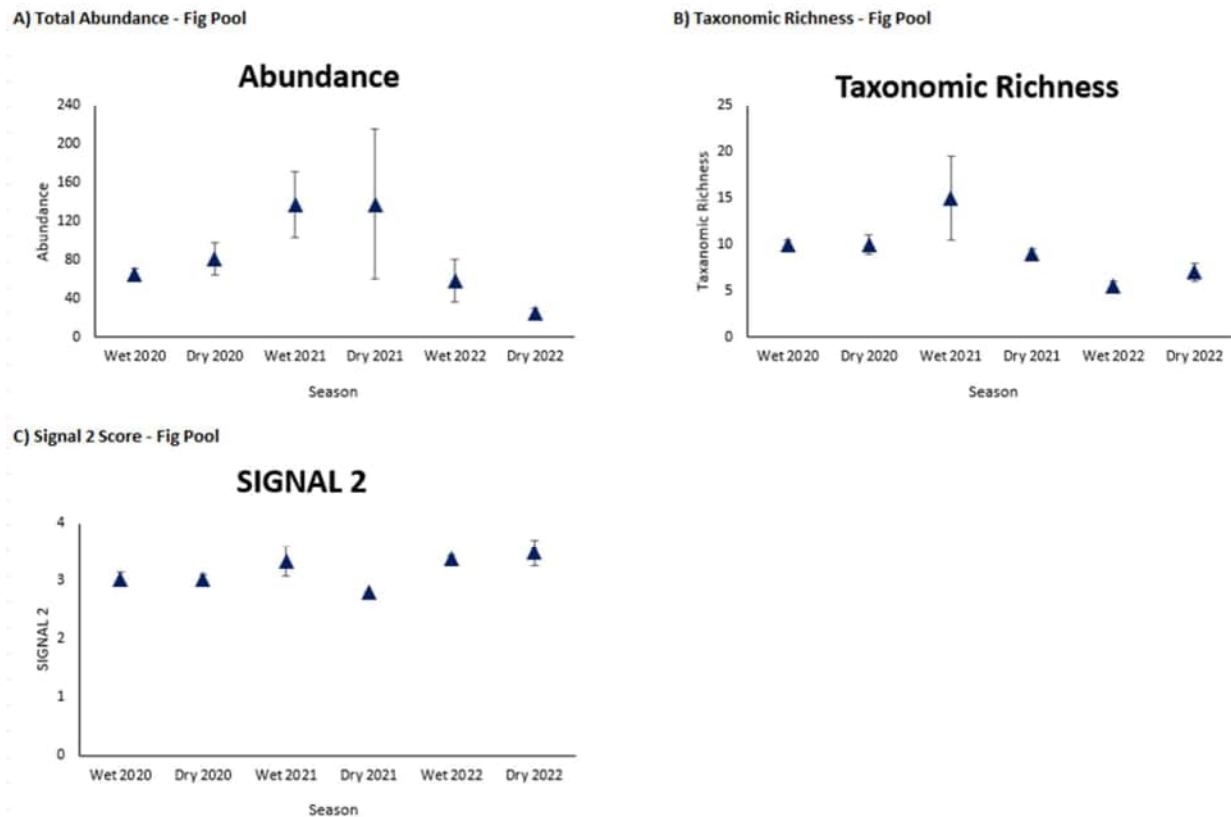


Figure 3-26 Macroinvertebrate indices for Fig Pool – Late Wet 2020, Late Dry 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022 and Late Dry 2022 seasons.

The abundance of taxa for the six seasonal surveys is provided in Figure 3-27 and shows taxa ranging from the most abundant (left) to the least abundant (right) along the x-axis. The non-biting midge of the Chironominae, dragonflies of the Libellulidae and water striders of the Veliidae were much more abundant in the Late Wet and Late Dry seasons of 2021 in comparison to the Late Wet and Dry seasons of 2022. Some macroinvertebrates, such as chironomids and oligochaetes, can increase in abundance following freshwater flow events such as flooding in wetlands (e.g., McInerney et al. 2017), which may explain increased abundances of such taxa in the 2021 wet season when greater rainfall levels were recorded. The reduced flows in the 2022 wet season may explain the general reduction in macroinvertebrate abundances which have had a flow on affect into the Late Dry 2022 season. Cladocera (water flea) and Ostracoda (seed shrimp) were recorded for the first time in the Late Dry 2022 season which may have been introduced by birds or furred animals in the area.

No macroinvertebrate species of conservation significance were found at Fig Pool.

Fig Pool

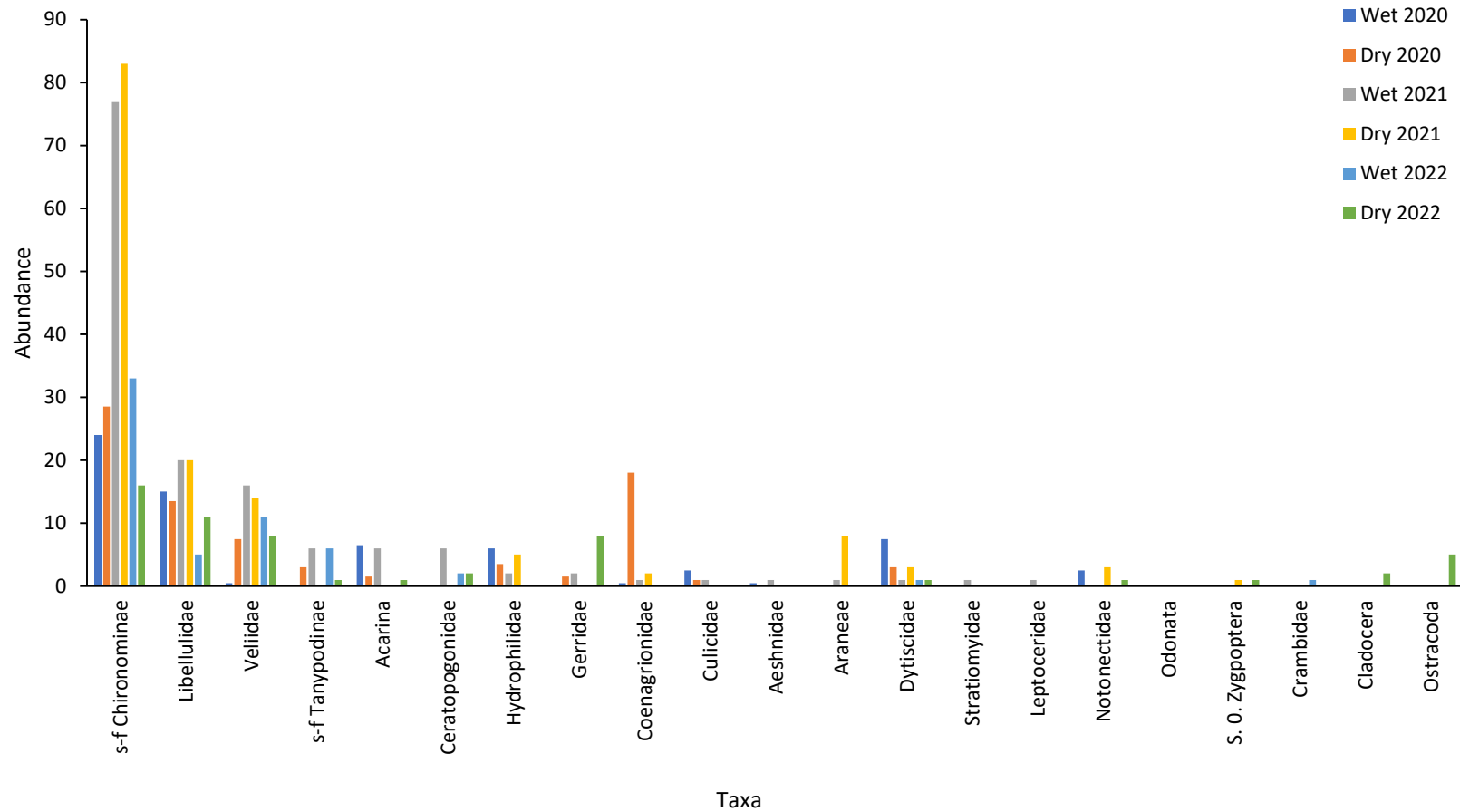


Figure 3-27 Average abundances of all macroinvertebrate taxa at Fig Pool in the Late Wet 2020, Late Dry 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022 and Late Dry 2022 seasons, with taxa arranged from most abundant (left) to least abundant (right) along the x axis.

3.2.6 DIATOMS AND PHYTOPLANKTON

Diatoms were recorded for the first time at Fig Pool in the Late Dry 2022 (Table 3-8). The most abundant diatom species was *Pinnularia subcapitata* (59 individuals) (Figure 3-28). No diatom species were detected at Fig Pool across the Late Wet 2020, Late Dry 2021 and Late Wet 2022 seasons by quantitative artificial substrate sampling. This indicates that the water conditions did not enable reproduction of diatoms during the sampling timeframe because none colonised the new artificial substrates. The Late Dry 2020 diatom samples were not analysed as there was a major flood event during the four-week sampler deployment time and therefore the samples were not considered representative or useful. The presence of diatoms in the Late Dry 2022 survey may be due to the slightly higher pH for this period.

Table 3-8 Summary of Fig Pool diatom average count per species, total abundance, species richness and DSIAR score in Late Dry 2022.

Taxon name	Dry 2022
<i>Pinnularia subcapitata</i>	59
<i>Frustulia rhomboides</i>	17
<i>Pinnularia divergens</i>	9
<i>Eolimna minima</i>	8
<i>Nitzschia palea</i>	8
<i>Gomphonema affine</i>	6
<i>Nitzschia liebetruithii</i>	3
<i>Caloneis bacillum</i>	1
<i>Epithemia gibba</i>	1
<i>Rhopalodia brebissonii</i>	1
Total Count	113
Species Richness	10
DSIAR Score	47

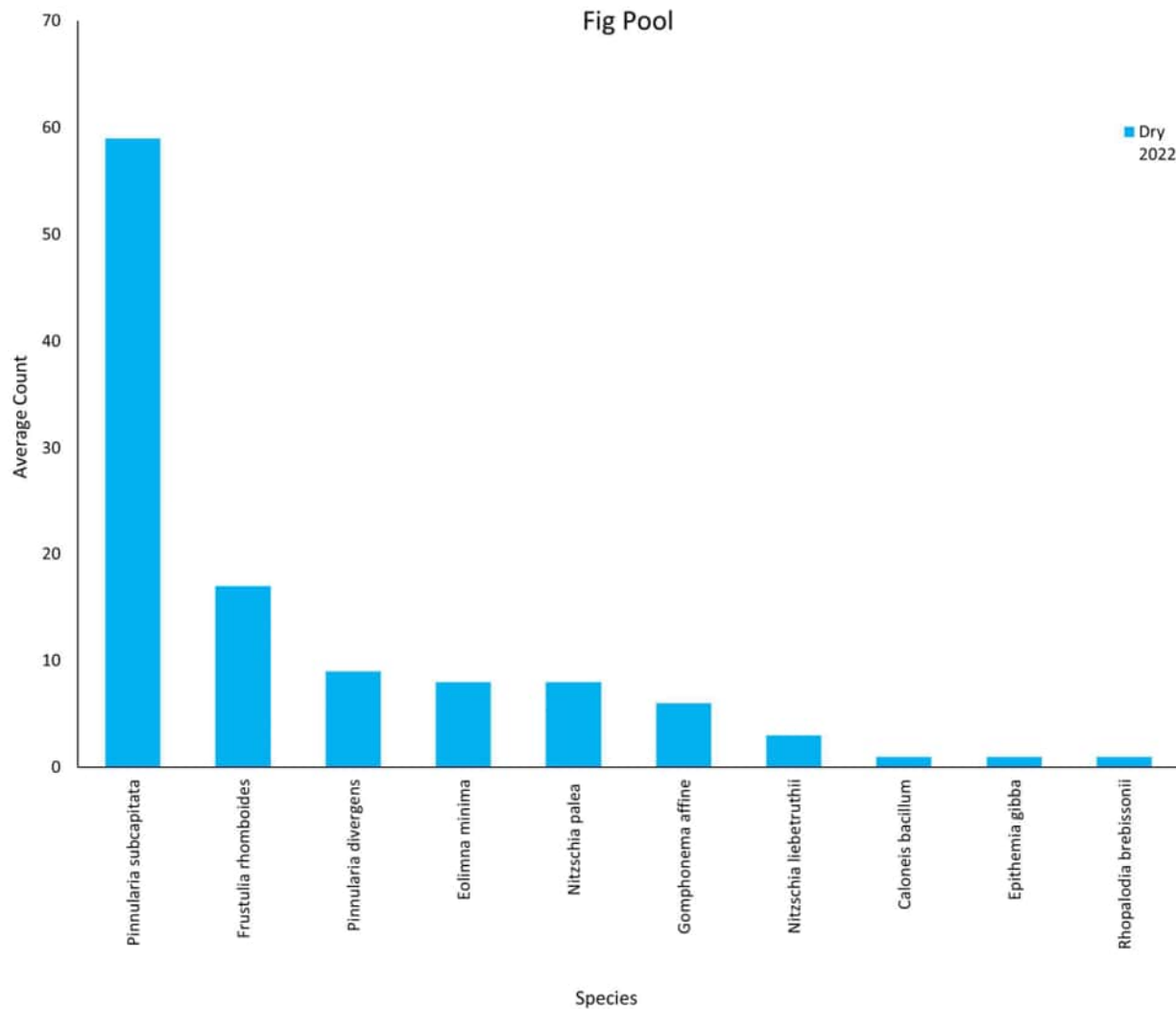


Figure 3-28 Average species abundance (diatom count per replicate) for diatoms sampled at Site 12 Pool in the Late Dry 2022. Arranged most abundant Late Dry 2022 left to right.

In the Late Dry 2022, an analysis of the phytoplankton abundance was conducted at Fig Pool. Overall, phytoplankton abundance at Fig Pool was once again low (Table 3-9). The cyanobacteria *Pseudanabaena* spp. Was the only species present, having not been recorded in previous sampling. There was no apparent correlation in water quality changes and the abundance of phytoplankton in the Lat Dry 2020 sampling as we as the presence of cyanobacteria in the Late Wet and Late Dry 2022 sampling.

Table 3-9 Summary of phytoplankton analytical results for Fig Pool sampled in Late Dry 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022 and Late Dry 2022 abundance (cells L⁻¹) and percentage contribution (%), limit of reporting 10 cell L⁻¹. No phytoplankton were recorded for either Late Wet 2021 or Late Dry 2021.

Taxon	Late Dry 2020		Late Wet 2021		Late Dry 2021		Late Wet 2022		Late Dry 2022	
	Abundance	%	Abundance	%	Abundance	%	Abundance	%	Abundance	%
Bacillariophyceae	200	8	-	-	-	-	-	-	-	-
<i>Microtabella spp</i>	100	4	-	-	-	-	-	-	-	-
<i>Navicula spp.</i>	100	4	-	-	-	-	-	-	-	-
Chlorophyceae	2200	88	-	-	-	-	-	-	-	-
<i>Cosmarium spp. (O)</i>	2200	88	-	-	-	-	-	-	-	-
Euglenophyceae	100	4	-	-	-	-	-	-	-	-
<i>Trachelomonas spp.</i>	100	4	-	-	-	-	-	-	-	-
Cyanobacteria	-	-	-	-	-	-	10000	100	230	100
<i>Synechococcus spp.</i>	-	-	-	-	-	-	10000	100	-	-
<i>Pseudanabaena spp.</i>	-	-	-	-	-	-	-	-	230	100

3.2.7 MACROPHYTES

Across the seven seasons that Fig Pool was surveyed, no macrophytes species were observed. The natural acidity (pH = 4.03) at Fig Pool is likely to be the cause for the absence of macrophytes (Section 3.2.1 Water Quality and Hydrology). A considerable proportion of Fig Pool is bordered by *Melaleuca spp.* With extensive root mats, which likely provided habitat structural complexity typically provided by macrophytes (Figure 3-29). The fauna visible in Fig Pool, such as Dytiscidae (dive beetles), Hydrophilidae (water scavenger beetles), Chironominae (midges) and tadpoles were noted to be inhabiting the root mats.



Figure 3-29 Fig Pool ecology. A) root mats of *Melaleuca* spp extend into Fig Pool covered in iron floc; b) unidentified tadpoles swimming over iron floc covered pool rocks; c) tadpole covered in adhesive iron floc; d) unidentified tadpole not previously observed in this pool.

3.2.8 ENVIRONMENTAL VALUE

Fig Pool is unique in its environmental value as it is a highly acidic pool that has no fish present, however in recent surveys, tadpoles have been sighted and frog calls have been recorded. This may indicate the pool is important as a possible refuge for aquatics species that may be displaced or having their natural range disrupted by various mine related activities. The absence of fish in the acidic waters of Fig Pool may also be providing a new habitat niche for tadpoles to exploit in the absence of competition for prey items. To date, there have been no fish, aquatic diatoms, phytoplankton, macroinvertebrates or macrophytes that are of conservation significance.

3.3 MUNDAGOORA POOL (GV_SW_POOL_MUNDAGOORA_SS)

Mundagoora Pool has a catchment area of approximately 3.3 km², draining two similarly sized basins (to the northeast and southeast; Figure 3-31). Discharge from the pool flows to Cockatoo Creek and the Turner River (see Figure 2-2). The likely permanent nature of the pool provides habitat to an abundance of fish, macroinvertebrates, and extensive beds of macrophytes and established riparian vegetation (Figure 3-30). Some key features of this pool are:

- The inflow is over a steep rock face (waterfall).
- The outflow is over a sill with little variation in pool height over wet/dry season (controlled by the sill level).
- It is a clear water pool dominated by submerged vegetation/algae and abundant fish (common species, not endangered).
- Downstream of the pool is dominated by dense emergent vegetation (reeds and sedges), which extends down a shallow braided channel downstream for several hundred metres from the pool.
- The pool contains a hard bottom (rock) at the inflow point, likely to be scoured out (removal of deposited sediments) during high-flow events.



Figure 3-30 Mundagoora Pool is a permanent pool with extensive macrophyte beds and riparian vegetation.

3.3.1 SITE SPECIFIC TRIGGER VALUES

The DGVs (ANZG 2018a) most parameters and analytes will provide sufficient trigger values Mundagoora Pool. Site specific triggers should be developed for SPC and TDS which will lead to the investigation when the long-term rolling median values exceed the 80th percentile of the baseline data collected up to this point. As both TN and NO_x exceeded the DGV in three wet seasons a site-specific trigger value for the wet season can be implemented, with the dry season retaining the generalised DGV (ANZG 2018a). In addition to the long-term 80th percentile median trigger, an instant value of exceedances over the 95th percentile median value could trigger investigation.

In terms of ecological triggers the highly variable data indicates that for fish and macroinvertebrates a presence/absence trigger may be the most appropriate. For diatoms if there is a significant decrease in the DISAR score over consecutive seasons this may trigger an investigation to water quality. As Mundagoora has significant heritage values the introduction of any toxic phytoplankton species would also trigger investigation. Any recordings of new or invasive fish species should also be investigated. The loss of significant proportions of permanent riparian vegetation would also be a trigger for investigation.

3.3.2 WATER QUALITY AND HYDROLOGY

Mundagoora pool is a relatively deep permanent pool located at the base of an intermittent waterfall, which appears to only flow during high rainfall events. The pool water level is controlled by a sill at the downstream edge. Water levels remain relatively consistent within the pool with the exception of short duration peaks during high rainfall events (Figure 3-32). Mundagoora Pool appears to be largely sustained by groundwater; however, it was periodically flushed with fresh surface water flows after rainfall events. It takes approximately 3 weeks for the groundwater to displace the surface water flows once a flushing event has occurred. Conductivity is typically very slightly brackish (~850 µS/cm) except during a surface water flow event when it would become extremely fresh (<50 µS/cm). Water levels were a maximum of approximately 0.6 m above the pool overflow levels during high-flow events, typically lasting less than 24 hours before flows receded. Water temperature within the pool was responsive to atmospheric temperature changes (Figure 3-32).

Note that the conductivity channel of the logger failed to record from the 16th June to 6th December 2021 and again from the 30th April to 21st June 2022. The logger has since been reset, cleaned and calibrated and is working properly (the other two channels – temperature and water level – recorded properly though the time stamps required manual corrections (Figure 3-32).

Mundagoora Pool is a clear water pool with low average turbidity (1.9 NTU), neutral average pH (7.29), low average salinity (876.3 µS/cm) and moderate average oxygenation (6.4 mg/L) (Table 3-10). Average TN, TP, Nitrate (NO₃⁻) and Nitrate/Nitrite (NO_x) concentration exceeded the 95% species protection levels (ANZG 2018) (Table 3-10), with only TP and NO₃⁻ in exceedance of 0.003 mg/L and 0.06 mg/L respectively in the Late Dry 2022. All dissolved metals in the Late Dry 2022 were below ANZG (2018) DGVs. See Appendix A for complete water quality data.

Flood peaks are typically very small (<0.6m) and of short duration. With the high amount of macrophyte and riparian vegetation within the pool and immediately downstream, it is unlikely that flushing plays a major roll in sediment scouring. However, flushing does regularly replace the groundwater inflows with temporary fresher surface water inflows. This is not likely to be a major ecological driver through, as evidenced by the stable ecology of the system before and after surface water flushing events.

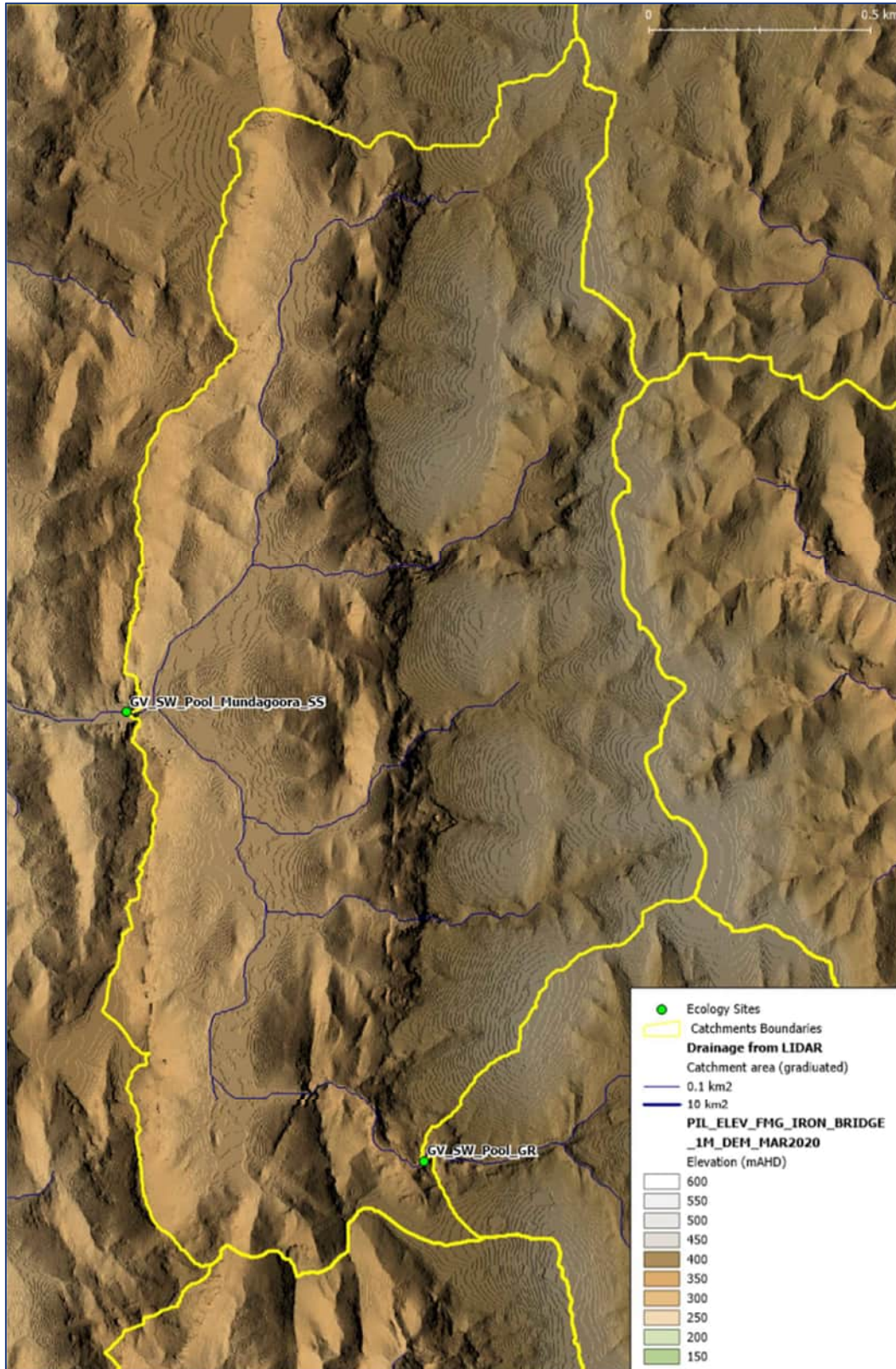


Figure 3-31 Mundagoora Pool catchment (3.2 km²)

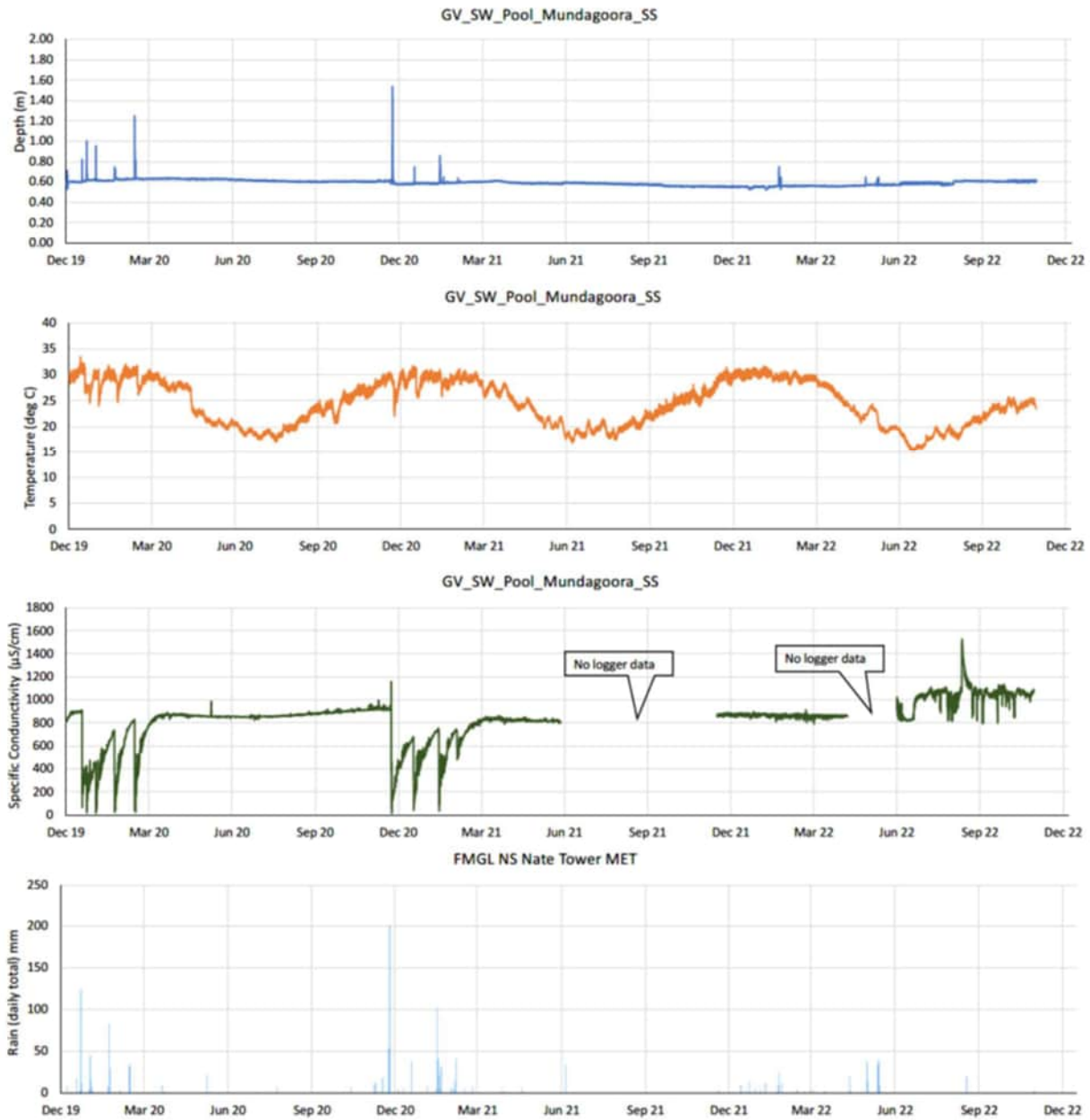


Figure 3-32 Mundagoora Pool logger record from 17/12/2019 to 24/11/2022 for pool water depth (m), water temperature (°C), specific conductivity (µS/cm) and daily rainfall at FMG LNS Nate Tower MET.

Table 3-8. Summary of water quality analytical results for Mundagoora Pool. Concentration for each analyte and analyte group described for Late Wet 2020, Late Dry 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022, and Late Dry 2022. Only total metals with Default Guideline Values (DGV) were included in this table. Bolded values denote results above the 95% species protection levels and DGVs for ANZG (2018).

Analyte/Water Quality Parameter	Mean	Median	Max	Min	Range	SE	95% Protection/DGV
Temp (°C)	24.8	23.65	31	20.5	10.5	2.08	
DO (%)	77.71	82.2	110	44.1	65.9	10.40	90
DO (mg/L)	6.37	6.75	8.8	3.32	5.48	0.84	
SPC (uS/cm)	876.28	874	1026	810	216	35.39	
TDS (mg/L)	575	575.5	667	480	187	31.44	
pH	7.3	7.16	8.1	6.93	1.17	0.21	6.0-7.5
Turbidity (NTU)	1.94	0.3	13.02	-4.62	17.64	3.02	15
Total Alkalinity as CaCO ₃	354.29	358	399	340	59	9.71	
Ammonium as N (mg/L)	0.005	0.005	0.005	0.005	0	-	0.006
Nitrite as N (mg/L)	0.005	0.005	0.005	0.005	0	-	0.03
Nitrate as N (mg/L)	0.09	0.09	0.09	0.09	0	-	0.03
Nitrite + Nitrate as N	0.06	0.03	0.26	0.005	0.255	0.04	0.03
Total Nitrogen as N	0.24	0.25	0.5	0.05	0.45	0.18	0.15
Total Phosphorus as P	0.014	0.0075	0.02	0.005	0.015	0.003	0.01
Reactive Phosphorus as P	0.005	0.005	0.005	0.005	0	0	0.005
Dissolved Organic Carbon	5.66	5	11	2	9	1.7	
<i>Dissolved Metals</i>							
Aluminium (mg/L)	0.002	0.0025	0.0025	0.0025	0	0	0.055
Arsenic (mg/L)	0.000443	0.0005	0.0005	0.0004	0.0001	0.00002	0.024(AsII),
Boron (mg/L)	0.24	0.23	0.28	0.208	0.072	0.015	0.94
Cadmium (mg/L)	0.0001	0.00005	0.0005	0.000025	0.000475	0.0001	0.0002
Chromium (mg/L)	0.0003	0.0005	0.0005	0.0001	0.0004	0.0001	0.001
Copper (mg/L)	0.0006	0.0005	0.0018	0.00025	0.00155	0.00025	0.0014
Lead (mg/L)	0.0003	0.0005	0.0005	0.00005	0.00045	0.000104	0.0034
Manganese (mg/L)	0.04	0.0395	0.088	0.009	0.079	0.013	1.9
Mercury (mg/L)	0.00004	0.00005	0.00007	0.00002	0.00005	0.00001	0.00006
Nickel (mg/L)	0.0005	0.0005	0.0009	0.00025	0.00065	0.0001	0.011
Selenium (mg/L)	0.0034	0.005	0.005	0.0001	0.0049	0.0011	0.011
Zinc (mg/L)	0.008	0.00425	0.026	0.0005	0.0255	0.0043	0.008

Figure 3-33 provides a Durov plot displaying the major ion balance of Mundagoora Pool over six sampling events. It can be seen that the water quality is relatively stable over the five seasonal sampling events with a slightly alkaline pH. Cations are evenly distributed between Calcium, Magnesium and Sodium+Potassium with anions dominated by carbonates.

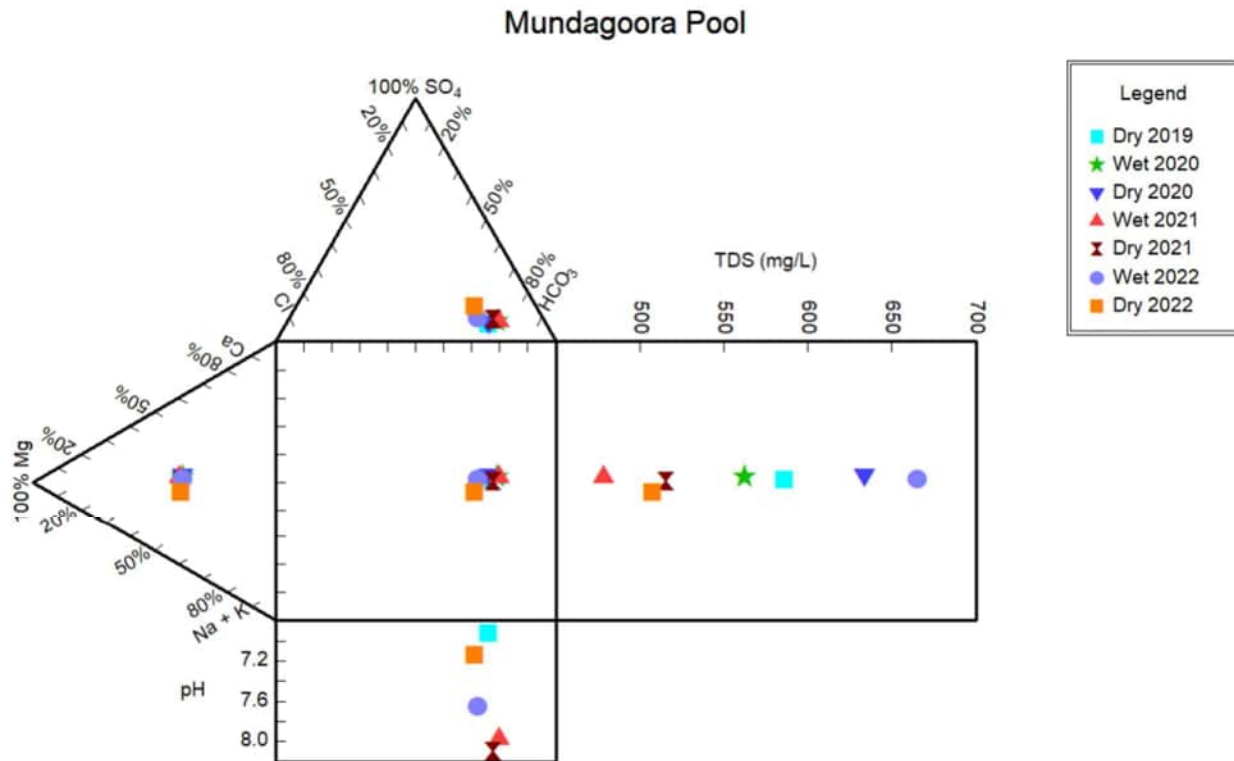


Figure 3-33 Durov diagram illustrates the Mundagoora Pool major ion distribution.

3.3.3 BATHYMETRY

Mundagoora Pool was surveyed in May 2020 using a down beam and side-scan sonar system attached to a remote-control boat. The maximum depth of the pool is approximately 3.5 m with the average depth 1.9 m (Figure 3-34). The volume of the pool has been calculated at 448 m³. The deepest section (3-3.5 m) is in the basin below the waterfall/rock face to the east with a shallower sill to the west at ~1 m deep (Figure 3-34 to Figure 3-38). The pool is 25 m in length (north-south) and 15 m at its widest point (east-west). The base of the pool is dominated by hard rock with gravel/sediments to the west at the pool overflow point.

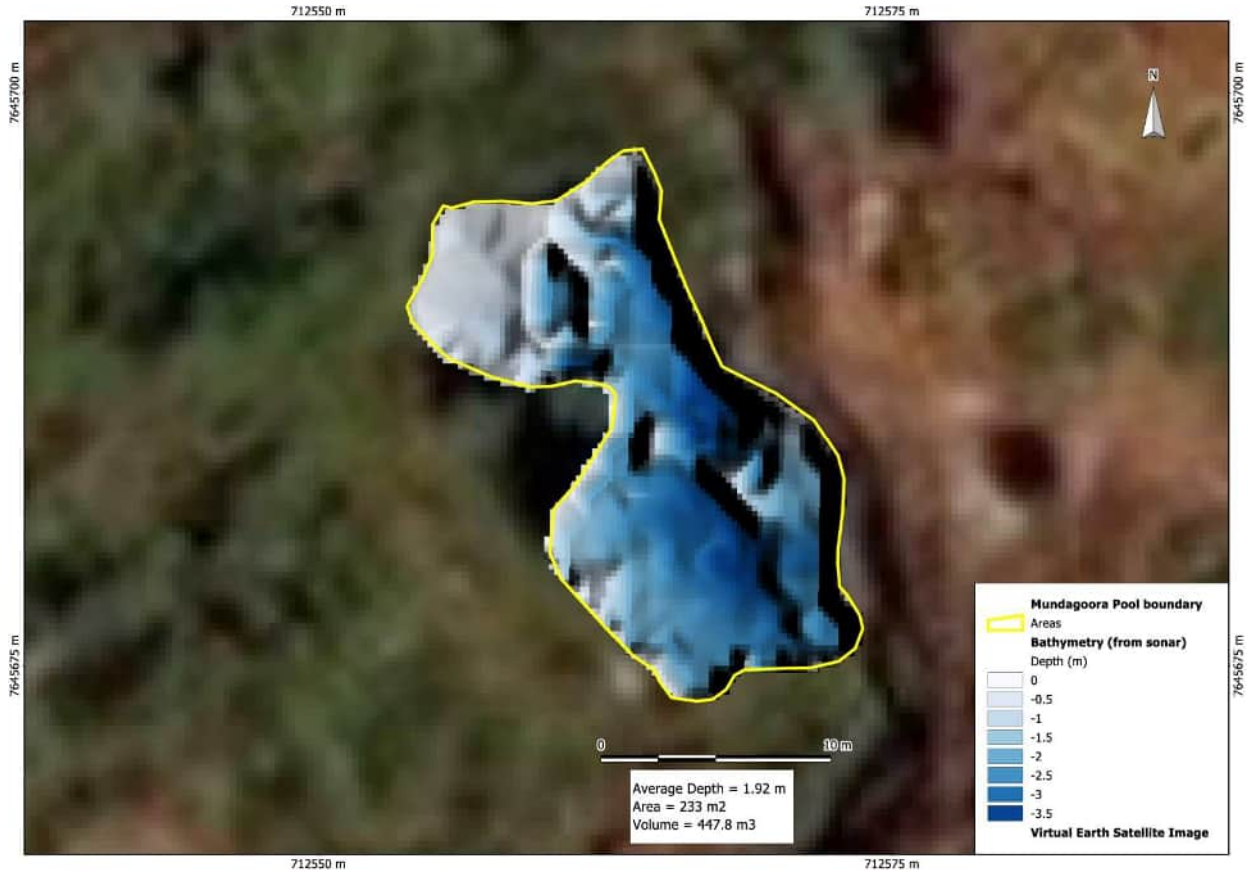


Figure 3-34 Bathymetry of Mundagoora Pool



Figure 3-35 Cross-section of deep southern portion of Mundagoora Pool (East-West)

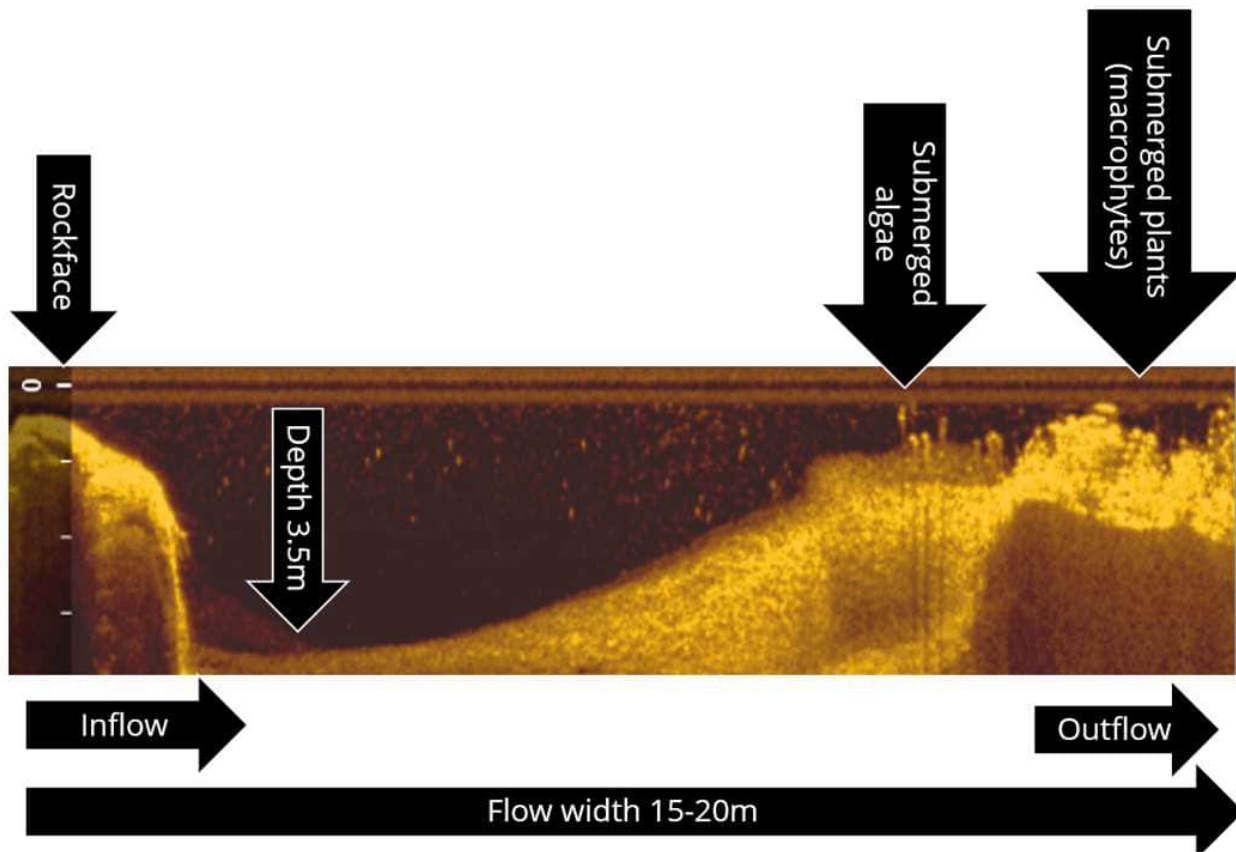


Figure 3-36 Sonar cross-section of Mundagoora Pool showing habitat features

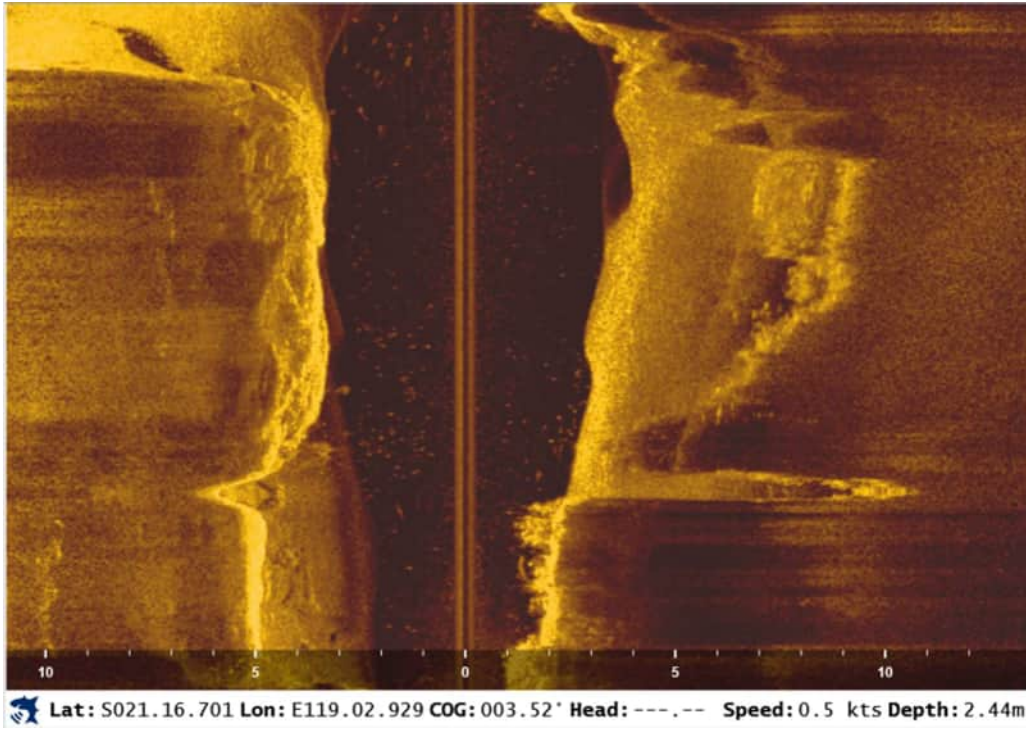


Figure 3-37 Side-scan sonar bathymetry: - cross-section north-south

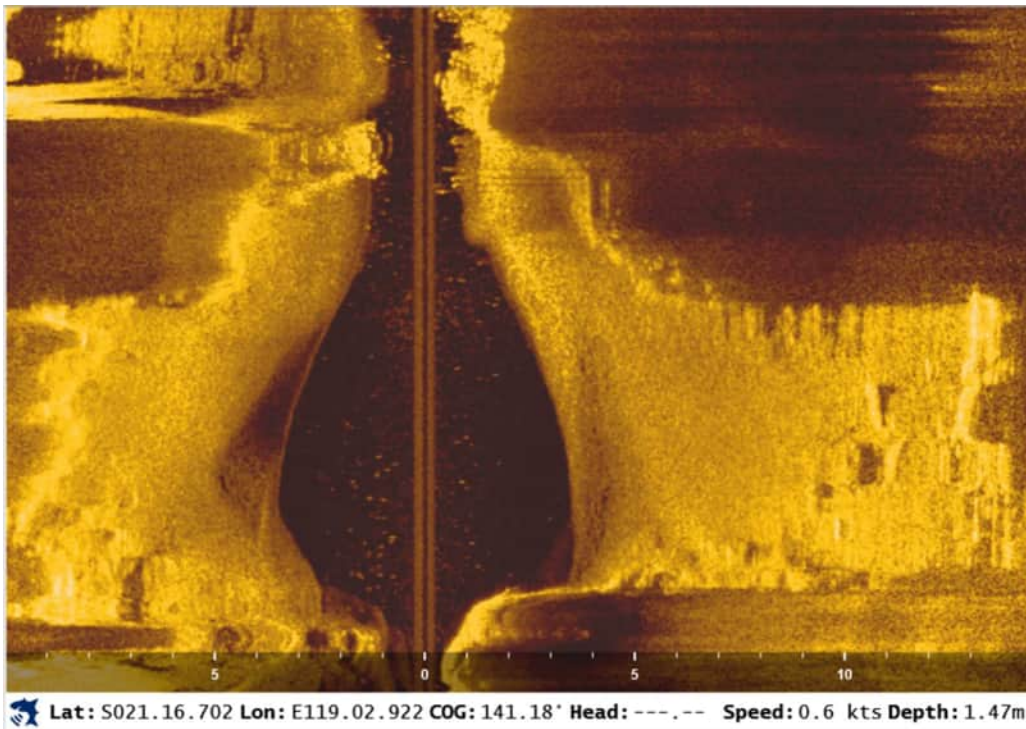


Figure 3-38 Side-scan sonar bathymetry: cross-section east-west

3.3.4 SEDIMENT QUALITY

Table 3-10 provides the surface sediment quality at Mundagoora Pool during the seven seasonal surveys. Metal and metalloid concentrations were assessed against the ANZG (2018) DGVs. In the Late Dry 2022 chromium concentration exceeded the DGV (80 mg/kg) but not the GV-high (370 mg/kg) as it did in the previous seasons. Nickel concentration again exceeded the DGV (21 mg/kg) and but not the GV-high (52 mg/kg) in the Late Dry 2022. These metals both naturally occur in high concentrations across the Project area.

Table 3-10. Summary of Mundagoora Pool sediment quality analyses for the Late Wet 2020, Late Dry 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022 and Late Dry 2022. Bolded values denote results above the ANZG (2018) DGVs .

Analyte grouping/Analyte	Unit	ANZG value	Late Wet 2020	Late Dry 2020	Late Wet 2021	Late Dry 2021	Late Wet 2022	Late Dry 2022
Total Soluble Salts	mg/kg	-	693	-	280	446	396	393
Moisture Content (Dried @ 105-110°C)	%	-	59.7	49.3	24.8	80.6	**	33.7
Total Alkalinity as CaCO₃	mg/kg	-	77	104	239	270	216	423
Bicarbonate Alkalinity as CaCO₃	mg/kg	-	77	104	239	270	194	423
Carbonate Alkalinity as CaCO₃	mg/kg	-	<1	<5	<5	<5	22	<5
Acidity	mg/kg	-	12	53	62	448	<5	10
Sulfate as SO₄²⁻ (soluble sulfate by ICPAES)	mg/kg	-	80	70	<10	20	30	30
Chloride (by Discrete Analyser)	mg/kg	-	100	40	20	150	30	20
Calcium	mg/kg	-	220	30	30	130	40	40
Magnesium	mg/kg	-	110	20	20	100	20	20
Sodium	mg/kg	-	170	100	30	230	40	50
Potassium	mg/kg	-	20	<10	<10	<10	<10	<10
Mercury (FIMS)	mg/kg	-	0.6	-	<0.1	24.2	<0.1	<0.1
Nitrite + Nitrate as N (Sol.)	mg/kg	-	<0.1	<0.1	<0.1	<0.2	0.2	<0.1
Total Kjeldahl Nitrogen as N	mg/kg	-	3950	1970	430	4910	170	270
Total Nitrogen as N	mg/kg	-	3950	1970	430	4910	170	270
Total Phosphorus as P	mg/kg	-	242	179	190	427	293	90
Reactive Phosphorus as P	mg/kg	-	<0.1	<0.1	<0.1	<0.2	0.2	<0.1

Analyte grouping/Analyte	Unit	ANZG value	Late Wet 2020	Late Dry 2020	Late Wet 2021	Late Dry 2021	Late Wet 2022	Late Dry 2022
Total Organic Carbon	%	-	3.15	4.88	0.13	5.78	0.21	0.34
Total Metals by ICP-AES								
Arsenic	mg/kg	20	9	-	9	15	<5	<5
Barium	mg/kg	-	40	-	60	<20	40	20
Beryllium	mg/kg	-	1	-	<1	<2	<1	<1
Boron	mg/kg	-	<50	-	50	<50	<50	<50
Cadmium	mg/kg	1.5	<1	-	<1	<1	<1	<1
Chromium	mg/kg	80	169	-	368	102	173	83
Cobalt	mg/kg	-	22	-	33	19	11	6
Copper	mg/kg	65	52	-	67	89	29	17
Iron	mg/kg	-	76600	57000	114000	56100	66900	43500
Lead	mg/kg	50	<5	-	6	9	<5	<5
Manganese	mg/kg	-	481	-	674	328	441	199
Nickel	mg/kg	21	79	-	134	69	92	27
Selenium	mg/kg	-	5	-	<5	<5	<5	<5
Vanadium	mg/kg	-	166	-	161	299	56	45
Zinc	mg/kg	200	39	-	30	32	31	12

** Sample too dry for analysis.

3.3.5 FISH

Table 3-11 presents the fish species, catch and size distribution collected during the Late Wet 2020, Late Dry 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022 and Late Dry 2022 surveys. Two fish species were present and were sampled by nets/traps and BRUVs; *M. australis* and *L. unicolor*. In all six seasons *M. australis* was substantially more abundant (Table 3-11). The highest number of *M. australis* were collected in both the Late Dry seasons (with 451 and 315 fish caught in 2020 and 2021 respectively). Fish abundance from Late Wet 2022 to Late Dry 2022 had a slight decline for both species of fish.

The size range distribution of *M. australis* in the Late Dry 2022 was consistent with the previous seasons (Figure 3-39 and Figure 3-40), however the abundance was considerably lower than previous Late Dry seasons (Table 3-11). The majority of *M. australis* ranged between approximately 30 mm to 90 mm in total length, with a few individuals being observed <30mm and > 90 mm in the Late Dry season (2022). Figure 3-39 displays the size distribution of measured *M. australis* individuals for each survey. Figure 3-40 displays the frequency of each size class, with the 30 – 60 mm size class being most frequent in all six seasons. In all six surveys, individuals <30 mm were observed at Mundagoora Pool, indicating a regular spawning and recruitment at the site (Pusey, B., Kennard, M., & Arthington, 2004).

L. unicolor was only captured in the largest size class (> 90mm) in the Late Dry 2022 (Figure 3-42). The size range of *L. unicolor* observed demonstrated likely interannual survival and reproduction. The low abundance of *L. unicolor* was likely due to the net being placed in habitat less frequented by this species (edge/macrophytes).

Table 3-11 Fish species, size class (SL, mm), overall count and CPUE for Mundagoora Pool

Species	Size class (mm)	Late Wet 2020		Late Dry 2020		Late Wet 2021		Late Dry 2021		Late Wet 2022		Late Dry 2022	
		Count	CPUE ¹	Count	CPUE ¹	Count	CPUE ¹	Count	CPUE ¹	Count	CPUE ¹	Count	CPUE ¹
<i>Melanotaenia australis</i>		212	12.8	451	27.3	213	12.9	315	20.3	127	7.7	115	7
	0 – 30	63		61		10		11		14		3	
	30 – 60	95		269		202		284		102		101	
	60 – 90	54		100		1		20		11		10	
	> 90	0		21		0		0		0		1	
<i>Leiopotherapon unicolor</i>		1	0.06	3	0.18	0	-	2	0.12	8	0.5	3	0.2
	30 – 60	0		0		0		0		1		0	
	60 – 90	0		0		0		0		1		0	
	> 90	1		3		0		2		6		3	
Total		213	12.9	454	27.5	213	12.9	317	20.4	135	8.2	118	7.2

¹ CPUE is catch per unit effort, a measure of relative abundance. Effort is fyke net set for 16.5 hours.

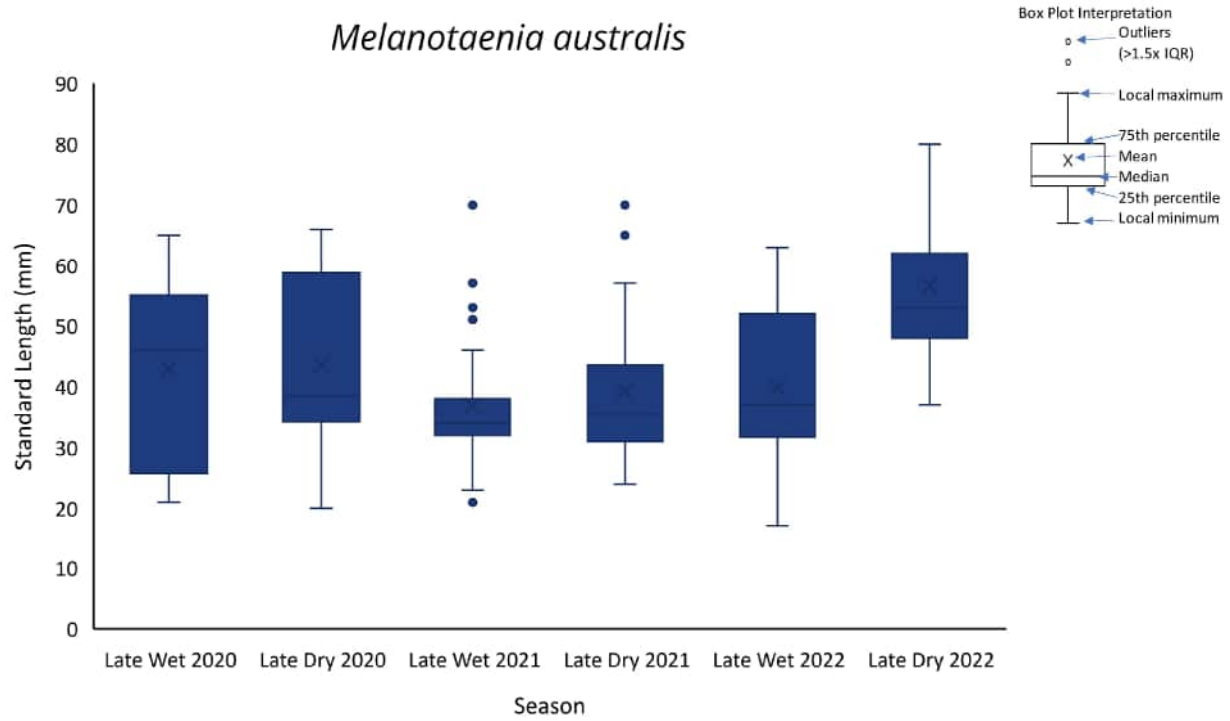


Figure 3-39 Distribution of standard length (SL, mm) for *Melanotaenia australis* in Mundagoora Pool sampled with Fyke nets for the Late Wet 2020, Late Dry 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022 and Late Dry 2022 surveys.

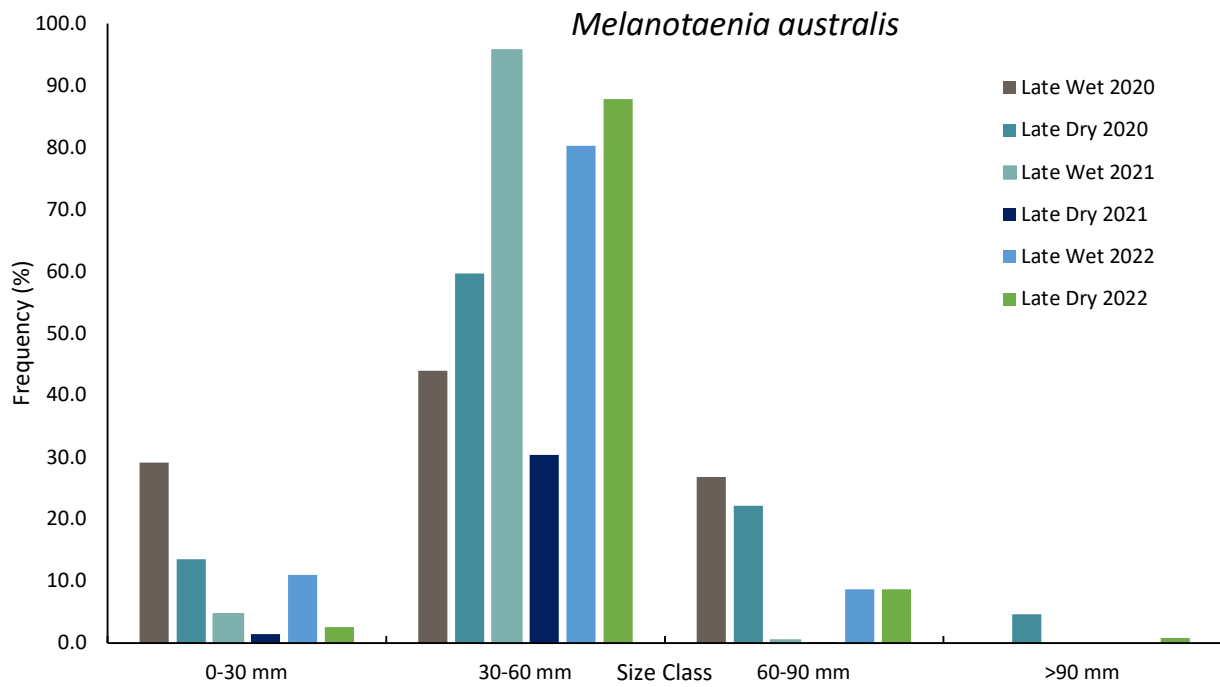


Figure 3-40 Frequency (%) of each size class (mm) for *M. australis* in Mundagoora Pool sampled with Fyke nets for the Late Wet 2020, Late Dry 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022 and Late Dry 2022 surveys.

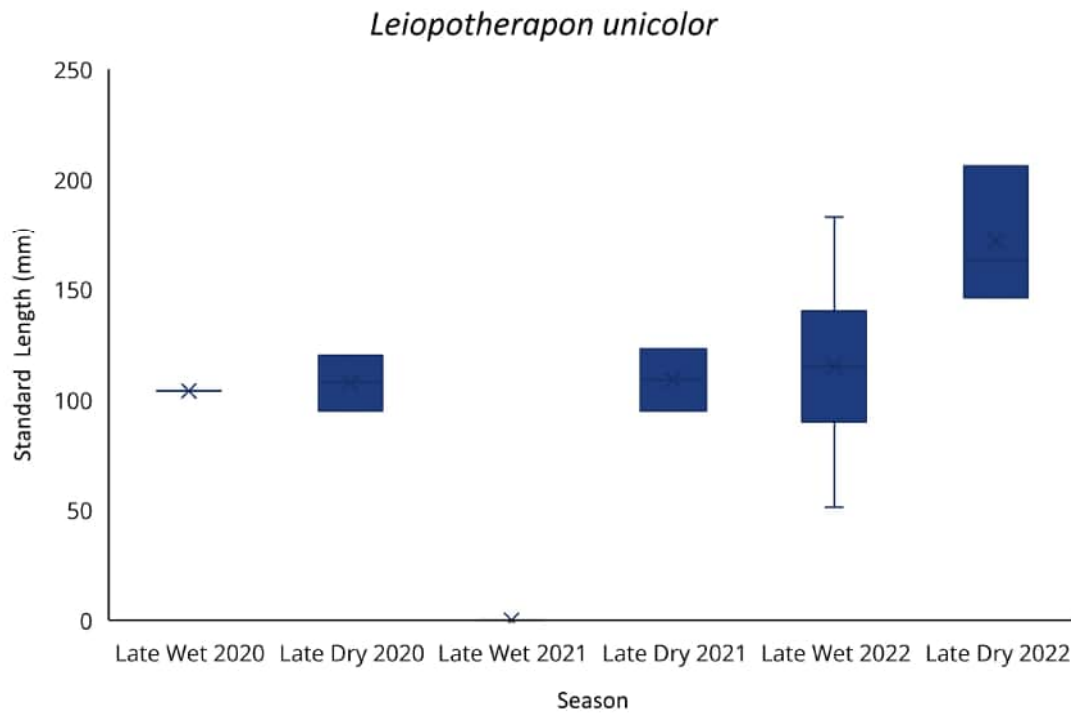


Figure 3-41 Distribution of standard length (SL, mm) for *Leiopotherapon unicolor* sampled from Mundagoora Pool in the Late Wey, Late Dry 2020, Late Dry 2021, Late Wet 2022 and Late Dry 2022 seasons.

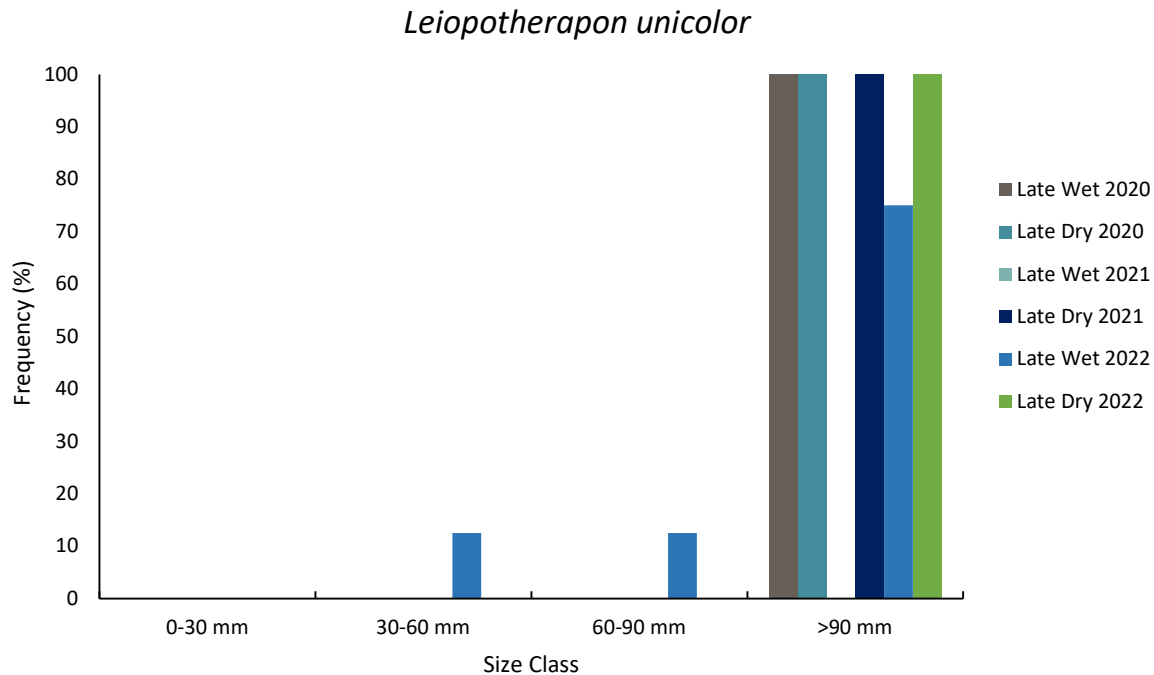


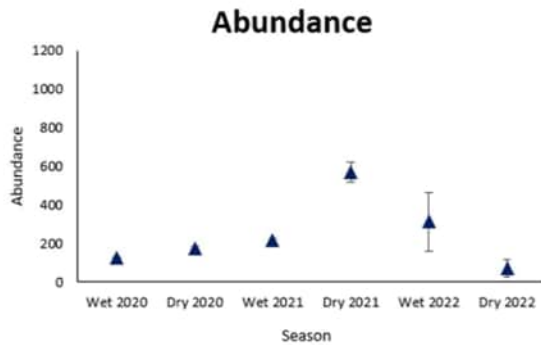
Figure 3-42 Frequency (%) of each size class (mm) for *L. unicolor* in Mundagoora Pool sampled with Fyke nets for the Late Wet 2020, Late Dry 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022 and Late Dry 2022 surveys.

3.3.6 AQUATIC MACROINVERTEBRATES

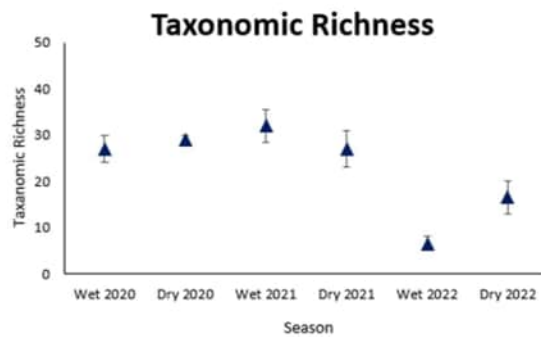
Figure 3-43 presents the total abundance, taxa richness, EPT richness and SIGNAL2 scores for Mundagoora Pool in the late wet and late dry seasons of 2020, 2021 and 2022. The key findings were as follows:

- The average total abundance in the Late Dry 2022 (69) was lower than all previous seasons (Figure 3-43a).
- Taxonomic richness increased in the Late Dry 2022 from the Late Wet 2022, with the composition in the Late Wet 2022 dominated by two taxa resulting in the decrease in richness compared to previous seasons (Figure 3-43b).
- An average of four taxa belonging to the Plecoptera, Ephemeroptera and Trichoptera were found in both seasons in 2020 (EPT richness = 4). This reduced to 3 in both seasons in 2021 (EPT richness = 3), further reducing to 1 in the Late Wet 2022 then increasing back up to 3 in the Late Dry 2022 (Figure 3-43c).
- There was a slight increase in the SIGNAL 2 score in the Late Dry 2022, with the data still indicating that the macroinvertebrate community is primarily dominated by tolerant taxa (Figure 3-43d).

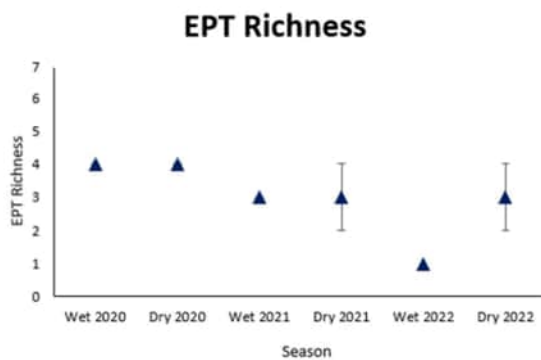
A) Total Abundance - Mundagoora Pool



B) Taxonomic Richness - Mundagoora Pool



C) EPT Richness - Mundagoora Pool



D) Signal 2 Score - Mundagoora Pool

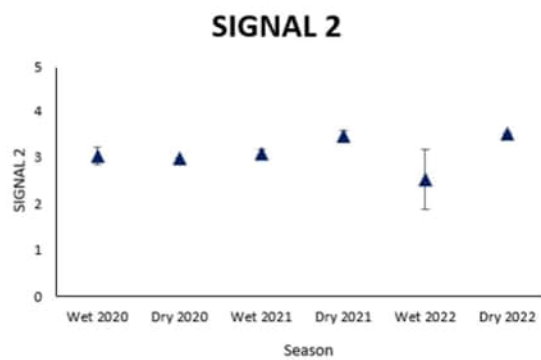


Figure 3-43 Macroinvertebrate indices for Mundagoora Pool – Late Wet 2020, Late Dry 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022 and Late Dry 2022 seasons.

The taxonomic composition of the macroinvertebrate community is provided in Figure 3-44, ranging from most abundant (left) to least abundant (right) along the x-axis. The community composition in the Late Dry 2022 was dominated by two taxa, Baetidae (mayflies, 43 individuals) which had not been recorded previously in such high abundance, and Planorbidae (Gastropod Ramshorn snails) (Figure 3-44).

No macroinvertebrate species of conservation significance were found at Mundagoora Pool.

Mundagoora Pool

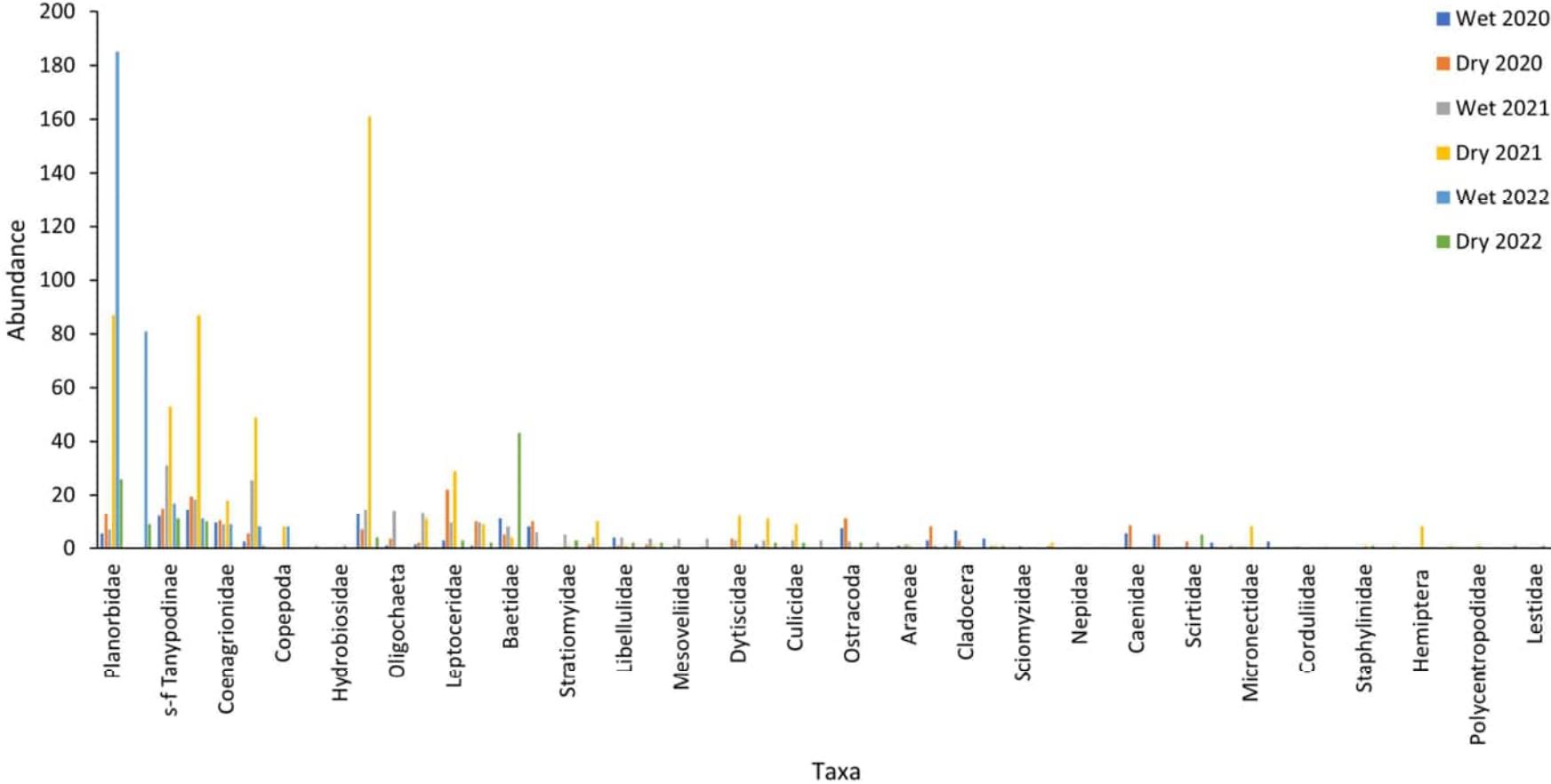


Figure 3-44 Average abundances of all macroinvertebrate taxa at Mundagoora Pool in the Late Wet 2020, Late Dry 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022 and Late Dry 2022 seasons, with taxa arranged from most abundant (left) to least abundant (right) along the x-axis.

3.3.7 DIATOMS AND PHYTOPLANKTON

3.3.7.1 DIATOMS

Table 3-12 presents the diatom species present, abundance and biotic indices as collected on Diatom plates in the Late Wet 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022 and Late Dry 2022. No data is available from the Late Dry 2020 due to flood conditions during the 4-week deployment period.

Table 3-12 shows the average count by diatom species present, with the total number of diatoms species highest in the Late Wet 2022 (30 species) and a high taxonomic diversity ranging across multiple families across each sampling event. The diatom species composition shows both seasonal and interannual variation, with two species dominant in the Late Wet 2020 (*Achnantheidium minutissimum* and *Brachysira vitrea*), while there were four species in the Late Wet 2021 (*A. minutissimum*, *B. vitrea*, *Eunotia bilunaris* and *Navicula cryptocephala*) that were most abundant (Table 3-12). In the Late Dry 2021 *A. minutissimum* was also abundant, however *Gomphonema angustum* var “*subminutum*” and *Navicula radiosa* were more abundant in the Late Dry 2021. In the Late Wet 2022 the new species *Discostella stelligera* was the most abundant (average count = 122) followed by *A. minutissimum* (average count = 45) (Table 3-12). In the Late Dry 2022 *A. minutissimum* was the most abundant (Table 3-12)

The lower average DSIAR score (17.4) in the Late Dry 2022 in comparison to previous seasons (average DSIAR 56 – 63 in Table 3-12) may be associated with higher levels of environmental stress due to a dryer antecedent wet season in 2022.

Table 3-12 Summary of Mundagoora Pool diatom average count per species, total abundance, species richness and DSIAR score in Late Wet 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022 and Late Dry 2022.

Taxon name	Wet 2020	Wet 2021	Dry 2021	Wet 2022	Dry 2022
<i>Achnantheidium minutissimum</i>	197	38	119	45	114
<i>Epithemia adnata</i>	0	0	0	1	29.5
<i>Achnantheidium exile</i>	0	0	0	0	27.5
<i>Eunotia bilunaris</i>	42	51	23	39	22
<i>Gomphonema angustum</i>	0	0	0	0	20
<i>Cyclotella spp. (small)</i>	0	0	0	0	17.5
<i>Encyonopsis perborealis</i>	0	0	0	0	15.5
<i>Gomphonema gracile</i>	0	1	2	1	12.5
<i>Epithemia sorex</i>	0	0	0	0	12
<i>Nitzschia amphibia</i>	0	0	0	0	7
<i>Eunotia spp.</i>	0	0	0	0	6
<i>Fragilaria acus</i>	0	0	0	0	6
<i>Mastogloia smithii</i>	0	0	0	3	5
<i>Brachysira vitrea</i>	106	62	6	6	4.5
<i>Mastogloia elliptica</i>	0	0	0	8	4.5
<i>Navicula radiosa</i>	18	12	53	4	4.5
<i>Nitzschia linearis</i>	0	0	0	1	3.5
<i>Achnanthes brevipes</i>	0	0	0	0	2

Taxon name	Wet 2020	Wet 2021	Dry 2021	Wet 2022	Dry 2022
<i>Achnantheidium exiguum</i>	0	0	0	0	2
<i>Encyonema mesianum</i>	0	0	0	0	2
<i>Pinnularia microtauron</i>	0	0	0	0	2
<i>Cymbella cystula</i>	0	0	0	0	1.5
<i>Gomphonema affine</i>	0	2	0	0	1
<i>Nitzschia gracilis</i>	0	0	0	0	1
<i>Nitzschia subacicularis</i>	0	0	1	4	1
<i>Rhopalodia brebissonii</i>	0	0	0	0	1
<i>Brachysira brebissonii</i>	0	0	0	1	0
<i>Brachysira styriaca</i>	0	8	0	0	0
<i>Caloneis silicula</i>	1	0	0	0	0
<i>Craticula halophila</i>	1	0	0	0	0
<i>Cymbella affinis</i>	7	0	0	0	0
<i>Cymbella spp</i>	4	0	0	0	0
<i>Diploneis parma</i>	1	0	0	0	0
<i>Discostella stelligera</i>	0	0	0	122	0
<i>Encyonema gracile</i>	0	0	0	1	0
<i>Encyonema minutum</i>	2	0	0	0	0
<i>Encyonema silesiacum</i>	0	0	0	1	0
<i>Encyonopsis cesatii</i>	0	0	0	1	0
<i>Encyonopsis microcephala</i>	0	12	0	0	0
<i>Encyonopsis spp.</i>	0	0	0	11	0
<i>Epithemia cystula</i>	0	0	0	5	0
<i>Epithemia gibba</i>	0	1	0	0	0
<i>Eunotia exigua</i>	0	0	2	0	0
<i>Eunotia incisa</i>	0	3	3	0	0
<i>Eunotia minor</i>	0	0	0	1	0
<i>Eunotia mucophila</i>	0	3	0	0	0
<i>Eunotia naeglii</i>	0	4	0	0	0
<i>Eunotia pectinalis</i>	0	1	0	0	0
<i>Fragilaria tenera</i>	0	2	0	0	0
<i>Gomphonema angustum</i> var "subminutum"	0	0	70	0	0
<i>Gomphonema girdle</i>	0	0	0	4	0
<i>Gomphonema pumilum</i>	0	0	0	10	0

Taxon name	Wet 2020	Wet 2021	Dry 2021	Wet 2022	Dry 2022
<i>Gomphonema unknown</i>	0	0	2	0	0
<i>Gyrosigma acuminatum</i>	0	0	0	1	0
<i>Karayevia clevei</i>	0	1	0	0	0
<i>Mastogloia elliptica var. dansei</i>	0	0	0	2	0
<i>Navicula cryptocephala</i>	3	42	0	0	0
<i>Navicula cryptotenella</i>	1	4	0	12	0
<i>Navicula erifuga</i>	0	2	0	0	0
<i>Navicula gregaria</i>	2	1	0	0	0
<i>Navicula lanceolata</i>	4	1	0	0	0
<i>Navicula leptostriata</i>	0	2	22	0	0
<i>Navicula menisculoides</i>	6	0	0	0	0
<i>Navicula menisculus</i>	0	7	0	0	0
<i>Navicula recens</i>	2	0	1	0	0
<i>Navicula rostellata</i>	0	0	1	0	0
<i>Navicula spp</i>	0	1	0	0	0
<i>Navicula veneta</i>	0	1	0	0	0
<i>Navicula viridula</i>	0	6	2	0	0
<i>Nitzschia fonticola</i>	0	2	0	0	0
<i>Nitzschia frustulum</i>	0	0	0	19	0
<i>Nitzschia inconspicua</i>	0	2	0	0	0
<i>Nitzschia palea</i>	0	4	0	0	0
<i>Nitzschia paleaceae</i>	0	0	2	0	0
<i>Nitzschia perminuta</i>	0	0	2	0	0
<i>Nitzschia valdestrata</i>	0	0	1	0	0
<i>Pinnularia gibba</i>	0	0	1	0	0
<i>Pinnularia legumen</i>	0	0	2	0	0
<i>Pinnularia subcapitata</i>	0	0	0	1	0
<i>Sellaphora seminulum</i>	0	0	0	1	0
<i>Surirella minuta</i>	0	0	2	0	0
<i>Tryblionella angustulata</i>	0	0	0	1	0
<i>Tryblionella apiculata</i>	0	0	0	1	0
<i>Ulnaria acus</i>	0	0	0	3	0
<i>Ulnaria ulna</i>	6	0	3	1	0
Total Abundance	206	238	201	258	154

Taxon name	Wet 2020	Wet 2021	Dry 2021	Wet 2022	Dry 2022
Species Richness	16	27	20	28	23
DSIAR Score	62.7	60	56	56	17.4

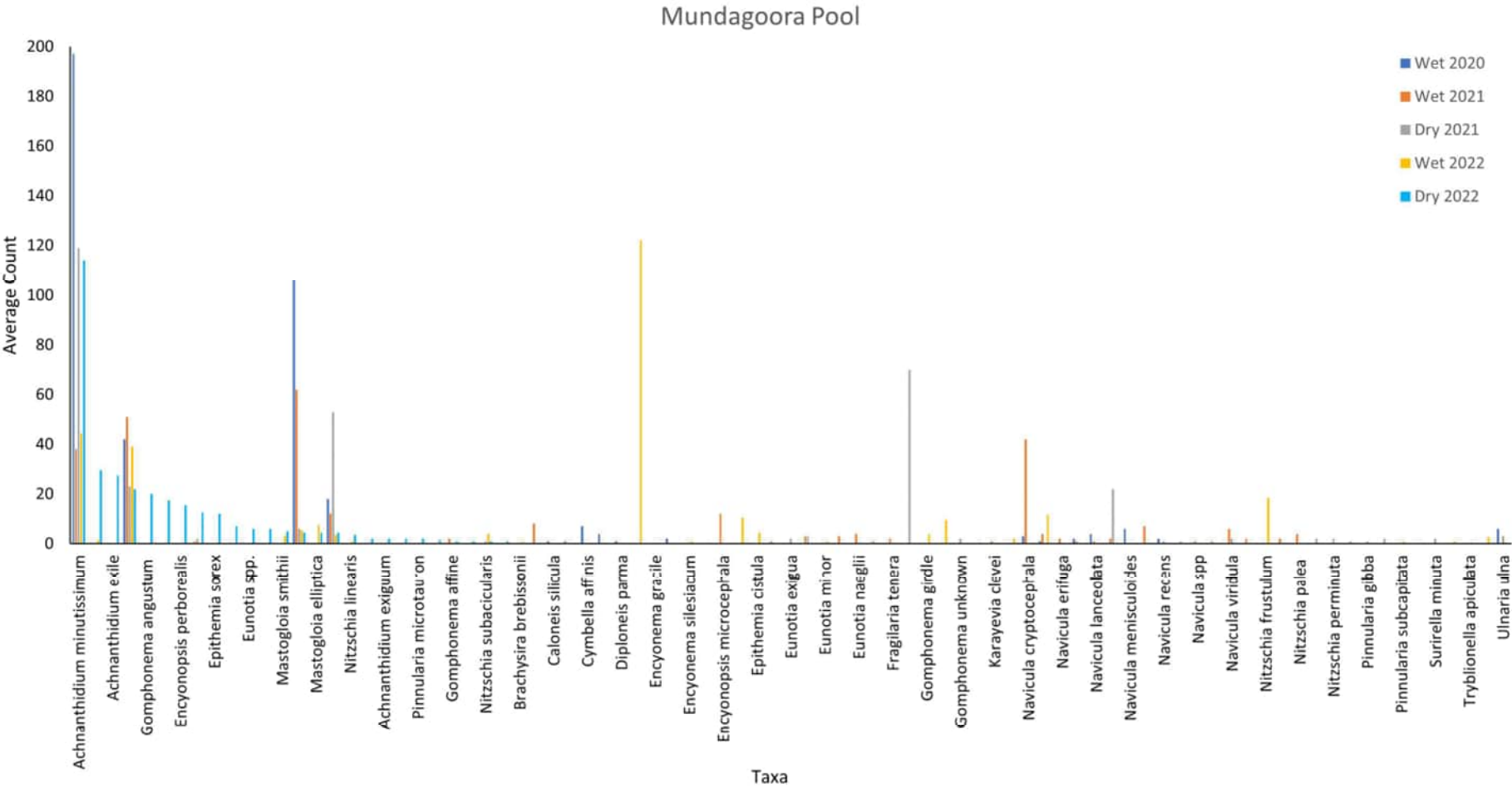


Figure 3-45 Average species abundance (diatom count per replicate) for diatoms sampled at Mundagoora Pool in the Late Wet 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022 and Late Dry 2022. Arranged most abundant Late Dry 2022 left to right.

3.3.7.2 PHYTOPLANKTON

In the Late Dry 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022 and Late Dry 2022, water samples were taken from Mundagoora Pool for phytoplankton taxonomy and abundance. Table 3-13 summarises the abundance of the phytoplankton taxon identified at Mundagoora Pool. Overall, seven classes of phytoplankton with ~33 species identified across the five seasons indicating a high phytoplankton diversity.

The abundance of phytoplankton was considerably lower during the Late Dry 2022 in comparison to the Late Wet 2022 and Late Dry 2021. Cyanobacteria were the most abundant Class in the Late Dry 2022, with the species *Cyanogranis spp.* Not recorded in previous seasons and the Chlorophaecea (green algae) species *Spaerocystis spp.* And *Staurastrum spp. (O)* were recorded for the first time at this site.

Table 3-13 Summary of phytoplankton analytical results for Mundagoora Pool sampled in Late Dry 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022 and Late Dry 2022 abundance (cells L⁻¹) and percentage contribution (%), limit of reporting 10 cell L⁻¹.

Taxon	Late Dry 2020		Late Wet 2021		Late Dry 2021		Late Wet 2021		Late Dry 2022	
	Abundance	%	Abundance	%	Abundance	%	Abundance	%	Abundance	%
Bacillariophyceae	80,300	76.11	70	63.64	40,000	0.37	480,000	14.95	1,520	7.1
<i>Achnantheidium sp.</i>	35,200	33.36	10	9.09	30,000	0.28	0	0	0	0
<i>Amphora spp.</i>	0	0	10	9.09	0	0	0	0	0	0
<i>Cocconeis spp.</i>	700	0.66	0	0	0	0	0	0	0	0
<i>Cymbella spp.</i>	300	0.28	0	0	0	0	0	0	0	0
<i>Lyrella spp.</i>	100	0.09	0	0	0	0	0	0	0	0
<i>Navicula spp.</i>	19,600	18.58	40	36.36	0	0	0	0	10	0.05
<i>Nitzschia spp.</i>	100	0.09	0	0	0	0	0	0	10	0.05
<i>Pinnularia spp.</i>	200	0.19	0	0	0	0	0	0	0	0
<i>Synedra spp. (O)</i>	4,500	4.27	10	9.09	0	0	0	0	0	0
<i>Gomphonema spp.</i>	0	0	0	0	10,000	0.09	0	0	0	0
<i>Cyclotella spp. (O)</i>	0	0	0	0	0	0	480,000	14.95	1,500	7
Chlorophyceae	900	0.85	40	36.36	10,060,000	93.06	1,260,000	39.25	6,950	32.45
<i>Crucigenia spp.</i>	0	0	0	0	70,000	0.65	0	0	450	2.1
<i>Dictyosphaerium spp. (O)</i>	0	0	0	0	1,240,000	11.47	800,000	24.92	2,480	11.58

Taxon	Late Dry 2020		Late Wet 2021		Late Dry 2021		Late Wet 2021		Late Dry 2022	
<i>Kirchneiella spp.</i>	0	0	0	0	320,000	2.96	0	0	240	1.12
<i>Monoraphidium contorta</i>	0	0	0	0	0	0	60,000	1.87	3,400	15.87
<i>Monoraphidium spp.</i>	0	0	0	0	8,200,000	75.86	0	0	20	0.09
<i>Oocystis spp. (O)</i>	0	0	0	0	230,000	2.13	400,000	12.46	40	0.19
<i>Mougeotia sp.</i>	0	0	40	36.36	0	0	0	0	0	0
<i>Spaerocystis spp</i>	0	0	0	0	0	0	0	0	300	1.4
<i>Staurastrum spp (O)</i>	0	0	0	0	0	0	0	0	20	0.09
Cryptophyceae	8,800	8.34	0	0	0	0	170,000	5.3	10	0.05
<i>Chroomonas spp.</i>	800	0.76	0	0	0	0	0	0	0	0
<i>Cryptomonas spp. (O)</i>	8,000	7.58	0	0	0	0	170000	5.3	10	0.05
Cyanobacteria	8,200	7.77	0	0	0	0	660,000	20.56	11,660	54.44
<i>Pseudoanabaena spp. (O) (PT)</i>	8,200	7.77	0	0	0	0	660,000	20.56	60	0.28
<i>Cyanogranis spp.</i>	0	0	0	0	0	0	0	0	11,600	54.15
Dinophyceae	7,200	6.82	0	0	0	0	0	0	20	0.09
<i>Gomphonema spp.</i>	500	0.47	0	0	0	0	0	0	0	0
<i>Gonyaulax spp.</i>	800	0.76	0	0	0	0	0	0	0	0
<i>Gymnodinium spp.</i>	1,400	1.33	0	0	0	0	0	0	0	0

Taxon	Late Dry 2020		Late Wet 2021		Late Dry 2021		Late Wet 2021		Late Dry 2022	
<i>Peridinium spp. (O)</i>	4,500	4.27	0	0	0	0	0	0	20	0.09
Euglenophyceae	100	0.09	0	0	10,000	0.09	20,000	0.62	60	0.28
<i>Euglena spp. (O)</i>	100	0.09	0	0	10,000	0.09	0	0	0	0
<i>Trachelomonas spp.</i>	0	0	0	0	0	0	20,000	0.62	60	0.28
Prasinophyceae	0	0	0	0	700,000	6.48	620,000	19.31	1,200	5.6
<i>Prasinophytes (unknown)</i>	0	0	0	0	700,000	6.48	600,000	18.69	1,200	5.6
<i>Tetraselmis spp.</i>	0	0	0	0	0	0	20,000	0.62	0	0

3.3.8 MACROPHYTES

Table 3-14 presents the macrophyte species and qualitative abundance during the six season surveys at Mundagoora Pool. The key findings were as follows:

- A total of six macrophyte species were recorded and show a range of emergent (bulrush and sedges) and submerged (charophyte and ribbon weed) types.
- Emergent macrophytes were the dominant edge habitat, occurring in wide dense beds along the pools edge except for along the upstream eastern rockface. Submerged macrophytes occurred in scattered abundance on the bed.
- There were no significant changes noted for macrophyte presence, abundance or health over the six survey periods.

Table 3-14 Macrophytes present at Mundagoora Pool

Common name	Species name	Late Wet 2020 Abundance ¹	Late Dry 2020 Abundance ¹	Late Wet 2021 Abundance ¹	Late Dry 2021 Abundance ¹	Late Wet 2022 Abundance ¹	Late Dry 2022 Abundance ¹
Ribbon weed	<i>Vallisneria sp.</i>	Abundant	Abundant	Abundant	Abundant	Abundant	Abundant
Charophytes	<i>Nitella sp., Chara sp.</i>	Isolated	Isolated	Isolated	Isolated	Isolated	Isolated
Clubrush	<i>Schoenoplectus sp.</i>	Abundant	Abundant	Abundant	Abundant	Abundant	Abundant
Sedges	Cyperaceae	Isolated	Isolated	Isolated	Isolated	Isolated	Isolated
Bulrush	<i>Typha sp.</i>	Abundant	Abundant	Abundant	Abundant	Abundant	Abundant

¹ Abundance based on *Western Australia AUSRIVAS field sampling sheet* (DoW, 2009).

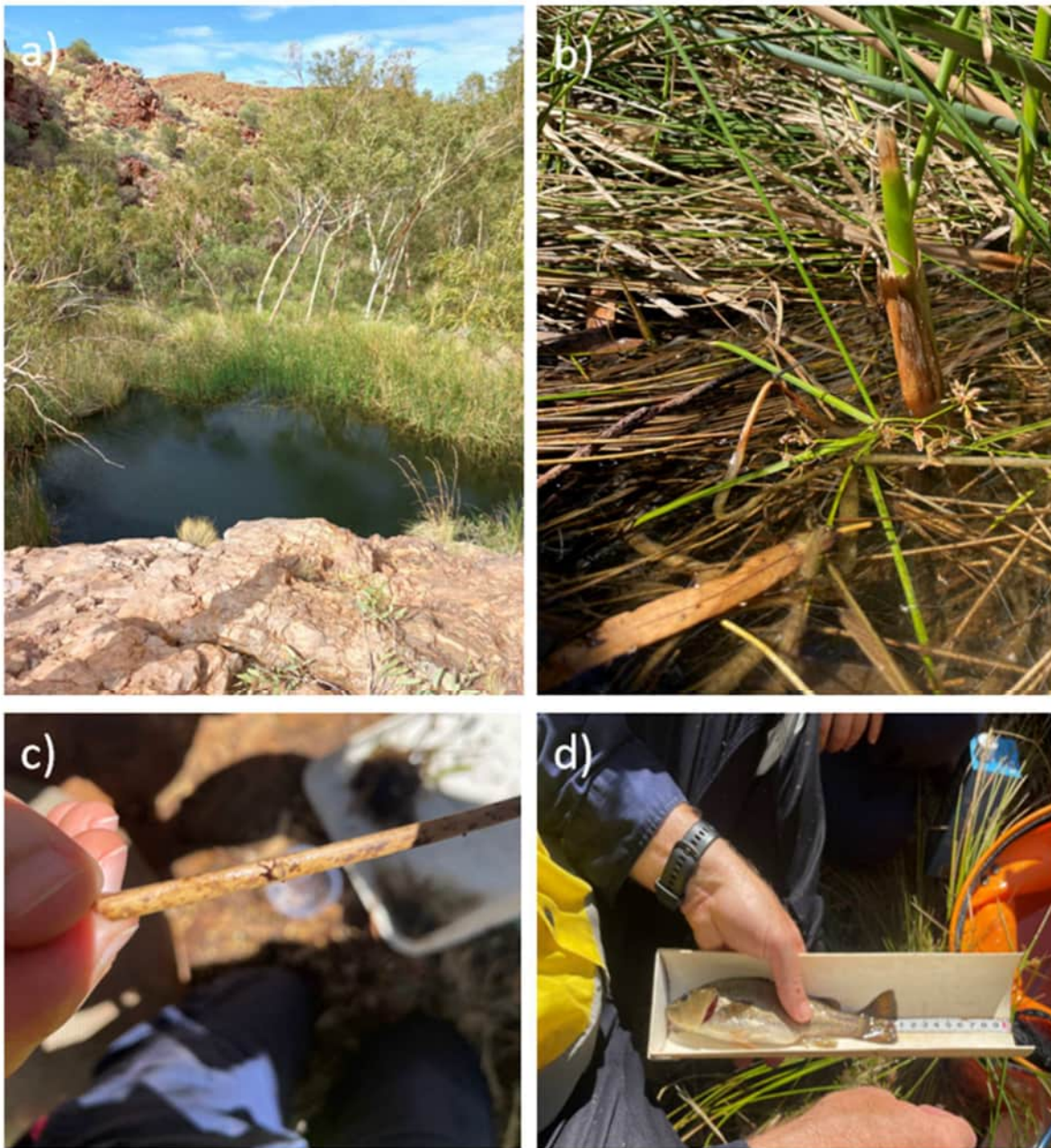


Figure 3-46 Mundagoora Pool aquatic ecology. A) emergent macrophytes forms beds at the edge of the pools; b) submerged macrophytes create important habitat for macroinvertebrates, fish and other species; c) unidentified beetle; d) *L. unicolor* being measured.

3.3.9 ENVIRONMENTAL VALUE

Mundagoora Pool has significant environmental value in the Pilbara landscape being a permanent pool and therefore provides and sustains the ecological functioning of various habitats. The groundwater flow into the pool continually discharges out from the pool into the lower catchment, sustaining a wetland (a string of pools and riparian/macrophyte vegetation) for several hundred metres downstream of the pool.

Mundagoora Pool contains high ecological values including an abundant fish population (*M. australis* and *L. unicolor*), submerged and emergent macrophytes, fishing birds and other wetland associated fauna. Kangaroos and dingoes have been recorded as using the wetland sustained by Mundagoora Pool indicating that its environmental value extends beyond the immediate vicinity as it provides a permanent water resource throughout the dry season. Mundagoora Pool is likely to be of conservation significance due to being a potential Pilbara Olive Python habitat, as it is the closest permanent pool to Pool_GR where the Pilbara Olive Python has been sighted by FMG staff during surveys. Mundagoora Pool is surrounded by a large rock ledge and wall, as well as surrounding spinifex, the preferred microhabitat for Pilbara Olive Pythons (Tutt et al., 2004).

3.4 CENTRAL CREEK POOL (IB_SW_POOL_CENTRAL CK)

Central Creek Pool is a shallow pool that lies on deep alluvial sediments on Cockatoo Creek, which experiences high flows in the wet season. The pool is predominantly sustained by surface/hyporheic water and consequently undergoes high rates of evapo-concentration and has minimal established macrophyte habitat. The water quality is relatively turbid in comparison to other Iron Bridge pools and there is evidence of cattle visitation.

In the Late Dry 2020, samples were not obtained from Central Creek as the site was dry. In the Late Dry 2021 water quality and sediment samples were collected, but due to the limited water present no additional ecological parameters were able to be recorded. Due to the low flows during the Late Wet 2022 Central Creek Pool was dry (Figure 3-49) and no water samples or other ecological parameters were able to be recorded, apart from sediment analysis. The pool was dry during the Late Dry 2022 sampling trip as well, with no water or ecological sampling conducted.



Figure 3-47 Central Creek Pool is a shallow ephemeral pool on Cockatoo Creek that experiences substantial evapo-concentration; a) Pool with water in Late Wet 2021; b) pool dry in Late Wet 2022 after low flow wet season.

3.4.1 SITE SPECIFIC TRIGGER VALUES

As Central Creek pool is an ephemeral pool, and the water quality and ecological parameters are highly dependent on surface water flows over the wet season it is difficult to assign site specific triggers for any parameters in the dry season where evapotranspiration can significantly affect readings. However, site

specific wet season triggers can be developed for pH, SPC, TDS and TN, which will lead to the investigation when the long-term rolling median values exceed the 80th percentile of the three seasons of data collected up to this point. In addition to the long-term 80th percentile median trigger, an instant value of exceedances over the 95th percentile median value could trigger investigation.

In terms of ecological triggers, the few data points are insufficient for fish, macroinvertebrates, diatoms and phytoplankton to have site specific triggers and a presence/absence trigger may be the most appropriate when pool water is present. This highly variable data is to be expected in ephemeral pools, with the hydrological cycle having the greatest influence on ecological functioning of the pool habitat.

3.4.2 WATER QUALITY AND HYDROLOGY

Central Creek Pool has a catchment area of 82.6 km², draining to Cockatoo Creek and the Turner River (Figure 3-48). The surface water level logger was installed in Central Creek Pool during the Late Wet 2020 sampling round and as such there is no direct hydrology data available for the previous wet season. However, there was a logger installed on the same creek system approximately 550 m downstream in a similar pool (MAR Cockatoo Creek; Figure 3-49) and it is considered that this represents a reasonable analogue for the hydrology of Central Creek Pool. The logger data for May 2020 to November 2022 at Central Creek Pool is provided in Figure 3-49. Central Creek Pool shows a typical Pilbara creek flooding profile driven by alluvial (hyporheic) flows. There is an initial peak water level during high-rainfall events with a longer “tail” to the peak as water levels recede, driven by discharge from upper catchment alluvial storage and groundwater. Once recharged after the first flush event, the pool water levels are maintained over the wet season, receding slowly as the alluvial sediment dry out over the early dry season.

It can be seen from Figure 3-49 that Central Creek Pool was dry by July 2020 and filled again with a major rainfall event on 10th December 2020. Following the 2021 wet season, the pool was almost dry by the first week of August 2021 (Figure 3-49). The rate of recedence between flood events appears to lower as the wet season progresses, potentially in response to increase groundwater inflows to the hyporheic system of the creek. However, due to the low 2022 wet season flows and catchment recharge the pool remained dry except in response to a rainfall event on 28/04/2022 where the water depth increased briefly to 0.91m (Figure 3-49). The pool then dried out by 04/05/2022 and remained dry throughout the 2022 dry season (Figure 3-49).

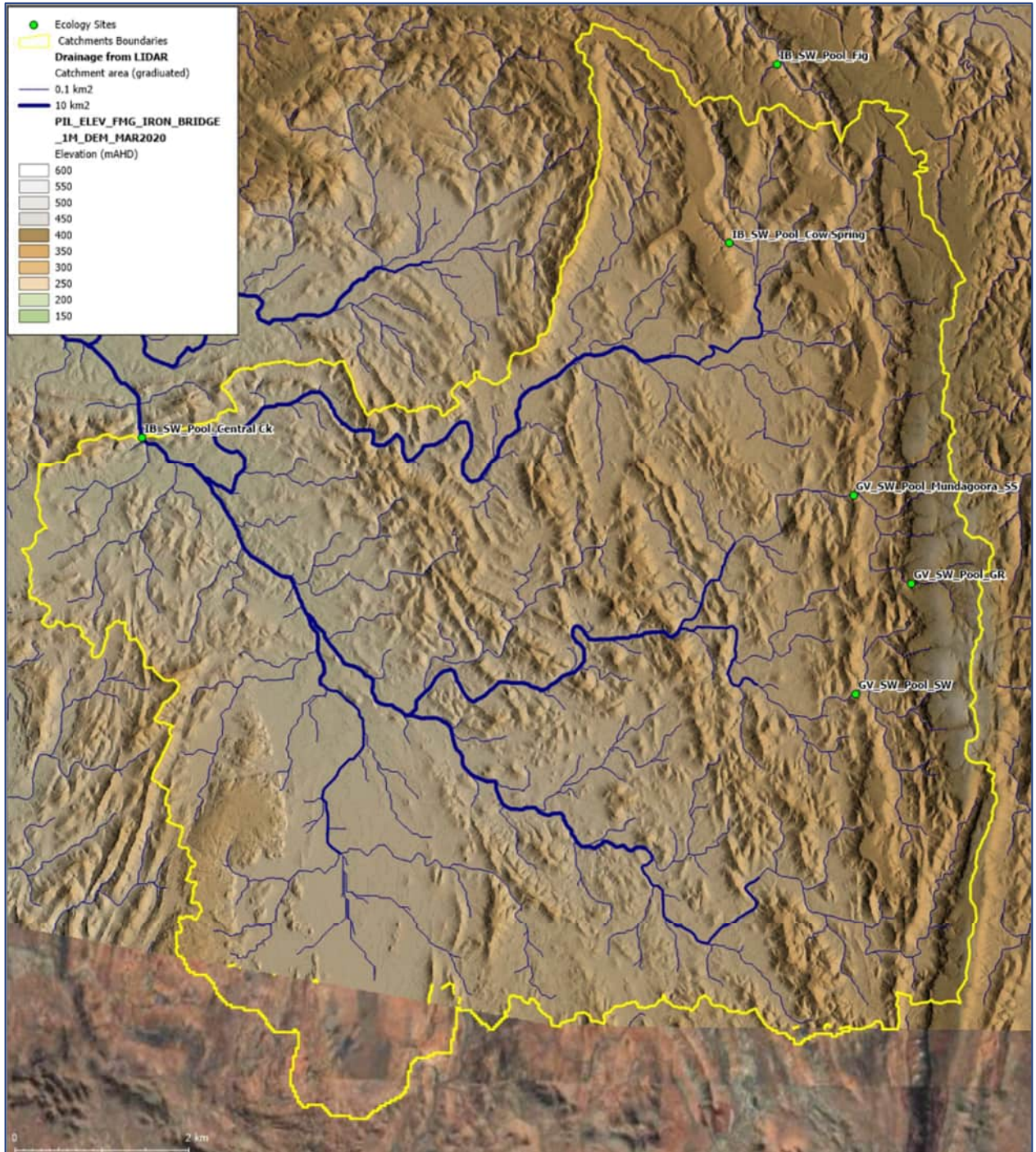


Figure 3-48 Central Creek Pool catchment area (82.6 km²)

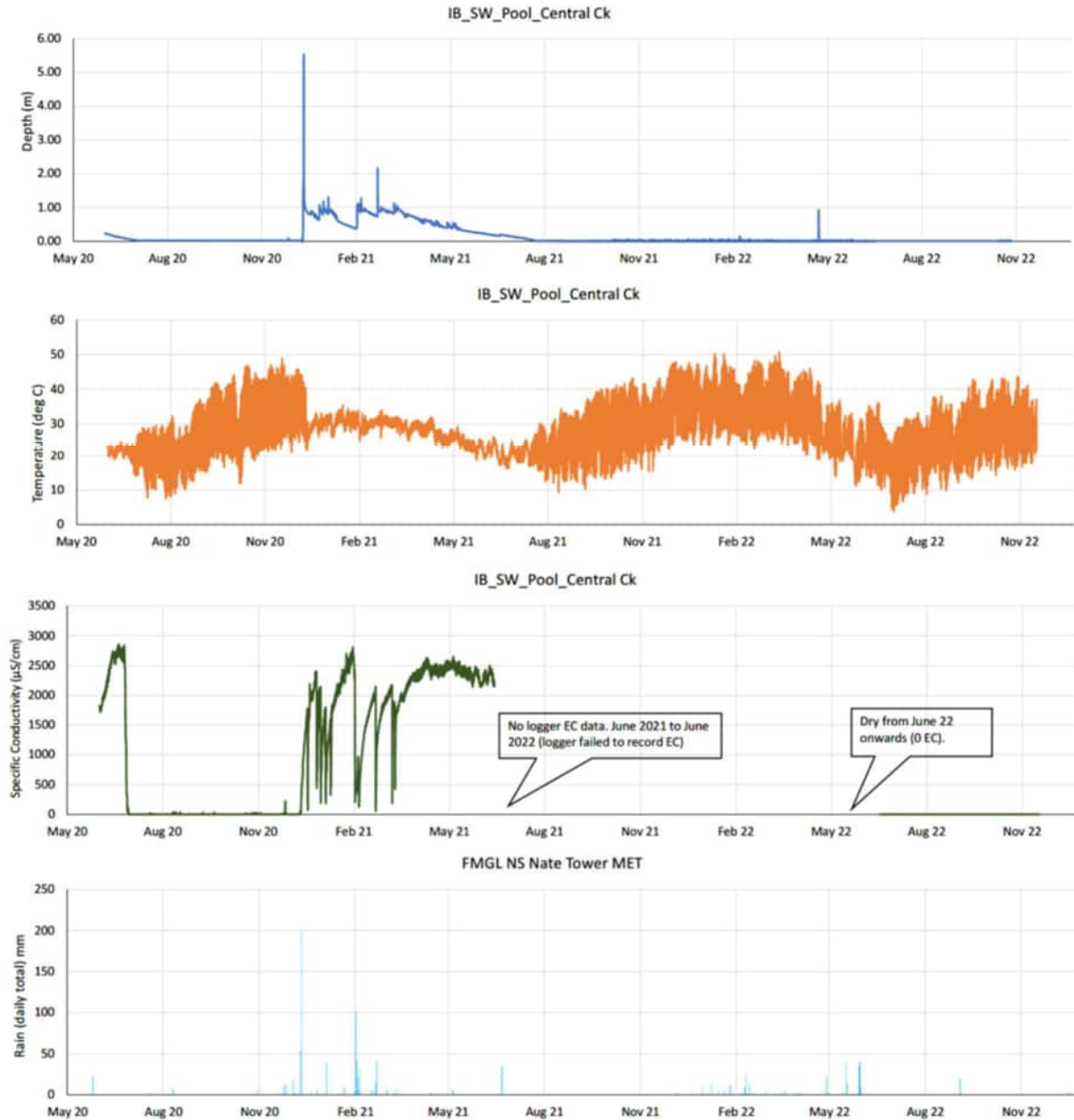


Figure 3-49 Central Creek logger record from 31/05/2020 to 24/11/2022 for pool water depth (m), water temperature (°C), specific conductivity ($\mu\text{S}/\text{cm}$) and daily rainfall at FMG LNS Nate Tower MET.

The ecology of Central Creek pool is dependent on the longevity of supporting flows through the upstream alluvium/hyporheic zone, which in turn are related to groundwater discharge from the upper catchment and flood plain materials. Single large inflows, and periodic larger supporting flows are important for the ecology of this pool. Smaller (higher frequency) flows may provide some additional longevity, though the sandy nature of the bed material drives rapid drawdown in the absence of a saturated alluvium and ongoing hyporheic flows.

Note that the conductivity channel of the logger failed to record from the 16th June 2021 to 18th August 2022. The logger has since been reset, cleaned and calibrated and is working properly (the other two channels – temperature and water level – recorded properly though the time stamps required manual corrections. It should also be noted that no water samples were collected during the Late Wet 2022 and Late Dry 2022 as the creek was dry.

Central Creek Pool displayed average brackish salinity (2744 $\mu\text{S}/\text{cm}$ conductivity) (Table 3-15) over the monitoring period, likely representing evapo-concentration effects since the last major flushing event occurred in March 2021. Water quality was representative of typical Pilbara streams with near-neutral average pH (8.02), with the pH gradually increasing over the seasons (Figure 3-50). Central Creek has low-moderate average turbidity (5.26 NTU) and moderate average oxygenation (102.4% saturation). Alkalinity was moderate-high at 406 mg/L (as CaCO_3) with major ions dominated by sodium chloride (Figure 3-50). Note that Figure 3-50 also shows the MAR Cockatoo Creek results for the Late Dry 2020 as these were opportunistically obtained following the large (200 mm) rainfall event on the 10th December 2020. The MAR Cockatoo Creek site is 550 m downstream of Central Creek Pool on the same reach.

Only dissolved Arsenic concentrations in the Late Dry 2021 slightly exceeded the ANZG (2018) 95% Ecosystem Protection Levels (EPLs) for As(V) though not As(III). This is likely due to the evapo-concentrating and receding stage of the pool hydrocycle and unlikely to represent a significant ecotoxicological issue. No other dissolved metals exceeded the ANZG (2018) 95% EPLs (Table 3-15). The average nutrient concentrations of TN and TP for those seasons when water is present in the pool exceeded the ANZG (2018) 95% EPL.

Table 3-15. Summary of water quality analytical results for Central Creek. Concentration for each analyte and analyte group described for Late Wet season 2020, Late Wet season 2021 and Late Dry season 2021. No data available for Late Wet 2022 and Late Dry 2022 as creek was dry. Only dissolved metals with Default Guideline Values (DGV) were included in this table. Bolded values denote results above the 95% species protection levels ANZG (2018) DGVs.

Analyte/Water Quality Parameter	Mean	Median	Max	Min	Range	SE	95% Protection/DGV
Temp (°C)	26.33	25.90	29.30	23.80	5.50	1.60	
DO (%)	102.38	92.00	125.15	90.00	35.15	11.40	90
DO (mg/L)	7.96	7.48	9.79	6.60	3.19	0.95	
SPC ($\mu\text{S}/\text{cm}$)	2744.67	2874.00	3133.00	2227.00	906.00	269.42	
TDS (mg/L)	1685.67	1760.00	1850.00	1447.00	403.00	122.13	
pH	8.02	8.00	8.38	7.69	0.69	0.20	6.0-7.5
Turbidity (NTU)	5.26	2.54	11.04	2.20	8.84	2.89	15
Total Alkalinity as CaCO_3 (mg/L)	541.67	576.00	643.00	406.00	237.00	70.54	
Ammonium as N (mg/L)	0.005	0.005	0.005	0.005	0.000	-	0.006
Nitrite as N (mg/L)	0.005	0.005	0.005	0.005	0.000	-	0.03
Nitrate as N (mg/L)	0.005	0.005	0.005	0.005	0.000	-	0.03
Nitrite + Nitrate as N (mg/L)	0.017	0.005	0.040	0.005	0.035	0.012	0.03
Total Nitrogen as N (mg/L)	1.57	0.20	4.40	0.10	4.30	1.42	0.15
Total Phosphorus as P (mg/L)	0.06	0.03	0.12	0.02	0.10	0.03	0.01
Reactive Phosphorus as P (mg/L)	0.007	0.005	0.010	0.005	0.005	0.002	0.005

Analyte/Water Quality Parameter	Mean	Median	Max	Min	Range	SE	95% Protection/DGV
Dissolved Organic Carbon (mg/L)	8.0	4.0	18.0	2.0	16.0	5.033	
<i>Dissolved Metals</i>							
Aluminium (mg/L)	0.09433	0.05000	0.21600	0.01700	0.19900	0.06157	0.055
Arsenic (mg/L)	0.01600	0.01220	0.02380	0.01200	0.01180	0.00390	0.024(AsII), 0.013(AsV)
Boron (mg/L)	0.74433	0.69000	0.94300	0.60000	0.34300	0.10267	0.94
Cadmium (mg/L)	0.00003	0.00003	0.00005	0.00003	0.00003	0.00001	0.0002
Chromium (mg/L)	0.00170	0.00050	0.00420	0.00040	0.00380	0.00125	0.001
Copper (mg/L)	0.00068	0.00050	0.00130	0.00025	0.00105	0.00032	0.0014
Lead (mg/L)	0.00028	0.00030	0.00050	0.00005	0.00045	0.00013	0.0034
Manganese (mg/L)	0.50173	0.19800	1.27000	0.03720	1.23280	0.38693	1.9
Mercury (mg/L)	0.00002	0.00002	0.00002	0.00002	0.00000	0.00000	0.00006
Nickel (mg/L)	0.00407	0.00120	0.01000	0.00100	0.00900	0.00297	0.011
Selenium (mg/L)	0.00183	0.00030	0.00500	0.00020	0.00480	0.00158	0.011
Zinc (mg/L)	0.00167	0.00200	0.00250	0.00050	0.00200	0.00060	0.008

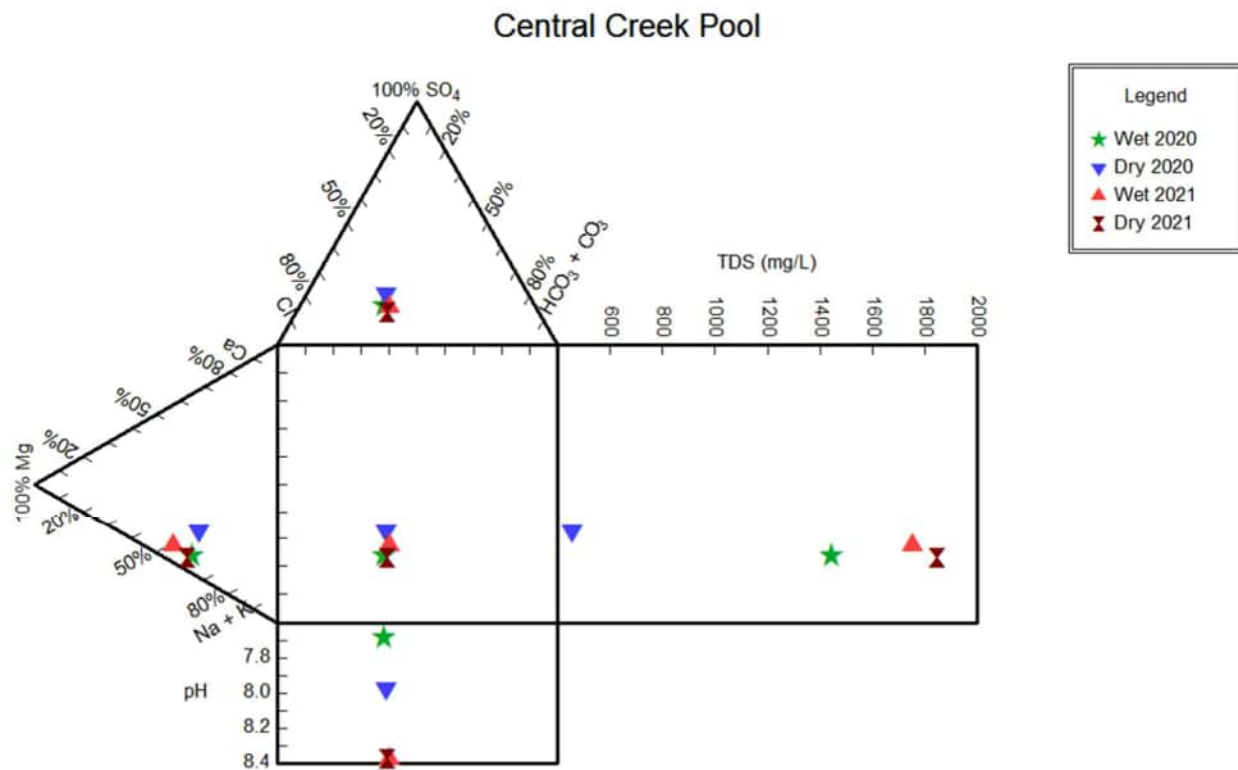


Figure 3-50 Durov diagram showing the Central Creek Pool major ion distribution.

3.4.3 SEDIMENT QUALITY

Table 3-16 provides the surface sediment quality at Central Creek Pool during the Late Wet 2020, Late Wet 2021 and Late Dry 2021. No sediment samples were collected for the Late Dry 2022 due to the site being dry.

Table 3-16. Summary of sediment quality analyses for Central Creek for the late wet seasons (2020 and 2021), no analysis recorded for late dry season (2020) and late dry season (2022) due to the site being dry. Bolded values denote results above the ANZG (2018) DGVs.

Analyte grouping/Analyte	Unit	ANZG value	Late Wet (2020)	Late Wet (2021)	Late Dry 2021
Total Soluble Salts	mg/kg	-	1,180	559	635
Moisture Content (Dried @ 105-110°C)	%	-	29.8	19.1	22.7
Carbonate Alkalinity as CaCO₃	mg/kg	-	<1	<5	<5
Bicarbonate Alkalinity as CaCO₃	mg/kg	-	120	198	299
Total Alkalinity as CaCO₃	mg/kg	-	120	198	299
Acidity	mg/kg	-	4	<5	<5
Sulfate as SO₄ 2- (soluble sulfate by ICPAES)	mg/kg	-	200	40	40
Chloride (by Discrete Analyser)	mg/kg	-	170	90	140
Calcium	mg/kg	-	40	<10	30
Magnesium	mg/kg	-	70	40	80
Sodium	mg/kg	-	220	10	190
Potassium	mg/kg	-	20	<10	30
Mercury (FIMS)	mg/kg	-	<0.1	<0.1	<0.1
Nitrite + Nitrate as N (Sol.)	mg/kg	-	<0.1	<0.1	<0.1
Total Kjeldahl Nitrogen as N	mg/kg	-	1,090	80	220
Total Nitrogen as N	mg/kg	-	1,090	80	220
Total Phosphorus as P	mg/kg	-	100	43	73
Reactive Phosphorus as P	mg/kg	-	<0.1	<0.1	<0.1
Total Organic Carbon	%	-	1.80	0.18	0.18
Total Metals by ICP-AES					
Arsenic	mg/kg	20	9	10	6
Barium	mg/kg	-	40	30	40
Beryllium	mg/kg	-	<1	<1	<1
Boron	mg/kg	-	<50	<50	<50
Cadmium	mg/kg	1.5	<1	<1	<1
Chromium	mg/kg	80	219	247	216

Analyte grouping/Analyte	Unit	ANZG value	Late Wet (2020)	Late Wet (2021)	Late Dry 2021
Cobalt	mg/kg	-	16	18	14
Copper	mg/kg	65	22	17	18
Iron	mg/kg	-	26,600	30,600	23100
Lead	mg/kg	50	<5	<5	<5
Manganese	mg/kg	-	476	492	334
Nickel	mg/kg	21	112	113	110
Selenium	mg/kg	-	<5	<5	<5
Vanadium	mg/kg	-	39	36	33
Zinc	mg/kg	200	35	20	26

3.4.4 FISH

Fish were present at Central Creek Pool during 2020 and 2021 wet season surveys and were not present in either dry season due to the pool being dry (2020 and 2022) or little more than a puddle (2021). No fish samples were collected in the Late Wet 2022 as the pool was dry. Two fish species were present during 2020 and 2021 wet season surveys: *M. australis* and *L. unicolor*. Both species were observed roughly equal abundance in 2020 and considerably higher numbers of *M. australis* (n = 266) were observed in 2021.

Table 3-17 presents the fish species, catch and size distribution. The two fish species present, *M. australis* and *L. unicolor*, occurred at similarly high abundances for the size of the pool. The high abundance is likely a function of the high catchability due to evaporation reducing the pool habitat and thereby increasing fish density, rather than the pool providing a preferred habitat.

For both seasons, the size distribution of *M. australis* was similar, with the SL size ranging from Figure 3-51 displays the size-frequency for *M. australis*, notably most fish were recorded in the 30 – 60 mm size class. Only one *M. australis* individual in the <30 mm size category was observed for both seasons, indicating minimal juvenile abundance in this site. However, due to Central Creek being dry over the late dry season and similar abundances of fish in both wet seasons, breeding and recruitment are likely occur in nearby water bodies that seasonally open to Central Creek. This site is unlikely to represent a significant habitat for either species on a regional scale.

The size range for *L. unicolor* was generally larger in the Late Wet 2020 (subsamped range SL: 32 – 174 mm) than in the Late Wet 2021 (subsamped range SL: 39 – 110 mm), with a higher frequency of juveniles present in the Late Wet 2021 (Figure 3-52). The large proportion of *L. unicolor* individuals observed in the 30 – 60 mm size class indicates a notable juvenile presence in Central Creek in both years (Figure 3-52). *L. unicolor* displays rapid growth in the juvenile stage, attaining a length of ~25 mm TL in under 60 days (Llewellyn, 1973). Although very young juveniles (<30 mm) were not observed during each survey, most *L. unicolor* caught were between 30 – 60 mm, indicating spawning around 2 to 3 months before the survey. The elevated water levels in conjunction with stable elevated water temperatures in February (Figure 3-46 and 3-47) coincide with the apparent recruitment of juvenile *L. unicolor*. Most *L. unicolor* present at Central Creek were not sexually mature, as length at maturity is typically above 60 mm TL (Llewellyn, 1973).

Table 3-17. Fish species, size class (SL, mm), total catch number and CPUE for Central Creek surveyed in late wet seasons in 2020 and 2021. No fish data for Late Wet and Late Dry 2022 as creek was dry.

Species	Size class (mm)	Late Wet 2020 Fish Count	Late Wet 2020 CPUE ¹	Late Wet 2021 Fish Count	Late Wet 2021 CPUE ¹
<i>Melanotaenia australis</i>		188	9.8	266	14
	0 – 30	1		1	
	30 – 60	128		237	
	60 – 90	590		28	
	> 90	0		0	
<i>Leiopotherapon unicolor</i>		214	11.2	111	5.8
	30 – 60	110		79	
	60 – 90	55		19	
	> 90	49		13	
Total		402	21.1	377	19.8

1 CPUE is catch per unit effort, a measure of relative abundance. Effort is fyke net set for 19 hours.

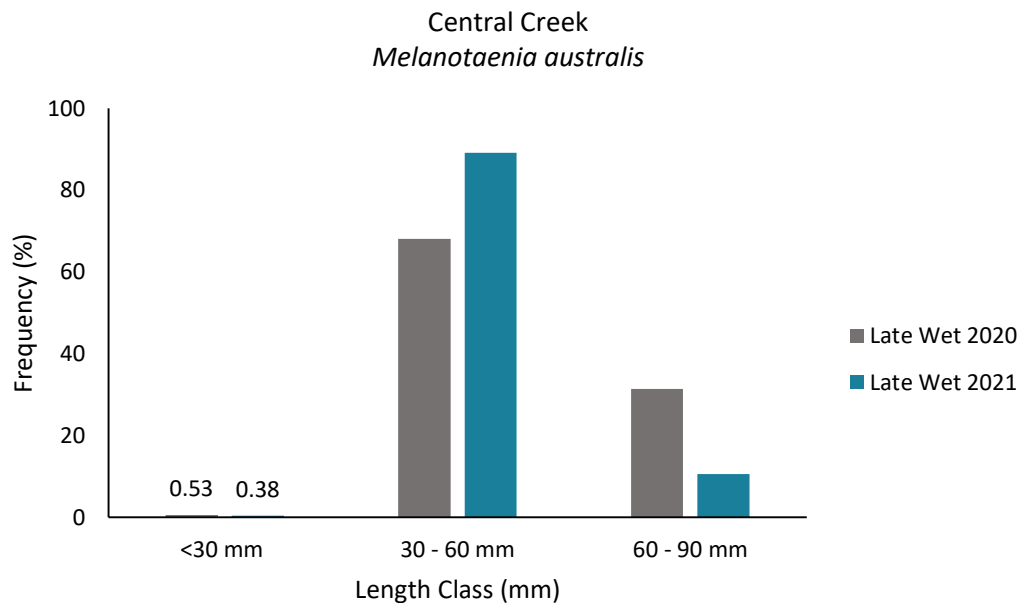


Figure 3-51 Frequency (%) of occurrence of each length class (SL, mm) *M. australis* sampled from Central Creek in the Late Wet 2020 and Late Wet 2021. No fish data for Late Wet and Late Dry 2022 as creek was dry.

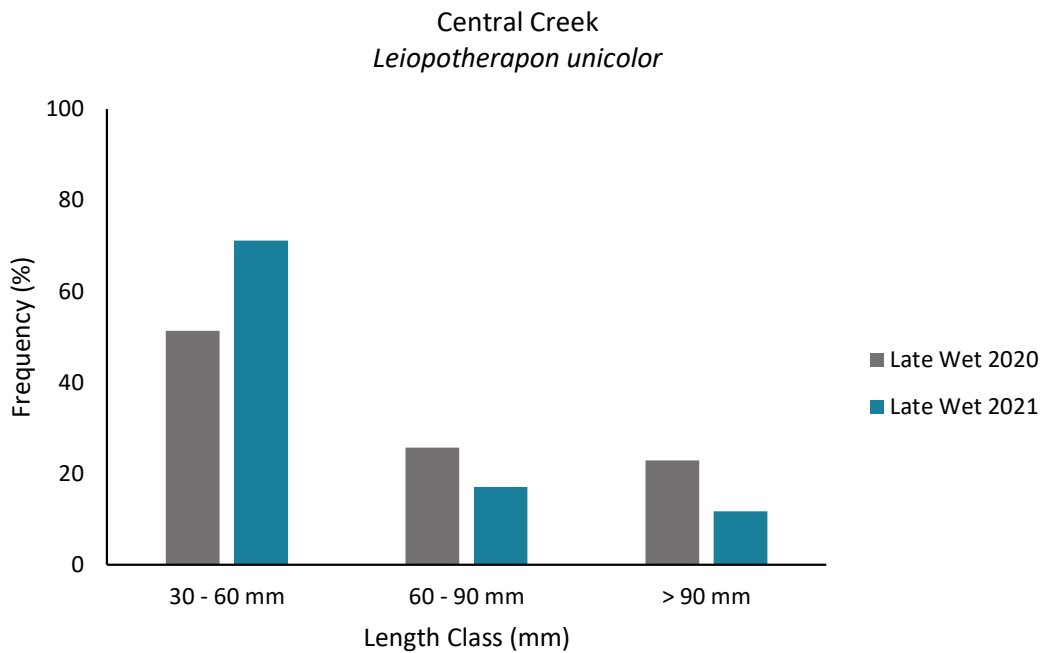


Figure 3-52 Frequency (%) of occurrence of each standard length class (SL, mm) for *L. unicolor* sampled from Central Creek in the Late Wet 2020 and Late Wet 2021. No fish data for Late Wet and Late Dry 2022 as creek was dry.

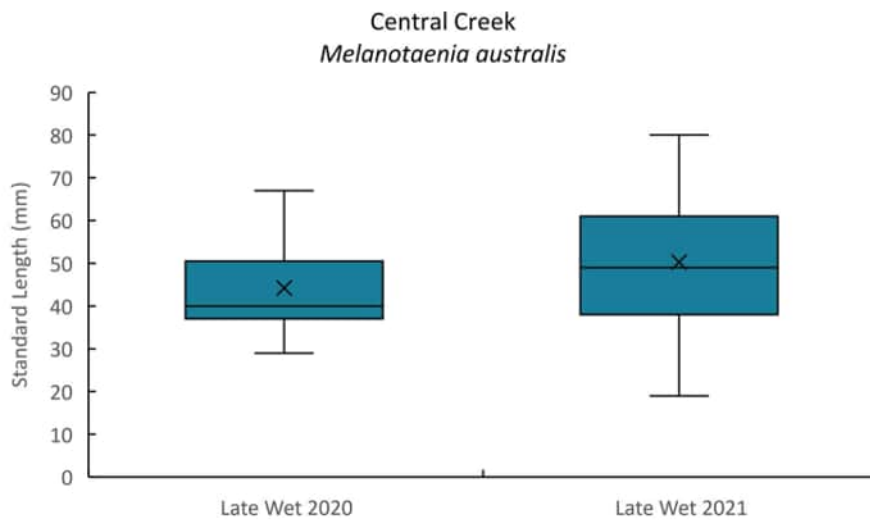


Figure 3-53 Distribution of standard length (SL, mm) of *Melanotaenia australis* sampled from Central Creek in the late wet season in 2020 (June) and 2021 (May). No fish data for Late Wet and Late Dry 2022 as creek was dry.

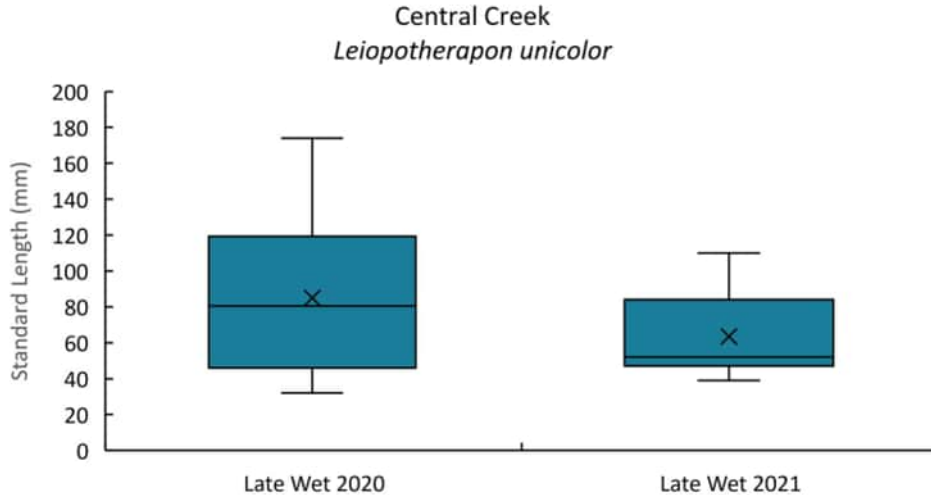


Figure 3-54 Distribution of standard length (SL, mm) of *Leiopotherapon unicolor* sampled from Central Creek in the late wet season in 2020 (June) and 2021 (May). No fish data for Late Wet and Late Dry 2022 as creek was dry.

3.4.5 AQUATIC MACROINVERTEBRATES

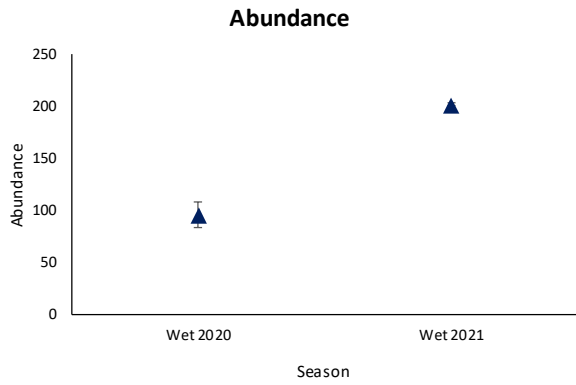
Figure 3-55 presents the total abundance, taxa richness, EPT richness and SIGNAL2 scores for the Late Wet seasons of 2020 and 2021. No data is available for the Late Dry 2020, Late Dry 2021, Late Wet 2022 and Late Dry 2022 seasons due to the pool being dry and the pool only containing enough water for water quality sampling. The key findings from both wet seasons were as follows:

- Average total abundance of macroinvertebrates doubled from 96 in the Late Wet season of 2020 to 2021 in the corresponding season in 2021 (Figure 3-55a).
- Similarly, EPT richness also increased from 3 to 4.5 between seasons of 2020 and 2021 (Figure 3-55c), with a total of five families recorded from the Plecoptera and Trichoptera orders.
- In contrast, taxa richness (21.5) and SIGNAL2 (3.08-3.38) scores were consistent between the Late Wet seasons (Figure 3-55b, d), indicating that Central Creek Pool can maintain a relatively stable macroinvertebrate community in the wet seasons despite its ephemeral presence.
- A low SIGNAL2 score (SIGNAL2 grade = 3) indicates predominantly tolerant taxa were collected and the system experiences associated environmental stress (Chessman, 2003).

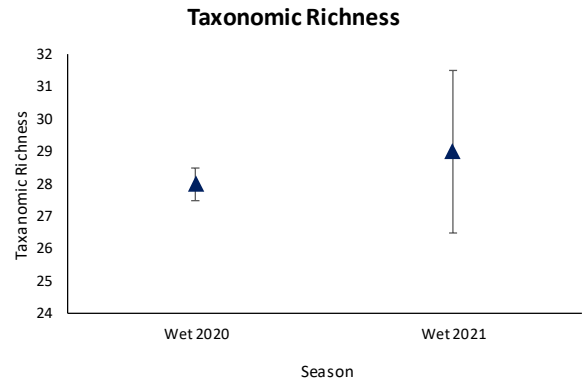
Many macroinvertebrate taxa were much more abundant in the Late Wet 2021 season than the previous Late Dry season, such as mayflies of the Baetidae and Caenidae, water boatman of the Micronectidae, and the non-biting midge belonging to s-f Tanyptodinae. In comparison, the backswimmer Pleidae, the diving beetle Dytiscidae and damselflies of the Coenagrionidae were more abundant in the Late Wet season of 2020. The increased abundances of macroinvertebrates in Late Wet 2021 after a period of desiccation suggest that the community is well adapted to this drying pattern. For example, chironomids are recognised to burrow deeper into the sediments when pools dry out and can also enter a period of aestivation (i.e. dormancy during dry periods; Jones 1997, Frouz et al. 2003). The relative abundance of taxa is also a function of pond permanence, with chironomids seen in high abundances when ponds have been recently established (Brooks 2000). As the mayflies Baetidae and Caenidae belong to the sensitive order Ephemeroptera, their presence in the Late Wet season of 2021 may suggest that the environmental quality of Central Creek Pool was apparently better during this period (Menetrey et al. 2007).

No macroinvertebrate species of conservation significance were found at Central Creek Pool.

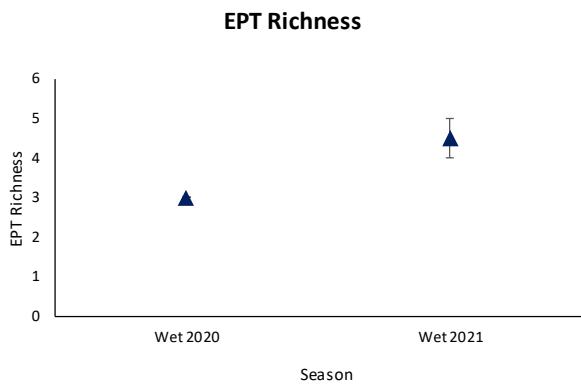
A) Total Abundance - Central Creek Pool



B) Taxonomic Richness - Central Creek Pool



C) EPT Richness - Central Creek Pool



D) Signal 2 Score - Central Creek Pool

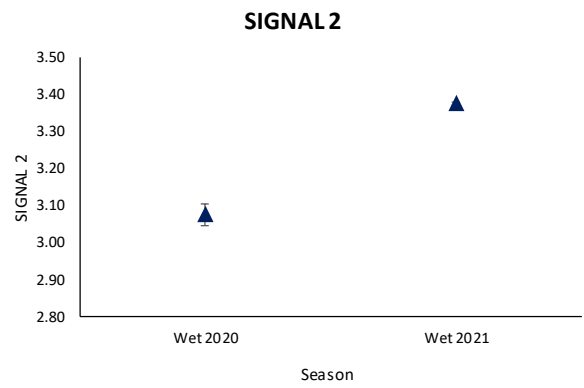


Figure 3-55 Macroinvertebrate indices for Central Creek Pool – Late Wet 2020 and Late Wet 2021

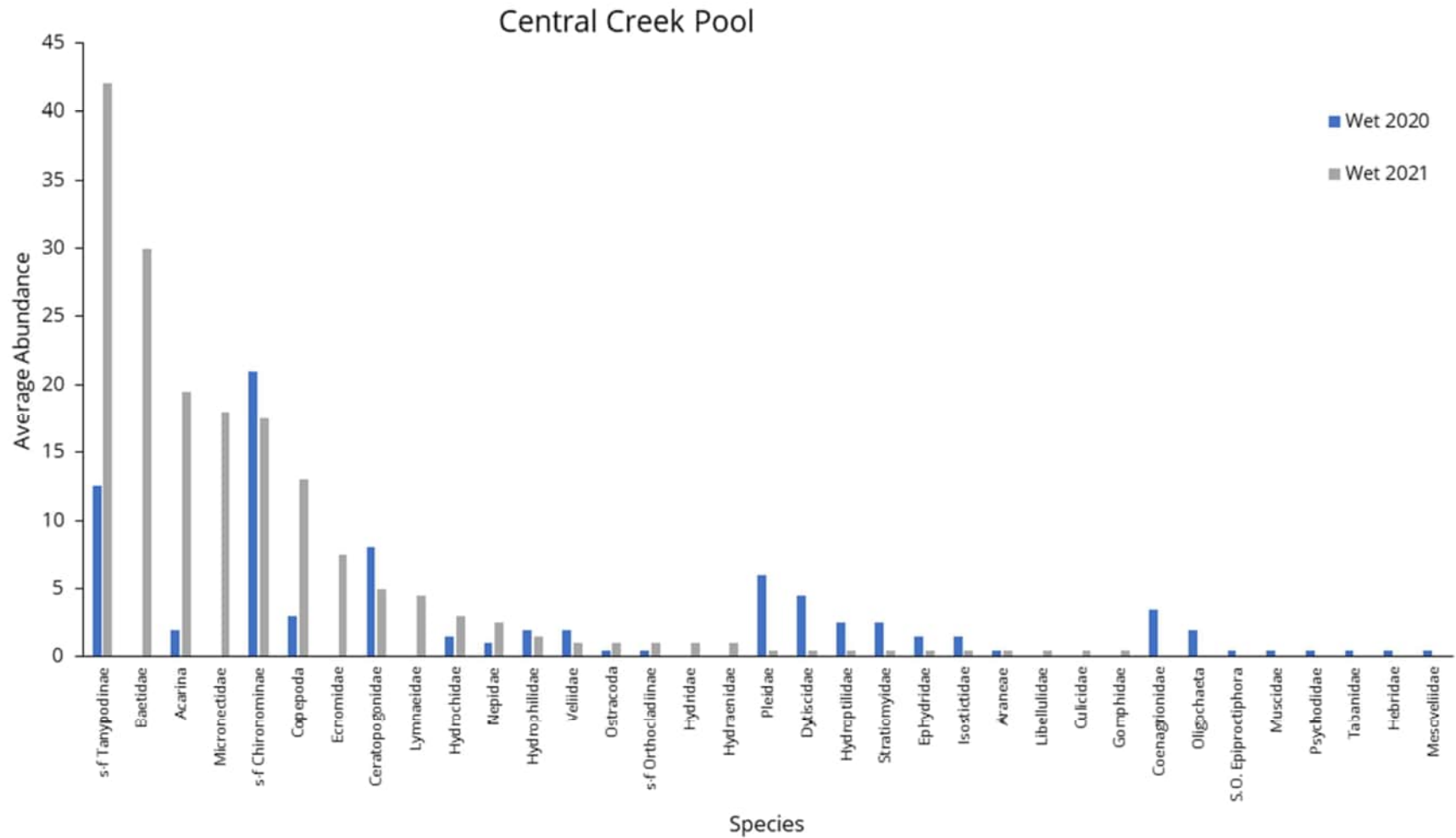


Figure 3-56 Average abundances of all macroinvertebrate taxa at Central Creek Pool in the Late Wet seasons of 2020 and 2021, with taxa arranged from most abundant (left) to least abundant (right) along the x-axis

3.4.6 PHYTOPLANKTON & DIATOMS

3.4.6.1 DIATOMS

Table 3-18 presents the Late Wet 2020 and Late Wet 2021 diatom species present, abundance, and biotic indices at Central Creek Pool. Figure 3-57 shows the average count by diatom species present. No diatom data was collected in the Late Dry 2020, Late Dry 2021, Late Wet 2022 and Late Dry 2022 due to the pool being dry at the end of the collection period.

High taxonomic diversity of diatoms was observed for both seasons at Central Creek. A total of 42 species were observed at Central Creek ranging across many families, with the Late Wet 2021 season recording slightly lower species richness with 25 species compared with Late Wet 2020 which recorded 27 diatom species. Only 11 diatom species (26% of total species) observed in Central Creek were recorded in both seasons, however these species made up 92% of the average total diatom abundance in the Late Wet 2020 and 84% of the average total diatom abundance in the Late Wet 2021 indicating a few species that are best adapted to the environmental conditions in this pool (Figure 3-57).

Late Wet 2021 recording a higher average total abundance of 433. *Achnantheidium exiguum* (average count = 258) was dominant in the Late Wet 2020, while only third most abundant in Late Wet 2021 (average count = 44). The Late Wet 2021 season most abundant species was *Pleurosigma elongatum* (average count = 116), with this species being the fourth most abundant in Late Wet 2020 (average count = 14).

The tolerance to environmental stress is reflected in the low DSIAR scores for both 2020 and 2021 (42.0 and 36.5, respectively), which indicates the pool is dominated by species tolerant to degraded water quality. While the DSIAR score is low, no teratological forms were detected and the diversity of species is relatively high for North Star pools. The low presence or abundance of species associated with lower water quality likely reflects the environmental stress resulting from nutrient pollution from cattle visitation and declining water quality due to high evapo-concentration.

Table 3-18 Summary of Diatom species abundance (total count per species), average abundance and DSIAR score for Central Creek in the Late Wet 2020 and 2021. No diatom data for Late Wet 2022 as creek was dry.

Taxon name	Late Wet 2020			Late Wet 2021		
	R1	R2	Average	R1	R2	Average
<i>Achnantheidium exiguum</i>	246	270	258	88	0	44
<i>Pleurosigma elongatum</i>	28	0	14	118	114	116
<i>Navicula menisculus</i>	0	4	2	74	96	85
<i>Nitzschia palea</i>	40	16	28	44	38	41
<i>Diploneis parma</i>	6	2	4	46	16	31
<i>Achnantheidium minutissimum</i>	22	12	17	0	46	23
<i>Nitzschia frustulum</i>	10	8	9	14	12	13
<i>Achnanthes subexigua</i>	0	0	0	6	14	10
<i>Epithemia gibba</i>	0	0	0	0	18	9
<i>Navicula veneta</i>	12	6	9	0	0	0
<i>Nitzschia paleaceae</i>	0	0	0	10	8	9
<i>Nitzschia lacuum</i>	8	4	6	8	4	6
<i>Nitzschia linearis</i>	0	0	0	4	4	4

Taxon name	Late Wet 2020			Late Wet 2021		
<i>Nitzschia inconspicua</i>	0	6	3	0	0	0
<i>Brachysira vitrea</i>	0	0	0	0	4	2
<i>Eunotia bilunaris</i>	4	0	2	0	0	0
<i>Eunotia minor</i>	0	0	0	0	4	2
<i>Gomphonema minutum</i>	0	0	0	0	4	2
<i>Hantzschia amphioxys</i>	0	4	2	2	0	1
<i>Nitzschia filiformis</i>	0	0	0	4	0	2
<i>Nitzschia fonticola</i>	0	0	0	0	4	2
<i>Nitzschia graciliformis</i>	4	0	2	2	0	1
<i>Nitzschia microcephala</i>	0	4	2	0	0	0
<i>Pinnularia spp.</i>	0	4	2	0	0	0
<i>Ulnaria ulna</i>	4	0	2	0	0	0
<i>Amphora libyca</i>	0	0	0	0	2	1
<i>Brachysira brebissonii</i>	0	2	1	0	0	0
<i>Cymbella affinis</i>	0	0	0	0	2	1
<i>Cymbella spp</i>	0	2	1	0	0	0
<i>Diploneis smithii</i>	0	0	0	0	2	1
<i>Eolimna minima</i>	2	0	1	0	0	0
<i>Eunotia exigua</i>	0	0	0	0	2	1
<i>Fragilaria spp.</i>	2	0	1	0	0	0
<i>Haslea duerrenbergiana</i>	0	0	0	2	0	1
<i>Mastogloia smithii</i>	0	2	1	2	0	1
<i>Navicula lanceolata</i>	2	0	1	0	0	0
<i>Navicula phyllepta</i>	0	2	1	0	0	0
<i>Navicula radiosa</i>	2	0	1	0	0	0
<i>Nitzschia gracilis</i>	2	0	1	0	0	0
<i>Nitzschia suchlandii</i>	0	2	1	0	0	0
<i>Pinnularia legumen</i>	0	2	1	0	0	0
Total Abundance	394	352	373	424	442	433
Species Richness	16	18	27	15	19	25
DSIAR Score	41.3	42.6	42	34	39	36.5

Central Creek Pool

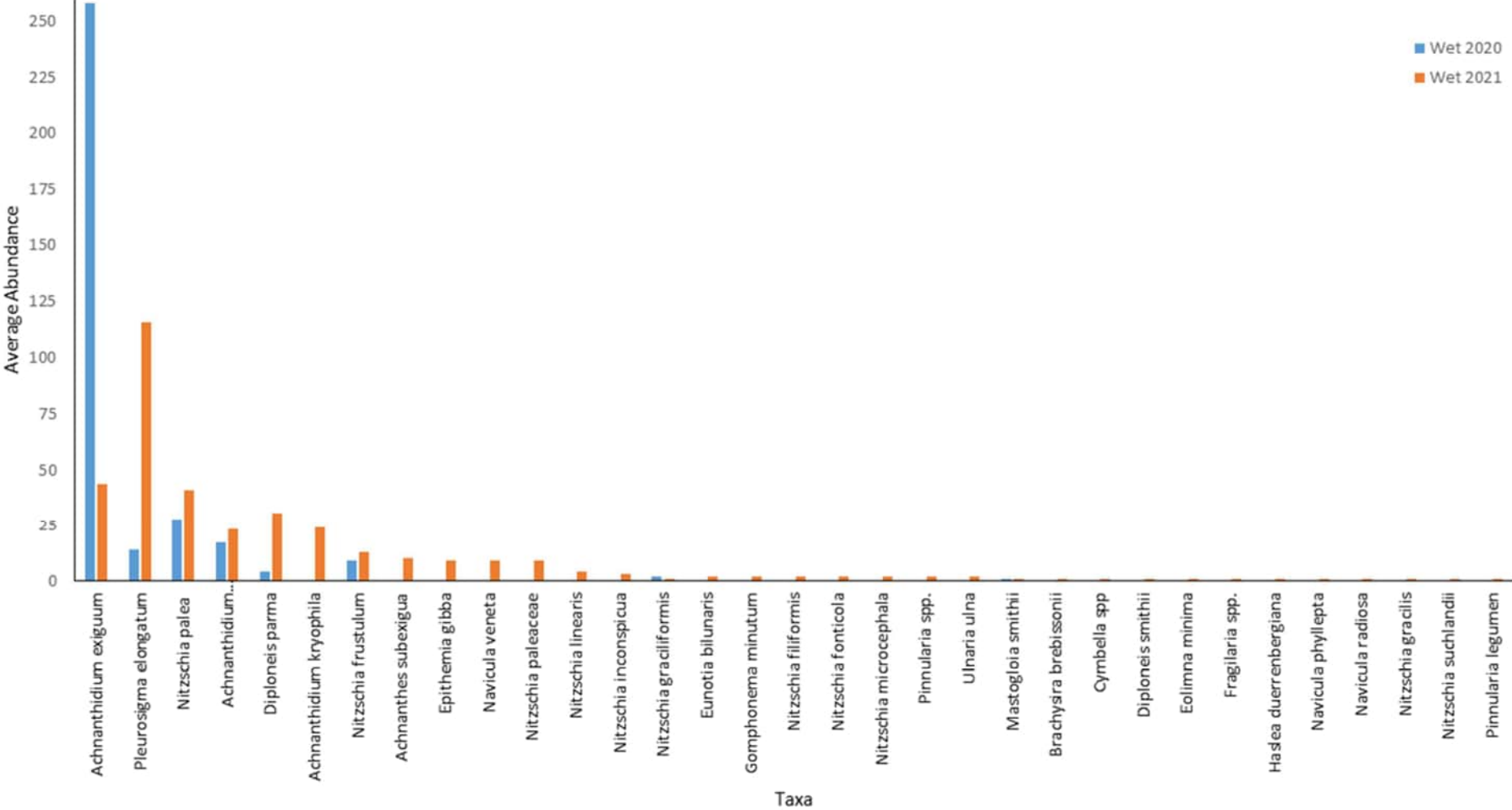


Figure 3-57 Average abundance of diatom taxa recorded at Central Creek Pool in the Late Wet and Dry 2020, Late Wet and Dry 2021 seasons, with taxa arranged from most abundant (left) to least abundant (right) along the x-axis

3.4.6.2 PHYTOPLANKTON

In the Late Wet 2021, a full phytoplankton profile for Central Creek was analysed. Overall, there were relatively low numbers of phytoplankton recorded for Central Creek, indicating relatively low phytoplankton diversity. Two phytoplankton classes were identified: Diatoms (Bacillariophyceae) and Cryptophyceae. Diatoms were observed in considerably higher abundance than Cryptophyceae, and the recorded species in Late Wet 2021 are similar to those observed in Late Wet 2020 (Appendix E). Therefore, while the relative phytoplankton biodiversity is low, the diversity within the Diatoms remains high across both wet seasons (Table 3-19).

Table 3-19 Summary of phytoplankton analytical results for Central Creek Pool sampled in late wet season (2021), abundance (cells L⁻¹) and percentage contribution (%), limit of reporting 10 cell L⁻¹. Central Creek Pool did not have phytoplankton samples taken in the Late Dry 2020, Late Dry 2021, Late Wet 2022 and Late Dry 2022 as the creek was dry.

Taxon	Late Wet (2021)	
	Abundance	%
Bacillariophyceae	460	93.88
<i>Entomoneis sp.</i>	10	2.04
<i>Fragilaria sp. (O)</i>	10	2.04
<i>Microtabella spp.</i>	10	2.04
<i>Navicula spp.</i>	10	2.04
<i>Navicula spp.</i>	50	10.2
<i>Nitzschia spp.</i>	130	26.53
<i>Pleurosigma sp. (O)</i>	220	44.9
<i>Synedra spp. (O)</i>	10	2.04
Cryptophyceae	30	6.12
<i>Cryptomonas spp. (O)</i>	30	6.12

3.4.7 MACROPHYTES

There were very few and sparse macrophytes present at Central Creek Pool. These were represented by a small clump of emergent Clubrush reeds (*Schoenoplectus sp*) and a few individual sedge (Cyperacea) plants on the southern side of the pool behind a protective in-stream boulder. Less than 1% of the pool area represented macrophyte habitat.



Figure 3-58 Central Creek Pool ecology. A) and b) the shallow pool over alluvial deposits lies on a wide creek bed; c) adult *L. unicolor* as well as juveniles were abundant; d) macroinvertebrates collected that utilise the sediment habitat; e) sparse macrophytes remain and will likely be absent by the late dry season; f) turbid waters may reduce visibility and provide a refuge from large fish predation and terrestrial predation.

3.4.8 ENVIRONMENTAL VALUE

While the ephemeral nature of Central Creek Pool results in the absence of water over the dry season the pool still has significant environmental value. After significantly large rainfall events or sustained wet seasons the pool remains full for up to 6 months, providing habitat for widespread fish and macroinvertebrates. The pool may act as a staging area for fish (*M. australis* and *L. unicolor*) migrating up or downstream along Cockatoo Creek during the establishment of flows and connectivity of the creek system. It may also provide a refuge for fish as water levels recede into the dry season providing predators a valuable source of prey. The pool also supports more resilient species of macroinvertebrates best adapted to exploit transient water pools as part of their lifecycles, in turn providing prey species for birds and other insectivorous fauna. There is also evidence that as the pool water recedes into the dry season that dingos and kangaroos utilise the pool as a watering hole highlighting its environmental value in the landscape. However, this pool has little macrophyte habitat, is shallow and provides little cover for fish or other species. Together with its ephemeral water presence, absence of species of conservation significance and, poorer water quality towards the receding/drying phase, it is unlikely that Central Creek pool is a significant aquatic habitat on a regional scale.

3.5 COW SPRING POOL (IB_SW_POOL_COW SPRING)

Cow Spring Pool is a small pool (~8 m by 4 m, average of 1 m depth) confined by bedrock habitat dominated by macrophytes and benthic algal cover (Figure 3-59). The pool is likely to be sustained by groundwater and has an established macrophyte habitat and an abundance of rainbowfish (*M. australis*), despite slightly acidic water quality.

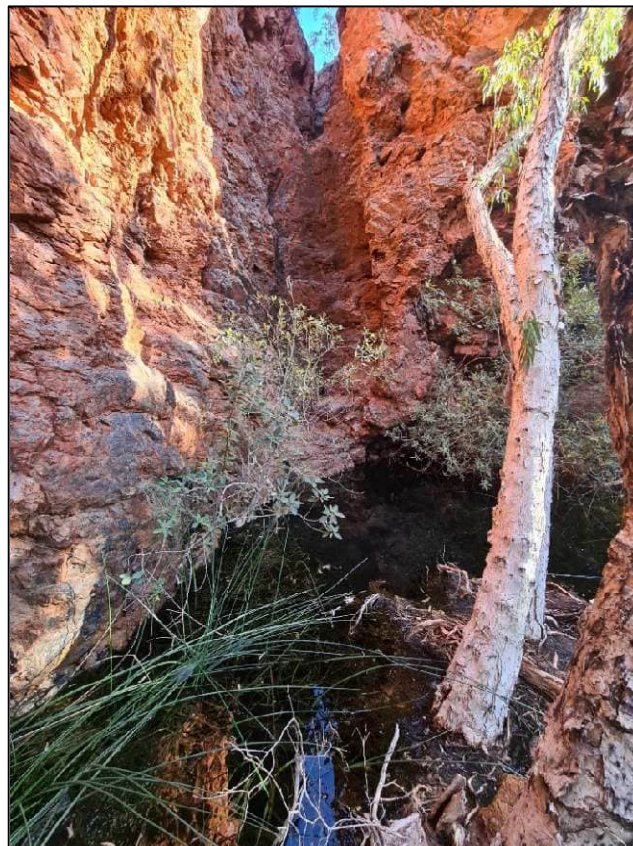


Figure 3-59 Cow Spring Pool

3.5.1 SITE SPECIFIC TRIGGER VALUES

For most parameters and analytes the default guidelines (ANZG 2018a) will provide sufficient trigger values. However, site specific triggers should be developed for SPC, TDS, Zn, TN, and NO_x which will lead to the investigation when the long-term rolling median values exceed the 80th percentile of the baseline data collected up to this point. In addition to the long-term 80th percentile median trigger, an instant value of exceedances over the 95th percentile median value could trigger investigation. There is no need to develop season site specific triggers for any parameters.

In terms of ecological triggers the highly variable data indicates that for fish, macroinvertebrates, diatoms and phytoplankton a presence/absence trigger may be the most appropriate. The loss of significant proportions of permanent riparian vegetation would also be a trigger for investigation. Also, any invasive fish species recorded would trigger an investigation.

3.5.2 WATER QUALITY AND HYDROLOGY

Cow Spring has a small surface water catchment area of 0.26 km² (Figure 3-60), draining a single ridgeline to the west. The pool is shaded by the adjacent rockface and forms a micro-climate area with dense melaleuca woodland covering the pool and the downstream drainage line for approximately 50 m. The permanent water presence, lack of seasonal water quality variation and static water level at this site would indicate that the pool is sustained by groundwater over its entire hydrocycle. Figure 3-61 displays a high-resolution water level and temperature logger record from Cow Spring Pool for the late dry season 2020 to late wet season 2022. The area immediately surrounding Cow Spring Pool was burnt by a fire prior to sampling in the Late Wet 2022 and may have affected some of the ecological and environmental parameters recorded for this site.

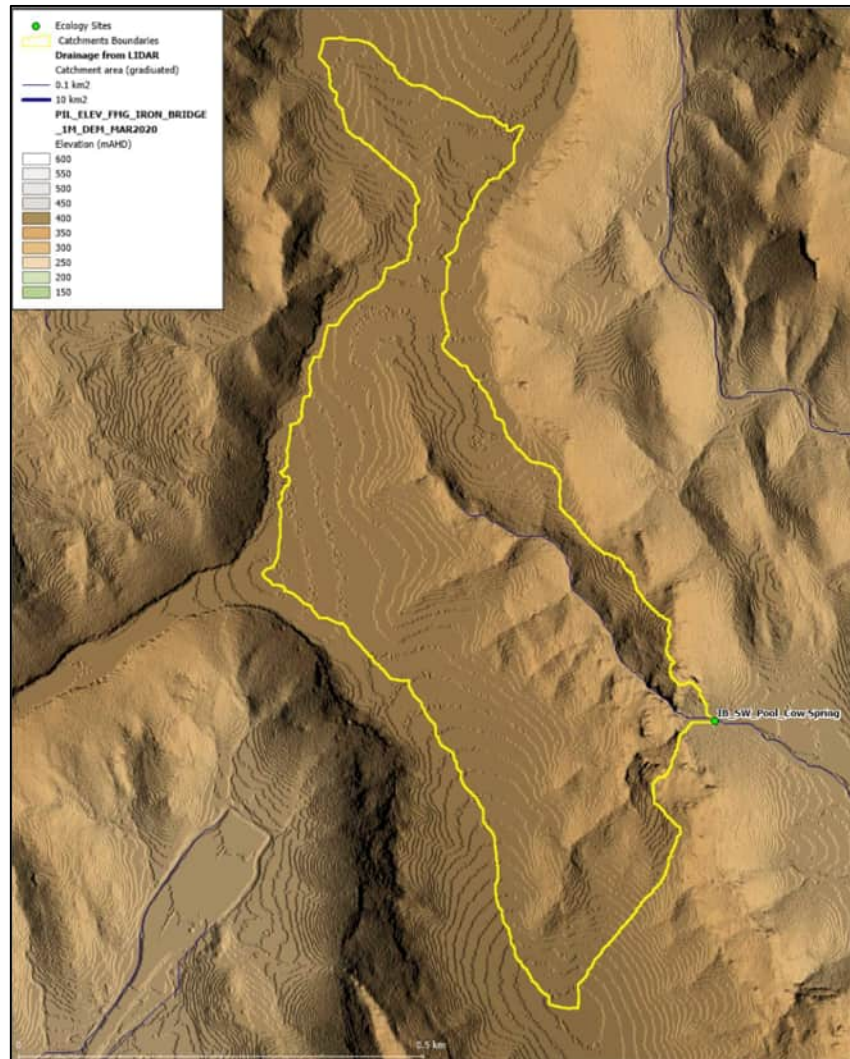


Figure 3-60 Cow Spring catchment area (0.26 km²)

The water level of Cow Spring Pool is relatively constant over the wet-dry season, with very short peaks of 10 to 20 cm above the mean level during high rainfall events (Figure 3-61). Due to the shaded positioning of the pool, the water temperature tends to be more stable than other pools in the region, ranging between 20-30°C over the annual cycle. Similarly, the water quality in the pool is relatively constant over the seasonal cycles with a mixed cation and SO_4^- anion dominance (Figure 3-62). Cow Spring Pool is very clear (mean <1 NTU turbidity), low pH (6.17) fresh (433.92 $\mu\text{S}/\text{cm}$ conductivity) and slightly acidic (8.67 mg/L as CaCO_3). The pool is typically slightly acidic though it approached neutral pH in the Late Wet 2021 and 2022 sampling. The mean Ammonium (NH_4^+) (0.017 mg/L), Total Nitrogen (TN) (1.36 mg/L), Nitrate (NO_3^-) (1.26 mg/L) and Nitrate + Nitrite (NO_x) (1.19 mg/L) values for Cow Spring Pool were above the ANZG (2018) values applicable for north-west Western Australia (Table 3-20), however Masini and Walker (1989) state that mean TN concentrations around 1.0 mg/L may be indicative of pristine waters in the Pilbara region. These nutrient levels are likely a product of N mineralisation within the pool of the readily available organic matter in the form of leaf litter and decaying macrophytes. Zinc (0.026 mg/L) was the only dissolved metal to exceed the ANZG (2018) values.

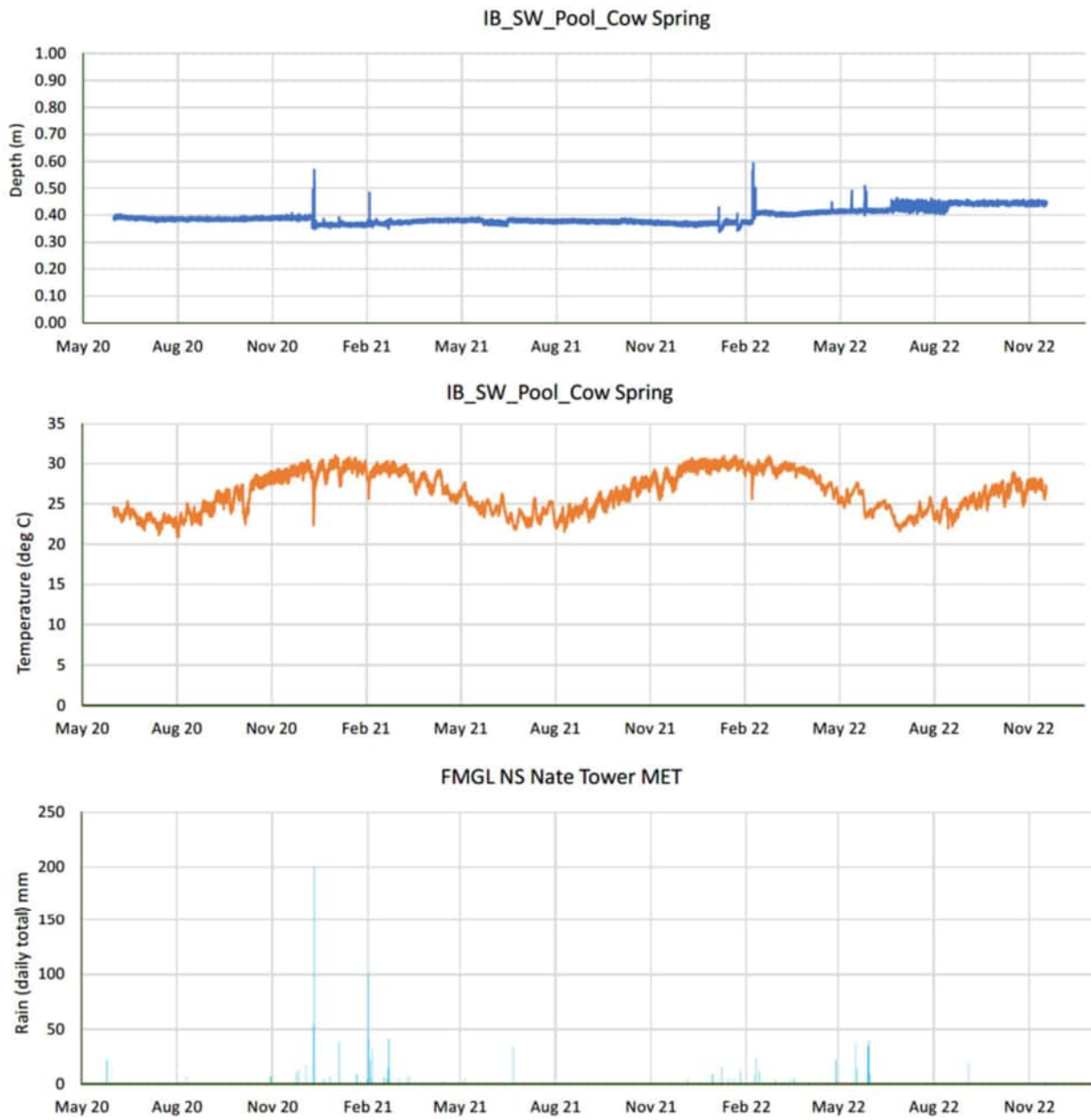


Figure 3-61 Cow Spring Pool logger record from 31/05/2020 to 24/11/2022 for pool water depth (m), water temperature (°C), and daily rainfall at FMG LNS Nate Tower MET.

Table 3-20. Summary of water quality analytical results for Cow Spring. Concentration for each analyte and analyte group described for the Late Wet 2020, Late Dry 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022 and Late Dry 2022. Only dissolved metals with Default Guideline Values (DGV) were included in this table. Bolded values denote results above the 95% species protection levels ANZG (2018) DGVs.

Analyte/Water Quality Parameter	Mean	Median	Max	Min	Range	SE	95% Protection/DGV
Temp (°C)	26.04	25.19	28.9	24.1	4.8	0.821348	
DO (%)	64.85	67.35	83.08	29.3	53.78	10.93999	90
DO (mg/L)	5.17	5.53	6.67	2.39	4.28	0.872553	
SPC (uS/cm)	433.93	456.9	521	270	251	38.6763	
TDS (mg/L)	279.5	287.5	339	192	147	21.76373	
pH	6.17	6.235	7	5.72	1.28	0.1902	6.0-7.5
Turbidity (NTU)	-0.82	0.075	3.51	-4.96	8.47	1.211875	15
Total Alkalinity as	34	36	40	16	24	3.872123	
Ammonium as N	0.017	0.005	0.005	0.005	0	-	0.006
Nitrite as N (mg/L)	0.005	0.005	0.005	0.005	0	-	0.03
Nitrate as N (mg/L)	1.26	1.26	1.26	1.26	0	-	0.03
Nitrite + Nitrate as N	1.20	1.24	1.32	1.11	0.21	0.038936	0.03
Total Nitrogen as N	1.37	1.4	1.5	1.2	0.3	0.04899	0.15
Total Phosphorus as P	0.012	0.005	0.02	0.005	0.015	0.002915	0.01
Reactive Phosphorus	0.005	0.005	0.005	0.005	0	0	0.005
Dissolved Organic	1.42	0.5	2	0.5	1.5	0.3	
<i>Dissolved Metals</i>							
Aluminium (mg/L)	0.002	0.0025	0.0025	0.0025	0	0	0.055
Arsenic (mg/L)	0.00034	0.0005	0.0005	0.0001	0.0004	0.0001	0.024(AsII),
Boron (mg/L)	0.14	0.1425	0.17	0.12	0.05	0.0103	0.94
Cadmium (mg/L)	0.00004	0.00005	0.00005	0.000025	0.000025	0.00001	0.0002
Chromium (mg/L)	0.0006	0.0005	0.0008	0.0005	0.0003	0.00005	0.001
Copper (mg/L)	0.0004	0.0005	0.0005	0.00025	0.00025	0.0001	0.0014
Lead (mg/L)	0.00032	0.0005	0.0005	0.00005	0.00045	0.0001	0.0034
Manganese (mg/L)	0.002	0.001	0.002	0.001	0.001	0.00024	1.9
Mercury (mg/L)	0.00005	0.00005	0.00007	0.00002	0.00005	0.00001	0.00006
Nickel (mg/L)	0.005	0.005	0.0063	0.005	0.0013	0.0002	0.011
Selenium (mg/L)	0.0031	0.005	0.005	0.0002	0.0048	0.001	0.011
Zinc (mg/L)	0.022	0.023	0.038	0.0025	0.0355	0.007	0.008

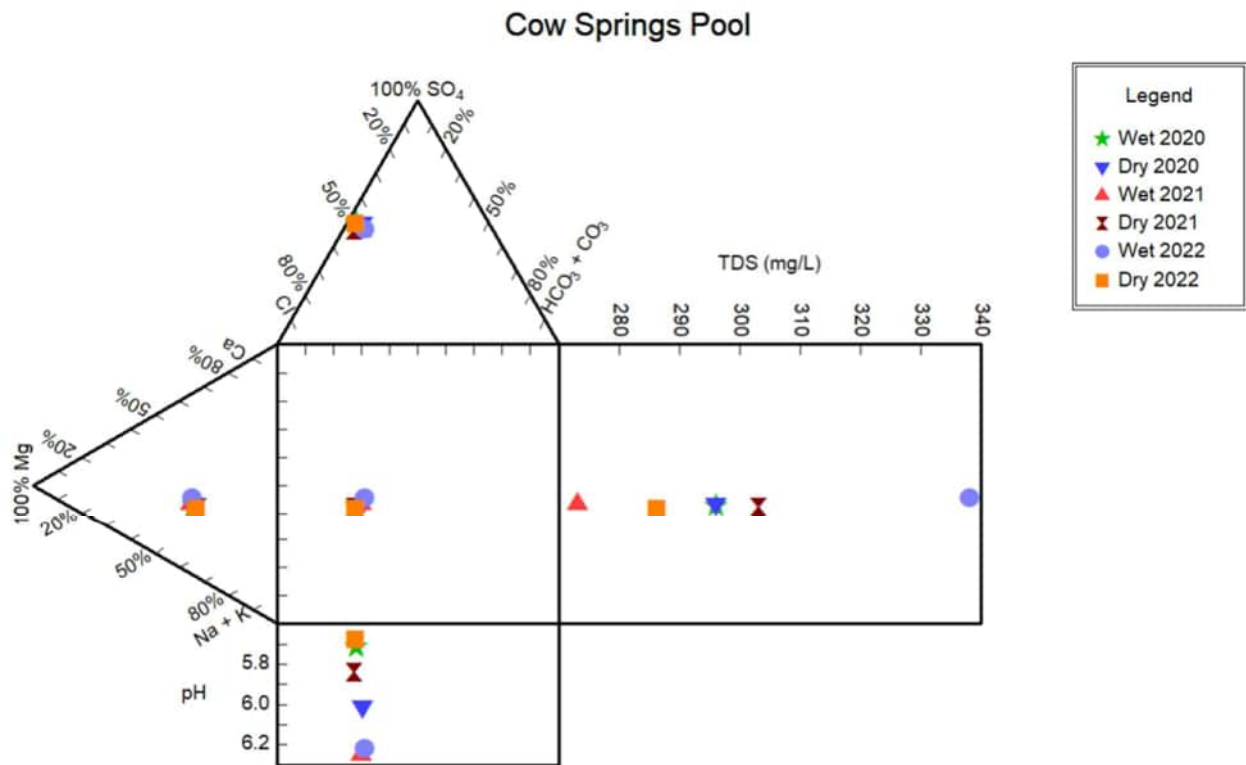


Figure 3-62 Durov diagram showing the Cow Spring Pool major ion distribution.

3.5.3 SEDIMENT QUALITY

Table 3-20 provides the surface sediment quality at Cow Spring Pool during the Late Wet 2020, Late Dry 2021, Late Wet 2022 and Late Dry 2022. Metal and metalloid concentrations were assessed against the ANZG (2018) DGVs. In the Late Dry 2022, Nickel exceeded the DGV (21 mg/kg), however did not exceed the GV-high (52 mg/kg).

Table 3-18 Summary of the sediment analysis for Cow Spring Pool in late wet 2020, late dry 2021, late wet 2022 and late dry 2022. Bolded values denote results above the ANZG (2018) DGVs.

Analyte grouping/Analyte	Unit	ANZG value	Wet 2020	Dry 2021	Wet 2022	Dry 2022
Total Soluble Salts	mg/kg	-	114	730	*	1760
Moisture Content (Dried @ 105-110°C)	%	-	23.9	78.7	44	53.7
Total Alkalinity as CaCO₃	mg/kg	-	4	196	*	828
Bicarbonate Alkalinity as CaCO₃	mg/kg	-	4	196	*	828
Carbonate Alkalinity as CaCO₃	mg/kg	-	<1	<5	*	<5
Acidity	mg/kg	-	<1	285	*	<5

Analyte grouping/Analyte	Unit	ANZG value	Wet 2020	Dry 2021	Wet 2022	Dry 2022
Sulfate as SO ₄ 2- (soluble sulfate by ICPAES)	mg/kg	-	40	810	*	850
Chloride (by Discrete Analyser)	mg/kg	-	20	300	*	330
Calcium	mg/kg	-	<10	290	*	190
Magnesium	mg/kg	-	<10	230	*	140
Sodium	mg/kg	-	20	350	*	480
Potassium	mg/kg	-	<10	80	*	370
Mercury (FIMS)	mg/kg	-	4.4	1.6	2.4	1.2
Nitrite + Nitrate as N (Sol.)	mg/kg	-	0.1	0.2	*	0.2
Total Kjeldahl Nitrogen as N	mg/kg	-	750	7700	*	4760
Total Nitrogen as N	mg/kg	-	750	7700	*	4760
Total Phosphorus as P	mg/kg	-	320	493	*	408
Reactive Phosphorus as P	mg/kg	-	<0.1	0.1	*	0.2
Total Organic Carbon	%	-	0.22	0.22	1.44	8.74
<i>Total Metals by ICP-AES</i>						
Arsenic	mg/kg	20	9	24	9	6
Barium	mg/kg	-	<10	30	10	60
Beryllium	mg/kg	-	<1	<1	<1	<1
Boron	mg/kg	-	<50	<50	<50	<50
Cadmium	mg/kg	1.5	<1	<1	1	<1
Chromium	mg/kg	80	165	90	73	64
Cobalt	mg/kg	-	4	6	4	6
Copper	mg/kg	65	7	11	8	13
Iron	mg/kg	-	124,000	148,000	66,800	39,800
Lead	mg/kg	50	9	<5	6	<5
Manganese	mg/kg	-	151	380	126	877
Nickel	mg/kg	21	18	23	19	25
Selenium	mg/kg	-	6	<5	<5	<5
Vanadium	mg/kg	-	62	59	49	36
Zinc	mg/kg	200	16	22	11	22

*Not enough sediment sample left in the second analysis for all analytes.

3.5.4 FISH

Only one species of fish, *M. australis* was observed at Cow Spring Pool throughout the six seasons. Table 3-21 presents the abundance, size distribution and CPUE for *M. australis* for all seasons surveyed.

Leiopotherapon unicolor was not detected at the pool through any methods, which may be due to various factors such as survival, aestivation, or connectivity with downstream populations. Similarly, no decapod crustaceans were collected or observed.

A similar frequency of very small fish (<30 mm) were present in each season prior to and after the Late Wet 2022, indicating there is consistent juvenile recruitment occurring (Figure 3-64) probably related to the relatively stable environmental conditions within the pool (Figure 3-61). The <30mm and 30-60 mm length classes equally dominated the size distribution in the Late Dry 2022. *M. australis* is considered to reach sexual maturity at 50 mm SL (Evans *et al.* 2010) which suggests breeding within the pool since the Late Wet 2022 season.

Following a wildfire that burnt through the area during the Late Wet 2022 which may have had a negative impact on water quality and survival of fish, the abundance of *M. australis* caught in the Late Dry 2022 season significantly increased across all size ranges (Table 3-20).

Table 3-21 Summary of fish count for the standard length class (mm) and the CPUE for *M. australis* in Cow Spring Pool in the Late Wet 2020, Late Dry 2020, Late Wet 2021, Late Wet and Late Dry 2022 surveys.

Species	Size class (mm)	Late Wet 2020 Fish Count	Late Wet 2020 CPUE ¹	Late Dry 2020 Fish Count	Late Dry 2020 CPUE ¹	Late Wet 2021 Fish Count	Late Wet 2021 CPUE ¹	Late Dry 2021 Fish Count	Late Dry 2021 CPUE ¹	Late Wet 2022 Fish Count	Late Wet 2022 CPUE ¹	Late Dry 2022 Fish Count	Late Dry 2022 CPUE ¹
<i>Melanotaenia australis</i>		67	3.8	102	5.8	31	1.77	69	3.88	4	0.2	48	2.7
	0 – 30	13		12		5		9		0		20	
	30 – 60	37		20		23		43		4		20	
	60 – 90	15		67		3		17		0		8	
	> 90	2		3		0		0		0		0	

¹CPUE is catch per unit effort, a measure of relative abundance. Effort is fyke net set for 17.75 hours.

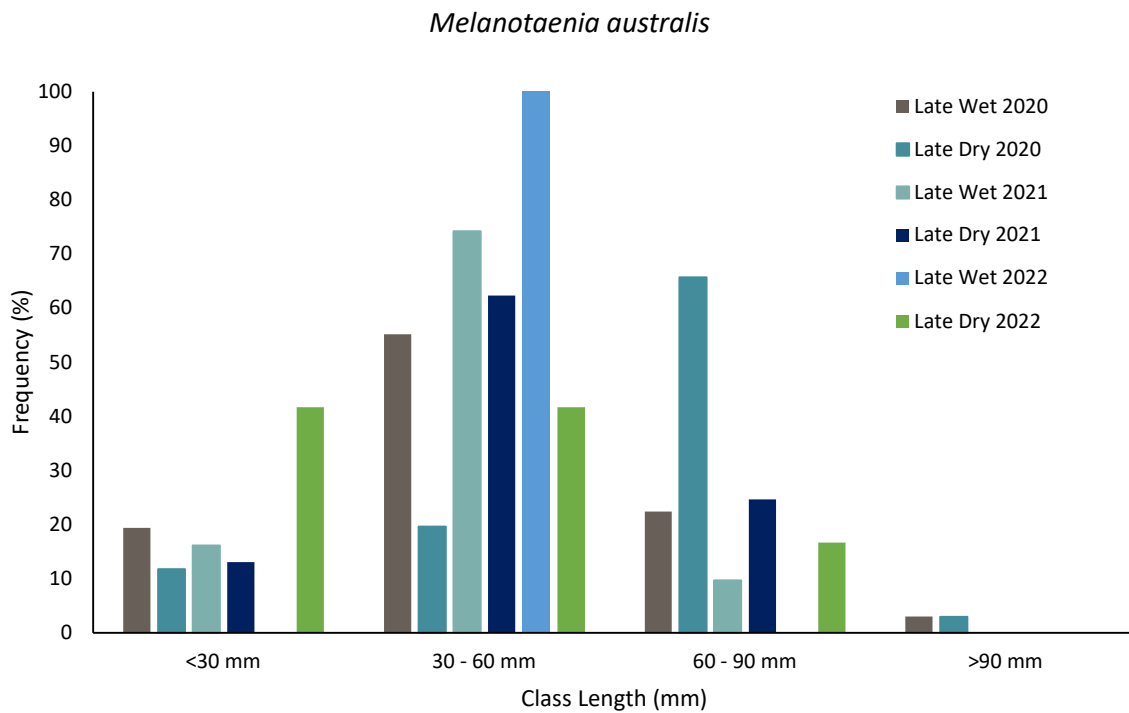


Figure 3-63 Frequency (%) of occurrence for each length class (SL, mm) for *Melanotaenia australis* sampled from Cow Spring Pool in Late Wet 2020, Late Dry 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022 and Late Dry 2022.

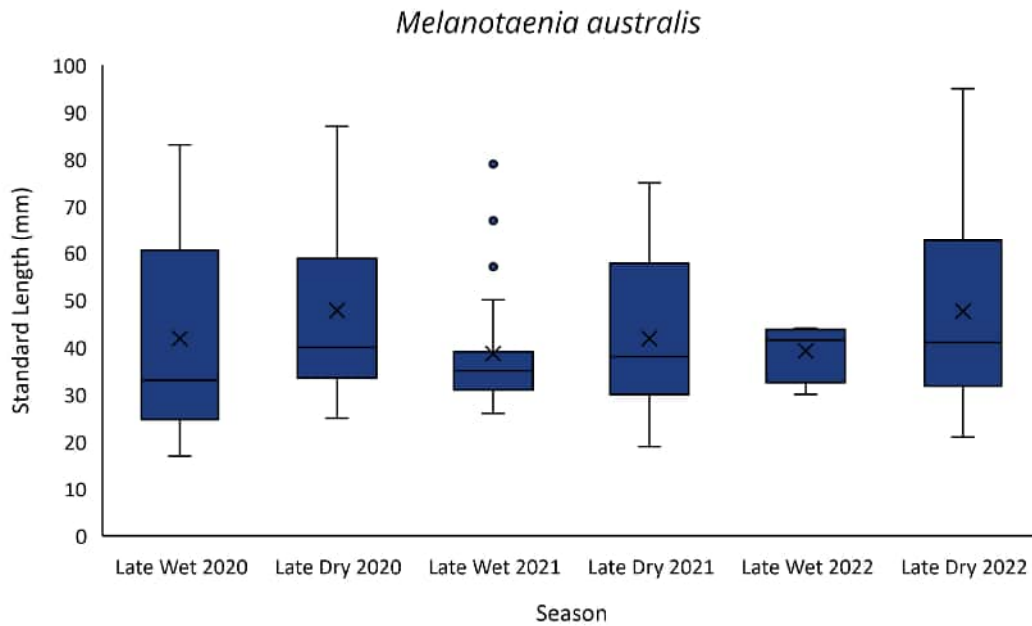


Figure 3-64 Size distribution of the standard length (SL, mm) for *Melanotaenia australis* sampled from Cow Spring Pool.

3.5.5 AQUATIC MACROINVERTEBRATES

Figure 3-65 presents the summary of the four macroinvertebrate indices for Cow Spring Pool in the Late Wet seasons of 2020, 2021 and 2022, and the Late Dry seasons of 2020, 2021 and 2022. The key findings were as follows:

- Average total abundances of macroinvertebrates were relatively consistent across the first three sampling seasons, with an increase in the average total abundance to 600 individuals in the Late Dry 2021 and declining (to 128 indiv.) in the Late Dry 2022 (Figure 3-65a).
- The average taxonomic richness for Late Dry 2022 returned to the trend prior to the Late Wet 2022 season decline (Figure 3-65b).
- Average EPT richness in the Late Dry 2022 remained fairly constant from the Late Wet 2022 season (Figure 3-65 c). The initial decline from the Late Dry 2021 to the Late Wet and Late Dry 2022 is likely due to the lower wet season flows alleviating the less favourable conditions experienced in the dry season.
- SIGNAL2 scores stayed relatively stable between seasons (Figure 3-65 d), with the range of scores (3.08 – 3.39) indicating the macroinvertebrate community is moderately tolerant.

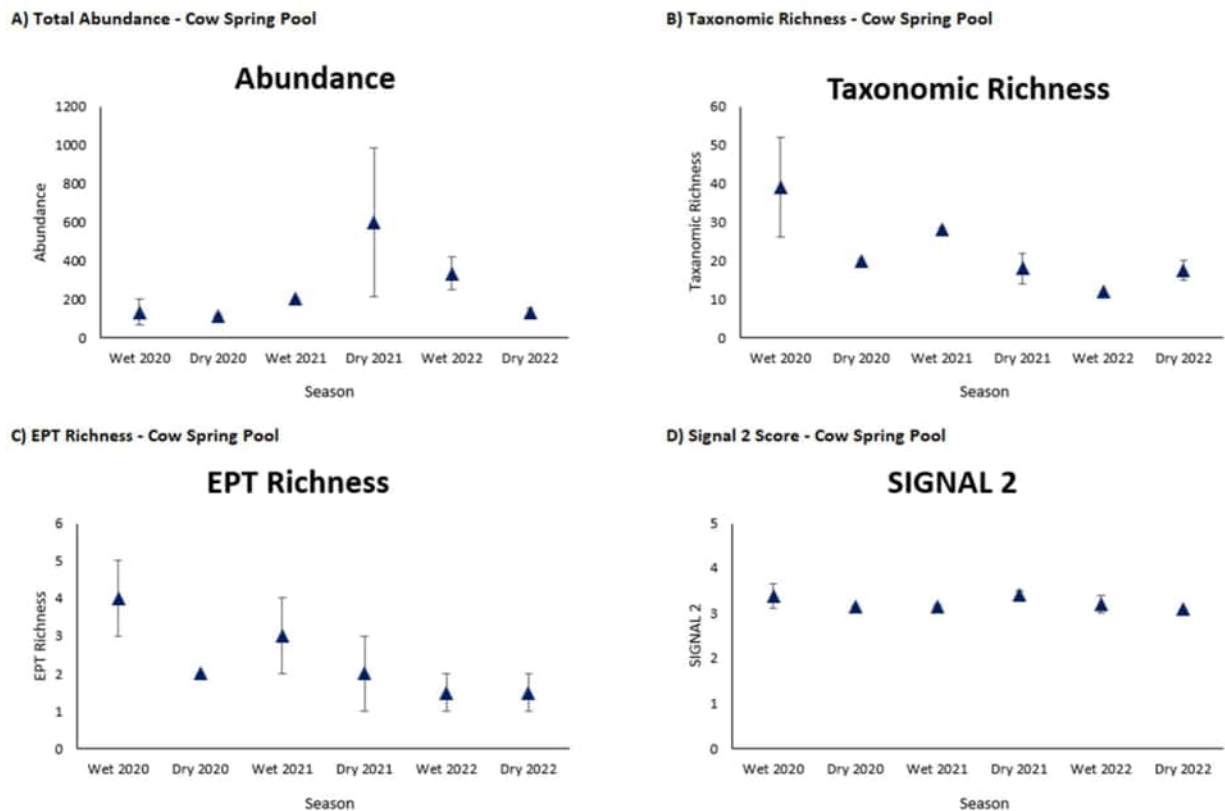


Figure 3-65 Macroinvertebrate indices showing averages and standard errors for Cow Spring Pool – Late Wet 2020, Late Dry 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022 and Late Dry 2022.

The abundance of taxa for the six seasonal surveys is provided in Figure 3-66 and shows taxa ranging from the most abundant (left) to the least abundant (right) along the x-axis. The non-biting midge Chironominae and Tanyptodinae were the most abundant taxa in Late Dry 2022, which was also dominant in the Late Dry 2021 and Late Wet 2022. One individual from Lestidae (spread-winged damselfly) was recorded for the first time in the Late Dry 2022.

No macroinvertebrate species of conservation significance were found at Cow Spring Pool.

Cow Spring Pool

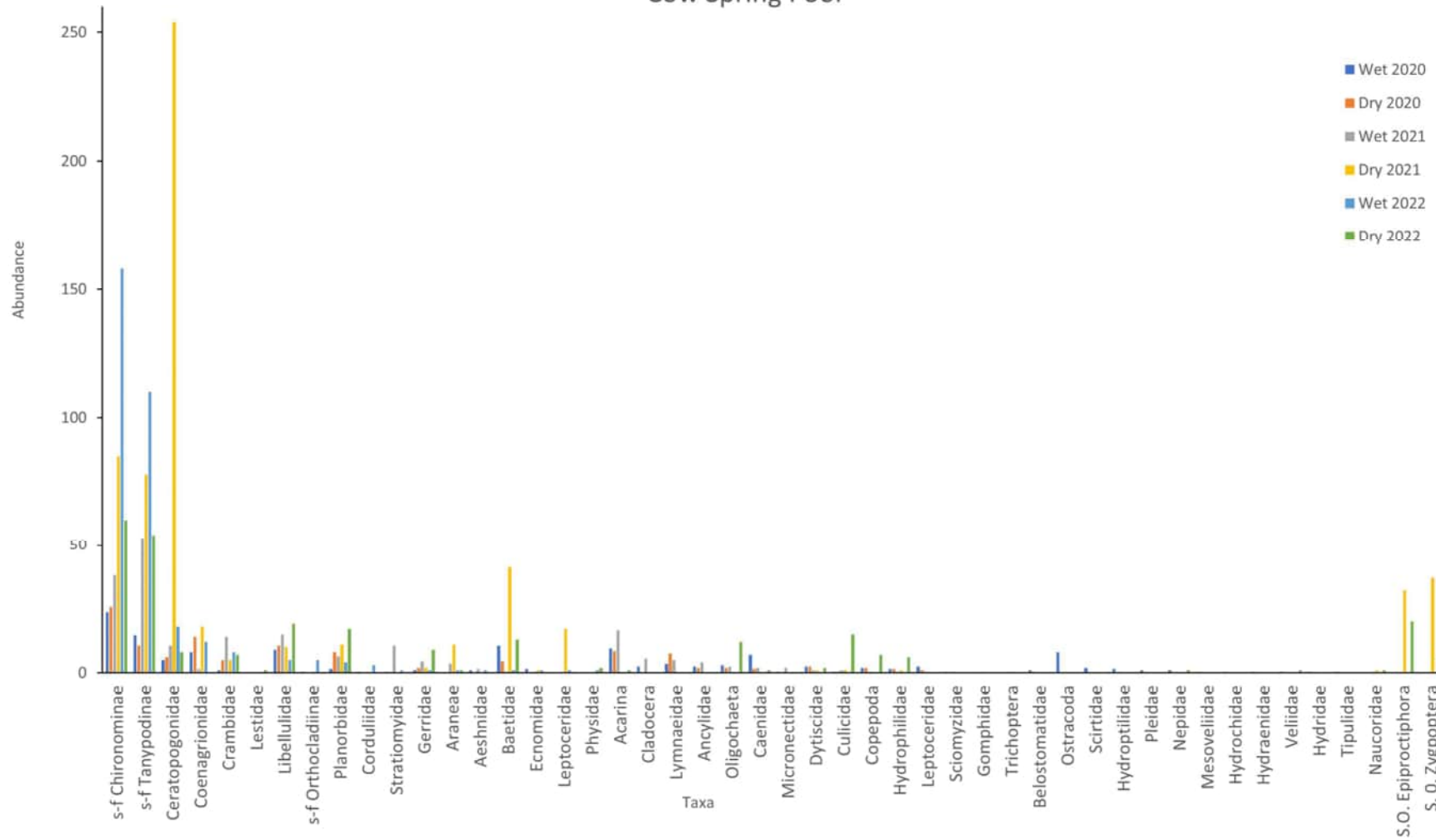


Figure 3-66 Average abundances of all macroinvertebrate taxa at Cow Spring Pool in the Late Wet 2022, Late Dry 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022 and Late Dry 2022 seasons with taxa arranged from most abundant (left) to least abundant (right) along the x-axis.

3.5.6 DIATOMS AND PHYTOPLANKTON

3.5.6.1 DIATOMS

Table 3-22 summarises the species present, the overall abundance, and biotic indices of diatoms surveyed in the Late Wet 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022 and Late Dry 2022. Only one replicate of diatoms collected in Late Wet 2021 was analysed, therefore only total count has been recorded for this season. No diatom data was available for the Late Dry 2020 due to flood flows during the deployment period.

In the Late Dry 2022, only 9 species were recorded, the second lowest seasonal species richness across the five sampling seasons (Table 3-22). One species (*Cocconeis placentula*). Total abundance of diatoms was slightly higher in Late Dry 2022 than in the Late Wet 2022, with *Eunotia biunaris* being most abundant in the Late Dry 2022.

The Late Dry 2022 DSIAR score (21.1) was lower than previous seasons which would usually indicate species less sensitive to environmental stress are present or degraded water quality. This could be due to the minimal significant rainfall and flow events throughout the Late Wet and Late Dry 2022 seasons.

Table 3-22 Summary of Cow Spring Pool diatom average count per species, total abundance, species richness and DSIAR score in Late Wet 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022 and Late Dry 2022.

Taxon name	Wet 2020	Wet 2021	Dry 2021	Wet 2022	Dry 2022
<i>Eunotia bilunaris</i>	0	62	63	120	191
<i>Brachysira vitrea</i>	4	218	165	12	102
<i>Ulnaria ulna</i>	1	22	7	15	15
<i>Encyonema silesiacum</i>	0	0	0	6	6
<i>Achnantheidium minutissimum</i>	0	14	152	14	4.5
<i>Brachysira styriaca</i>	4	12	6	2	2.5
<i>Gomphonema affine</i>	0	6	0	2	2.5
<i>Cocconeis placentula</i>	0	0	0	0	1
<i>Eunotia pectinalis</i>	0	0	0	0	1
<i>Adlafia spp.</i>	0	0	0	10	0
<i>Brachysira brebissonii</i>	0	0	0	93	0
<i>Caloneis 1</i>	0	0	0	1	0
<i>Caloneis clevei</i>	0	0	0	1	0
<i>Caloneis girdle</i>	0	0	0	2	0
<i>Cymbella affinis</i>	0	8	0	0	0
<i>Cymbella spp</i>	0	4	0	0	0
<i>Diploneis elliptica</i>	0	0	0	2	0
<i>Diploneis parma</i>	0	0	3	0	0
<i>Encyonema minutum</i>	0	0	0	4	0
<i>Eolimna minima</i>	0	0	0	2	0

Taxon name	Wet 2020	Wet 2021	Dry 2021	Wet 2022	Dry 2022
<i>Eunotia exigua</i>	0	4	0	0	0
<i>Eunotia girdle</i>	0	0	0	1	0
<i>Eunotia incisa</i>	1	6	0	0	0
<i>Eunotia minor</i>	0	0	0	1	0
<i>Eunotia paludosa</i>	0	4	0	0	0
<i>Eunotia spp.</i>	0	6	0	0	0
<i>Fragilaria acus</i>	2	16	0	0	0
<i>Fragilariforma virescens</i>	0	2	0	0	0
<i>Frustulia rhomboides</i>	0	2	0	1	0
<i>Girdle enc.</i>	0	0	0	1	0
<i>Gomphonema angustum</i>	0	0	0	1	0
<i>Gomphonema girdle</i>	0	0	0	1	0
<i>Gomphonema gracile</i>	0	0	0	4	0
<i>Gomphonema minutum</i>	0	4	0	0	0
<i>Luticola mutica</i>	0	4	0	0	0
<i>Mastogloia smithii</i>	0	2	0	0	0
<i>Navicula leptostriata</i>	0	0	2	0	0
<i>Navicula radiosa</i>	0	0	1	0	0
<i>Nitzschia frustulum</i>	0	0	0	2	0
<i>Nitzschia inconspicua</i>	0	0	2	0	0
<i>Nitzschia linearis</i>	1	0	4	0	0
<i>Nitzschia perminuta</i>	0	0	2	0	0
<i>Nitzschia sigma</i>	0	0	1	0	0
<i>Nitzschia supralitorea</i>	0	0	1	0	0
<i>Pinnularia spp.</i>	1	4	0	0	0
<i>Pinnularia viridiformis</i>	0	0	0	1	0
<i>Tryblionella angustulata</i>	0	0	0	3	0
<i>Unknown girdle</i>	0	0	0	1	0
Total Abundance	14	400	409	300	326
Species Richness	7	19	13	26	9
DSIAR Score	64.2	68	65.5	71	21.1

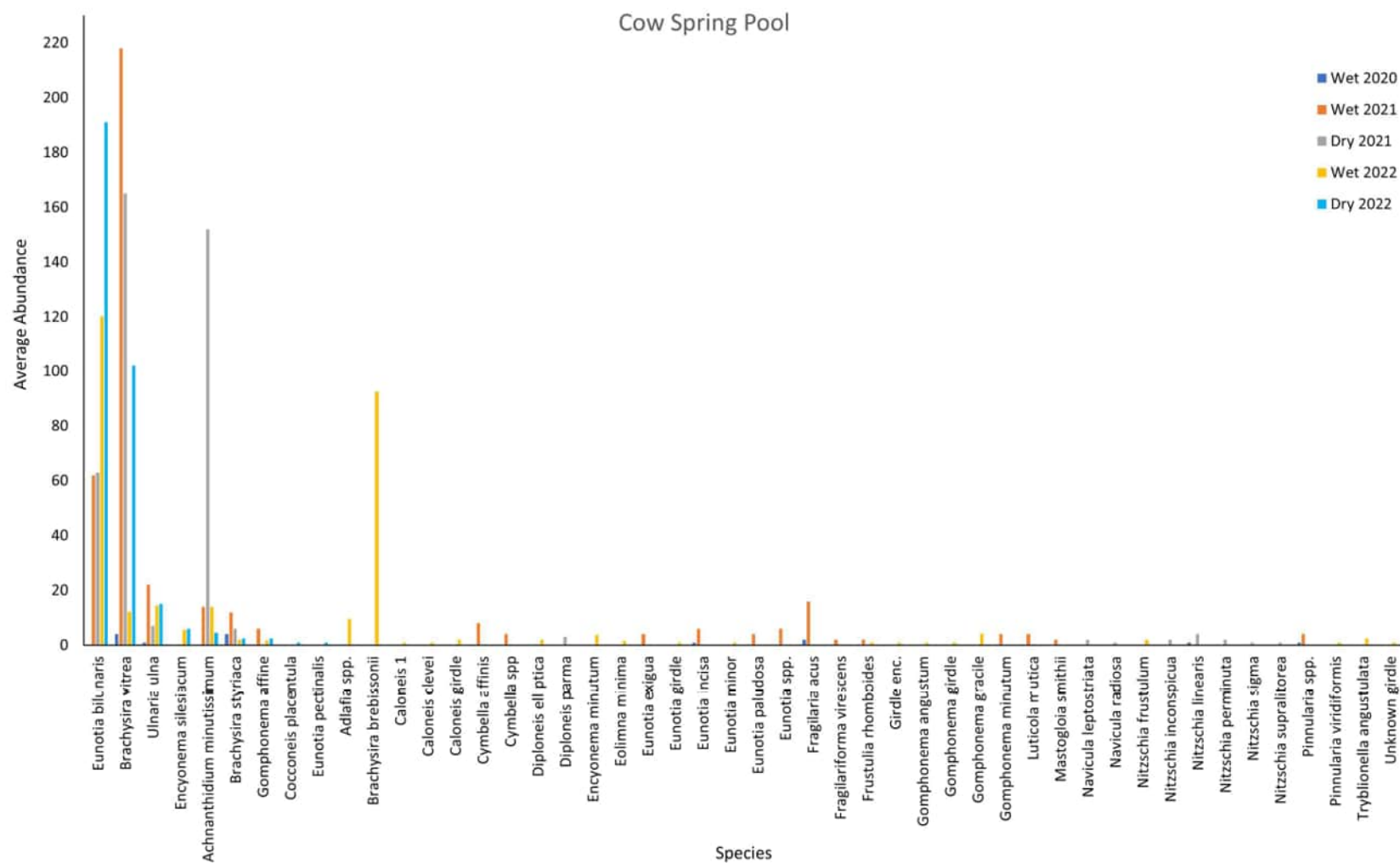


Figure 3-67 Average species abundance (diatom count per replicate) for diatoms sampled at Cow Spring Pool in the Late Wet 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022 and Late Dry 2022. Arranged most abundant Late Dry 2022 left to right

3.5.6.2 PHYTOPLANKTON

In the Late Dry 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022 and Late Dry 2022, water samples were taken from Cow Spring Pool to analyse a complete planktonic phytoplankton profile for the site. The total phytoplankton abundance in the Late Dry 2022 was over 800 times less than recorded in the Late Wet 2022 (Table 3 22). This is in contrast to previous years where phytoplankton abundances were higher over the dry season. The lower abundances in the Late Dry 2022 may have been due to dissolved organic carbon concentrations (DOC) (4.0 mg/L) being higher than average (1.42 mg/L), expressed as tannins in the water, and potentially limiting primary production via a shading effect. These higher concentrations may have also limited nutrient availability, such as iron and phosphorus, due to chemical interactions with DOC (Carpenter *et al.* 1998). There were no new species recorded during the Late Dry 2022 season.

Table 3-23 Summary of phytoplankton analytical results for Cow Spring Pool sampled in Late Dry 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022 and Late Dry 2022, abundance (cells L⁻¹) and percentage contribution (%), limit of reporting 10 cells L⁻¹.

Taxon	Late Dry (2020)		Late Wet (2021)		Late Dry (2021)		Late Wet 2022		Late Dry 2022	
	Abundance	%	Abundance	%	Abundance	%	Abundance	%	Abundance	%
Bacillariophyceae	7,000	19.02	20	100	10,000	8.33	200,000	38.46	340	53.13
<i>Achnantheidium minutissima</i>	1,400	3.8	0	0	0	0	0	0	0	0
<i>Amphora spp.</i>	200	0.54	0	0	10,000	8.33	30,000	5.77	80	12.5
<i>Cymbella spp.</i>	400	1.09	0	0	0	0	0	0	0	0
<i>Navicula spp.</i>	2,800	7.61	10	50	0	0	0	0	110	17.19
<i>Nitzschia spp.</i>	400	1.09	0	0	0	0	0	0	0	0
<i>Synedra spp. (O)</i>	1,800	4.89	10	50	0	0	170,000	32.69	150	23.44
Chlorophyceae	1,400	3.8	0	0	0	0	30,000	5.77	30	4.69
<i>Cosmarium spp. (O)</i>	1,200	3.26	0	0	0	0	0	0	0	0
<i>Staurastrum spp. (O)</i>	200	0.54	0	0	0	0	0	0	0	0
<i>Mougeotia spp.</i>	0	0	0	0	0	0	10,000	1.92	0	0

Taxon	Late Dry (2020)		Late Wet (2021)		Late Dry (2021)		Late Wet 2022		Late Dry 2022	
<i>Oocystis spp. (O)</i>	0	0	0	0	0	0	20,000	3.85	30	4.69
Cryptophyceae	15,000	40.76	0	0	20,000	16.67	0	0	150	23.44
<i>Chroomonas spp.</i>	3,000	8.15	0	0	0	0	0	0	0	0
<i>Cryptomonas spp. (O)</i>	11,800	32.07	0	0	20,000	16.67	0	0	150	23.44
<i>Plagioselmis spp.</i>	200	0.54	0	0	0	0	0	0	0	0
Cyanobacteria	0	0	0	0	0	0	280,000	53.85	0	0
<i>Cyanogranis spp</i>	0	0	0	0	0	0	0	0	0	0
<i>Pseudanabaena spp. (O) (PT)</i>	0	0	0	0	0	0	280,000	53.85	0	0
Dinophyceae	13,200	35.87	0	0	10,000	8.33	0	0	0	0
<i>Gonyaulax spp.</i>	12,200	33.15	0	0	0	0	0	0	0	0
<i>Gymnodinium spp.</i>	600	1.63	0	0	0	0	0	0	0	0
<i>Peridinium spp. (O)</i>	400	1.09	0	0	10,000	8.33	0	0	0	0
Euglenophyceae	200	0.54	0	0	0	0	0	0	10	1.56
<i>Trachelomonas spp.</i>	200	0.54	0	0	0	0	0	0	10	1.56
Prasinophyceae	0	0	0	0	80,000	66.67	10,000	1.92	110	17.19
<i>Prasinophytes (unknown)</i>	0	0	0	0	80,000	66.67	10,000	1.92	110	17.19

3.5.7 MACROPHYTES

Table 3-24 presents the macrophyte species and qualitative abundance during the Late Wet 2020, Late Dry 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022 and Late Dry 2022 surveys. A diverse range of macrophyte flora was observed within Cow Spring Pool. These comprised aquatic species and groundwater-dependent species. A total of seven macrophyte species were recorded in each season. These included reeds (Clubrush, *Typha* spp.), sedges (Cyperaceae) as well as submerged macrophytes (ribbon weed, charophytes and Hydrocharitaceae) (Figure 3-68 and Figure 3-69). The abundance and diversity of species of macrophytes present in this system indicate relatively high water quality and ecological health conditions. The macrophytes, both emergent and submerged, are providing important habitat structure, refuge, and food sources to organisms such as the *M. australis* (western rainbowfish). There was no noticeable change in the abundance of emergent macrophytes in the Late Dry 2022 compared to the Late Wet 2022.

Table 3-24. Description of macrophytes species and abundance observed at Cow Spring Pool in the Late Wet 2020, Late Dry 2020, Late Wet 2021, Late Dry 2021, Late Wet 2022 and Late Dry 2022 seasons.

Common name	Species name	Late Wet 2020 Abundance ¹	Late Dry 2020 Abundance ¹	Late Wet 2021 Abundance ¹	Late Dry 2021 Abundance ¹	Late Wet 2022 Abundance ¹	Late Dry 2022 Abundance ¹
Ribbon weed	<i>Vallisneria sp.</i>	Abundant	Abundant	Abundant	Abundant	Abundant	Abundant
Charophytes	<i>Nitella sp., Chara sp.</i>	Abundant	Abundant	Abundant	Abundant	Abundant	Abundant
Clubrush	<i>Schoenoplectus sp.</i>	Abundant	Abundant	Abundant	Abundant	Abundant	Abundant
Sedges	Cyperaceae	Isolated	Isolated	Isolated	Isolated	Isolated	Isolated
Bulrush	<i>Typha sp.</i>	Isolated	Isolated	Isolated	Isolated	Isolated	Isolated
Unidentified 1	Hydrocharitaceae	Isolated	Isolated	Isolated	Isolated	Isolated	Isolated
Unidentified 2	Hydrocharitaceae	Isolated	Isolated	Isolated	Isolated	Isolated	Isolated

¹ Abundance based on *Western Australia AUSRIVAS field sampling sheet* (DoW, 2009).



Figure 3-68 Two macrophytes pending taxonomic identification in Cow Spring Pool

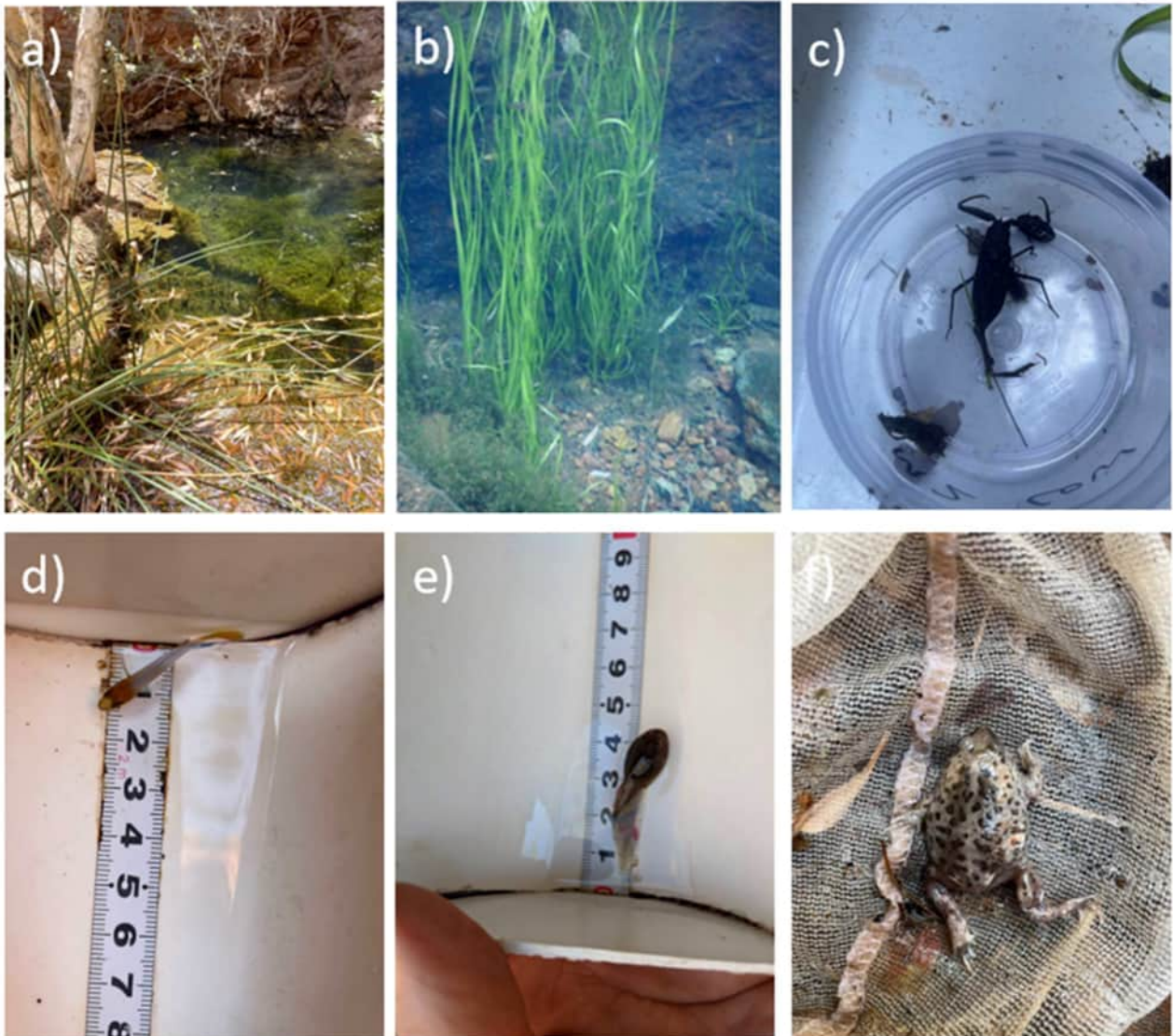


Figure 3-69 Cow Spring Pool aquatic ecology. A) and b) show a diversity of emergent and submerged macrophytes; c) *Nepidae* spp., an example of aquatic macroinvertebrate; d) *M. australis*; e) tadpoles of *Uperoleia* spp; f) new recorded frog species, *Cyclorana maini* (Main's Frog).

3.5.8 ENVIRONMENTAL VALUE

Cow Spring Pool has significant environmental value as it supports a diverse range of macrophyte flora (some groundwater dependent), a melaleuca strand, a stable population of *M. australis*, a diverse macroinvertebrate community and a persistent frog population, with tadpole, juvenile and adult frogs observed in the area. However, none of these species are of conservation significance. The groundwater feed pool provides a stable environment in terms of temperature due to its shaded position rarely seen in other pools in the region making somewhat unique. The pool also provides an important refuge for fauna during wildfires as was seen in the Late Wet 2022, for example, giving refuge to frog species in the area. The protected Pilbara Olive Python (POP; *Liasis olivaceus barroni*) has been previously observed at the site but not during Hydrobiology surveys.

3.6 GV POOL (GV_SW_POOL_SW)

The South-West Glacier Valley Pool (GV_SW_Pool_SW) is a series of small pools located in a cut across an adjacent ridgeline. The pool supports fish during the wet season (Spangled Perch – *Leiopotherapon unicolor*), likely to have migrated from downstream permanent pools as wet season flows provided habitat connectivity (Figure 3-70). The macrophyte (submerged vegetation community) was limited at GV Pool but some individual plants were observed within the various semi-connected pools along the drainage reach. Overall, the ecology observed at GV Pool was similar to other regional pools studied for the Iron Bridge aquatic ecology monitoring program. Initial sampling in this pool commenced in the Late Wet 2021 and was continued in the Late Dry 2021, Late Wet 2022, and Late Dry 2022. There was only a small pool of water in the Late Wet 2022 due to low flows during the 2022 wet season (Figure 3-71). However, there was no water in the pool during the Late Dry 2022 survey.



Figure 3-70 GV Pool; The South-West Glacier Valley Pool during the Late Wet Season 2021.



Figure 3-71 GV-Pool; The remaining small pool after a low flow Late Wet 2022 season (left) and the logger (right).



Figure 3-72 GV Pool; The pool was completely dry during the Late Dry Season 2022.

3.6.1 SITE SPECIFIC TRIGGER VALUES

As GV_SW_Pool_SW pool is ephemeral, and the water quality and ecological parameters are highly dependent on surface water flows over the wet season, it is difficult to assign site specific triggers for any parameters in the dry season where evapotranspiration can significantly affect readings (or the pool is mostly dry). However, site specific wet season triggers can be developed for pH, SPC, TDS, Zn, TP and TN, which will lead to investigation when the long-term rolling median values exceed the 80th percentile, derived from the current data. In addition to the long-term 80th percentile median trigger, an instant value of exceedances over the 95th percentile median value could trigger investigation. If the specified parameters above are outside of the 80th percentile, it is likely there will be a change in the ecosystem composition which will have knock-on effects of the pool to other organisms in the area.

In terms of ecological triggers, the few data points are insufficient for macroinvertebrates, diatoms and phytoplankton to have site specific triggers and a presence/absence trigger may be the most appropriate when pool water is present. The absence of the fish species *L. unicolor* (spangled perch) may be used as an investigative trigger, as this species has been observed on the two occasions that monitoring has occurred

when the pool has filled or partially filled. This highly variable data is to be expected in ephemeral pools, with the hydrological cycle having the greatest influence on ecological functioning of the pool habitat.

3.6.2 WATER QUALITY AND HYDROLOGY

The GV_SW_Pool_SW monitoring site is a string of shallow ephemeral pools perched on bedrock, fed by a 3.3 km² catchment (Figure 3-74) draining the western face of the Glacier Valley ridgeline. This catchment is similar in nature to the Mundagoora Pool catchment directly to the north, draining the same ridge system. GV_SW_Pool_SW differs in hydrology to the Mundagoora Pool, however, with surface water flows appearing to dominate inputs. The pool system was dry during observations in December 2020 and displayed remnant perched and semi-connected shallow (<0.5 m depth) pools during the wet season (May 2021). During the Late Dry 2021 sampling (6th October 2021), the pool retained water with ~0.15 m of depth. There was a steady decrease in pool water levels following a small rainfall event at the end of June 2021. In the Late Wet 2022 (June) the pool was reduced to a small puddle due to low wet season recharge that had a significant effect on water quality (Figure 3-73). The small fluctuations in the depth plot from late June to August 2022 in Figure 3-75 are due to manually barometric correcting logger readings, the pool was likely to be dry during this period. There was no water observed during the Late Dry 2022 survey.

GV_SW_Pool_SW in the Late Wet 2022 had a near-neutral average pH of 7.99, in line with other pools in the region. The moderately brackish salinity in Late Wet 2022 (3091 µS/cm) was above the mean salinity (1935 µS/cm) likely due to evapo-concentration in the small pool (Table 3-25, Appendix A). The dissolved oxygen (5.15 mg/L) in Late Wet 2022 was lower than the mean value. Both the nutrients TN and TP exceeded the ANZG 95% protection levels by approximately six times the DGV. Dissolved Zinc and Copper both exceeded the ANZG (2018) DGV in the Late Wet 2022 (Appendix A).

The major ion distribution across both seasons in 2021 is presented as a Durov Plot in Figure 3-73, showing sodium bicarbonate (Na-HCO₃) dominated water type that is saturated with respect to calcite precipitation.

This pool was characterised by a single filling event in late June 2021 after significant rainfall in the catchment, with subsequent gradual decline in water levels over the following three months. The wet season 2022/23 did not show any filling events, with only small flow peaks evident (0.1m) for a short duration (see graph below). This pattern would suggest that major events (such as the Dec 2020 200+mm rain event) drive the filling and subsequent ecology of the pool. Small frequent flushing events do not appear to sustain water levels within the pool sufficient for aquatic habitats to establish.

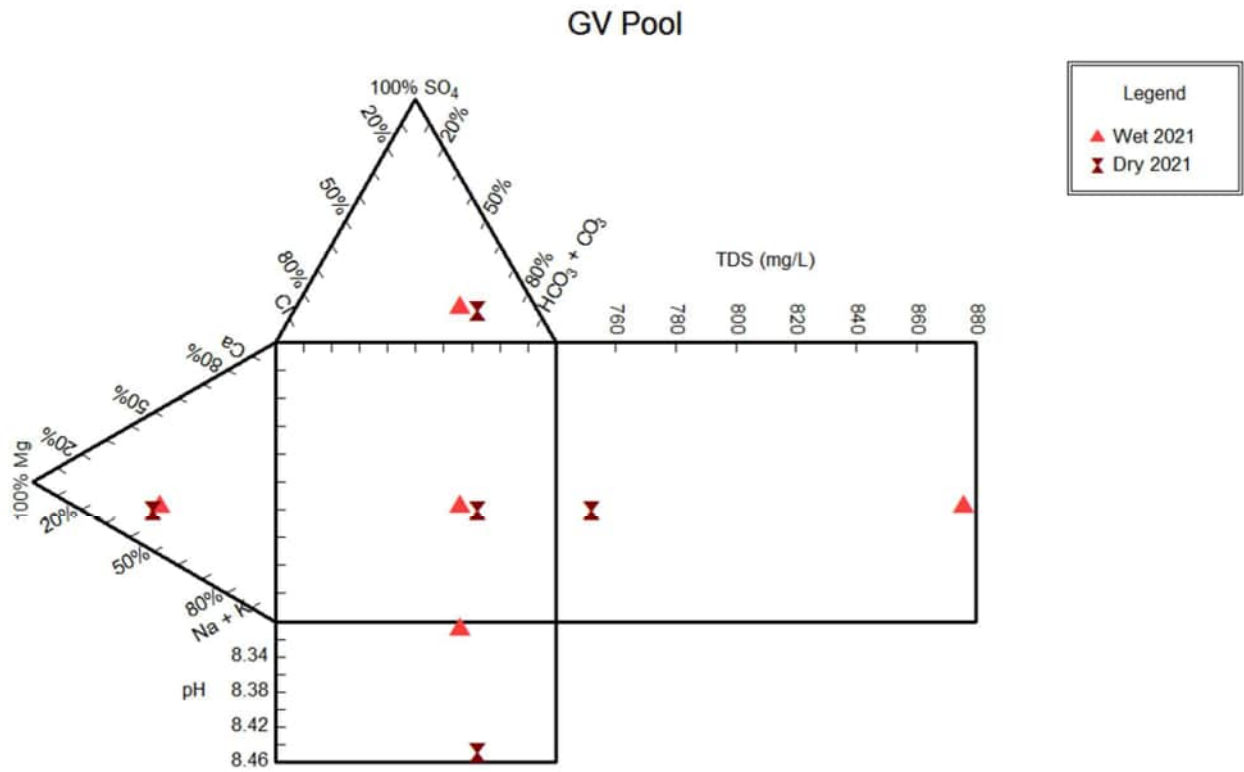


Figure 3-73 Durov diagram showing the South-West Glacier Valley Pool (GV SW Pool) major ion distribution.

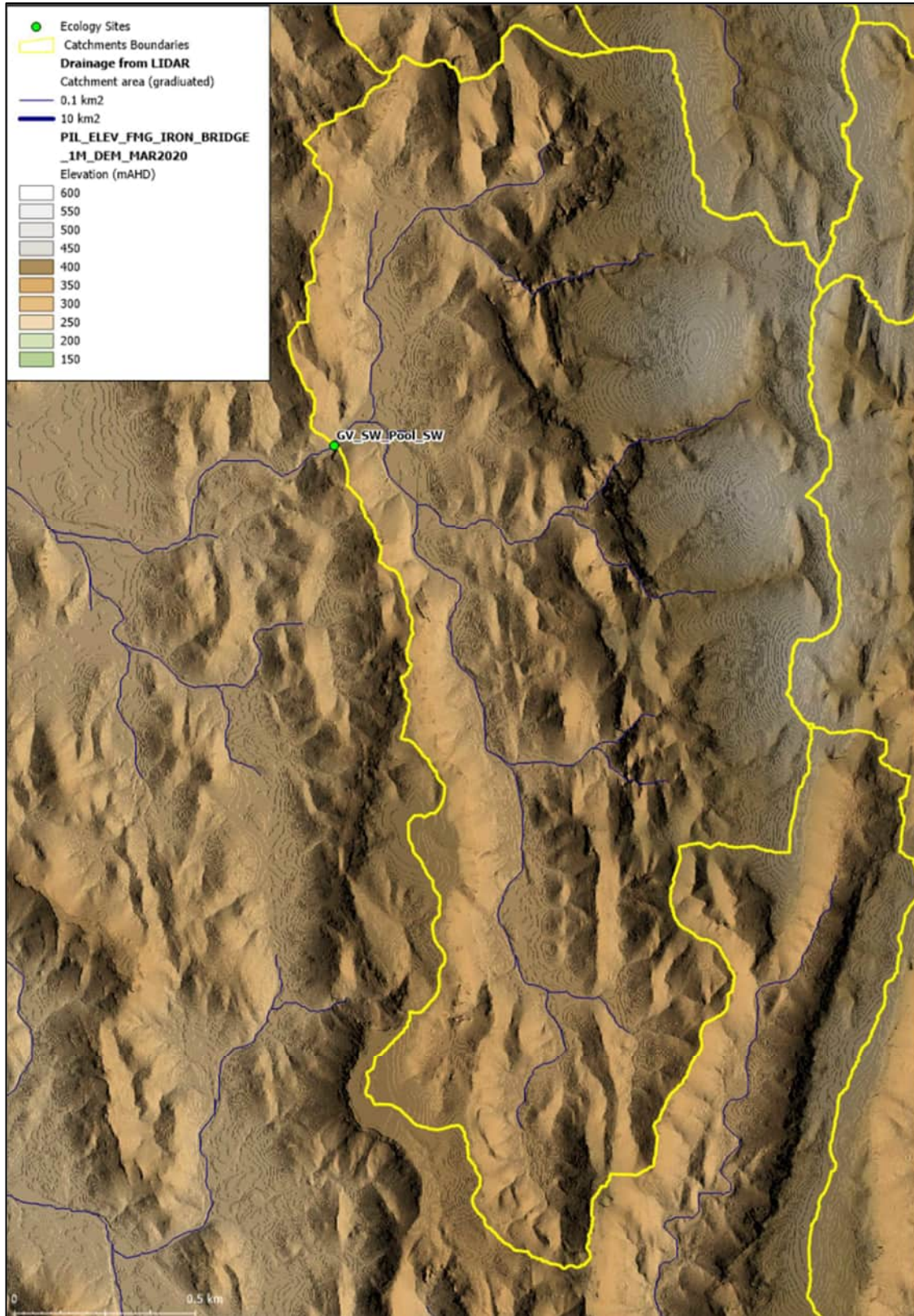


Figure 3-74 GV SW Pool catchment area (3.3 km²)

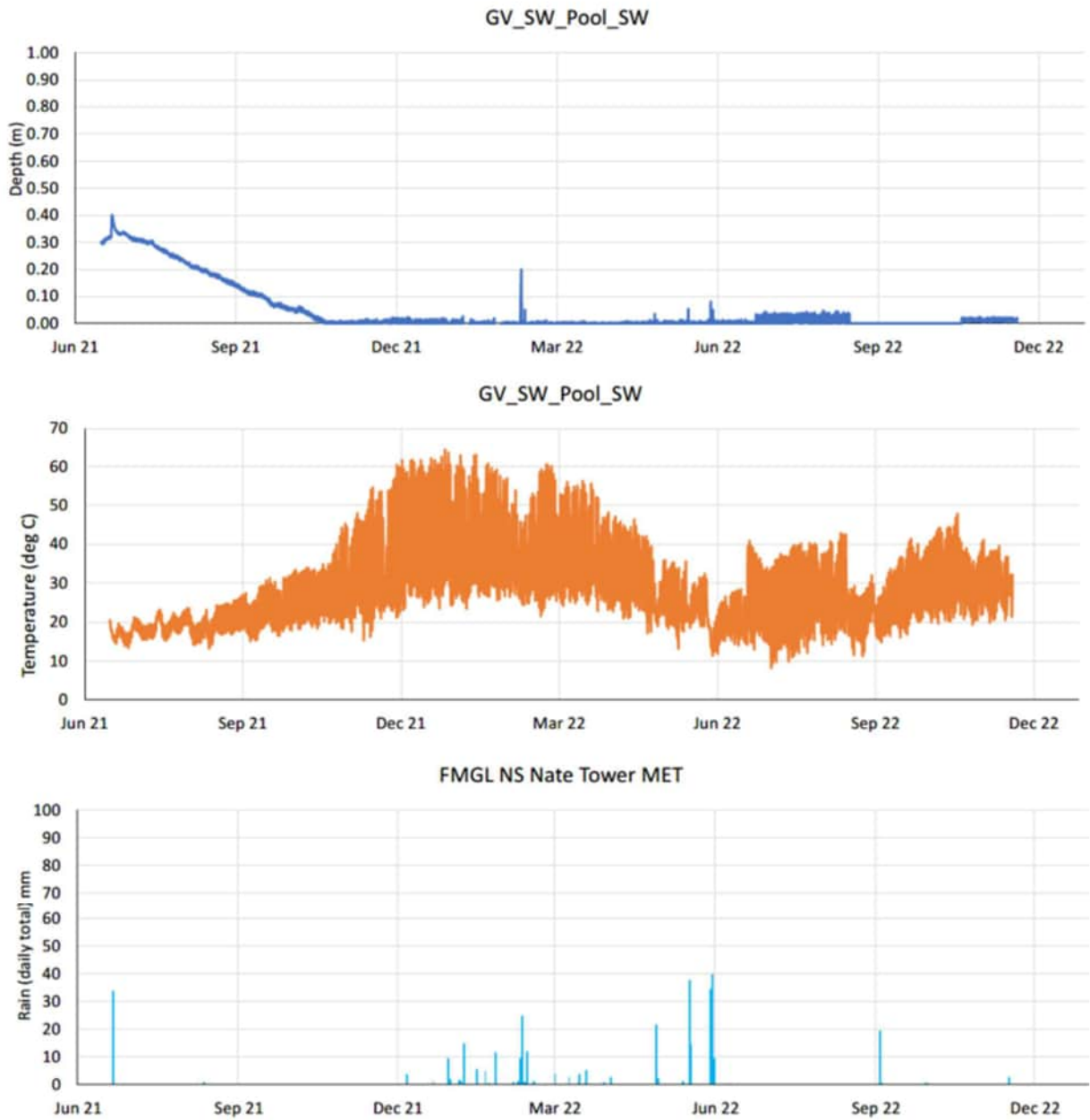


Figure 3-75 GV Pool logger record from 15/06/2021 to 24/11/2022 for pool water depth (m), water temperature (°C), and daily rainfall at FMG LNS Nate Tower MET.

Table 3-25 Summary of water quality analytical results for GV_SW_Pool_SW. Concentration for each analyte and analyte group described for Late Wet 2021, Late Dry 2021 and Late Wet 2022 seasons. No data available for Late Dry 2022 as creek was dry. Only dissolved metals with Default Guideline Values (DGV) were included in this table. Bolded values denote results above the 95% species protection levels ANZG (2018) DGVs and the ANZECC (2000) guidelines.

Analyte/Water Quality Parameter	Mean	Max	Min	Range	SE	95% Protection/DGV
Temp (°C)	20.17	24.80	17.50	7.30	2.85	
DO (%)	106.75	178.00	54.30	123.70	45.22	90
DO (mg/L)	9.11	14.20	5.15	9.05	3.27	
SPC (uS/cm)	1935	3091	1271	1820	710	
TDS (mg/L)	1214	2009	754	1255	489	
pH	8.11	8.45	7.88	0.57	0.21	6.0-7.5
Turbidity (NTU)	0.13	0.89	-0.69	1.58	0.56	15
Total Alkalinity as CaCO ₃	348	525	0	525	213	
Ammonium as N (mg/L)	0.0025	0.005	0	0.005	0.0025	0.006
Nitrite as N (mg/L)	0.0025	0.005	0	0.005	0.0025	0.03
Nitrate as N (mg/L)	0.0025	0.005	0	0.005	0.0025	0.03
Nitrite + Nitrate as N (mg/L)	0.005	0.005	0.005	0	0	0.03
Total Nitrogen as N (mg/L)	0.57	1.00	0.20	0.80	0.29	0.15
Total Phosphorus as P (mg/L)	0.035	0.06	0.005	0.055	0.019685	0.01
Reactive Phosphorus as P	0.005	0.005	0.005	0	0	0.005
Dissolved Organic Carbon	10.7	18.0	4.0	14.0	5.0	
<i>Dissolved metals</i>						
Aluminium (mg/L)	0.0025	0.0025	0.0025	0	0	0.055
Arsenic (mg/L)	0.0021	0.0030	0.0015	0.0015	0.0005	0.024(AsII), 0.013(AsV)
Boron (mg/L)	0.40	0.46	0.34	0.12	0.08	0.94
Cadmium (mg/L)	0.00003	0.00005	0.00003	0.00003	0.00001	0.0002
Chromium (mg/L)	0.0002	0.0005	0.0001	0.0004	0.0002	0.001
Copper (mg/L)	0.0023	0.0050	0.0003	0.0048	0.0017	0.0014
Lead (mg/L)	0.00020	0.00050	0.00005	0.00045	0.00018	0.0034
Manganese (mg/L)	0.07	0.18	0.01	0.17	0.06	1.9
Mercury (mg/L)	0.00003	0.00005	0.00002	0.00003	0.000012	0.00006
Nickel (mg/L)	0.0016	0.0030	0.0005	0.0025	0.0009	0.011
Silver (mg/L)	-	-	-	-	-	0.00005
Zinc (mg/L)	0.010	0.015	0.004	0.011	0.004	0.008

3.6.3 SEDIMENT QUALITY

The sediment quality for the Late Wet 2021, Late Dry 2021 and Late Wet 2022 sampling at GV_SW_Pool_SW is provided in Table 3-26. As there were problems with the initial Late Wet 2022 sediment analysis there was not enough sample left in the second analysis for all analytes. There is no analysis for Late Dry 2022 due to the site being dry.

Table 3-26 Summary of sediment quality analysis for GV_SW_Pool_SW in the Late Wet 2021, Late Dry 2021 and Late Wet 2022 seasons. No analysis recorded for late dry season (2022) due to the site being dry. Bolded values denote results above the ANZG (2018) DGVs .

Analyte grouping/Analyte	Unit	ANZG value	Late Wet 2021	Late Dry 2021	Late Wet 2022
Total Soluble Salts	mg/kg	-	200	561	*
Moisture Content (Dried @ 105-110°C)	%	-	24.8	28.0	28.8
Total Alkalinity as CaCO₃	mg/kg	-	239	399	*
Bicarbonate Alkalinity as CaCO₃	mg/kg	-	239	363	*
Carbonate Alkalinity as CaCO₃	mg/kg	-	<5	35	*
Acidity	mg/kg	-	62	<5	*
Sulfate as SO₄ 2- (soluble sulfate by ICPAES)	mg/kg	-	<10	30	*
Chloride (by Discrete Analyser)	mg/kg	-	20	40	*
Calcium	mg/kg	-	30	70	*
Magnesium	mg/kg	-	20	100	*
Sodium	mg/kg	-	30	120	*
Potassium	mg/kg	-	<10	<10	*
Mercury (FIMS)	mg/kg	-	<0.1	<0.1	<0.1
Nitrite + Nitrate as N (Sol.)	mg/kg	-	<0.1	<0.1	*
Total Kjeldahl Nitrogen as N	mg/kg	-	430	360	*
Total Nitrogen as N	mg/kg	-	430	360	*
Total Phosphorus as P	mg/kg	-	190	108	*
Reactive Phosphorus as P	mg/kg	-	<0.1	<0.1	*
Total Organic Carbon	%	-	0.13	0.24	0.69
<i>Total Metals by ICP-AES</i>					
Arsenic	mg/kg	20	9	<5	<5
Barium	mg/kg	-	60	70	60
Beryllium	mg/kg	-	<1	<1	<1
Boron	mg/kg	-	50	<50	<50
Cadmium	mg/kg	1.5	<1	1	1

Analyte grouping/Analyte	Unit	ANZG value	Late Wet 2021	Late Dry 2021	Late Wet 2022
Chromium	mg/kg	80	368	205	110
Cobalt	mg/kg	-	33	31	20
Copper	mg/kg	65	67	60	39
Iron	mg/kg	-	114000	70100	42100
Lead	mg/kg	50	6	<5	<5
Manganese	mg/kg	-	674	1280	1030
Nickel	mg/kg	21	134	118	57
Selenium	mg/kg	-	<5	<5	<5
Vanadium	mg/kg	-	161	115	67
Zinc	mg/kg	200	30	50	28

3.6.4 FISH

There were no fish observed in GV Pool in the Late Dry 2022 due to no water in the pool. In the Late Wet Season 2021 species composition and fish counts were conducted using BRUVs resulting in only 13 *L. unicolor* (spangled perch) observed. Fish were unable to be monitored during the Late Dry 2021 season survey as the water level had receded dramatically. *L. unicolor* (spangled perch) were observed within the remnants of the pool. This is a common characteristic of spangled perch, as they are a very hardy and tolerant species.

3.6.5 AQUATIC MACROINVERTEBRATES

Figure 3-74 presents the summary of total abundance, taxa richness, EPT richness and SIGNAL2 for the Late Wet and Dry 2021 surveys at GV Pool. No macroinvertebrate samples were obtained in the Late Wet and Late Dry 2022 as the creek was dry. The key findings were as follows:

- Total abundance increased between the two seasons by 84 individuals.
- EPT and Taxonomic richness both declined compared to the Late Wet season, which is to be expected due to the reduced water levels.
- Average EPT richness was 4 at the GV Pool during the Late Wet Survey, with a total of five families belonging to the Ephemeroptera and Trichoptera orders recorded. Average EPT richness declined by over a factor of five, now recording an average of 1.
- The Late Wet average SIGNAL2 score was 3.4, which indicates that the macroinvertebrate community at GV Pool is moderately tolerant. This increased to 3.72, coinciding with previous results, that the community is moderately tolerant.

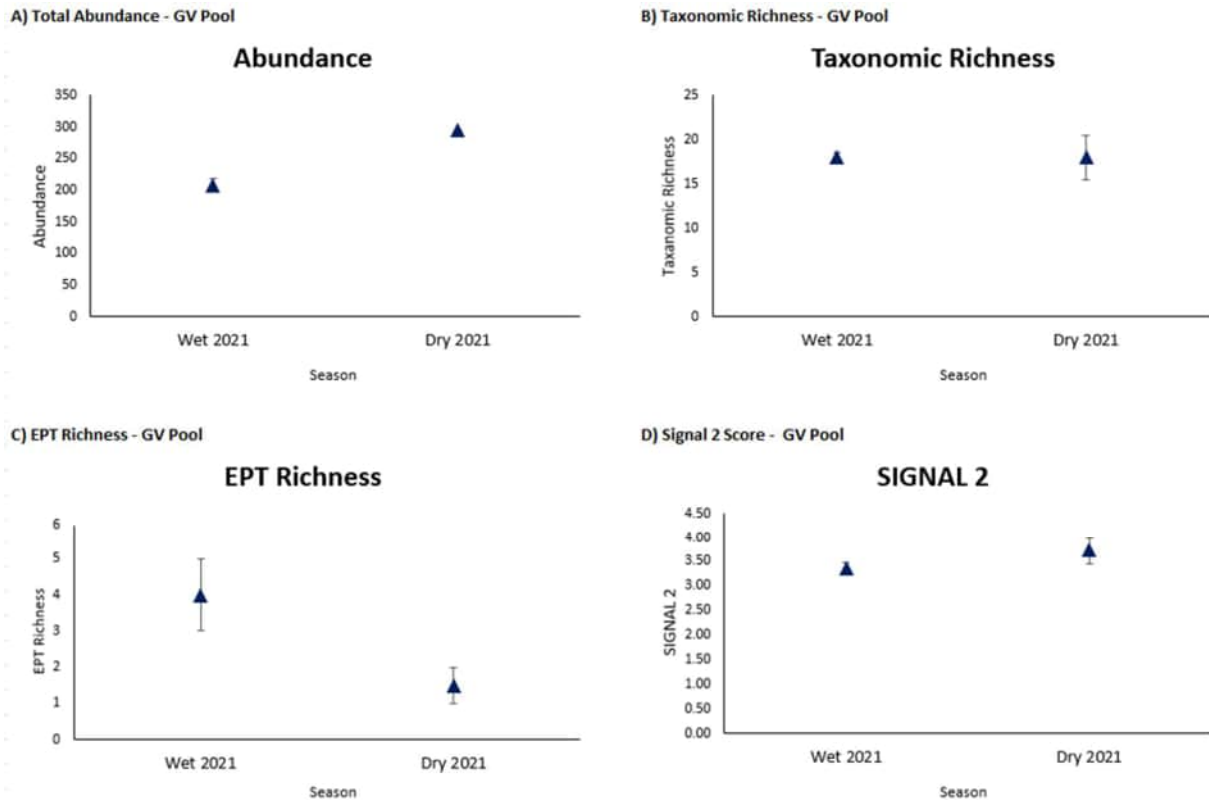


Figure 3-74 Macroinvertebrate indices showing averages and standard errors for GV Pool – Late Wet 2021 and Late Dry 2021.

Figure 3-75 shows the abundance of each macroinvertebrate taxa in GV Pool in the Late Wet and Dry seasons of 2021. The Late Wet 2021 sample was dominated by midges, water snails (Planorbidae) and mayflies (Caenidae). In the Late Dry 2021 season s-f Tanypodinae, s-f Chironominae, Acarina and Baetidae were the four most abundant macroinvertebrate taxonomic groups present. These species comprise the biting and non biting midges, arachnids and mayfly groups.

No macroinvertebrate species of conservation significance were found at GV_SW Pool.

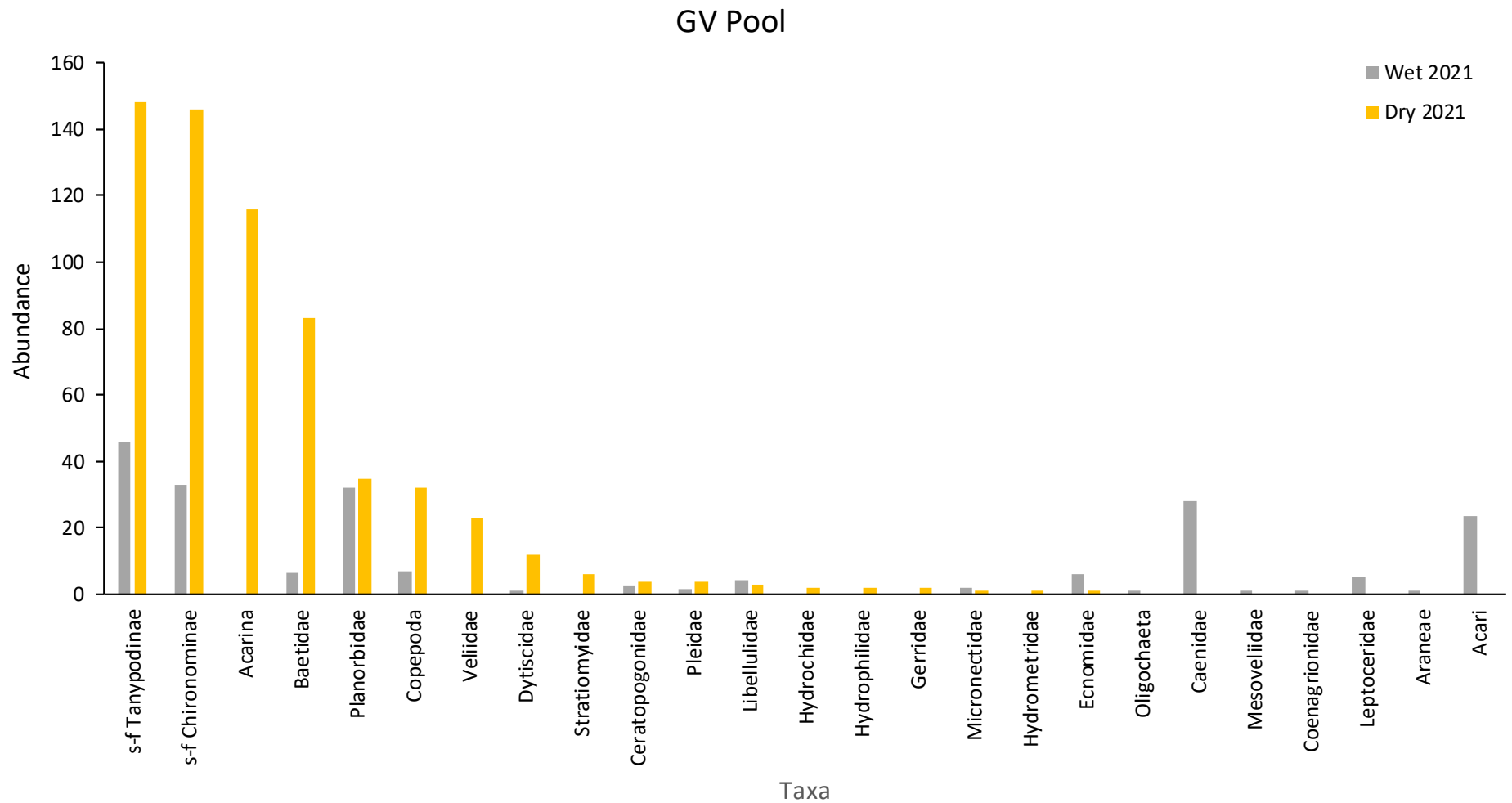


Figure 3-75 Average abundances of all macroinvertebrate taxa at GV Pool in the Late Wet and Late Dry seasons of 2021, with taxa arranged from most abundant (left) to least abundant (right) along the x-axis.

3.6.6 DIATOMS AND PHYTOPLANKTON

3.6.6.1 DIATOMS

No diatom data was collected in the Late Wet 2022 due to the plate having been crushed by either a dingo or kangaroo that used the receding pool. No diatom data was collected in Late Dry 2022 as pool was dry. Table 3-27 provides the diatom abundance (total count per species), average abundance and DSIAR score GV Pool surveyed in the Late Wet and Dry 2021. Figure 3-76 illustrates the mean abundance (diatom count per replicate) of diatom species recorded at GV Pool over both seasons. GV Pool was not sampled before 2021, and the main results are as follows:

- Total Count had minimal variation between Late Wet and Late Dry Surveys with both seasons recording similar abundances (average count = 400/420 respectively).
- GV Pool had a high taxonomic diversity in the Late Wet season with 34 species found, this reported number declines to 24 species within the Late Dry season.
- 7 new taxonomic groups were recorded during the Late Dry season which were not originally identified during the Late Wet. *Mastogloia smithii* not discovered in the previous seasons survey, contributed the largest total count percentage (36%) for all diatom species in Late Dry 2021.
- The tolerance to environmental stress for GV Pool is reflected in the moderate sensitivity DSIAR score (50.3 and 52.5 for Late Wet and Dry, respectively). There is likely to be some natural environmental (habitat) stress from the ephemeral nature of the shallow string of pools along the study reach. This was observed specifically in the dry season with water levels having considerably dropped within the small pools throughout the catchment. The catchment during the baseline phase is largely unimpacted by other activities such as grazing.

Table 3-27. Diatom abundance (total count per species), average abundance and DSIAR score GV Pool surveyed in the Late Wet 2021 and Late Dry 2021 seasons. No data for Late Wet 2022 and Late Dry 2022.

Taxon	Late Wet 2020			Late Dry 2021		
	R1	R2	Average	R1	R2	Average
<i>Mastogloia smithii</i>	0	0	0	82	224	153
<i>Achnantheidium minutissimum</i>	20	0	10	182	54	118
<i>Diploneis parma</i>	52	104	78	0	14	7
<i>Nitzschia paleacea</i>	0	96	48	4	0	2
<i>Ulnaria ulna</i>	6	0	3	74	22	48
<i>Nitzschia frustulum</i>	64	30	47	2	0	1
<i>Nitzschia fonticola</i>	22	46	34	4	4	4
<i>Navicula viridula</i>	16	42	29	0	8	4
<i>Gomphonema affine</i>	42	8	25	0	16	8
<i>Nitzschia filiformis</i>	46	4	25	0	0	0
<i>Nitzschia linearis</i>	4	2	3	18	32	25
<i>Nitzschia palea</i>	34	14	24	10	0	5
<i>Nitzschia microcephala</i>	14	8	11	24	10	17
<i>Fragilaria acus</i>	0	0	0	14	14	14

Taxon	Late Wet 2020			Late Dry 2021		
<i>Navicula erifuga</i>	0	16	8	0	0	0
<i>Achnantheidium exiguum</i>	14	0	7	2	0	1
<i>Nitzschia gracilis</i>	14	0	7	0	2	1
<i>Navicula menisculus</i>	4	8	6	4	0	2
<i>Navicula viridula var. linearis</i>	0	8	4	0	0	0
<i>Nitzschia lacuum</i>	8	0	4	0	4	2
<i>Diploneis smithii</i>	0	6	3	0	0	0
<i>Nitzschia inconspicua</i>	0	6	3	0	0	0
<i>Navicula cryptocephala</i>	0	4	2	4	2	3
<i>Achnanthes subexigua</i>	4	0	2	0	0	0
<i>Gomphonema minutum</i>	0	4	2	0	0	0
<i>Karayevia clevei</i>	0	4	2	0	0	0
<i>Navicula lanceolata</i>	0	4	2	0	0	0
<i>Navicula tenelloides</i>	4	0	2	0	0	0
<i>Navicula veneta</i>	4	0	2	0	0	0
<i>Navicula perminuta</i>	0	0	0	0	4	2
<i>Stauroneis spp</i>	0	0	0	0	4	2
<i>Fragilaria vaucheriae</i>	0	2	1	0	0	0
<i>Navicula radiosafallax</i>	0	2	1	0	0	0
<i>Navicula rhynchocephala</i>	2	0	1	0	0	0
<i>Nitzschia clausii</i>	2	0	1	0	0	0
<i>Nitzschia desertorum</i>	0	2	1	0	0	0
<i>Gomphonema gracile</i>	0	2	1	2	0	1
<i>Gomphonema unknown</i>	0	0	0	0	2	1
<i>Navicula radiosa</i>	0	0	0	0	2	1
<i>Navicula recens</i>	0	0	0	0	2	1
<i>Nitzschia palea var debilis</i>	2	0	1	0	0	0
Total Count	378	422	400	428	420	424
Species Richness	21	23	34	14	18	24
DSAIR Score	49.3	51.2	50.3	54	51	52.5

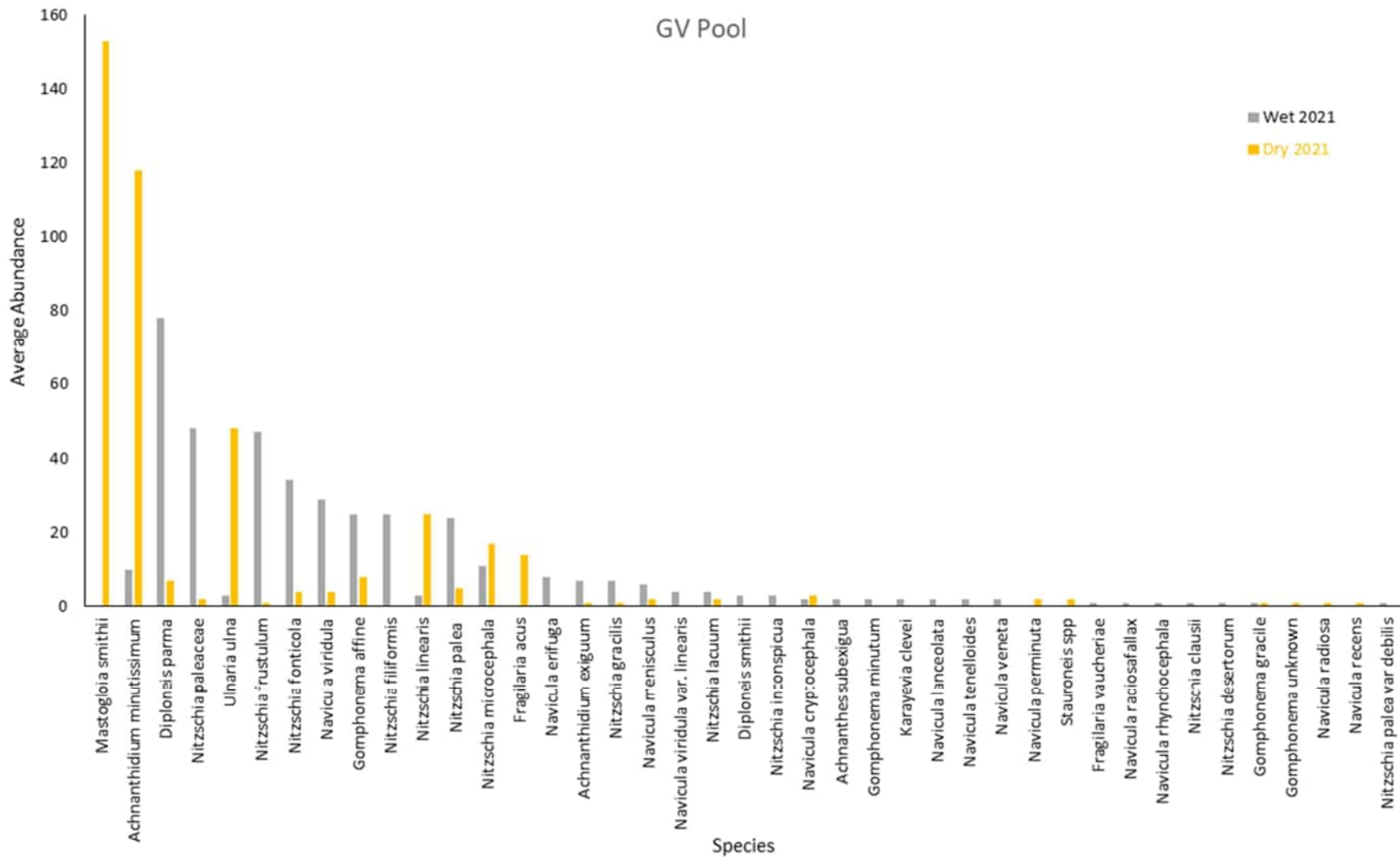


Figure 3-76 Average species abundance (diatom count per replicate) for diatoms sampled at GV Pool in the Late Wet 2021, with taxa arranged from most abundant (left) to least abundant (right) along the x-axis. No data for Late Wet and Late Dry 2022.

3.6.6.2 PHYTOPLANKTON

No phytoplankton samples were collected in the Late Wet 2022 to leave the small amount of remaining water in the pool for ecological processes. The pool was dry in the Late Dry 2022 and no phytoplankton samples were collected. Therefore, only the two the Late Wet and Late Dry 2021 survey data have been presented.

Two classes of phytoplankton were identified in the Late Wet season (2021). GV Pool was dominated by diatoms (98.9%, Bacillariophyceae). Only seven diatom genera were observed in the Late Wet 2021 water sample, indicating a moderate level of diatom diversity.

Six classes of phytoplankton were identified in the Late Dry season survey (2021), recording four classes which were not previously present. Overall, eleven genera were recorded within GV pool during the Late Dry season survey, with seven newly genera being identified in comparison to the previous seasons study.

The increase in phytoplankton abundance and richness during the Late Dry 2021 season may be connected to the reduction of water flow, creating shallow, warm and stagnant pools, which are preferable habitats for majority of algae taxonomic groups.

Table 3-28 Summary of phytoplankton species and abundance (cells/L) for GV Pool sampled in the Late Wet and Late Dry seasons in 2021. No Late Wet or Late Dry 2022 phytoplankton data.

Taxon	Late Wet (2021)		Late Dry (2021)	
	<i>Abundance</i>	<i>%</i>	<i>Abundance</i>	<i>%</i>
Bacillariophyceae	860	98.85	990000	5.74
<i>Amphora spp.</i>	40	4.6	0	0
<i>Placoneis sp.</i>	530	60.92	0	0
<i>Navicula spp.</i>	100	11.49	250000	1.38
<i>Nitzschia spp.</i>	110	12.64	40000	0.22
<i>Rhopalodia gibba</i>	60	6.9	0	0
<i>Synedra spp. (O)</i>	20	2.3	0	0
<i>Mastogloia spp</i>	0	0	700000	3.87
Chlorophyceae	0	0	30000	0.17
<i>Monoraphidium spp</i>	0	0	20000	0.11
<i>Oocystis spp (O)</i>	0	0	10000	0.06
Cryptophyceae	10	1.15	650000	3.59
<i>Cryptomonas spp. (O)</i>	10	1.15	650000	3.59
Cyanobacteria	0	0	4820000	26.63
<i>Merismopedia spp</i>	0	0	160000	0.88
<i>Pseudanabaena spp</i>	0	0	4660000	25.75
Dinophyceae	0	0	10000	0.06
<i>Gymnodinioid Dinoflagellates (unknown)</i>	0	0	10000	0.06
Prasinophyceae	0	0	11600000	64.09
<i>Prasinophytes (unknown)</i>	0	0	11600000	64.09

3.6.7 MACROPHYTES

There were no macrophytes in the in GV Pool in the Late Dry 2022 as it was dry. The macrophyte (submerged vegetation community) observed during the Late Wet 2021 survey (the initial baseline survey for this site) was limited at GV Pool, though some individual plants (sedges) were observed within the various semi-connected pools along the drainage reach. There was a range of macrophyte species including bull rush, sedges, ribbon weed and charophytes in low abundance at GV pool in the Late Dry 2021 survey.



Figure 3-77 Photographs of GV pool – Late Dry 2021 (Left), Late Wet 2022 (middle) and Late Dry 2022 (right).

3.6.8 ENVIRONMENTAL VALUE

Like other ephemeral pools in the region the fauna recorded in the pool are those best adapted to exploit the short term presence of water in the habitat. *L. unicolor* (Spangled Perch) have been observed in the pool indicating that like IB_SW_Pool_Central Ck the fish are using the pool as a refuge once water levels recede over after wet season flows have diminished. The presence of five families of EPT macroinvertebrates indicates that this pool also plays an important role in the life stages of sensitive insects that utilise the pool for reproduction. No fish, aquatic diatoms, phytoplankton, macroinvertebrates or macrophytes are of conservation significance have been found in this site.

3.7 GV_SW_POOL_GR

Pool_GR is comprised of a deep rock plunge pool along a creek line that descends through a small gorge from creeks on top of the Glacier Valley escarpment serving as one of the southern tributaries discharging into GV_SW_Pool_Mundagoora_SS from the east. It has been added to the seasonal survey as the pool is in the proposed Glacier Valley mine pit. Some information discussed about this pool is based on assumptions from other pools in the vicinity due to the pool only being visited for the first time by Hydrobiology in early June 2023. It had a depth of around 65cm at the time of survey in June 2023 but appears to fill to between 2-3 m, as indicated on surrounding rock colouring, after rainfall and flow events.



Figure 3-78 GV_SW_Pool_GR left; June 2012 and right; June 2023.

3.7.1 WATER QUALITY AND HYDROLOGY

Unlike the catchments of the other nearby monitoring sites (GV_SW_Pool_Mundagoora_SS and GV_SW_Pool_SW) the small Pool_GR catchment (0.72 km²) is located entirely on top of the Glacier Valley escarpment. While the pool is semi-permanent due to the bedrock formation, its ecology is likely to display similar characteristics to the ephemeral GV_SW_Pool_SW and GV_SW_Pool_NJA21-006_US Iron Bridge monitored pools, with seasonal flows over the wet season filling the pool with water presence potentially persisting into the early dry season.

From the recent field measurements, the pool water is slightly acidic with a pH of 5.90, very fresh (EC 91.6 µS/cm) and moderately oxygenated (DO 4.46mg/L). Dissolved zinc was the only dissolved metal to exceed the 95% species protection level ANZG (2018) DGVs. Both the nutrients TN and TP exceeded the ANZG 95% protection levels (Table 3-29). This is consistent with the high algal counts (see Section 3.7.2.1) and slight

green colouration of the water observed during the site visit in June 2023. By this stage the pool was likely to be in a receding phase.

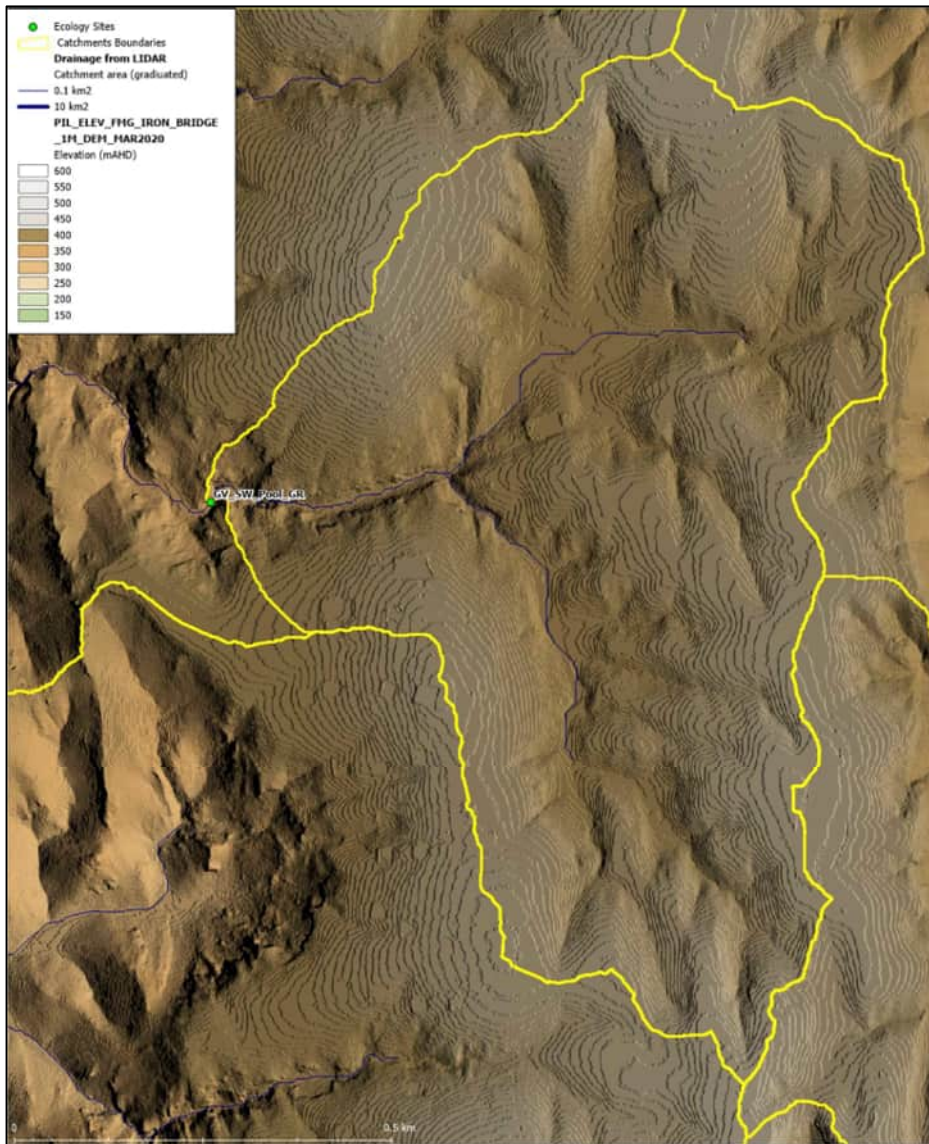


Figure 3-79 GV_SW_Pool_GR site location and catchment area.

Table 3-29 Summary of water quality analytical results for GV_SW_Pool_GR. Concentration for each analyte and analyte group described Late Wet 2023 season. Only dissolved metals with Default Guideline Values (DGV) were included in this table. Bolded values denote results above the 95% species protection levels ANZG (2018) DGVs and the ANZECC (2000) guidelines.

Analyte/Water Quality Parameter	Value	95% Protection/DGV
Temp (°C)	16.9	
DO (%)	46.1	90
DO (mg/L)	4.46	
SPC (uS/cm)	108.4	
TDS (mg/L)	70	
pH	5.90	6.0-7.5
Turbidity (NTU)	4.55	15
Total Alkalinity as CaCO ₃ (mg/L)	38	
Ammonium as N (mg/L)	0.49	0.006
Nitrite as N (mg/L)	<0.01	0.03
Nitrate as N (mg/L)	<0.01	0.03
Nitrite + Nitrate as N (mg/L)	<0.01	0.03
Total Nitrogen as N (mg/L)	0.8	0.15
Total Phosphorus as P (mg/L)	0.04	0.01
Reactive Phosphorus as P (mg/L)	<0.01	0.005
Dissolved Organic Carbon (mg/L)	35	
<i>Dissolved metals</i>		
Aluminium (mg/L)	0.006	0.055
Arsenic (mg/L)	<0.0002	0.024(AsII), 0.013(AsV)
Boron (mg/L)	0.077	0.94
Cadmium (mg/L)	<0.00005	0.0002
Chromium (mg/L)	<0.0002	0.001
Copper (mg/L)	<0.0005	0.0014
Lead (mg/L)	<0.0001	0.0034
Manganese (mg/L)	0.0185	1.9
Mercury (mg/L)	<0.00004	0.00006
Nickel (mg/L)	0.0007	0.011
Zinc (mg/L)	0.023	0.008

3.7.2 ECOLOGY

Pool_GR had large macroinvertebrates present, consisting mainly of water beetles, water scorpions (Figure 3-80) and water fleas. No fish were present in the pool. The pool provides a water source for fauna such as small birds and kangaroos in the area. The Pilbara Olive Python has also been sighted at this pool during a 2012 FMG survey along with quolls as evident in trap cameras set by FMG.



Figure 3-80 Water scorpion in macroinvertebrate sweep at Pool_GR.

3.7.2.1 PHYTOPLANKTON

A single phytoplankton sample was obtained during the Late Wet 2023 (June) site visit. The phytoplankton community was dominated by green algae - Chlorophyceae (99.98%) with 82% comprising *Koliella spp.* There was a presence of Cyanobacteria (blue-green algae), Euglenophyceae and Prasinophyceae (Table 3-30). The total algal count (abundance) was higher than other pool sampled in the Late Wet 2023 survey, likely due to the receding state of the pool without recent flushing inflows.

Table 3-30 Summary of phytoplankton species and abundance (cells/L) for GR Pool sampled in the Late Wet 2023.

Taxon	Late Wet (2023)	
	Abundance	%
Chlorophyceae	2699600	99.98
<i>Crucigenia spp</i>	368000	13.63
<i>Desmodesmus spp</i>	118000	4.37
<i>Koliella spp</i>	2208000	81.78
<i>Monoraphidium contorta</i>	5600	0.21
Cyanobacteria	40	0
<i>Pseudanabaena spp (O) (PT)</i>	40	0
Euglenophyceae	300	0.01
<i>Trachelomonas spp</i>	300	0.01
Prasinophyceae	100	0
Prasinophytes (unknown)	100	0
TOTAL	2700040	100

3.7.3 ENVIRONMENTAL VALUES

The semi-permanent nature of Pool_GR provides habitat for various macroinvertebrates (particularly those species that have airborne life stages) and small animals such as reptiles and birds. While both Northern Quolls and Pilbara Olive Pythons (POP) have been recorded at Pool_GR (FMG surveys), they have also been recorded at several other permanent pools nearby on the Iron Bridge tenement. With POP being recorded within close proximity at IB_SW_Pool12_01 and IB_SW_Pool_Cow Spring indicating that Pool_GR is not a sole refuge for this conservation significant species. Northern Quolls have also been sighted at other locations (by FMG) and therefore is also not a sole refuge for this conservation significant species. Due to the elevation of the pool on the Glacier Valley escarpment and downstream rockfall barriers it is unlikely the Pool_GR experiences any upstream migration of fish species and therefore would not provide a source of prey animals to other animals in the immediate area. This pool could be of conservation significance as it provides habitat for the Pilbara Olive Python, however, the nearby Mundagoora Pool could also be a site where the Pilbara Olive Python would access due to similar, more extensive and permanent aquatic habitat features.

3.8 GV_SW_POOL_NJA21-006-US

NJA21-006-US is a small pool located approximately 5.5 km east of Mundagoora Pool with its catchment draining the eastern face of the Glacier Valley ridgeline. It has been added to the seasonal survey to provide a baseline to any potential ecological disturbance outside the original footprint of the proposed project. Figure 3-81 shows the upstream ecology sampling pool and the downstream logger pool. Figure 3-82 shows the pool during the Late Dry 2022 survey.



Figure 3-81 NJA21-006-US Pool (left) and downstream pool with water level logger installation (right).



Figure 3-82 NJA21-006-US Pool (left) and downstream pool (right) during the Late Dry 2022 season.

3.8.1 SITE SPECIFIC TRIGGER VALUES

As there has only been one survey with water in this pool to conduct any analysis, there is insufficient data to confidently develop site specific triggers. The highly variable hydrology, and associated wet-drying cycle at this pool would indicate that any trigger values applied should be relative to specific periods of the hydro-cycle. For example, late-wet season, pool receding triggers would be required to be less stringent than those during mid-wet season pool full conditions. However, the pool could be treated in a similar manner to GV_SW_Pool_SW pool with modified wet season triggers developed for

pH, SPC, TDS, Cu, TP and TN. While no long-term rolling median values can be applied for NJA21-006-US Pool, the past values can provide a cautious guide to water quality in the ephemeral pool. In the interim period, default guidelines can be applied (DGVs; ANZG 2018).

3.8.2 WATER QUALITY AND HYDROLOGY

The NJA21-006-US Pool monitoring site consists of a string of shallow pools along a creek line fed by a 8.8 km² catchment (Figure 3-83). The hydrology of this pool system is similar to that of GV Pool with surface water flows appearing to dominate inputs. The water level logger was located in a pool downstream (Figure 3-85) and the ecological survey was completed in the pool downstream to be more representative of pools within the creek line. There is evidence of cattle visiting the pool.

During the Late Wet 2022 (June 2022) initial sampling trip, the NJA21-006-US Pool was approximately half full with ~0.70 m of water depth. The water in the pool was clear, though coloured with organic tannins from the leaf litter and high phytoplankton densities, slightly alkaline (pH = 8.14) and brackish (4488 µS/cm) (Table 3-31). The major ion balance consists of a mixed cation and Cl⁻ anion dominant water type with low sulphates (SO₄⁻) (Figure 3-86). Nutrients TN and TP exceeded the ANZG 95% protection levels which may be caused by decaying organic matter on the bottom of the pool and by nutrients delivered via cattle wastes. Dissolved copper exceeded the ANZG (2018) DGV in the Late Wet 2022.

The hydrology of this pool differs slightly to other nearby pools in that there is a steady decline in water levels instead of a rapid reduction in depth in response to flow events (Figure 3-85). This slow decline in depth may be explained by the higher clay and silt soil content observed in the creek line. In June 2022 the pool containing the logger had a water depth of approximately 0.3 m. On the return sampling trip in August 2022 both pools were dry and have remained dry in through to November 2022 (Figure 3-85).

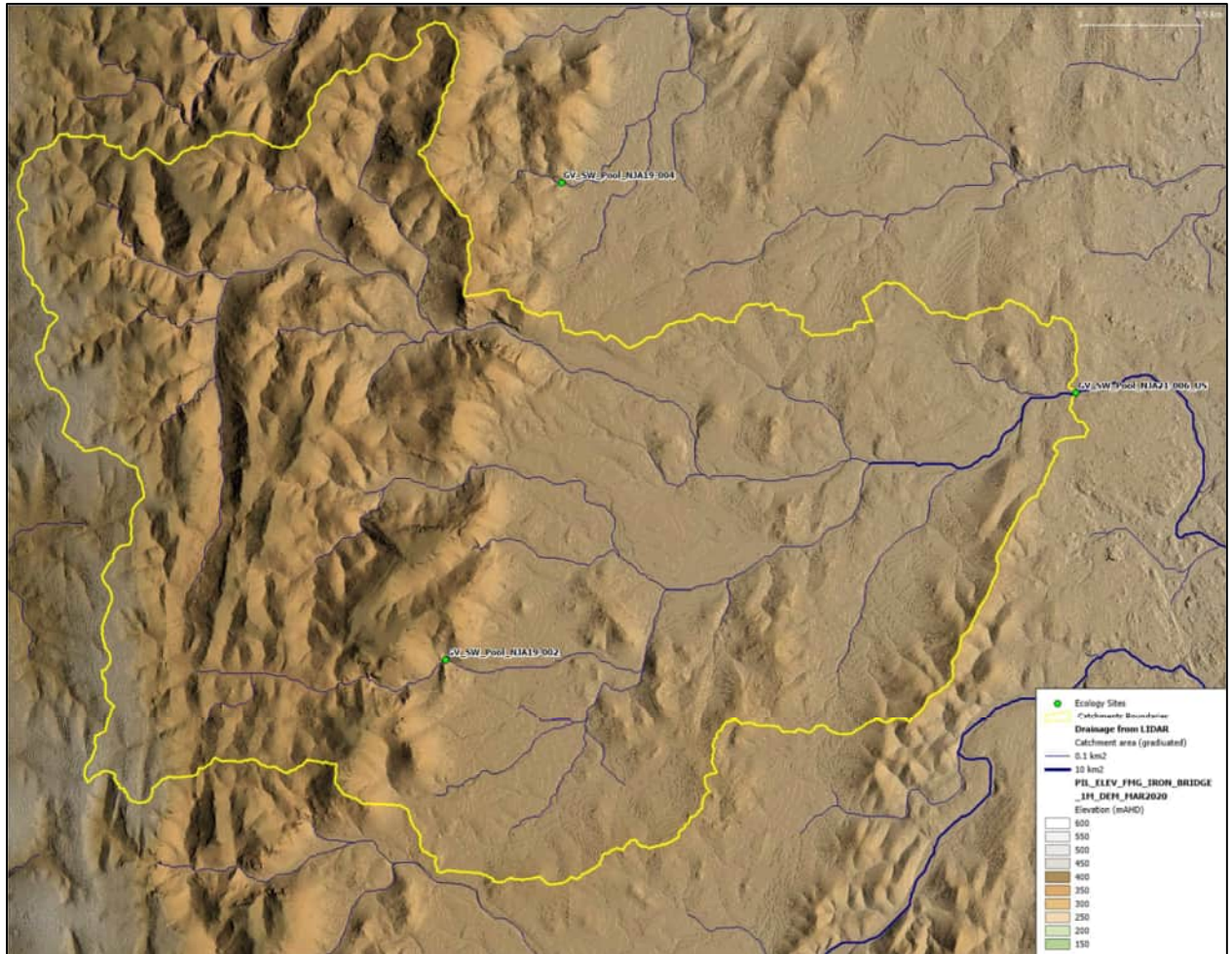


Figure 3-83 GV_SW_Pool_NJA21-006-US catchment area.

The hydrology of the GV_SW_Pool_NJA21-006_US pool controls the water quality, in particular in relation to the concentration of dissolved solids (salinity; electrical conductivity) as illustrated in Figure 3-84. Salinity increases with time following the previous (antecedent) large rainfall event. This pool exhibits a typical lowland ephemeral pool characteristic of rapid filling following large rainfall events, with subsequent trailing water level declines fed by receding flows through the alluvium (hyporheic zone) from the catchment. Large single flow events are likely to be more important to the establishment of a wetland type ecology within these pools than more frequent small flushing events. Small flushing events do however temporarily reduce salinity within the pools and may “top up” the water levels to sustain longer wetted periods (Figure 3-84).

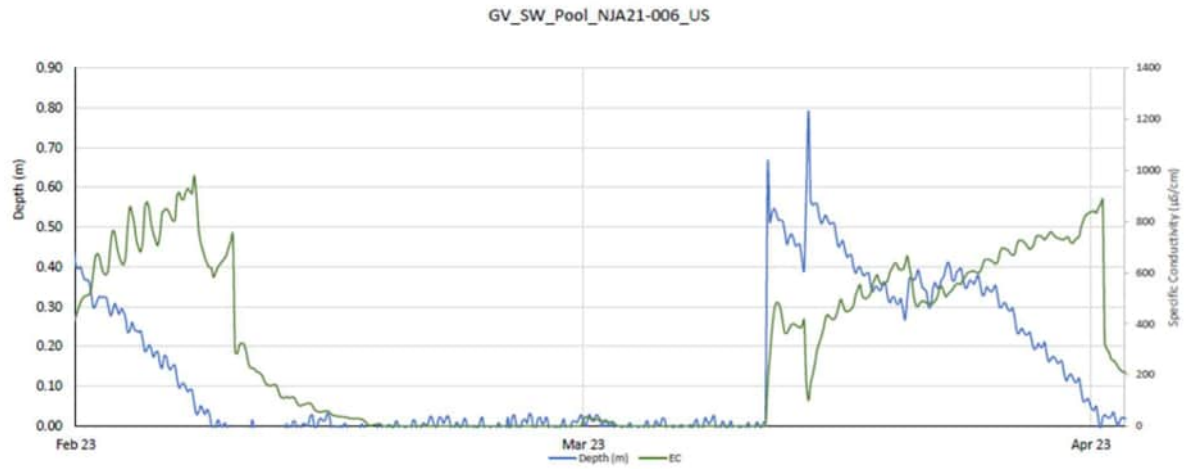


Figure 3-84 Water depth and salinity (specific conductivity) during a wet/drying cycle at GV_SW_Pool_NJA21-006_US (late wet 2023).

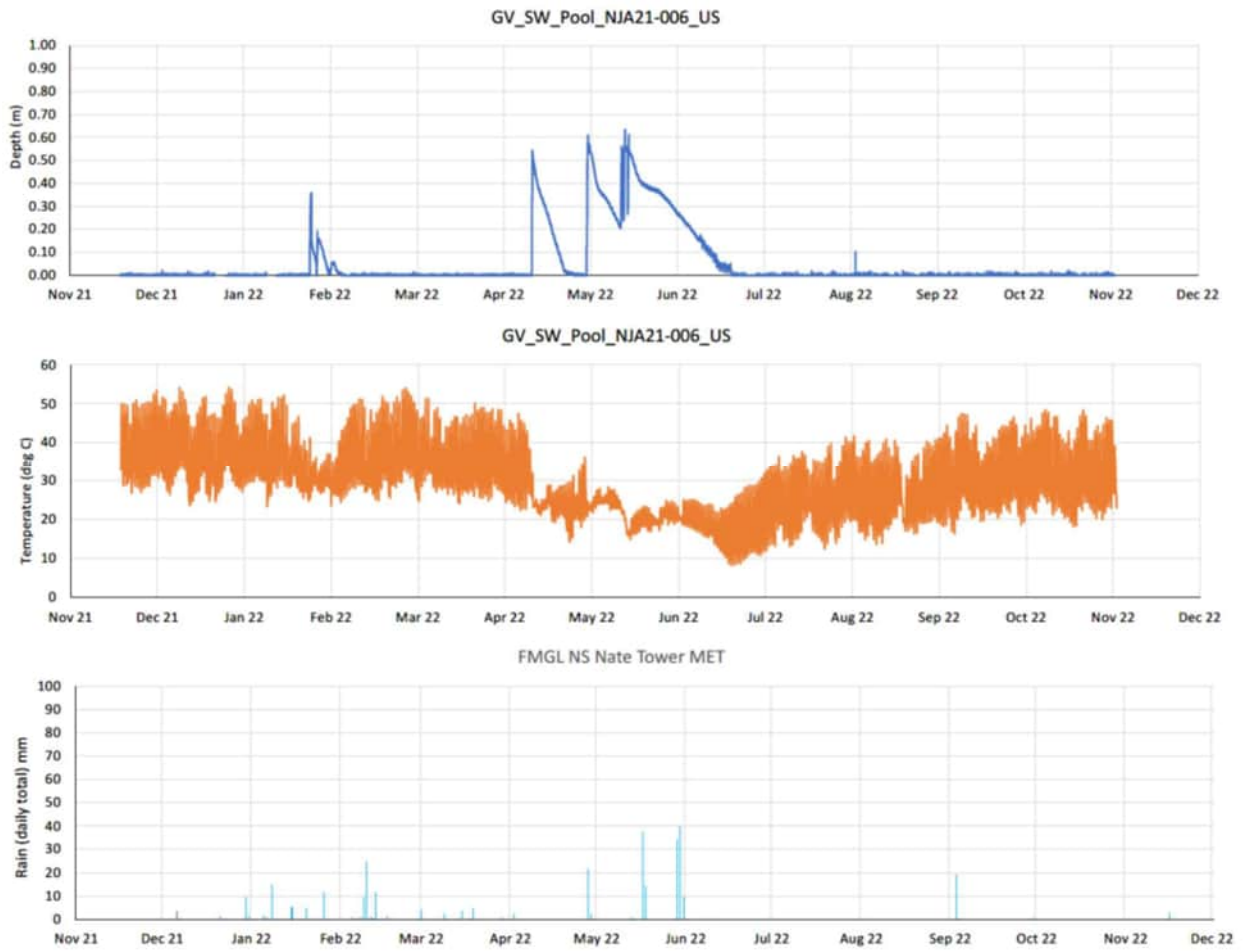


Figure 3-85 NJA21-006-US Pool logger record from 7/12/2021 to 24/11/2022 for pool water depth (m), water temperature (°C), and daily rainfall at FMG LNS Nate Tower MET.

Table 3-31 Summary of water quality analytical results for NJA21-006-US Pool. Concentration for each analyte and analyte group described for the Late Wet 2022 season. No data available for Late Dry 2022 as creek was dry. Only dissolved metals with Default Guideline Values (DGV) were included in in this table. Bolded values denote results above the 95% species protection levels ANZG (2018) DGVs and the ANZECC (2000) guidelines.

Analyte/Water Quality Parameter	Mean	95% Protection/DGV
Temp (°C)	19.10	
DO (%)	73.6	90
DO (mg/L)	6.72	
SPC (uS/cm)	4488	
TDS (mg/L)	2917	
pH	8.14	6.0-7.5
Turbidity (NTU)	-0.57	15
Total Alkalinity as CaCO ₃ (mg/L)	326	
Ammonium as N (mg/L)	-	0.006
Nitrite as N (mg/L)	-	0.03
Nitrate as N (mg/L)	-	0.03
Nitrite + Nitrate as N (mg/L)	0.005	0.03
Total Nitrogen as N (mg/L)	1.8	0.15
Total Phosphorus as P (mg/L)	0.11	0.01
Reactive Phosphorus as P (mg/L)		0.005
Dissolved Organic Carbon (mg/L) (mg/L)	36.0	
Dissovled metals		
Aluminium (mg/L)	-	0.055
Arsenic (mg/L)	0.023	0.024(AsII),
Boron (mg/L)	0.46	0.94
Cadmium (mg/L)	0.00003	0.0002
Chromium (mg/L)	0.0002	0.001
Copper (mg/L)	0.0023	0.0014
Lead (mg/L)	0.0005	0.0034
Manganese (mg/L)	0.178	1.9
Mercury (mg/L)	0.00005	0.00006
Nickel (mg/L)	0.007	0.011
Silver (mg/L)	-	0.00005
Zinc (mg/L)	0.0025	0.008

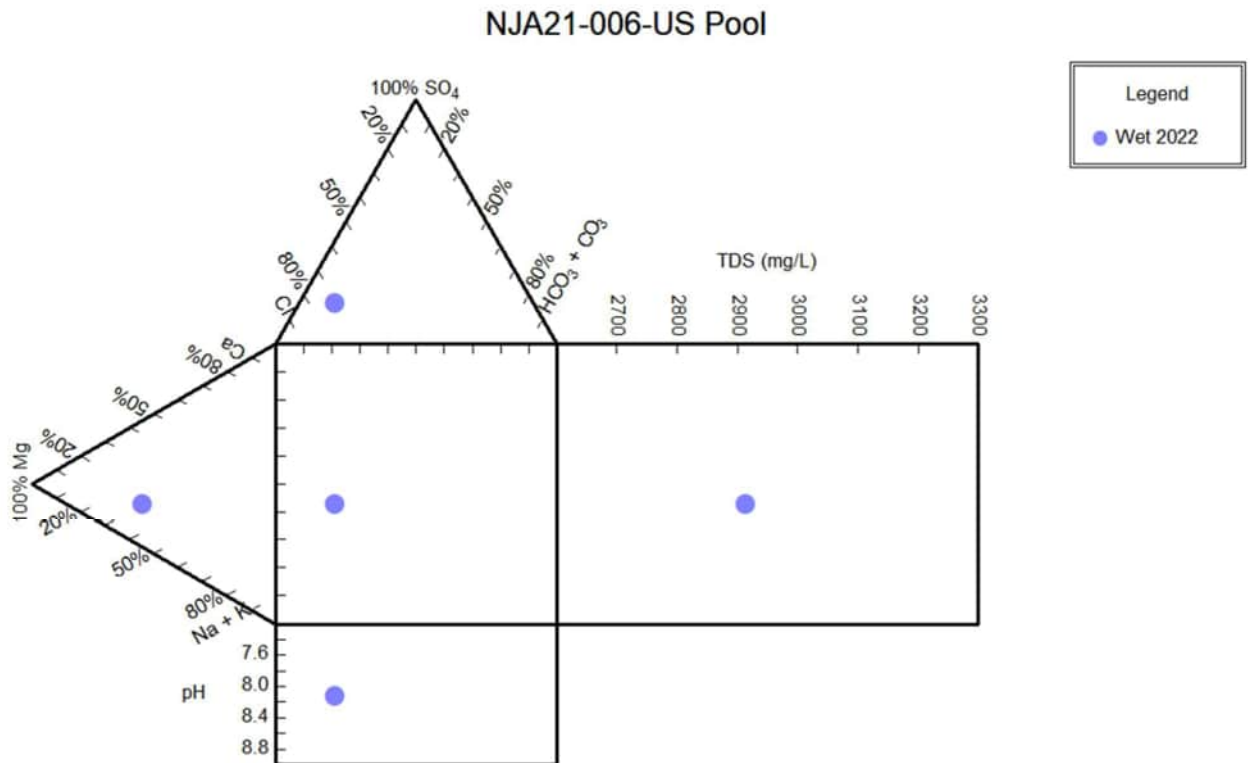


Figure 3-86 Durov diagram showing the NJA21-006-US Pool major ion distribution.

3.8.3 SEDIMENT QUALITY

Table 3-32 provides the surface sediment quality at NJA21-006-US Pool during the Late Wet 2022 season survey. The Late Dry 2022 season has no analysis due to the site being dry.

Table 3-32 Summary of sediment quality analysis for NJA21-006-US Pool in the Late Wet 2022 season. No analysis recorded for late dry season (2022) due to the site being dry. Bolded values denote results above the ANZG (2018) DGVs .

Analyte grouping/Analyte	Unit	ANZG value	Late Wet 2022
Total Soluble Salts	mg/kg	-	830
Moisture Content (Dried @ 105-110°C)	%	-	24
Total Alkalinity as CaCO₃	mg/kg	-	175
Bicarbonate Alkalinity as CaCO₃	mg/kg	-	163
Carbonate Alkalinity as CaCO₃	mg/kg	-	12
Acidity	mg/kg	-	<5

Analyte grouping/Analyte	Unit	ANZG value	Late Wet 2022
Sulfate as SO ₄ 2- (soluble sulfate by ICPAES)	mg/kg	-	100
Chloride (by Discrete Analyser)	mg/kg	-	310
Calcium	mg/kg	-	40
Magnesium	mg/kg	-	80
Sodium	mg/kg	-	150
Potassium	mg/kg	-	20
Mercury (FIMS)	mg/kg	-	<0.1
Nitrite + Nitrate as N (Sol.)	mg/kg	-	0.1
Total Kjeldahl Nitrogen as N	mg/kg	-	200
Total Nitrogen as N	mg/kg	-	200
Total Phosphorus as P	mg/kg	-	169
Reactive Phosphorus as P	mg/kg	-	0.4
Total Organic Carbon	%	-	0.16
<i>Total Metals by ICP-AES</i>			
Arsenic	mg/kg	20	95
Barium	mg/kg	-	100
Beryllium	mg/kg	-	<1
Boron	mg/kg	-	<50
Cadmium	mg/kg	1.5	<1
Chromium	mg/kg	80	254
Cobalt	mg/kg	-	32
Copper	mg/kg	65	71
Iron	mg/kg	-	51300
Lead	mg/kg	50	<5
Manganese	mg/kg	-	727
Nickel	mg/kg	21	228
Selenium	mg/kg	-	<5
Vanadium	mg/kg	-	61

Analyte grouping/Analyte	Unit	ANZG value	Late Wet 2022
Zinc	mg/kg	200	90

3.8.4 FISH

No fish were observed in the NJA21-006-US pools during the Late Wet 2022 survey. The pool was dry during the Late Dry 2022 survey.

3.8.5 AQUATIC MACROINVERTEBRATES

Macroinvertebrates were able to be sampled in Late Wet 2022, with Table 3-33 presenting the total abundance, taxa richness, EPT richness and SIGNAL2 scores for NJA21-006-US. No macroinvertebrates were collected in the Late Dry 2022 as the pool was dry. The key findings were as follows:

- The average abundance in this pool was approximately half that compared to GV Pool, which has similar features, in the Late Wet 2021 (when the pool contained water).
- The average taxonomic richness in NJA21-006-US was second only to Cow Springs Pool in the Late Wet 2022, however lower than any other pool in all previous seasons. This follows the trend that the low flows of the 2022 wet season having a significant effect on the ecology of pools in the project area.
- No taxa four taxa belonging to the Plecoptera, Ephemeroptera and Trichoptera were found in the Late Wet 2022. As this is the first sampling of this pool it is difficult to determine if the absence of these taxa indicates a degradation of habitat and water quality due to low 2022 wet seasonal flows.
- The SIGNAL 2 score in the Late Wet 2022 indicates that the macroinvertebrate community is primarily dominated by tolerant taxa, as is expected for a wet season with low flows and therefore less favourable environmental conditions.

The taxonomic composition of the macroinvertebrate community is provided in Figure 3-87, ranging from most abundant (left) to least abundant (right) along the x-axis. The community composition in the Late Wet 2022 was dominated by the non-biting midge of the Chironominae. The highly invasive freshwater Physidae snail was recorded in NJA21-006-US, as it was in Mundagoora Pool and Cow Spring Pool for the first time over the last five seasons. No macroinvertebrate species of conservation significance were found at NJA21-006-US.

Table 3-33 Macroinvertebrate indices for NJA21-006-US Pool in the Late Wet 2022 season. No Late Dry 2022 macroinvertebrates as pool was dry.

Indices	Average	Standard Error
Abundance	121	56
Taxonomic Richness	7.5	2.5
EPT Richness	0	0
SIGNAL2	2.85	0.25

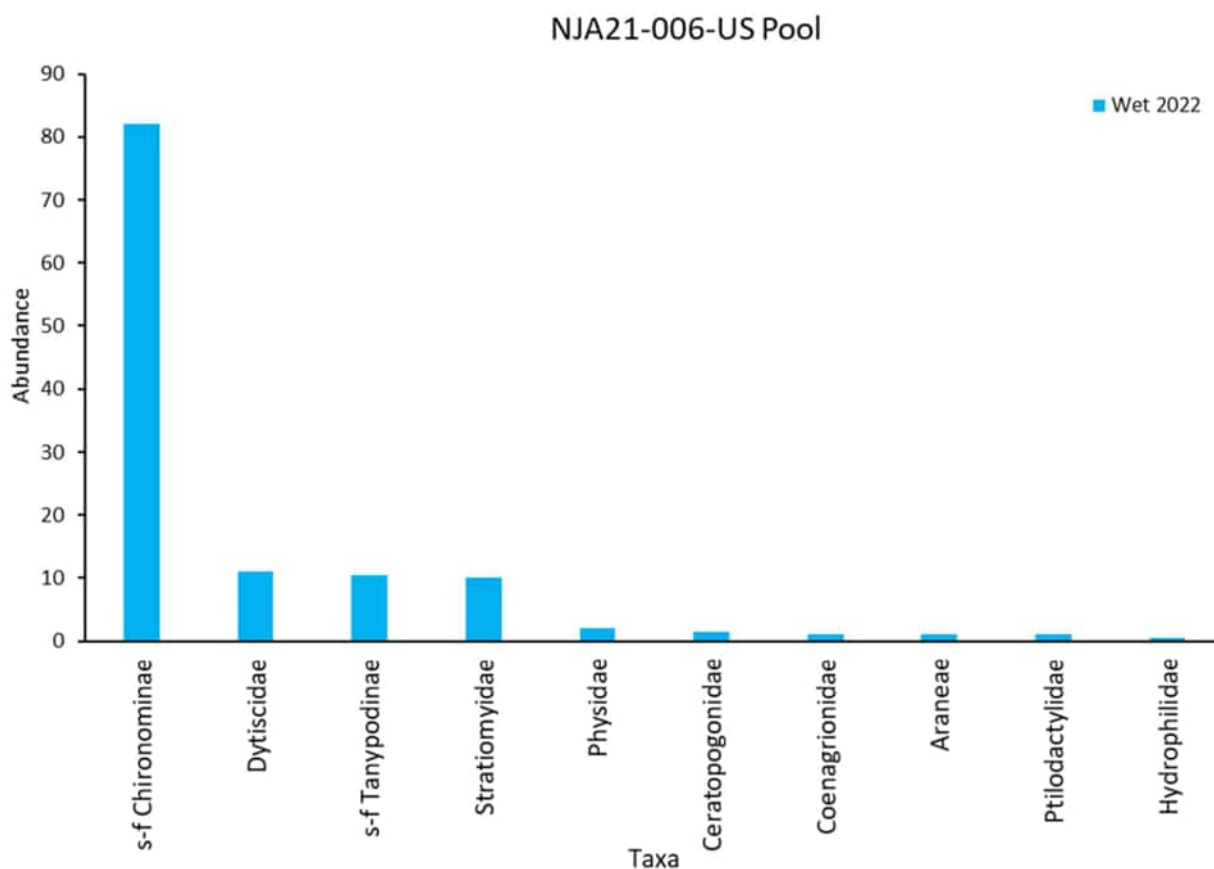


Figure 3-87 Average abundances of all macroinvertebrate taxa at NJA21-006-US Pool in the Late Wet 2022 season, with taxa arranged from most abundant (left) to least abundant (right) along the x-axis.

3.8.6 DIATOMS AND PHYTOPLANKTON

3.8.6.1 DIATOMS

The Late Wet 2022 diatom sampling recorded 35 species across the two replicates (Table 3-34). The species with the highest average abundance was *Nitzschia palea* followed by *Halamphora veneta*. The total diatom counts (307) were very similar to those of all other Iron Bridge pools surveyed in the Late Wet 2022. However, the DSIAR score (49) was slightly lower than that of any other Iron Bridge pool in the same season, which is associated with higher levels of environmental stress. This higher stress environment and associated DSIAR score is to be expected in ephemeral pools in the Pilbara. No diatoms were collected in the Late Dry 2022 as the pool was dry.

Table 3-34 Summary of diatom total count per species, average abundance and DSIAR score for NJA21-006-US Pool collected in Late Wet 2022.

Taxon Name	Late Wet 2022		
	Rep 1	Rep 2	Ave
<i>Nitzschia palea</i>	72	87	79
<i>Halamphora veneta</i>	100	27	63

Taxon Name	Late Wet 2022		
<i>Nitzschia gracilis</i>	11	80	46
<i>Nitzschia palea</i> var <i>debilis</i>	20	18	19
<i>Nitzschia</i> girdle	13	18	16
<i>Nitzschia microcephala</i>	16	11	14
<i>Nitzschia pura</i>	9	11	10
<i>Nitzschia frustulum</i>	15	4	10
<i>Nitzschia perminuta</i>	8	7	8
<i>Nitzschia lacuum</i>	0	13	7
<i>Nitzschia agnita</i>	0	12	6
<i>Navicula veneta</i>	6	3	5
<i>Nitzschia</i> sp.	4	4	4
<i>Mastogloia smithii</i>	6	2	4
<i>Navicymbula pusilla</i>	2	2	2
Unknown girdle	4	0	2
<i>Caloneis silicula</i>	4	0	2
<i>Gomphonema angustum</i>	3	0	2
<i>Brachysira vitrea</i>	3	0	1
<i>Caloneis clevei</i>	2	0	1
<i>Encyonema minutum</i>	2	0	1
<i>Diploneis elliptica</i>	2	0	1
<i>Nitzschia liebetruthii</i>	1	1	1
<i>Nitzschia linearis subtilis</i>	2	0	1
<i>Nitzschia paleacea</i>	2	0	1
<i>Planothidium delicatulum</i>	2	0	1
<i>Eunotia bilunaris</i>	1	0	1
<i>Encyonopsis</i> spp.	1	0	1
<i>Gomphonema</i> sp.	0	1	1
<i>Hantzschia amphioxys</i>	1	0	1
<i>Navicula schroeterii</i>	1	0	1
<i>Achnantheidium minutissimum</i>	1	0	0
<i>Pinnularia subcapitata</i>	1	0	0
<i>Ulnaria ulna</i>	1	0	0
<i>Nitzschia linearis</i>	1	0	0
Total	314	300	307

Taxon Name	Late Wet 2022		
Species Richness	32	17	25
DSIAR score	47	50	49

3.8.6.2 PHYTOPLANKTON

Four classes of phytoplankton were identified in the Late Wet 2022 season in NJA21-006-US Pool (Table 3-35). The fast-growing green chlorophyte algal species *Monoraphidium* spp. Was the overwhelmingly dominant phytoplankton (98.42%) in the pool. The very high phytoplankton densities recorded in NJA21-006-US Pool is likely to be a reflection of the high pool TN and TP concentrations (Table 3-31) and likely the source of the observed water colouration. No phytoplankton were collected in the Late Dry 2022 as the pool was dry.

Table 3-35 Summary of phytoplankton analytical results for Cow Spring Pool sampled in the Late Wet 2022, abundance (cells L⁻¹) and percentage contribution (%), limit of reporting 10 cells L⁻¹.

Taxon	Late Wet 2022	
	Abundance	%
Bacillariophyceae	60,000	0.01
<i>Navicula</i> spp.	40,000	0.01
<i>Cyclotella</i> spp. (O)	20,000	0
Chlorophyceae	483,680,000	99.18
<i>Acutodesmus</i> spp.	180,000	0.04
<i>Chlorella</i> spp.	900,000	0.18
<i>Chodatella</i> spp.	1,000,000	0.21
<i>Desmodesmus</i> spp.	1,600,000	0.33
<i>Monoraphidium</i> spp.	480,000,000	98.42
Dinophyceae	50,000	0.01
<i>Gymnodinioid Dinoflagellates</i> (unknown)	50,000	0.01
Prasinophyceae	3,900,000	0.8
<i>Prasinophytes</i> (unknown)	3,900,000	0.8

3.8.7 MACROPHYTES

There were few and sparse macrophytes present at NJA21-006-US Pool. These were represented by clumps of fringing sedge (Cyperacea) plants and a few individual Clubrush reeds (*Schoenoplectus sp*) (Figure 3-88). There were a few submerged macrophytes present in the June 2022 wet season sampling when the pool retained water, likely a species of Hydrocharitaceae. There were no observed macrophytes during the Late Dry 2022 as the pool was dry.



Figure 3-88 NJA21-006-US macrophytes; Cyperacea sedges (left) and *Schoenoplectus sp.* clubrush reeds (right).

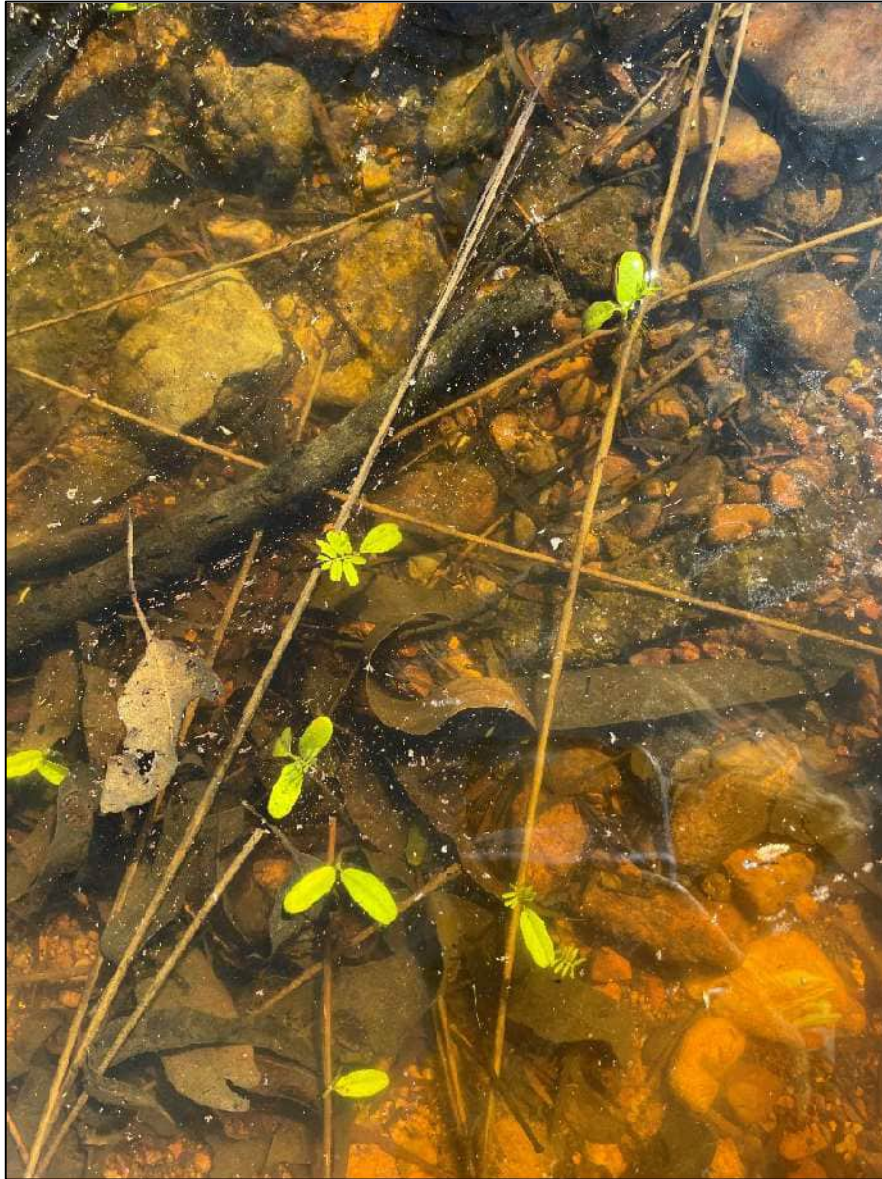


Figure 3-89 NJA21-006-US submerged macrophytes; likely Hydrocharitaceae (unidentified).

3.8.8 ENVIRONMENTAL VALUES

Due to the ephemeral nature of NJA21-006-US pool, the surrounding terrestrial ecosystem will be well adapted to the temporary presence of water in the pool. The surrounding vegetation is well adapted to the seasonal availability of water that is retained in the pool after significant rainfall events and is not dependant on a permanent surface waterbody. However, the steady decline in water levels of the pool after flow events may provide a more reliable source of water to fauna while smaller pools in the immediate area tend to dry over a shorter time frame. The slightly longer residency time of pool water may also provide a valuable habitat for macroinvertebrate species to reproduce in a landscape where permanent water bodies are scarce. No fish or other large aquatic fauna, turtles or Pilbara Olive Pythons, have been recorded at this pool and therefore indicates that NJA21-006-US pool is not a significant ecosystem and is unlikely to be a refuge for any listed fauna.

3.9 GV_SW_POOL_NJA19_002

NJA19_002 is a small intermittent pool located approximately 2.8 km south-west of NJA21_006_US, with the pool feeding into the catchment of NJA21_006_US on the eastern face of the Glacier Valley ridgeline. Figure 3-90 shows the pool during the Late Dry 2021 survey.



Figure 3-90 GV_SW_Pool_NJA19_002 pool with large cliff face (left) and logger installation (right).

3.9.1 SITE SPECIFIC TRIGGER VALUES

As GV_SW_Pool_NJA19_002 pool is intermittent, and the water quality and ecological parameters are highly dependent on surface water flows over the wet season, it is difficult to assign site specific triggers for any parameters in the dry season where evapotranspiration can significantly affect readings (or the pool is mostly dry).

This pool has insufficient data to determine ecological triggers for fish, macroinvertebrates, diatoms and phytoplankton to have site specific triggers and a presence/absence trigger may be the most appropriate when pool water is present.

3.9.2 WATER QUALITY AND HYDROLOGY

GV_SW_Pool_NJA19_002 monitoring site is an intermittent pool on bedrock draining the eastern face of the Glacier Valley ridgeline (Figure 3-91) and is part of the catchment that feeds GV_SW_Pool_NJA21_006_US. In the Wet Season (May 2022), the pool was a remnant, shallow pool (<0.2 m depth) until subsequent rainfall increased the depth to its maximum recorded level of 1.59m in June 2022 (Figure 3-92). The pool maintained a significant level of water, that slowly declined through

the 2022 Wet Season and was observed as a shallow pool (<0.2 m depth) during the Late Dry 2022 sampling.

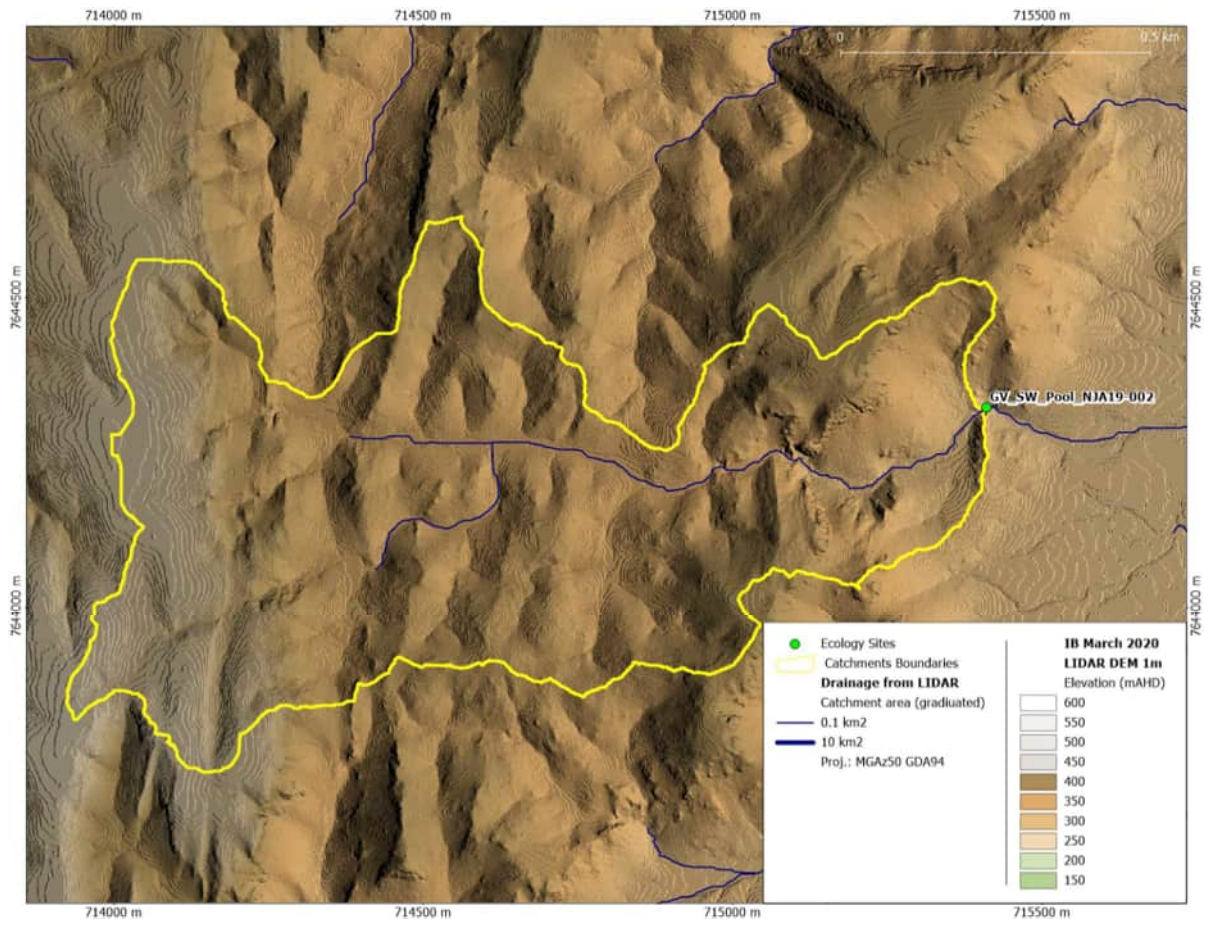


Figure 3-91 GV_SW_Pool_NJA19_002 drainage area (0.74 km²).

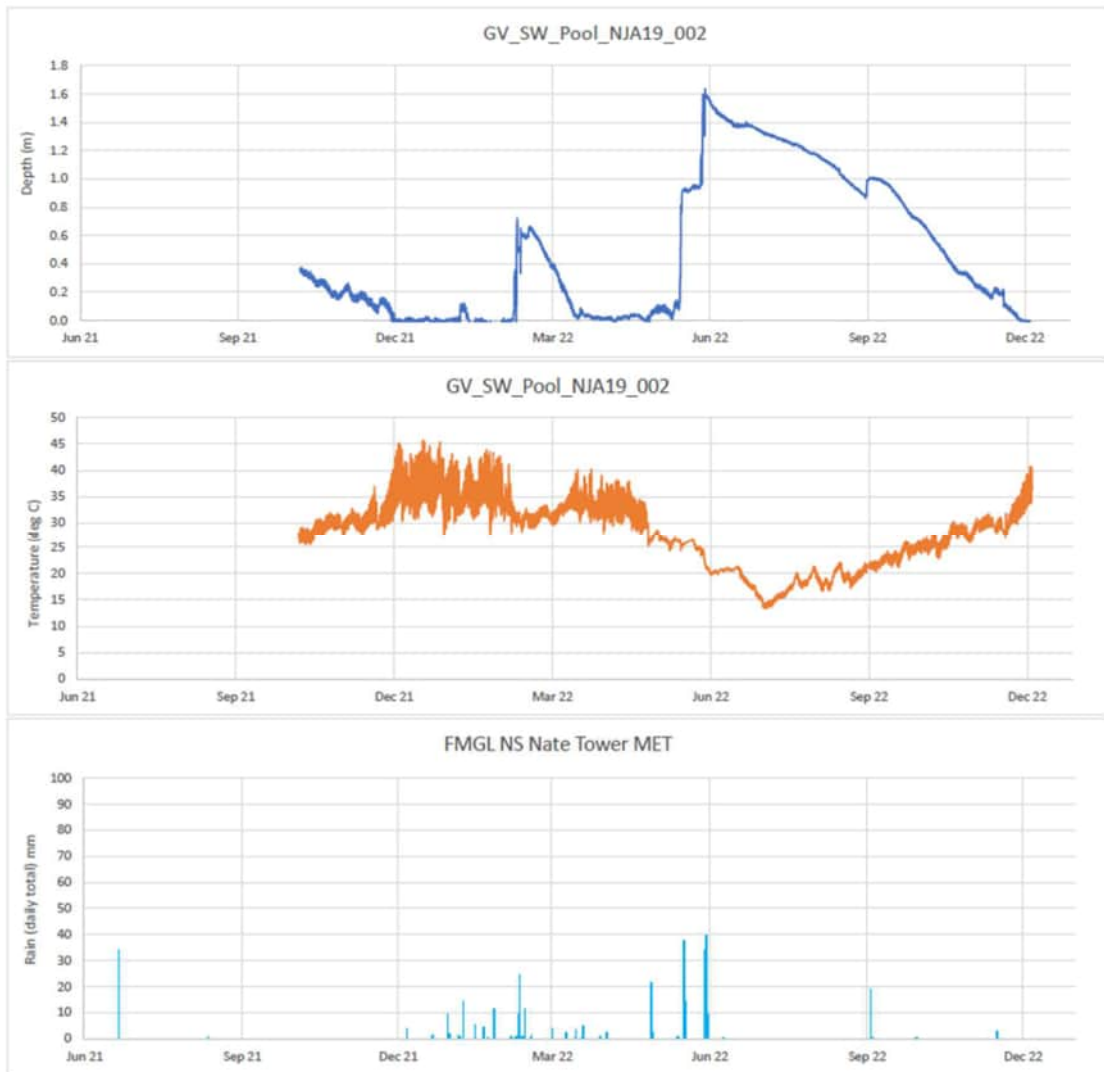


Figure 3-92 NJA19_002 Pool logger record from 7/10/2021 to 07/12/2022 for pool water depth (m), water temperature (°C), and daily rainfall at FMG LNS Nate Tower MET.

3.9.3 ECOLOGY

The pool has no surrounding macrophyte vegetation (Figure 3-93). Aquatic macroinvertebrates were observed at the site in the Late Dry 2022 (Figure 3-94). No fish were observed in the pool at the time of survey. There is insufficient data on diatoms and phytoplankton in the pool as they have not been surveyed at this location.



Figure 3-93 GV_SW_Pool_NJA19_002 in Late Wet 2022 with water level logger.

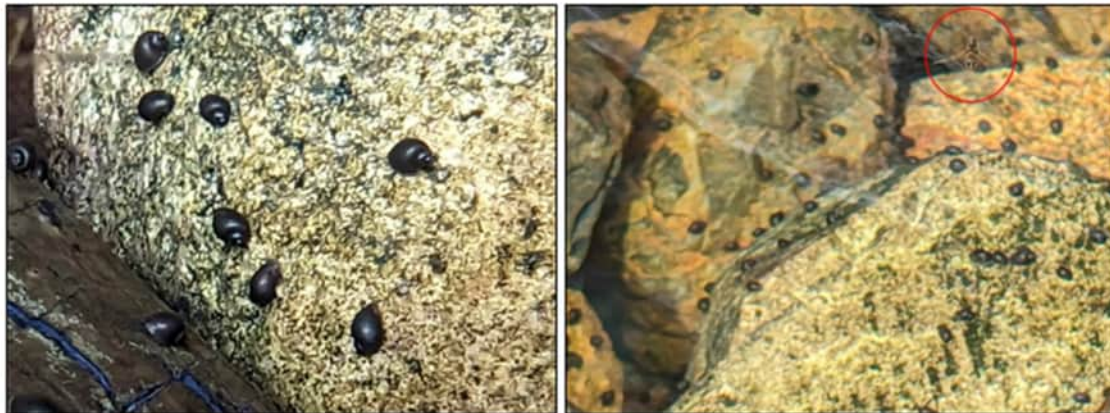


Figure 3-94 Aquatic macroinvertebrates at GV_SW_Pool_NJA19_002

3.9.4 ENVIRONMENTAL VALUES

NJA19_002 has similar environmental value characteristics to those observed at NJA21-006-US due to its ephemeral nature and capability of retaining water over a few months once filled after significant

rainfall events. This pool is likely to provide a valuable water source for fauna allowing fauna to remain in the direct vicinity longer into the dry season. Like NJA21-006-US, the long residency of water in the pool will allow for the completion of aquatic fauna life stages for macroinvertebrates and various frog species that have been observed in the pool; however, the pool is not considered a significant ecosystem and is unlikely to be a refuge for any listed fauna.

3.10 GV_SW_POOL_NJA19_004

NJA19_004 is a small ephemeral pool located on the eastern face of the Glacier Valley ridgeline. Figure 3-95 shows the pool during the Late Dry 2021 survey.



Figure 3-95 GV_SW_Pool_NJA19_004 pool location (left) and logger installation (right).

3.10.1 SITE SPECIFIC TRIGGER VALUES

As GV_SW_Pool_NJA19_004 pool is ephemeral, and the water quality and ecological parameters are highly dependent on surface water flows over the wet season, it is difficult to assign site specific triggers for any parameters in the dry season where evapotranspiration can significantly affect readings (or the pool is mostly dry).

This pool has insufficient data to determine ecological triggers for fish, macroinvertebrates, diatoms and phytoplankton to have site specific triggers and a presence/absence trigger may be the most appropriate when pool water is present.

3.10.2 WATER QUALITY AND HYDROLOGY

GV_SW_Pool_NJA19_004 monitoring site is an ephemeral pool draining the eastern face of the Glacier Valley ridgeline (Figure 3-96). Figure 3-97 shows the detailed elevation (LIDAR, March 2020) of the site catchment area and drainage. The pool tends to fill during rain/flow events then quickly dries. During the Late Wet 2021, Late Dry 2021, the pool was completely dry (Figure 3-98). There is a small (~3m length) rock pool approximately 20m upstream of the GV_SW_Pool_NJA19_004 monitoring site location that fills during the wet season (~0.2m depth; Figure 3-99). In the late wet 2023 monitoring (report in preparation) the water quality of this temporary pool was fresh (228 $\mu\text{S}/\text{cm}$ conductivity), slightly alkaline (8.62 pH), oxygenated (7.08 mg/L) and slightly turbid (6.75 NTU turbidity).

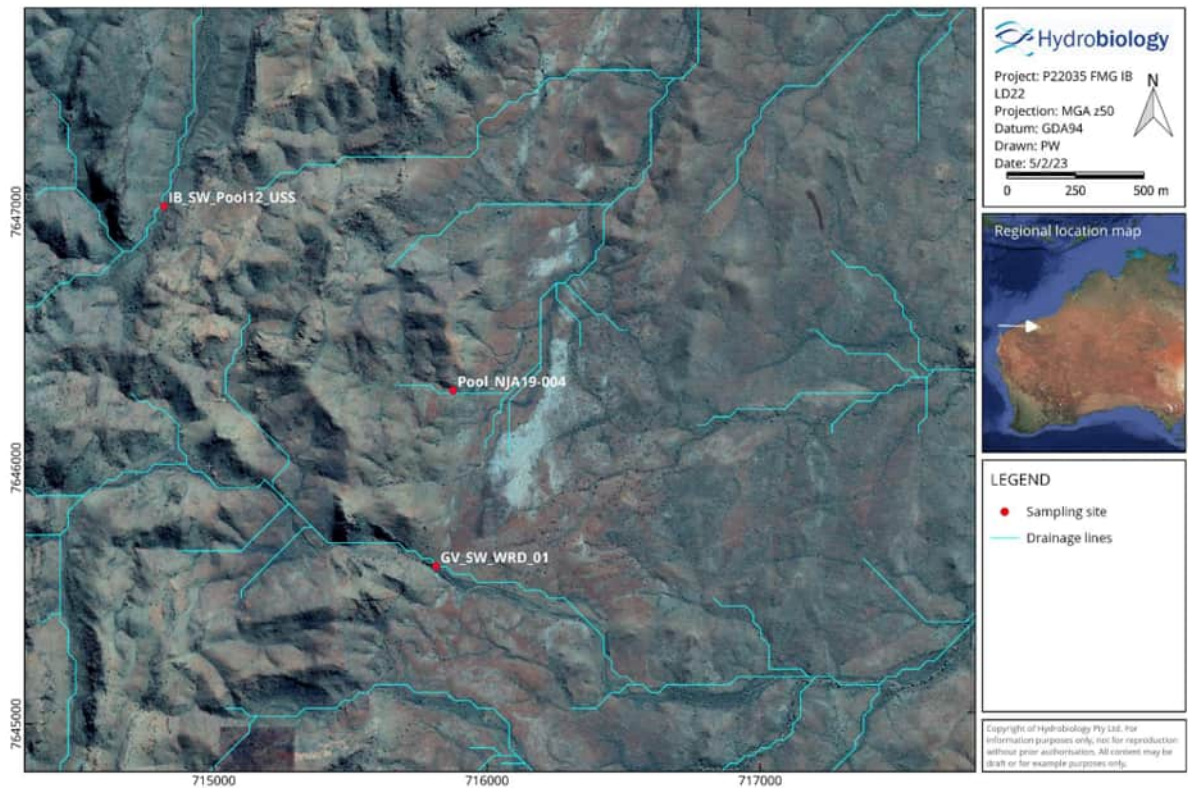


Figure 3-96 GV_SW_Pool_NJA19_004 drainage area.

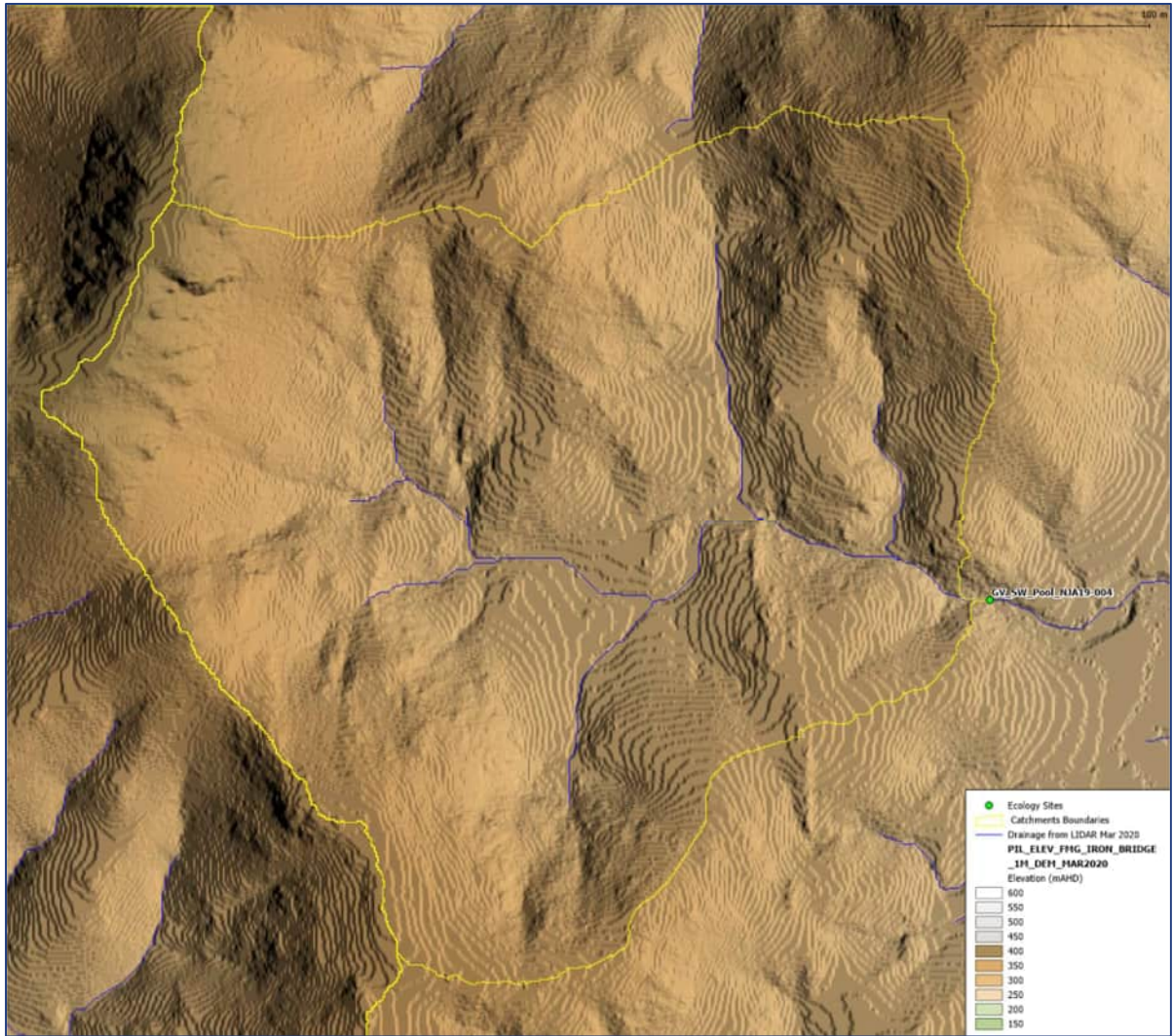


Figure 3-97 Detail of the catchment of site GV_SW_POOL_NJA19_004 elevations (LIDAR, March 2020)



Figure 3-98 NJA19_004 Pool logger record from 7/10/2021 to 07/12/2022 for pool water depth (m), water temperature (°C), and daily rainfall at FMG LNS Nate Tower MET.

3.10.3 ECOLOGY

The GV_SW_POOL_NJA19_004 pool has surrounding riparian vegetation however no macrophytes were observed as the pool was dry. There is insufficient data on fish, macroinvertebrates, diatoms and phytoplankton in the pool as they have not been surveyed at this location and is often dry during surveys. There is a small (~3m length) rock pool approximately 20m upstream of the GV_SW_Pool_NJA19_004 monitoring site location that fills during the wet season (~0.2m depth; Figure 3-99). This pool is ephemeral and no fish or macrophytes were present during the wet season observations.



Figure 3-99 Photograph of a small ephemeral rock pool approximately 20m upstream of the GV_SW_Pool_NJA19_004 monitoring site.

3.10.4 ENVIRONMENTAL VALUE

The highly ephemeral nature and short water residency times of this pool indicates that apart from some terrestrial and avian fauna possibly utilising the pool when full, the pool has little in the way of significant environmental value. To date, there are no current records of conservation significant species at this pool and is not considered a significant ecosystem as it is unlikely to be a refuge for any listed fauna.

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APPENDIX A. WATER QUALITY DATA

Table A-1 Water quality data – Late Wet season 2020.

Analyte grouping/Analyte	Unit	LOR	Site 12 Pool	Central Ck Pool	Cow Spring Pool	Site 12 Pool GW	Mundagoora Pool	Fig Pool GW	Fig Pool	Central Creek GW	TSF-1	TSF-2
		Site Code	IB_SW_Pool 12_01	IB_SW_Pool_Central CK	IB_SW_Pool_Cow Spring	NS-0664	GV_SW_Pool_Mundagoora_SS	NS-Obs29	IB_SW_Pool_Fig	NS-ObsW17	IB_SW_TS F_01	IB_SW_TS F_02
		Sample Date	29/05/2020	31/05/2020	01/06/2020	29/05/2020	31/05/2020	01/06/2020	30/05/2020	01/06/2020	01/06/2020	01/06/2020
		ALS Sample Number	EP200566001	EP2005660002	EP2005660003	EP2005660004	EP2005660005	EP2005660006	EP2005660007	EP2005660008	EP2005660009	EP2005660010
Suspended Solids (SS)	mg/L	5	<5	<5	<5	----	<5	----	<5	----	9480	3220
Hydroxide Alkalinity as CaCO3	mg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	mg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	mg/L	1	478	406	34	204	399	142	<1	422	79	80
Total Alkalinity as CaCO3	mg/L	1	478	406	34	204	399	142	<1	422	79	80
Acidity as CaCO3	mg/L	1	<1	6	10	12	11	21	16	18	3	3
Sulfate as SO4 - Turbidimetric	mg/L	1	22	158	80	9	34	111	34	92	30	32
Chloride	mg/L	1	235	405	56	14	52	104	24	208	39	50
Calcium	mg/L	1	63	28	22	45	63	49	3	48	32	20
Magnesium	mg/L	1	120	100	18	30	45	41	5	99	15	17
Sodium	mg/L	1	52	317	39	18	64	58	16	142	20	32

Analyte grouping/Analyte	Unit	LOR	Site 12 Pool	Central Ck Pool	Cow Spring Pool	Site 12 Pool GW	Mundagoora Pool	Fig Pool GW	Fig Pool	Central Creek GW	TSF-1	TSF-2
Potassium	mg/L	1	<1	9	2	2	<1	3	1	3	4	3
Arsenic	mg/L	0.001	0.001	0.013	<0.001	<0.001	<0.001	0.002	<0.001	0.012	----	----
Beryllium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	----	----
Barium	mg/L	0.001	0.026	0.057	0.003	0.135	0.016	0.040	0.023	0.024	----	----
Cadmium	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	----	----
Chromium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	----	----
Cobalt	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.004	0.002	0.001	----	----
Copper	mg/L	0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	0.016	----	----
Lead	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	----	----
Manganese	mg/L	0.001	0.017	0.179	0.001	0.009	0.051	0.623	0.349	0.001	----	----
Nickel	mg/L	0.001	<0.001	0.002	0.005	0.002	<0.001	0.026	0.010	0.004	----	----
Selenium	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	----	----
Vanadium	mg/L	0.01	<0.01	0.02	<0.01	0.02	0.01	<0.01	<0.01	0.04	----	----
Zinc	mg/L	0.005	<0.005	<0.005	<0.005	0.017	<0.005	0.021	<0.005	0.034	----	----
Boron	mg/L	0.05	0.20	0.66	0.14	0.11	0.23	0.16	0.06	0.35	----	----

Analyte grouping/Analyte	Unit	LOR	Site 12 Pool	Central Ck Pool	Cow Spring Pool	Site 12 Pool GW	Mundagoora Pool	Fig Pool GW	Fig Pool	Central Creek GW	TSF-1	TSF-2
Iron	mg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	2.98	0.59	<0.05	----	----
Aluminium	mg/L	0.01	<0.01	0.05	<0.01	<0.01	0.01	<0.01	0.16	0.01	68.7	4.13
Antimony	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic	mg/L	0.001	<0.001	0.012	<0.001	<0.001	<0.001	0.003	<0.001	0.011	0.011	0.003
Beryllium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.004	<0.001
Barium	mg/L	0.001	0.026	0.056	0.003	0.096	0.018	0.019	0.022	0.024	0.523	0.065
Bismuth	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0004	<0.0001
Cerium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.154	0.010
Caesium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.015	<0.001
Chromium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.774	0.070
Cobalt	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.004	0.001	0.002	0.202	0.011
Copper	mg/L	0.001	<0.001	<0.001	0.001	0.002	<0.001	<0.001	<0.001	0.019	0.212	0.017
Dysprosium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.005	<0.001
Erbium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001

Analyte grouping/Analyte	Unit	LOR	Site 12 Pool	Central Ck Pool	Cow Spring Pool	Site 12 Pool GW	Mundagoora Pool	Fig Pool GW	Fig Pool	Central Creek GW	TSF-1	TSF-2
Europium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001
Gadolinium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.008	<0.001
Gallium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.006	0.003
Hafnium	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Holmium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Indium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Lanthanum	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.040	0.008
Lead	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.056	0.003
Lithium	mg/L	0.001	0.005	0.020	0.005	0.003	0.005	0.031	0.002	0.005	0.097	0.007
Lutetium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	mg/L	0.001	0.014	0.198	<0.001	0.012	0.192	0.562	0.305	0.006	4.66	0.277
Molybdenum	mg/L	0.001	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001
Neodymium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.048	0.008
Nickel	mg/L	0.001	<0.001	0.001	0.005	0.002	<0.001	0.023	0.007	0.004	1.13	0.053
Praseodymium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.012	0.002

Analyte grouping/Analyte	Unit	LOR	Site 12 Pool	Central Ck Pool	Cow Spring Pool	Site 12 Pool GW	Mundagoora Pool	Fig Pool GW	Fig Pool	Central Creek GW	TSF-1	TSF-2
Rubidium	mg/L	0.001	<0.001	0.006	0.002	<0.001	<0.001	0.007	0.002	0.002	0.071	0.006
Samarium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.009	<0.001
Selenium	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Silver	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Strontium	mg/L	0.001	0.191	0.271	0.087	0.081	0.182	0.099	0.038	0.232	0.245	0.109
Tellurium	mg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Terbium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Thallium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Thorium	mg/L	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.023	<0.001
Thulium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Tin	mg/L	0.001	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Titanium	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.23	0.06
Uranium	mg/L	0.001	<0.001	0.008	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	0.004	<0.001
Vanadium	mg/L	0.01	<0.01	0.02	<0.01	0.03	0.02	<0.01	<0.01	0.04	0.09	0.02
Ytterbium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001

Analyte grouping/Analyte	Unit	LOR	Site 12 Pool	Central Ck Pool	Cow Spring Pool	Site 12 Pool GW	Mundagoora Pool	Fig Pool GW	Fig Pool	Central Creek GW	TSF-1	TSF-2
Yttrium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.023	0.004
Zinc	mg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.012	<0.005	0.036	0.511	0.037
Zirconium	mg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Boron	mg/L	0.05	0.17	0.69	0.11	0.11	0.22	0.17	0.06	0.34	0.15	0.08
Iron	mg/L	0.05	<0.05	0.11	<0.05	<0.05	0.19	2.85	0.49	<0.05	112	11.5
Mercury	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0002	----	----
Nitrite + Nitrate as N	mg/L	0.01	0.05	0.04	1.32	5.45	0.26	<0.01	0.02	0.70	7.48	0.24
Total Kjeldahl Nitrogen as N	mg/L	0.1	<0.1	0.2	0.1	1.0	0.2	0.1	<0.1	0.2	7.6	2.8
Total Nitrogen as N	mg/L	0.1	<0.1	0.2	1.4	6.4	0.5	0.1	<0.1	0.9	15.1	3.0
Total Phosphorus as P	mg/L	0.01	0.01	0.02	<0.01	0.05	0.01	0.06	0.01	0.02	1.43	0.46
Reactive Phosphorus as P	mg/L	0.01	<0.01	0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	0.06	<0.01
Total Anions	meq/L	0.01	16.6	22.8	3.92	5.05	10.1	8.08	1.38	16.2	3.30	3.68
Total Cations	meq/L	0.01	15.3	23.6	4.33	5.55	9.63	8.42	1.28	16.8	3.80	3.86
Ionic Balance	%	0.01	4.25	1.76	4.87	4.69	2.61	2.04	3.83	1.76	7.04	2.53
Dissolved Organic Carbon	mg/L	1	----	4	<1	----	4	----	<1	----	----	----

Analyte grouping/Analyte	Unit	LOR	Site 12 Pool	Central Ck Pool	Cow Spring Pool	Site 12 Pool GW	Mundagoora Pool	Fig Pool GW	Fig Pool	Central Creek GW	TSF-1	TSF-2
Total Organic Carbon	mg/L	1	----	4	1	----	2	----	<1	----	----	----

Table A-2. Water quality data – Late Dry season 2020.

Analyte grouping/Analyte	Unit	LOR	IB_SW_O PF_DS_02	IB_SW_Dr y Reject_W W	IB_SW_M AR_US	IB_SW_Po ol_Fig	IB_SW_O PF_DS_01	NS-0664	IB_SW_Po ol_Cow Spring	IB_SW_Co ckatoo Cr_MAR	IB_SW_Po ol12_01	IB_SW_Po ol_Cow Spring	GV_SW_P ool_Mund agoora_S S
Sample Date:			13/12/2020	13/12/2020	13/12/2020	10/12/2020	13/12/2020	09/12/2020	11/12/2020	13/12/2020	09/12/2020	10/12/2020	08/12/2020
ALS Sample Number:			EP201396 4001	EP201396 4002	EP201396 4003	EP201396 4004	EP201396 4005	EP201396 4006	EP201396 4007	EP201396 4008	EP201396 4009	EP201396 4010	EP201396 4011
Suspended Solids (SS)	mg/L	5	32	1000	305	<5	50	----	18	<5	<5	<5	<5
Hydroxide Alkalinity as CaCO3	mg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	mg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	101	<1	<1
Bicarbonate Alkalinity as CaCO3	mg/L	1	84	25	16	<1	75	389	16	112	489	37	366
Total Alkalinity as CaCO3	mg/L	1	84	25	16	<1	75	389	16	112	590	37	366
Sulfate as SO4 - Turbidimetric	mg/L	1	41	2	3	33	41	39	41	61	20	84	32
Chloride	mg/L	1	51	3	3	24	48	77	30	112	101	56	59
Dissolved Major Cations													
Calcium	mg/L	1	28	5	5	4	30	54	11	23	37	24	72
Magnesium	mg/L	1	23	2	2	5	18	72	9	28	126	18	50
Sodium	mg/L	1	35	3	2	15	33	74	20	82	68	40	69

Analyte grouping/Analyte	Unit	LOR	IB_SW_O PF_DS_02	IB_SW_Dr y Reject_W W	IB_SW_M AR_US	IB_SW_Po ol_Fig	IB_SW_O PF_DS_01	NS-0664	IB_SW_Po ol_Cow Spring	IB_SW_Co ckatoo Cr_MAR	IB_SW_Po ol12_01	IB_SW_Po ol_Cow Spring	GV_SW_P ool_Mund agoora_S S
Potassium	mg/L	1	3	1	1	1	3	1	3	5	<1	2	1
EG020F: Dissolved Metals by ICP-MS													
Arsenic	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	----	0.004	0.001	<0.001	<0.001
Beryllium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	----	<0.001	<0.001	<0.001	<0.001
Barium	mg/L	0.001	0.061	0.125	0.060	0.052	0.074	0.119	----	0.051	0.053	0.058	0.042
Cadmium	mg/L	0.000 1	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	----	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	mg/L	0.001	0.002	<0.001	<0.001	<0.001	0.002	<0.001	----	0.002	<0.001	<0.001	<0.001
Cobalt	mg/L	0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	----	<0.001	<0.001	<0.001	<0.001
Copper	mg/L	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	----	0.001	<0.001	<0.001	<0.001
Lead	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	----	<0.001	<0.001	<0.001	<0.001
Manganese	mg/L	0.001	0.001	0.002	0.008	0.341	0.003	0.017	----	0.016	0.010	0.002	0.088
Nickel	mg/L	0.001	<0.001	<0.001	0.001	0.009	<0.001	0.002	----	0.001	<0.001	0.005	<0.001
Selenium	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	----	<0.01	<0.01	<0.01	<0.01
Vanadium	mg/L	0.01	0.01	<0.01	<0.01	<0.01	<0.01	0.04	----	0.01	<0.01	<0.01	0.01
Zinc	mg/L	0.005	0.008	0.020	0.023	0.016	0.014	0.008	----	0.009	0.007	0.038	0.006
Boron	mg/L	0.05	0.10	<0.05	<0.05	0.09	0.09	0.74	----	0.20	0.32	0.17	0.28
Total Metals by ICP-MS													

Analyte grouping/Analyte	Unit	LOR	IB_SW_0 PF_DS_02	IB_SW_Dr y Reject_W W	IB_SW_M AR_US	IB_SW_Po ol_Fig	IB_SW_0 PF_DS_01	NS-0664	IB_SW_Po ol_Cow Spring	IB_SW_Co ckatoo Cr_MAR	IB_SW_Po ol12_01	IB_SW_Po ol_Cow Spring	GV_SW_P ool_Mund agoora_S S
Arsenic	mg/L	0.001	<0.001	0.004	0.001	<0.001	<0.001	<0.001	<0.001	0.004	0.002	<0.001	<0.001
Beryllium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Barium	mg/L	0.001	0.015	0.121	0.040	0.023	0.021	0.104	0.005	0.023	0.014	0.004	0.016
Cadmium	mg/L	0.000 1	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	mg/L	0.001	0.020	0.300	0.283	<0.001	0.018	0.001	0.001	0.003	<0.001	0.001	<0.001
Cobalt	mg/L	0.001	0.002	0.045	0.022	0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper	mg/L	0.001	0.003	0.069	0.031	<0.001	0.004	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Lead	mg/L	0.001	<0.001	0.007	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	mg/L	0.001	0.037	1.14	0.607	0.319	0.033	0.023	0.024	0.011	0.021	0.002	0.097
Nickel	mg/L	0.001	0.009	0.186	0.142	0.008	0.008	0.002	0.005	0.002	<0.001	0.005	<0.001
Selenium	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	mg/L	0.01	0.02	0.06	0.04	<0.01	0.01	0.04	<0.01	0.01	<0.01	<0.01	<0.01
Zinc	mg/L	0.005	<0.005	0.141	0.173	<0.005	0.009	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Boron	mg/L	0.05	0.09	<0.05	<0.05	0.07	0.08	0.68	0.10	0.18	0.30	0.14	0.26
Dissolved Mercury by FIMS													
Mercury	mg/L	0.000 1	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	----	<0.0001	<0.0001	<0.0001	<0.0001
Total Recoverable Mercury by FIMS													

Analyte grouping/Analyte	Unit	LOR	IB_SW_O PF_DS_02	IB_SW_Dr y Reject_W W	IB_SW_M AR_US	IB_SW_Po ol_Fig	IB_SW_O PF_DS_01	NS-0664	IB_SW_Po ol_Cow Spring	IB_SW_Co ckatoo Cr_MAR	IB_SW_Po ol12_01	IB_SW_Po ol_Cow Spring	GV_SW_P ool_Mund agoora_S S
Mercury	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0002	<0.0001	<0.0001	0.0004	<0.0001
Nitrite plus Nitrate as N (NOx) by Discrete Analyser													
Nitrite + Nitrate as N	mg/L	0.01	7.01	0.08	0.12	<0.01	6.88	0.42	----	3.08	<0.01	1.11	<0.01
Total Kjeldahl Nitrogen By Discrete Analyser													
Total Kjeldahl Nitrogen as N	mg/L	0.1	1.8	2.6	1.6	<0.1	1.6	<0.1	----	0.6	0.2	0.1	<0.1
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser													
Total Nitrogen as N	mg/L	0.1	8.8	2.7	1.7	<0.1	8.5	0.4	----	3.7	0.2	1.2	<0.1
EK067G: Total Phosphorus as P by Discrete Analyser													
Total Phosphorus as P	mg/L	0.01	<0.02	0.41	0.17	<0.01	<0.02	<0.01	----	0.01	<0.01	<0.01	<0.01
Reactive Phosphorus as P by discrete analyser													
Reactive Phosphorus as P	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	----	<0.01	<0.01	<0.01	<0.01
Ionic Balance													
Total Anions	meq/L	0.01	4.47	0.62	0.48	1.36	4.20	10.8	2.02	6.67	15.0	4.07	9.64
Total Cations	meq/L	0.01	4.89	0.57	0.53	1.29	4.49	11.9	2.24	7.15	15.2	4.47	10.7
Ionic Balance	%	0.01	4.45	4.65	5.09	2.82	3.35	4.90	5.09	3.47	0.40	4.71	5.36
Dissolved Organic Carbon (DOC)													
Dissolved Organic Carbon	mg/L	1	----	----	----	4	----	----	----	----	10	2	11

Analyte grouping/Analyte	Unit	LOR	IB_SW_O PF_DS_02	IB_SW_Dr y Reject_W W	IB_SW_M AR_US	IB_SW_Po ol_Fig	IB_SW_O PF_DS_01	NS-0664	IB_SW_Po ol_Cow Spring	IB_SW_Co ckatoo Cr_MAR	IB_SW_Po ol12_01	IB_SW_Po ol_Cow Spring	GV_SW_P ool_Mund agoora_S S
EP005: Total Organic Carbon (TOC)													
Total Organic Carbon	mg/L	1	----	----	----	2	----	----	----	----	16	1	----

Table A-3. Water quality data – Late Wet season 2021.

Analyte grouping/analyte	Unit	LOR	GV_SW_Pool_Mundago ora_SS	GV_SW_Pool _SW	IB_SW_Pool_Cent ral Ck	IB_SW_Pool_Cow Spring	IB_SW_Pool _Fig	IB_SW_Pool12_ 01
			Sample date: 21/05/2021	21/05/2021	22/05/2021	25/05/2021	24/05/2021	23/05/2021
EA005P: pH by PC Titrator								
pH Value	pH Unit	0.01	7.98	8.31	8.38	7.05	4.19	8.42
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	µS/cm	1	738	1350	2710	421	189	1120
EA016: Calculated TDS (from Electrical Conductivity)								
Total Dissolved Solids (Calc.)	mg/L	1	480	878	1760	274	123	728
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	mg/L	5	<5	<5	5	<5	<5	<5
EA045: Turbidity								

Analyte grouping/analyte	Unit		GV_SW_Pool_Mundago ora_SS	GV_SW_Pool _SW	IB_SW_Pool_Cent ral Ck	IB_SW_Pool_Cow Spring	IB_SW_Pool _Fig	IB_SW_Pool12_ 01
		Sample date:	21/05/2021	21/05/2021	22/05/2021	25/05/2021	24/05/2021	23/05/2021
		LOR						
Turbidity	NTU	0.1	0.3	0.2	0.4	0.1	3.6	0.2
EA065: Total Hardness as CaCO3								
Total Hardness as CaCO3	mg/L	1	327	508	735	128	28	623
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	mg/L	1	<1	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	mg/L	1	<1	6	19	<1	<1	31
Bicarbonate Alkalinity as CaCO3	mg/L	1	344	512	558	35	<1	561
Total Alkalinity as CaCO3	mg/L	1	344	518	576	35	<1	592
ED038A: Acidity								
Acidity as CaCO3	mg/L	1	6	<1	<1	6	10	<1
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	mg/L	1	29	94	209	81	34	14
ED045G: Chloride by Discrete Analyser								
Chloride	mg/L	1	43	138	522	61	23	63

Analyte grouping/analyte	Unit		GV_SW_Pool_Mundago ora_SS	GV_SW_Pool _SW	IB_SW_Pool_Cent ral Ck	IB_SW_Pool_Cow Spring	IB_SW_Pool _Fig	IB_SW_Pool12_ 01
		Sample date:	21/05/2021	21/05/2021	22/05/2021	25/05/2021	24/05/2021	23/05/2021
		LOR						
ED093F-DW: Dissolved Major Cations - Drinking Water								
Calcium	mg/L	0.1	58.6	54.1	37.0	21.6	2.8	54.8
Magnesium	mg/L	0.1	43.8	90.7	156	18.0	5.2	118
Potassium	mg/L	0.1	0.7	1.3	12.9	2.3	1.4	0.7
Sodium	mg/L	0.1	60.0	126	348	36.6	14.4	52.1
EG035F: Dissolved Mercury by FIMS								
Mercury	mg/L	0.00004	0.00007	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004
EG035T: Total Mercury by FIMS								
Mercury	mg/L	0.00004	<0.00004	<0.00004	<0.00004	0.00023	<0.00004	<0.00004
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS								
Aluminium	mg/L	0.005	<0.005	<0.005	<0.005	<0.005	0.198	<0.005
Iron	mg/L	0.002	0.007	<0.002	0.005	0.005	0.414	0.014
Selenium	mg/L	0.0002	<0.0002	<0.0002	0.0002	0.0002	<0.0002	<0.0002
Arsenic	mg/L	0.0002	0.0004	0.0015	0.0139	<0.0002	<0.0002	0.0010
Barium	mg/L	0.0005	0.0164	0.0330	0.0555	0.0530	0.0222	0.0243

Analyte grouping/analyte	Unit		GV_SW_Pool_Mundago ora_SS	GV_SW_Pool _SW	IB_SW_Pool_Cent ral Ck	IB_SW_Pool_Cow Spring	IB_SW_Pool _Fig	IB_SW_Pool12_ 01
		Sample date:	21/05/2021	21/05/2021	22/05/2021	25/05/2021	24/05/2021	23/05/2021
		LOR						
Beryllium	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Boron	mg/L	0.005	0.160	0.283	0.680	0.125	0.058	0.159
Cadmium	mg/L	0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Chromium	mg/L	0.001	<0.0002	<0.0002	<0.0002	0.0006	<0.0002	<0.0002
Cobalt	mg/L	0.0001	<0.0001	<0.0001	0.0002	<0.0001	0.0016	<0.0001
Copper	mg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Lead	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Manganese	mg/L	0.0005	0.0566	0.0055	0.0138	0.0010	0.359	0.0128
Nickel	mg/L	0.0005	0.0009	0.0005	0.0013	0.0055	0.0098	<0.0005
Vanadium	mg/L	0.0002	0.0136	0.0074	0.0312	<0.0002	<0.0002	0.0008
Zinc	mg/L	0.001	<0.001	0.004	<0.001	0.034	0.002	<0.001
EG094T: Total metals in Fresh water by ORC-ICPMS								
Aluminium	mg/L	0.005	0.008	0.011	0.017	<0.005	0.227	0.007
Iron	mg/L	0.002	0.125	0.016	0.067	0.017	1.46	0.027
Selenium	mg/L	0.0002	<0.0002	<0.0002	0.0002	<0.0002	<0.0002	<0.0002
Arsenic	mg/L	0.0002	0.0004	0.0012	0.0122	<0.0002	0.0004	0.0008
Barium	mg/L	0.0005	0.0147	0.0218	0.0521	0.0033	0.0214	0.0228
Beryllium	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Boron	mg/L	0.005	0.141	0.251	0.600	0.119	0.053	0.138

Analyte grouping/analyte	Unit		GV_SW_Pool_Mundago ora_SS	GV_SW_Pool _SW	IB_SW_Pool_Cent ral Ck	IB_SW_Pool_Cow Spring	IB_SW_Pool _Fig	IB_SW_Pool12_ 01
		Sample date:	21/05/2021	21/05/2021	22/05/2021	25/05/2021	24/05/2021	23/05/2021
		LOR						
Cadmium	mg/L	0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Chromium	mg/L	0.0002	<0.0002	0.0003	0.0004	0.0006	<0.0002	0.0003
Cobalt	mg/L	0.0001	<0.0001	<0.0001	0.0002	<0.0001	0.0016	<0.0001
Copper	mg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Lead	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Manganese	mg/L	0.0005	0.0793	0.0229	0.0372	0.0008	0.331	0.0129
Nickel	mg/L	0.0005	0.0006	0.0006	0.0012	0.0049	0.0095	<0.0005
Vanadium	mg/L	0.0002	0.0132	0.0068	0.0284	<0.0002	<0.0002	0.0008
Zinc	mg/L	0.001	<0.001	<0.001	<0.001	0.002	0.002	<0.001
EK055G-NH4: Ammonium as N by DA								
Ammonium as N	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Analyte grouping/analyte	Unit	Sample date:	GV_SW_Pool_Mundago ora_SS	GV_SW_Pool _SW	IB_SW_Pool_Cent ral Ck	IB_SW_Pool_Cow Spring	IB_SW_Pool _Fig	IB_SW_Pool12_ 01
			21/05/2021	21/05/2021	22/05/2021	25/05/2021	24/05/2021	23/05/2021
LOR								
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	mg/L	0.01	0.09	<0.01	<0.01	1.26	<0.01	<0.01
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	mg/L	0.01	0.09	<0.01	<0.01	1.26	<0.01	<0.01
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	mg/L	0.1	0.3	0.2	0.1	0.2	0.1	0.1
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
Total Nitrogen as N	mg/L	0.1	0.4	0.2	0.1	1.5	0.1	0.1
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	mg/L	0.01	0.01	<0.01	0.03	<0.01	0.02	<0.01
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Analyte grouping/analyte	Unit		GV_SW_Pool_Mundagoora_SS	GV_SW_Pool_SW	IB_SW_Pool_Central Ck	IB_SW_Pool_Cow Spring	IB_SW_Pool_Fig	IB_SW_Pool12_01
		Sample date:	21/05/2021	21/05/2021	22/05/2021	25/05/2021	24/05/2021	23/05/2021
		LOR						
Reactive Phosphate	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
EP002: Dissolved Organic Carbon (DOC)								
Dissolved Organic Carbon	mg/L	1	2	3	2	<1	<1	2
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	mg/L	1	6	4	3	<1	<1	2
EP025: Oxygen - Dissolved (DO)								
Dissolved Oxygen	mg/L	0.1	9.1	10.0	10.3	9.9	9.2	10.3
ED009: Anions								
Fluoride	mg/L	0.010	0.180	0.392	0.345	0.069	0.019	0.166

Table A-4. Water quality data – Late Dry season 2021.

Analyte grouping/Analyte	Units	LOR	IB_SW_Pool12_01	IB_SW_Pool_Fig	GV_SW_Pool_Mundagoora_SS	IB_SW_Pool_Central Ck	IB_SW_Pool_Cow Spring	GV_SW_Pool_SW
		Sample Date	7/10/2021	5/10/2021	6/10/2021	8/10/2021	5/10/2021	6/10/2021

Analyte grouping/Analyte	Units	LOR	IB_SW_Pool12_01	IB_SW_Pool_Fig	GV_SW_Pool_Mundagoora_SS	IB_SW_Pool_Central Ck	IB_SW_Pool_Cow Spring	GV_SW_Pool_SW
Water Quality (field parameters)								
Temperature	(°C)		27.4	24.4	25	29.3	26.3	24.8
Dissolved Oxygen	(%)		162	47	110	90	82	178
Dissolved Oxygen	(mg/L)		12.3	3.7	8.8	6.6	6.4	14.2
Specific Conductivity (SPC)	(uS/cm)		1221	200	880	3133	468	1271
Total Dissolved Solids (TDS)	(mg/L)		728	124	517	1850	278	754
Salinity	(ppt)		0.6	0.09	0.43	1.62	0.22	0.63
pH			8.63	4.04	8.10	8.38	7.00	8.45
Oxidation Reduction Potential (ORP)	(mV)		112	261.8	182.6	107.3	195.6	149.4
Turbidity	(NTU)		12.29	2.62	<0.1	11.04	<0.1	0.89
Total Suspended Solids	(mg/L)	5	<5	<5	<5	17	<5	<5
Water Quality (Isotopes)								
d18O [‰ VSMOW]			-4.84	-8.12	-6.61	-5.30	-8.85	-2.31
d2H [‰ VSMOW]			-41.43	-55.94	-49.20	-41.32	-60.53	-32.45
Alkalinity								
Hydroxide Alkalinity as CaCO₃	(mg/L)	1	<1	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO₃	(mg/L)	1	82	<1	<1	21	<1	30

Analyte grouping/Analyte	Units	LOR	IB_SW_Pool12_01	IB_SW_Pool_Fig	GV_SW_Pool_Mundagoora_SS	IB_SW_Pool_Central Ck	IB_SW_Pool_Cow Spring	GV_SW_Pool_SW
Bicarbonate Alkalinity as CaCO₃	(mg/L)	1	504	<1	367	622	37	496
Total Alkalinity as CaCO₃	(mg/L)	1	586	<1	367	643	37	525
Total Hardness as CaCO₃	(mg/L)	1	541	25	310	607	118	431
Acidity as CaCO₃	(mg/L)	1	<1	17	5	<1	10	<1
Sulfate as SO₄ - Turbidimetric	(mg/L)	1	21	36	37	195	82	75
Chloride	(mg/L)		82	24	52	602	64	96
Dissolved Major Cations								
Calcium	(mg/L)	1	18.7	2.5	55.4	25.4	20.4	38.3
Magnesium	(mg/L)	1	120	4.5	41.8	132	16.4	81.4
Sodium	(mg/L)	1	60.1	14.8	62.6	377	36.7	108
Fluoride	(mg/L)	1	0.171	0.012	0.229	0.701	0.076	0.615
Potassium	(mg/L)	1	0.5	1.2	0.3	33.8	2.3	1.4
Dissolved Metals								
Arsenic	(mg/L)	0.001	0.0013	<0.0002	0.0004	0.0222	<0.0002	0.0019
Aluminium	(mg/L)	0.005	<0.005	0.158	<0.005	<0.005	<0.005	<0.005
Beryllium	(mg/L)	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Barium	(mg/L)	0.001	0.0652	0.0717	0.0728	0.188	0.0178	0.0620
Cadmium	(mg/L)	0.0005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Chromium	(mg/L)	0.0002	<0.0002	<0.0002	<0.0002	0.0005	0.0008	<0.0002
Cobalt	(mg/L)	0.0001	<0.0001	0.0019	<0.0001	0.0014	<0.0001	0.0003

Analyte grouping/Analyte	Units	LOR	IB_SW_Pool12_01	IB_SW_Pool_Fig	GV_SW_Pool_Mundagoora_SS	IB_SW_Pool_Central Ck	IB_SW_Pool_Cow Spring	GV_SW_Pool_SW
Copper	(mg/L)	0.0005	0.0076	<0.0005	0.0018	0.0008	<0.0005	0.0015
Iron	(mg/L)	0.0001	0.012	0.948	0.003	0.218	0.005	0.014
Lead	(mg/L)	0.0001	<0.0001	<0.0001	<0.0001	0.0002	<0.0001	<0.0001
Manganese	(mg/L)	0.001	0.0040	0.360	0.0226	1.13	0.0010	0.0402
Nickel	(mg/L)	0.0005	<0.0005	0.0105	<0.0005	0.0068	0.0063	0.0013
Vanadium	(mg/L)	0.0002	0.0010	<0.0002	0.0145	0.0237	<0.0002	0.0099
Zinc	(mg/L)	0.005	0.009	0.030	0.026	0.017	0.008	0.015
Boron	(mg/L)	0.005	0.215	0.078	0.208	0.863	0.145	0.343
Total Metals								
Aluminium	(mg/L)	0.005	0.005	0.182	0.011	0.216	<0.005	0.035
Arsenic	(mg/L)	0.0002	0.0013	0.0005	0.0004	0.0238	<0.0002	0.0020
Beryllium	(mg/L)	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Barium	(mg/L)	0.001	0.0103	0.0261	0.0149	0.202	0.0040	0.0243
Cadmium	(mg/L)	0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Chromium	(mg/L)	0.0002	<0.0002	<0.0002	<0.0002	0.0042	0.0009	0.0004
Cobalt	(mg/L)	0.0001	<0.0001	0.0019	<0.0001	0.0021	<0.0001	0.0004
Copper	(mg/L)	0.0005	<0.0005	<0.0005	<0.0005	0.0013	<0.0005	0.0019
Lead	(mg/L)	0.0001	<0.0001	<0.0001	<0.0001	0.0003	<0.0001	<0.0001
Manganese	(mg/L)	0.0001	0.0145	0.383	0.0578	1.27	0.0011	0.114
Nickel	(mg/L)	0.0005	<0.0005	0.0107	<0.0005	0.0100	0.0064	0.0016
Selenium	(mg/L)	0.0002	<0.0002	<0.0002	0.0002	0.0003	0.0003	<0.0002
Vanadium	(mg/L)	0.0002	0.0011	<0.0002	0.0160	0.0269	<0.0002	0.0106
Zinc	(mg/L)	0.001	<0.001	0.002	<0.001	0.002	0.002	0.001

Analyte grouping/Analyte	Units	LOR	IB_SW_Pool12_01	IB_SW_Pool_Fig	GV_SW_Pool_Mundagoora_SS	IB_SW_Pool_Central Ck	IB_SW_Pool_Cow Spring	GV_SW_Pool_SW
Boron	(mg/L)	0.005	0.209	0.068	0.228	0.943	0.135	0.327
Iron	(mg/L)	0.001	0.040	1.26	0.074	0.756	0.028	0.080
Dissolved Mercury	(mg/L)	0.00004	<0.00004	<0.00004	<0.00004	<0.00004	0.00007	<0.00004
Total Recoverable Mercury	(mg/L)	0.00004	<0.00004	<0.00004	<0.00004	<0.00004	0.00020	<0.00004
Ammonium as N	(mg/L)		-	-	-	-	-	-
Nitrite as N	(mg/L)		-	-	-	-	-	-
Nitrate as N	(mg/L)		-	-	-	-	-	-
Nitrite plus Nitrate as N (NOx)	(mg/L)	0.01	<0.01	<0.01	<0.01	<0.01	1.24	<0.01
Total Kjeldahl Nitrogen	(mg/L)	0.1	0.3	<0.1	0.1	4.4	0.2	0.5
Total Nitrogen as N (TKN + NOx)	(mg/L)	0.1	0.3	<0.1	0.1	4.4	1.4	0.5
Total Phosphorus as P	(mg/L)	0.01	0.02	0.01	0.02	0.12	0.02	0.04
Reactive Phosphorus as P	(mg/L)	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Dissolved Organic Carbon (DOC)	(mg/L)	1	6	<1	5	18	<1	6
Total Organic Carbon (TOC)	(mg/L)	1	4	<1	5	21	<1	10

Table A-5 Water Quality for Late Wet 2022.

Analyte grouping/Analyte	Units	LOR	GV_SW_Pool_SW	GV_SW_Pool_Mundagoo ra_SS	GV_SW_Pool_NJA21_00 6_US	IB_SW_Pool_Cow Spring	IB_SW_Pool_Fig	NS-Obs29	IB_SW_Pool12_01	NS-0664	NS-ObsW17
		Sample Date	21/06/2022	22/06/2022	21/06/2022	23/06/2022	23/06/2022	24/06/2022	24/06/2022	24/06/2022	25/06/2022
Temperture	(°C)		17.5	20.5	19.1	24.2	22.4	30.2	13.9	29.5	32
Dissolved Oxygen	(%)		54.3	76.6	73.6	56.4	60.9	36.7	89.6	3.5	78.2
Dissolved Oxygen	(mg/L)		5.15	6.88	6.72	4.73	5.28	2.76	9.19	0.26	5.68
Specific Conductivity (SPC)	µS/cm		3091	1026	4488	521	192.4	956	1833	945	1647
Total Dissolved Solids (TDS)	(mg/L)		2009	667	2917	339	125	621	1192	614	1071
pH			7.99	7.66	8.14	6.22	5.19	6.29	8.5	7.03	7.4
Oxidation Reduction Potential (ORP)	(mV)		135.9	144.6	128.6	133	133.4	22.7	90.2	106	128.4
Turbidity	(NTU)		-0.69	-4.62	-0.57	-4.96	-3.21	-1.24	2.09	-1.11	-1.75
Total Suspended Solids	mg/L	5	<5	<5	<5	<5	<5	<5	<5	<5	<5
d18O [‰ VSMOW]			-5.30	-6.77	-1.56	-8.99	-7.99	----	-6.88	-8.51	-7.10
d2H [‰ VSMOW]			-40.34	-49.02	-24.64	-61.13	-54.90	----	-48.45	-57.66	-47.65
Alkalinity											

Analyte grouping/Analyte	Units	LOR	GV_SW_Pool_SW	GV_SW_Pool_Mundagoo ra_SS	GV_SW_Pool_NJA21_006_US	IB_SW_Pool_Cow Spring	IB_SW_Pool_Fig	NS-Obs29	IB_SW_Pool12_01	NS-0664	NS-ObsW17
Hydroxide Alkalinity as CaCO3	mg/L	1	----	<1	<1	<1	<1	----	<1	<1	<1
Carbonate Alkalinity as CaCO3	mg/L	1	----	8	<1	<1	<1	----	74	<1	<1
Bicarbonate Alkalinity as CaCO3	mg/L	1	----	332	326	40	3	----	577	314	444
Total Alkalinity as CaCO3	mg/L	1	----	340	326	40	3	----	651	314	444
Sulfate as SO4 - Turbidimetric	mg/L	1	----	38	307	83	33	----	75	31	89
Dissolved Major Cations											
Chloride	mg/L	1	----	66	1000	59	25	----	188	57	188
Calcium	mg/L	1	----	60	120	24	4	----	65	48	52
Magnesium	mg/L	1	----	44	258	18	5	----	142	54	98
Sodium	mg/L	1	----	64	264	35	14	----	94	46	113
Potassium	mg/L	1	----	<1	13	2	1	----	<1	1	2
Dissolved Metals											
Arsenic	mg/L	0.001	0.003	<0.001	0.023	<0.001	<0.001	0.002	<0.001	<0.001	0.01
Beryllium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Barium	mg/L	0.001	0.091	0.054	0.172	0.033	0.052	0.048	0.036	0.179	0.042
Cadmium	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0002

Analyte grouping/Analyte	Units	LOR	GV_SW_Pool_SW	GV_SW_Pool_Mundagoo ra_SS	GV_SW_Pool_NJA21_006_US	IB_SW_Pool_Cow Spring	IB_SW_Pool_Fig	NS-Obs29	IB_SW_Pool12_01	NS-0664	NS-ObsW17
Chromium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
Cobalt	mg/L	0.001	<0.001	<0.001	0.002	<0.001	0.002	0.005	<0.001	<0.001	<0.001
Copper	mg/L	0.001	0.005	<0.001	0.004	<0.001	<0.001	<0.001	<0.001	<0.001	0.012
Lead	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	mg/L	0.001	0.177	0.009	0.178	0.002	0.328	0.714	0.008	0.115	<0.001
Nickel	mg/L	0.001	0.003	<0.001	0.007	0.005	0.008	0.031	<0.001	0.004	0.004
Selenium	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	mg/L	0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.03	0.04
Zinc	mg/L	0.005	0.012	0.012	<0.005	0.023	0.008	0.022	0.008	0.013	0.032
Boron	mg/L	0.05	0.46	0.22	0.46	0.12	<0.05	0.14	0.3	0.44	0.33
Iron	mg/L	0.05	<0.05	<0.05	<0.05	<0.05	2.36	3.12	<0.05	<0.05	<0.05
Total Metals											
Arsenic	mg/L	0.001	0.003	<0.001	0.026	<0.001	<0.001	0.002	<0.001	<0.001	0.01
Beryllium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Barium	mg/L	0.001	0.096	0.018	0.188	0.005	0.03	0.02	0.03	0.155	0.024
Cadmium	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0008	<0.0001	<0.0001	<0.0001	0.0002
Chromium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003
Cobalt	mg/L	0.001	<0.001	<0.001	0.002	<0.001	0.002	0.005	<0.001	<0.001	0.01

Analyte grouping/Analyte	Units	LOR	GV_SW_Pool_SW	GV_SW_Pool_Mundagoo ra_SS	GV_SW_Pool_NJA21_006_US	IB_SW_Pool_Cow Spring	IB_SW_Pool_Fig	NS-Obs29	IB_SW_Pool12_01	NS-0664	NS-ObsW17
Copper	mg/L	0.001	0.009	<0.001	0.065	<0.001	<0.001	<0.001	<0.001	0.001	0.016
Lead	mg/L	0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	mg/L	0.001	0.188	0.027	0.205	0.003	0.369	0.73	0.01	0.136	0.033
Nickel	mg/L	0.001	0.003	<0.001	0.008	0.005	0.008	0.032	<0.001	0.005	0.004
Selenium	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	mg/L	0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.04	0.05
Zinc	mg/L	0.005	0.011	<0.005	<0.005	<0.005	<0.005	0.015	<0.005	0.006	0.032
Boron	mg/L	0.05	0.41	0.21	0.42	0.1	<0.05	0.13	0.3	0.46	0.33
Dissolved Mercury	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0002
Total Recoverable Mercury	mg/L	0.0001	<0.0001	<0.0001	<0.0001	0.0003	<0.0001	<0.0001	<0.0001	<0.0001	0.0005
Nutrients											
Nitrite + Nitrate as N	mg/L	0.01	<0.01	0.05	<0.01	1.14	0.03	<0.01	<0.01	1.15	0.75
Total Kjeldahl Nitrogen as N	mg/L	0.1	1	0.2	1.8	0.3	<0.1	<0.1	0.3	0.2	0.2
Total Nitrogen as N	mg/L	0.1	1	0.2	1.8	1.4	<0.1	<0.1	0.3	1.4	1
Total Phosphorus as P	mg/L	0.01	0.06	<0.01	0.11	0.01	<0.01	0.07	0.02	0.02	<0.01
Total Anions	meq/L	0.01	----	9.45	41.1	4.19	1.45	----	19.9	8.53	16
Total Cations	meq/L	0.01	----	9.4	39	4.25	1.37	----	19	8.87	15.6

Analyte grouping/Analyte	Units	LOR	GV_SW_Pool_SW	GV_SW_Pool_Mundagoora_SS	GV_SW_Pool_NJA21_006_US	IB_SW_Pool_Cow Spring	IB_SW_Pool_Fig	NS-Obs29	IB_SW_Pool12_01	NS-0664	NS-ObsW17
Ionic Balance	%	0.01	----	0.25	2.59	0.72	2.83	----	2.19	1.95	1.26
Dissolved Organic Carbon	mg/L	1	16	6	36	1	<1	2	5	5	7
Total Organic Carbon	mg/L	1	18	6	37	2	<1	3	5	5	7
Nonionic Surfactants as CTAS	mg/L	3	<3	<3	<3	<3	<3	<3	<3	<3	<3

Table A-6 Water quality for Late Dry 2022. *Note that results reported for IB_SW_Pool12_01 are for a down-stream remanent pool.

Analyte grouping/Analyte	Units	LOR	GV_SW_Pool_Mundagoora_SS	IB_SW_Pool_Cow Spring	IB_SW_Pool_Fig	NS-Obs29	*IB_SW_Pool12_01	NS-0664	NS-ObsW17
		Sample Date	22/10/2022	22/10/2022	23/10/2022	24/11/2022	23/10/2022	25/11/2022	26/11/2022
Temperture	(°C)		24	28.4	26.3	31.9	29.8	32.6	-
Dissolved Oxygen	(%)		75.7	91.1	60.1	11	12.2	99.1	-
Dissolved Oxygen	(mg/L)		6.36	7.07	4.85	0.81	0.92	7.15	-
Specific Conductivity (SPC)	µS/cm		834	459.7	176.8	843	1727	816	-
Total Dissolved Solids (TDS)	(mg/L)		-	-	115	548	-	530	-
pH			7.15	5.68	3.88	5.92	7.04	7.3	-
Oxidation Reduction Potential (ORP)	(mV)		183	95.4	303.1	46.6	195.9	118.6	-

Analyte grouping/Analyte	Units	LOR	GV_SW_Pool_Mundagoora_SS	IB_SW_Pool_Cow Spring	IB_SW_Pool_Fig	NS-Obs29	*IB_SW_Pool12_01	NS-0664	NS-ObsW17
Turbidity	(NTU)		3.69	-4.05	4.31	40.17	3.57	5.76	-
Total Suspended Solids	mg/L	5	2.5	<5	<5	8	20	<5	<5
d18O [‰ VSMOW]			-6.37	-9.00	-7.84	-9.14	5.80	-8.21	-7.07
d2H [‰ VSMOW]			-48.23	-61.42	-54.75	-61.75	7.82	-55.03	-48.95
Alkalinity									
Hydroxide Alkalinity as CaCO3	mg/L	1	0.5	<1	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	mg/L	1	0.5	<1	<1	<1	89	19	37
Bicarbonate Alkalinity as CaCO3	mg/L	1	314	39	<1	148	550	283	436
Total Alkalinity as CaCO3	mg/L	1	314	39	<1	148	639	303	473
Sulfate as SO4 - Turbidimetric	mg/L	1	56	85	34	120	54	36	86
Dissolved Major Cations									
Chloride	mg/L	1	62	61	24	106	159	74	183
Calcium	mg/L	1	43.1	20	2.8	43.5	20.1	38	45.4
Magnesium	mg/L	1	38.2	16.3	4.8	40.5	136	48.7	97.1
Sodium	mg/L	1	63.6	37.5	15.2	61	90.2	60.8	114
Potassium	mg/L	1	0.5	2.4	1.3	4.2	1.5	2.7	2.4
Dissolved Metals									

Analyte grouping/Analyte	Units	LOR	GV_SW_Pool_Mundagoora_SS	IB_SW_Pool_Cow Spring	IB_SW_Pool_Fig	NS-Obs29	*IB_SW_Pool12_01	NS-0664	NS-ObsW17
Arsenic	mg/L	0.001	0.0003	<0.0002	<0.0002	0.0006	0.0030	0.0008	0.0116
Beryllium	mg/L	0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Barium	mg/L	0.001	0.0350	0.0421	0.0769	0.0520	0.0524	0.141	0.0484
Cadmium	mg/L	0.0001	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00014
Chromium	mg/L	0.001	<0.0002	0.0007	<0.0002	<0.0002	<0.0002	0.0018	0.0015
Cobalt	mg/L	0.001	<0.0001	<0.0001	0.0015	0.0054	0.0002	0.0001	0.0006
Copper	mg/L	0.001	<0.0005	<0.0005	<0.0005	0.0007	<0.0005	0.0011	0.0106
Lead	mg/L	0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Manganese	mg/L	0.001	0.0063	0.0034	0.332	0.701	0.0210	0.0046	0.0010
Nickel	mg/L	0.001	<0.0005	0.0059	0.0079	0.0341	0.0005	0.0035	0.0060
Selenium	mg/L	0.01	<0.0002	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0023
Vanadium	mg/L	0.01	0.0098	<0.0002	<0.0002	<0.0002	0.0162	0.0272	0.0393
Zinc	mg/L	0.005	0.005	0.026	0.045	0.032	0.014	0.006	0.052
Boron	mg/L	0.05	0.222	0.148	0.078	0.158	0.350	0.654	0.319
Iron	mg/L	0.05	0.004	0.009	1.17	1.89	0.018	0.002	<0.002
Total Metals									
Arsenic	mg/L	0.001	0.0003	<0.0002	0.0004	0.0036	0.0029	0.0007	0.0110
Beryllium	mg/L	0.001	<0.0001	<0.0001	<0.0001	0.0002	<0.0001	<0.0001	<0.0001

Analyte grouping/Analyte	Units	LOR	GV_SW_Pool_Mundagoora_SS	IB_SW_Pool_Cow Spring	IB_SW_Pool_Fig	NS-Obs29	*IB_SW_Pool12_01	NS-0664	NS-ObsW17
Barium	mg/L	0.001	0.0145	0.0028	0.0254	0.0241	0.0152	0.134	0.0202
Cadmium	mg/L	0.0001	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00014
Chromium	mg/L	0.001	<0.0002	0.0004	<0.0002	0.0008	0.0002	0.0020	0.0020
Cobalt	mg/L	0.001	<0.0001	<0.0001	0.0016	0.0056	0.0002	0.0003	0.0099
Copper	mg/L	0.001	<0.0005	<0.0005	<0.0005	0.0011	<0.0005	0.0015	0.0152
Lead	mg/L	0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Manganese	mg/L	0.001	0.0238	0.0013	0.336	0.678	0.0638	0.0145	0.0272
Nickel	mg/L	0.001	<0.0005	0.0022	0.0087	0.0375	0.0006	0.0046	0.0056
Selenium	mg/L	0.01	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0020
Vanadium	mg/L	0.01	0.0106	<0.0002	<0.0002	<0.0002	0.0168	0.0276	0.0401
Zinc	mg/L	0.005	<0.001	<0.001	0.002	0.027	<0.001	0.007	0.030
Boron	mg/L	0.05	0.202	0.054	0.076	0.159	0.310	0.646	0.323
Dissolved Mercury	mg/L	0.0001	<0.00004	0.00008	<0.00004	0.00019	<0.00004	0.00010	0.00008
Total Recoverable Mercury	mg/L	0.0001	<0.00004	0.00022	<0.00004	0.00042	<0.00004	0.00014	0.00044
Nutrients									
Nitrite + Nitrate as N	mg/L	0.01	<0.01	1.08	<0.01	<0.01	<0.01	1.15	0.79
Total Kjeldahl Nitrogen as N	mg/L	0.1	0.1	0.2	<0.1	0.2	0.8	0.5	0.4
Total Nitrogen as N	mg/L	0.1	0.1	1.3	<0.1	0.2	0.8	1.6	1.2

Analyte grouping/Analyte	Units	LOR	GV_SW_Pool_Mundagoora_SS	IB_SW_Pool_Cow Spring	IB_SW_Pool_Fig	NS-Obs29	*IB_SW_Pool12_01	NS-0664	NS-ObsW17
Total Phosphorus as P	mg/L	0.01	0.04	0.03	<0.01	0.1	0.04	0.07	0.02
Total Anions	meq/L	0.01							
Total Cations	meq/L	0.01							
Ionic Balance	%	0.01							
Dissolved Organic Carbon	mg/L	1	6	4	<1	4	11	8	2
Total Organic Carbon	mg/L	1	6	2	<1	4	12	9	5
Nonionic Surfactants as CTAS	mg/L	3	<3	<3	<3	<3	<3	<3	<3

APPENDIX B. SEDIMENT QUALITY DATA

Table B-1 Sediment quality data – late wet season 2019/2020.

Analyte grouping/Analyte	Unit	LOR	GV_SW_Pool_Mundagoora_SS	IB_SW_Pool_Cow Spring	IB_SW_Pool_Fig	IB_SW_Pool12_01	IB_SW_Pool_Central Ck
		<i>Sample Date</i>	30/05/2020	30/05/2020	30/05/2020	29/05/2020	31/05/2020
		<i>ALS Sample Number</i>	EP2005660011	EP2005660012	EP2005660013	EP2005660014	EP2005660015
Total Soluble Salts	mg/kg	5	693	114	248	408	1180
Moisture Content (Dried @ 105-110°C)	%	1.0	59.7	23.9	----	28.6	29.8
Total Alkalinity as CaCO ₃	mg/kg	1	77	4	2	71	120
Bicarbonate Alkalinity as CaCO ₃	mg/kg	1	77	4	2	67	120
Carbonate Alkalinity as CaCO ₃	mg/kg	1	<1	<1	<1	4	<1
Acidity	mg/kg	1	12	<1	14	4	4
Sulfate as SO ₄ ²⁻ (soluble sulfate by ICPAES)	mg/kg	10	80	40	120	20	200
Chloride (by Discrete Analyser)	mg/kg	10	100	20	<10	30	170
Calcium	mg/kg	10	220	<10	30	50	40
Magnesium	mg/kg	10	110	<10	<10	60	70
Sodium	mg/kg	10	170	20	10	40	220
Potassium	mg/kg	10	20	<10	10	<10	20
Mercury (FIMS)	mg/kg	0.1	0.6	4.4	<0.1	<0.1	<0.1
Nitrite + Nitrate as N (Sol.)	mg/kg	0.1	<0.1	0.1	<0.1	<0.1	<0.1
Total Kjeldahl Nitrogen as N	mg/kg	20	3950	750	1110	520	1090
Total Nitrogen as N	mg/kg	20	3950	750	1110	520	1090
Total Phosphorus as P	mg/kg	2	242	320	60	73	100
Reactive Phosphorus as P	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Analyte grouping/Analyte	Unit	LOR	GV_SW_Pool_Mundagoora_SS	IB_SW_Pool_Cow Spring	IB_SW_Pool_Fig	IB_SW_Pool12_01	IB_SW_Pool_Central Ck
Total Organic Carbon	%	0.02	3.15	0.22	0.30	0.18	1.80
<i>Total Metals by ICP-AES</i>							
Arsenic	mg/kg	5	9	9	<5	<5	9
Barium	mg/kg	10	40	<10	10	50	40
Beryllium	mg/kg	1	1	<1	<1	<1	<1
Boron	mg/kg	50	<50	<50	<50	<50	<50
Cadmium	mg/kg	1	<1	<1	<1	<1	<1
Chromium	mg/kg	2	169	165	143	384	219
Cobalt	mg/kg	2	22	4	<2	23	16
Copper	mg/kg	5	52	7	8	23	22
Iron	mg/kg	50	76600	124000	58500	32800	26600
Lead	mg/kg	5	<5	9	<5	<5	<5
Manganese	mg/kg	5	481	151	94	561	476
Nickel	mg/kg	2	79	18	6	179	112
Selenium	mg/kg	5	5	6	<5	<5	<5
Vanadium	mg/kg	5	166	62	27	48	39
Zinc	mg/kg	5	39	16	5	26	35

Table B-2. Sediment quality data – Late Dry season 2020.

Analyte grouping/Analyte	Unit	LOR	GV_SW_Pool_Mundagoora_SS	IB_SW_Pool_Fig	IB_SW_Pool12_01
		<i>Sample Date</i>	08/12/2020	10/12/2020	09/12/2020
		<i>ALS Sample Number</i>	EP2013964-012	EP2013964-013	EP2013964-014
Total Soluble Salts	mg/kg	5	-		
Moisture Content (Dried @ 105-110°C)	%	1.0	49.3	38.3	20.9
Total Alkalinity as CaCO ₃	mg/kg	1	104	<5	329
Bicarbonate Alkalinity as CaCO ₃	mg/kg	1	104	<5	265
Carbonate Alkalinity as CaCO ₃	mg/kg	1	<5	<5	65
Acidity	mg/kg	1	53	166	<5
Sulfate as SO ₄ 2- (soluble sulfate by ICPAES)	mg/kg	10	70	160	<10
Chloride (by Discrete Analyser)	mg/kg	10	40	40	30
Calcium	mg/kg	10	30	<10	40
Magnesium	mg/kg	10	20	10	90
Sodium	mg/kg	10	100	40	40
Potassium	mg/kg	10	<10	30	<10
Mercury (FIMS)	mg/kg	0.1	-		
Nitrite + Nitrate as N (Sol.)	mg/kg	0.1	<0.1	<0.1	<0.1
Total Kjeldahl Nitrogen as N	mg/kg	20	1970	1670	200
Total Nitrogen as N	mg/kg	20	1970	1670	200
Total Phosphorus as P	mg/kg	2	179	223	61
Reactive Phosphorus as P	mg/kg	0.1	<0.1	<0.1	<0.1
Total Organic Carbon	%	0.02	4.88	3.60	0.29

Analyte grouping/Analyte	Unit	LOR	GV_SW_Pool_Mundagoora_SS	IB_SW_Pool_Fig	IB_SW_Pool12_01
<i>Total Metals by ICP-AES</i>					
Arsenic	mg/kg	5	-		
Barium	mg/kg	10	-		
Beryllium	mg/kg	1	-		
Boron	mg/kg	50	-		
Cadmium	mg/kg	1	-		
Chromium	mg/kg	2	-		
Cobalt	mg/kg	2	-		
Copper	mg/kg	5	-		
Iron	mg/kg	50	57000	90200	41200
Lead	mg/kg	5	-		
Manganese	mg/kg	5	-		
Nickel	mg/kg	2	-		
Selenium	mg/kg	5	-		
Vanadium	mg/kg	5	-		
Zinc	mg/kg	5	-		

Table B-3. Sediment quality data – Late Wet season 2021.

Analyte grouping/Analyte	Unit	LOR	GV_SW_Pool_Mun dagoora_SS	IB_SW_Pool_Fig	IB_SW_Pool12_01	IB_SW_Pool_Centr al Ck
		<i>Sample Date</i>	21/05/2021	30/05/2020	23/05/2021	28/05/2021
		<i>ALS Sample Number</i>	EP2106077-001	EP2106077-005	EP2106077-006	EP2106077-003
Total Soluble Salts	mg/kg	5	200	384	402	559
Moisture Content (Dried @ 105-110°C)	%	1.0	24.8	37	25	19.1
Total Alkalinity as CaCO ₃	mg/kg	1	<5	<5	26	<5
Bicarbonate Alkalinity as CaCO ₃	mg/kg	1	239	<5	26	198
Carbonate Alkalinity as CaCO ₃	mg/kg	1	239	<5	253	198
Acidity	mg/kg	1	62	1000	<5	<5
Sulfate as SO ₄ 2- (soluble sulfate by ICPAES)	mg/kg	10	<10	150	<10	40
Chloride (by Discrete Analyser)	mg/kg	10	20	60	20	90
Calcium	mg/kg	10	30	<10	30	<10
Magnesium	mg/kg	10	20	10	60	40
Sodium	mg/kg	10	30	12	6	10
Potassium	mg/kg	10	<10	10	<10	<10
Mercury (FIMS)	mg/kg	0.1	<0.1	0.2	<0.1	<0.1
Nitrite + Nitrate as N (Sol.)	mg/kg	0.1	<0.1	0.2	<0.1	<0.1
Total Kjeldahl Nitrogen as N	mg/kg	20	430	3030	80	80
Total Nitrogen as N	mg/kg	20	430	3030	80	80
Total Phosphorus as P	mg/kg	2	190	310	56	43

Analyte grouping/Analyte	Unit	LOR	GV_SW_Pool_Mun dagoora_SS	IB_SW_Pool_Fig	IB_SW_Pool12_01	IB_SW_Pool_Centr al Ck
Reactive Phosphorus as P	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
Total Organic Carbon	%	0.02		3.08	0.2	0.18
<i>Total Metals by ICP-AES</i>						
Arsenic	mg/kg	5	9	12	6	10
Barium	mg/kg	10	60	40	70	30
Beryllium	mg/kg	1	<1	<1	<1	<1
Boron	mg/kg	50	50	<50	<50	<50
Cadmium	mg/kg	1	<1	<1	<1	<1
Chromium	mg/kg	2	68	127	492	247
Cobalt	mg/kg	2	33	2	36	18
Copper	mg/kg	5	67	24	37	17
Iron	mg/kg	50	114000	64600	49400	30600
Lead	mg/kg	5	6	<5	<5	<5
Manganese	mg/kg	5	674	39	894	492
Nickel	mg/kg	2	134	12	246	113
Selenium	mg/kg	5	<5	<5	<5	<5
Vanadium	mg/kg	5	161	53	65	36
Zinc	mg/kg	5	30	8	44	20

Table B-4. Sediment quality data – Late Dry season 2021.

Analyte grouping/Analyte	Unit	LOR	IB_SW_Pool_Fig	IB_SW_Pool_Cow Spring	GV_SW_Pool_SW	GV_SW_Pool_Mundagoora_SS	IB_SW_Pool_Central Ck	IB_SW_Pool12_01
		Sample Date	05/10/2021	05/10/2021	06/10/2021	09/10/2021	08/10/2021	07/10/2021
Total Soluble Salts	mg/kg	5	278	730	561	446	635	1870
Moisture Content	%	1.0	52.6	78.7	28.0	80.6	22.7	39.2
Carbonate Alkalinity as CaCO₃	mg/kg	5	<5	<5	35	<5	<5	722
Bicarbonate Alkalinity as CaCO₃	mg/kg	5	<5	196	363	270	299	521
Total Alkalinity as CaCO₃	mg/kg	5	<5	196	399	270	299	1240
Acidity	mg/kg	5	753	285	<5	448	<5	<5
Sulfate as SO₄ 2-	mg/kg	10	120	810	30	20	40	130
Chloride	mg/kg	10	40	300	40	150	140	290
Calcium	mg/kg	10	<10	290	70	130	30	30
Magnesium	mg/kg	10	20	230	100	100	80	410
Sodium	mg/kg	10	30	350	120	230	190	340
Potassium	mg/kg	10	40	80	<10	<10	30	10
Arsenic	mg/kg	5	10	24	<5	15	6	<5
Barium	mg/kg	10	20	30	70	<20	40	40
Beryllium	mg/kg	1	<1	<1	<1	<2	<1	<1

Analyte grouping/Analyte	Unit	LOR	IB_SW_Pool_Fig	IB_SW_Pool_Cow Spring	GV_SW_Pool_SW	GV_SW_Pool_Mundagoora_SS	IB_SW_Pool_Central Ck	IB_SW_Pool12_01
Boron	mg/kg	50	<50	<50	<50	<50	<50	<50
Cadmium	mg/kg	1	<1	<1	1	<1	<1	<1
Chromium	mg/kg	2	258	90	205	102	216	244
Cobalt	mg/kg	2	3	6	31	19	14	16
Copper	mg/kg	5	15	11	60	89	18	19
Iron	mg/kg	50	92700	148000	70100	56100	23100	29600
Lead	mg/kg	5	<5	<5	<5	9	<5	<5
Manganese	mg/kg	5	81	380	1280	328	334	504
Nickel	mg/kg	2	14	23	118	69	110	115
Selenium	mg/kg	5	<5	<5	<5	<5	<5	<5
Vanadium	mg/kg	5	61	59	115	299	33	40
Zinc	mg/kg	5	8	22	50	32	26	22
Total Recoverable Mercury	mg/kg	0.1	0.1	1.6	<0.1	24.2	<0.1	<0.1
Nitrite + Nitrate as N (Sol.)	mg/kg	0.1	<0.1	0.2	<0.1	<0.2	<0.1	<0.1
Total Kjeldahl Nitrogen as N	mg/kg	20	1820	7700	360	4910	220	660
Total Nitrogen as N	mg/kg	20	1820	7700	360	4910	220	660
Total Phosphorus as P	mg/kg	2	238	493	108	427	73	106
Reactive Phosphorus as P	mg/kg	0.1	<0.1	0.1	<0.1	<0.2	<0.1	0.1

Analyte grouping/Analyte	Unit	LOR	IB_SW_Pool_Fig	IB_SW_Pool_Cow Spring	GV_SW_Pool_SW	GV_SW_Pool_Mundagoora_SS	IB_SW_Pool_Central Ck	IB_SW_Pool12_01
Total Organic Carbon	%	0.02	3.26	0.22	0.24	5.78	0.18	1.13

Table B-4: Sediment quality data for the Late Wet 2022 season.

*Not enough sediment sample left in the second analysis for all analytes ** Sample too dry for analysis.

Analyte grouping/Analyte	Unit	LOR	GV_SW_Pool_SW	GV_SW_Pool_Mundagoora_SS	GV_SW_Pool_NJA21_006_US	IB_SW_Pool_Cow Spring	IB_SW_Pool_Fig	IB_SW_Pool12_01
		Sample Date:	21/06/2022	22/06/2022	21/06/2022	23/06/2022	23/06/2022	24/06/2022
Total soluble Salts	mg/kg		*	396	830	*	393	688
Moisture Content	%	1.0	28.8	**	24	44	66.4	30.2
Alkalinity								
Carbonate Alkalinity as CaCO₃	mg/kg	5	*	22	12	*	<5	60
Bicarbonate Alkalinity as CaCO₃	mg/kg	5	*	194	163	*	11	452
Total Alkalinity as CaCO₃	mg/kg	5	*	216	175	*	11	512
Acidity	mg/kg	5	*	<5	<5	*	452	<5

Analyte grouping/Analyte	Unit	LOR	GV_SW_Pool_SW	GV_SW_Pool_Mundagoo ra_SS	GV_SW_Pool_NJA21_006_US	IB_SW_Pool_Cow Spring	IB_SW_Pool_Fig	IB_SW_Pool12_01
Sulfate as SO4 2-	mg/kg	10	*	30	100	*	300	20
Chloride	mg/kg	10	*	30	310	*	200	80
Soluble Major Cations								
Calcium	mg/kg	10	*	40	40	*	10	50
Magnesium	mg/kg	10	*	20	80	*	20	110
Sodium	mg/kg	10	*	40	150	*	140	80
Potassium	mg/kg	10	*	<10	20	*	110	<10
Total Metals								
Arsenic	mg/kg	5	<5	<5	95	9	11	<5
Barium	mg/kg	10	60	40	100	10	90	60
Beryllium	mg/kg	1	<1	<1	<1	<1	<1	<1
Boron	mg/kg	50	<50	<50	<50	<50	<50	<50
Cadmium	mg/kg	1	1	<1	<1	1	<1	<1
Chromium	mg/kg	2	110	173	254	73	238	301
Cobalt	mg/kg	2	20	11	32	4	7	22
Copper	mg/kg	5	39	29	71	8	15	17

Analyte grouping/Analyte	Unit	LOR	GV_SW_Pool_SW	GV_SW_Pool_Mundagoo ra_SS	GV_SW_Pool_NJA21_00 6_US	IB_SW_Pool_C ow Spring	IB_SW_Pool_ Fig	IB_SW_Pool12 _01
Iron	mg/kg	50	42100	66900	51300	66800	142000	28000
Lead	mg/kg	5	<5	<5	<5	6	8	<5
Manganese	mg/kg	5	1030	441	727	126	1340	667
Nickel	mg/kg	2	57	92	228	19	18	128
Selenium	mg/kg	5	<5	<5	<5	<5	<5	<5
Vanadium	mg/kg	5	67	56	61	49	52	30
Zinc	mg/kg	5	28	31	90	11	9	18
Total Recoverable Mercury	mg/kg	0.1	<0.1	<0.1	<0.1	2.4	0.2	<0.1
Nitrite + Nitrate as N (Sol.)	mg/kg	0.1	*	0.2	0.1	*	0.2	<0.1
Total Kjeldahl Nitrogen as N	mg/kg	20	*	170	200	*	4930	440
Total Nitrogen as N	mg/kg	20	*	170	200	*	4930	440
Total Phosphorus as P	mg/kg	2	*	293	169	*	301	111
Reactive Phosphorus as P	mg/kg	0.1	*	0.2	0.4	*	<0.1	<0.1
Total Organic Carbon	%	0.02	0.69	0.21	0.16	1.44	12.8	0.16

Table B-5: Sediment quality data for the Late Dry 2022 season.

Analyte grouping/Analyte	Unit	LOR	GV_SW_Pool_Mundagoora_SS	IB_SW_Pool_Cow Spring	IB_SW_Pool_Fig
		Sample Date:	22/10/2022	22/10/2022	24/10/2022
Total soluble Salts	mg/kg				
Moisture Content	%	1.0	33.7	53.7	92.6
Alkalinity					
Carbonate Alkalinity as CaCO₃	mg/kg	5	<5	<5	<5
Bicarbonate Alkalinity as CaCO₃	mg/kg	5	423	828	6
Total Alkalinity as CaCO₃	mg/kg	5	423	828	6
Acidity	mg/kg	5	10	<5	1190
Sulfate as SO₄ 2-	mg/kg	10	30	850	5330
Chloride	mg/kg	10	20	330	470
Soluble Major Cations					
Calcium	mg/kg	10	40	190	130
Magnesium	mg/kg	10	20	140	120
Sodium	mg/kg	10	50	480	210
Potassium	mg/kg	10	<10	370	180
Total Metals					

Analyte grouping/Analyte	Unit	LOR	GV_SW_Pool_Mundagoora_SS	IB_SW_Pool_Cow Spring	IB_SW_Pool_Fig
Arsenic	mg/kg	5	<5	6	25
Barium	mg/kg	10	20	60	<50
Beryllium	mg/kg	1	<1	<1	<5
Boron	mg/kg	50	<50	<50	70
Cadmium	mg/kg	1	<1	<1	<2
Chromium	mg/kg	2	83	64	114
Cobalt	mg/kg	2	6	6	16
Copper	mg/kg	5	17	13	19
Iron	mg/kg	50	43500	39800	291000
Lead	mg/kg	5	<5	<5	<5
Manganese	mg/kg	5	199	877	1680
Nickel	mg/kg	2	27	25	19
Selenium	mg/kg	5	<5	<5	<5
Vanadium	mg/kg	5	45	36	61
Zinc	mg/kg	5	12	22	17
Total Recoverable Mercury	mg/kg	0.1	<0.1	1.2	<0.2

Analyte grouping/Analyte	Unit	LOR	GV_SW_Pool_Mundagoora_SS	IB_SW_Pool_Cow Spring	IB_SW_Pool_Fig
Nitrite + Nitrate as N (Sol.)	mg/kg	0.1	<0.1	0.2	<0.5
Total Kjeldahl Nitrogen as N	mg/kg	20	270	4760	4290
Total Nitrogen as N	mg/kg	20	270	4760	4290
Total Phosphorus as P	mg/kg	2	90	408	572
Reactive Phosphorus as P	mg/kg	0.1	<0.1	0.2	<5.0
Total Organic Carbon	%	0.02	0.34	8.74	13.0

APPENDIX C. FISH DATA

Table C-1 Fish catch summary table – Late Wet 2020

Species	IB_SW_Pool_Central Ck	IB_SW_Pool_Co w Spring l	IB_SW_Pool12_01	GV_SW_Pool_Mun dagoora_SS	IB_SW_Pool_Fig
<i>Neosilurus hyrtlii</i>	0	0	37	0	0
50 - 90 mm	0	0	18	0	0
90 - 130 mm	0	0	16	0	0
130 - 170 mm	0	0	3	0	0
<i>Melanotaenia australis</i>	171	67	196	212	0
30 mm <	1	13	0	63	0
30 - 60 mm	113	37	84	95	0
60 - 90 mm	57	15	112	54	0
90 mm >	0	2	0	0	0
<i>Leiopotherapon unicolor</i>	207	0	24	1	0
30 - 60 mm	109	0	7	0	0
60 - 90 mm	53	0	10	0	0
90 mm >	45	0	7	1	0
Total catch	378	67	257	213	0
Soak duration	19	17.7	15.5	16.5	16
CPUE	19.9	3.8	16.6	12.9	0

¹ CPUE is catch per unit effort, a measure of relative abundance. Effort is net and trap soak duration hours.

Table C-2: Fish standard length and total length - Late Wet 2020

Site Name	Gear Type	Rep- licate	Date	Time In	Time Out	Habitat Type	Species	Standard Length (mm)	Total length (mm)
Central Ck Pool	Fyke	1	26/06/2020	16:00	11:00	Pool	<i>Leiopotherapon unicolor</i>	32	37
Central Ck Pool	Fyke	1	26/06/2020	16:00	11:00	Pool	<i>Leiopotherapon unicolor</i>	36	45
Central Ck Pool	Fyke	1	26/06/2020	16:00	11:00	Pool	<i>Leiopotherapon unicolor</i>	38	47
Central Ck Pool	Fyke	1	26/06/2020	16:00	11:00	Pool	<i>Leiopotherapon unicolor</i>	37	49
Central Ck Pool	Fyke	1	26/06/2020	16:00	11:00	Pool	<i>Leiopotherapon unicolor</i>	41	49
Central Ck Pool	Bait	2	26/06/2020	16:00	9:45	Muddy	<i>Leiopotherapon unicolor</i>	42	50
Central Ck Pool	Fyke	1	26/06/2020	16:00	11:00	Pool	<i>Leiopotherapon unicolor</i>	46	56
Central Ck Pool	Fyke	1	26/06/2020	16:00	11:00	Pool	<i>Leiopotherapon unicolor</i>	46	58
Central Ck Pool	Fyke	1	26/06/2020	16:00	11:00	Pool	<i>Leiopotherapon unicolor</i>	49	58
Central Ck Pool	Fyke	1	26/06/2020	16:00	11:00	Pool	<i>Leiopotherapon unicolor</i>	55	67
Central Ck Pool	Fyke	1	26/06/2020	16:00	11:00	Pool	<i>Leiopotherapon unicolor</i>	60	74
Central Ck Pool	Box	1	26/06/2020	16:00	10:30	Muddy	<i>Leiopotherapon unicolor</i>	66	81
Central Ck Pool	Box	2	26/06/2020	16:00	10:45	Muddy	<i>Leiopotherapon unicolor</i>	69	85
Central Ck Pool	Box	2	26/06/2020	16:00	10:45	Muddy	<i>Leiopotherapon unicolor</i>	75	94
Central Ck Pool	Box	2	26/06/2020	16:00	10:45	Muddy	<i>Leiopotherapon unicolor</i>	80	97
Central Ck Pool	Box	2	26/06/2020	16:00	10:45	Muddy	<i>Leiopotherapon unicolor</i>	81	100
Central Ck Pool	Fyke	1	26/06/2020	16:00	11:00	Pool	<i>Leiopotherapon unicolor</i>	87	109
Central Ck Pool	Box	1	26/06/2020	16:00	10:30	Muddy	<i>Leiopotherapon unicolor</i>	94	115
Central Ck Pool	Fyke	1	26/06/2020	16:00	11:00	Pool	<i>Leiopotherapon unicolor</i>	100	125
Central Ck Pool	Fyke	1	26/06/2020	16:00	11:00	Pool	<i>Leiopotherapon unicolor</i>	107	130
Central Ck Pool	Fyke	1	26/06/2020	16:00	11:00	Pool	<i>Leiopotherapon unicolor</i>	115	139
Central Ck Pool	Fyke	1	26/06/2020	16:00	11:00	Pool	<i>Leiopotherapon unicolor</i>	119	141
Central Ck Pool	Fyke	1	26/06/2020	16:00	11:00	Pool	<i>Leiopotherapon unicolor</i>	119	142
Central Ck Pool	Fyke	1	26/06/2020	16:00	11:00	Pool	<i>Leiopotherapon unicolor</i>	120	144

Site Name	Gear Type	Rep- licate	Date	Time In	Time Out	Habitat Type	Species	Standard Length (mm)	Total length (mm)
Central Ck Pool	Fyke	1	26/06/2020	16:00	11:00	Pool	<i>Leiopotherapon unicolor</i>	120	145
Central Ck Pool	Fyke	1	26/06/2020	16:00	11:00	Pool	<i>Leiopotherapon unicolor</i>	127	154
Central Ck Pool	Fyke	1	26/06/2020	16:00	11:00	Pool	<i>Leiopotherapon unicolor</i>	134	160
Central Ck Pool	Fyke	1	26/06/2020	16:00	11:00	Pool	<i>Leiopotherapon unicolor</i>	134	161
Central Ck Pool	Fyke	1	26/06/2020	16:00	11:00	Pool	<i>Leiopotherapon unicolor</i>	147	173
Central Ck Pool	Fyke	1	26/06/2020	16:00	11:00	Pool	<i>Leiopotherapon unicolor</i>	174	205
Central Ck Pool	Fyke	1	26/06/2020	16:00	11:00	Pool	<i>Melanotaenia australis</i>	29	38
Central Ck Pool	Bait	2	26/06/2020	16:00	9:45	Muddy	<i>Melanotaenia australis</i>	33	41
Central Ck Pool	Fyke	1	26/06/2020	16:00	11:00	Pool	<i>Melanotaenia australis</i>	33	42
Central Ck Pool	Bait	2	26/06/2020	16:00	9:45	Muddy	<i>Melanotaenia australis</i>	33	42
Central Ck Pool	Bait	2	26/06/2020	16:00	9:45	Muddy	<i>Melanotaenia australis</i>	39	43
Central Ck Pool	Fyke	1	26/06/2020	16:00	11:00	Pool	<i>Melanotaenia australis</i>	37	46
Central Ck Pool	Bait	2	26/06/2020	16:00	9:45	Muddy	<i>Melanotaenia australis</i>	37	46
Central Ck Pool	Bait	2	26/06/2020	16:00	9:45	Muddy	<i>Melanotaenia australis</i>	38	47
Central Ck Pool	Bait	2	26/06/2020	16:00	9:45	Muddy	<i>Melanotaenia australis</i>	37	48
Central Ck Pool	Bait	2	26/06/2020	16:00	9:45	Muddy	<i>Melanotaenia australis</i>	38	48
Central Ck Pool	Bait	2	26/06/2020	16:00	9:45	Muddy	<i>Melanotaenia australis</i>	37	49
Central Ck Pool	Bait	2	26/06/2020	16:00	9:45	Muddy	<i>Melanotaenia australis</i>	38	50
Central Ck Pool	Bait	2	26/06/2020	16:00	9:45	Muddy	<i>Melanotaenia australis</i>	38	50
Central Ck Pool	Bait	2	26/06/2020	16:00	9:45	Muddy	<i>Melanotaenia australis</i>	39	50
Central Ck Pool	Bait	2	26/06/2020	16:00	9:45	Muddy	<i>Melanotaenia australis</i>	41	50
Central Ck Pool	Bait	2	26/06/2020	16:00	9:45	Muddy	<i>Melanotaenia australis</i>	40	51
Central Ck Pool	Bait	2	26/06/2020	16:00	9:45	Muddy	<i>Melanotaenia australis</i>	41	51
Central Ck Pool	Bait	2	26/06/2020	16:00	9:45	Muddy	<i>Melanotaenia australis</i>	40	52
Central Ck Pool	Fyke	1	26/06/2020	16:00	11:00	Pool	<i>Melanotaenia australis</i>	47	60
Central Ck Pool	Fyke	1	26/06/2020	16:00	11:00	Pool	<i>Melanotaenia australis</i>	47	61

Site Name	Gear Type	Rep- licate	Date	Time In	Time Out	Habitat Type	Species	Standard Length (mm)	Total length (mm)
Central Ck Pool	Fyke	1	26/06/2020	16:00	11:00	Pool	<i>Melanotaenia australis</i>	49	61
Central Ck Pool	Bait	2	26/06/2020	16:00	9:45	Muddy	<i>Melanotaenia australis</i>	49	62
Central Ck Pool	Fyke	1	26/06/2020	16:00	11:00	Pool	<i>Melanotaenia australis</i>	50	64
Central Ck Pool	Fyke	1	26/06/2020	16:00	11:00	Pool	<i>Melanotaenia australis</i>	52	65
Central Ck Pool	Fyke	1	26/06/2020	16:00	11:00	Pool	<i>Melanotaenia australis</i>	53	65
Central Ck Pool	Fyke	1	26/06/2020	16:00	11:00	Pool	<i>Melanotaenia australis</i>	53	66
Central Ck Pool	Fyke	1	26/06/2020	16:00	11:00	Pool	<i>Melanotaenia australis</i>	59	75
Central Ck Pool	Fyke	1	26/06/2020	16:00	11:00	Pool	<i>Melanotaenia australis</i>	65	80
Central Ck Pool	Fyke	1	26/06/2020	16:00	11:00	Pool	<i>Melanotaenia australis</i>	67	84
Central Ck Pool	Box	2	26/06/2020	16:00	10:45	Muddy	<i>Melanotaenia australis</i>	67	85
Cow Spring Pool	Fyke	1	29/06/2020	16:00	9:45	Pool	<i>Melanotaenia australis</i>	17	22
Cow Spring Pool	Fyke	1	29/06/2020	16:00	9:45	Pool	<i>Melanotaenia australis</i>	18	23
Cow Spring Pool	Fyke	1	29/06/2020	16:00	9:45	Pool	<i>Melanotaenia australis</i>	20	25
Cow Spring Pool	Fyke	1	29/06/2020	16:00	9:45	Pool	<i>Melanotaenia australis</i>	23	27
Cow Spring Pool	Fyke	1	29/06/2020	16:00	9:45	Pool	<i>Melanotaenia australis</i>	23	30
Cow Spring Pool	Fyke	1	29/06/2020	16:00	9:45	Pool	<i>Melanotaenia australis</i>	24	30
Cow Spring Pool	Fyke	1	29/06/2020	16:00	9:45	Pool	<i>Melanotaenia australis</i>	24	31
Cow Spring Pool	Fyke	1	29/06/2020	16:00	9:45	Pool	<i>Melanotaenia australis</i>	25	32
Cow Spring Pool	Fyke	1	29/06/2020	16:00	9:45	Pool	<i>Melanotaenia australis</i>	29	37
Cow Spring Pool	Fyke	1	29/06/2020	16:00	9:45	Pool	<i>Melanotaenia australis</i>	30	39
Cow Spring Pool	Fyke	1	29/06/2020	16:00	9:45	Pool	<i>Melanotaenia australis</i>	32	40
Cow Spring Pool	Fyke	1	29/06/2020	16:00	9:45	Pool	<i>Melanotaenia australis</i>	30	41
Cow Spring Pool	Fyke	1	29/06/2020	16:00	9:45	Pool	<i>Melanotaenia australis</i>	30	41
Cow Spring Pool	Fyke	1	29/06/2020	16:00	9:45	Pool	<i>Melanotaenia australis</i>	31	41
Cow Spring Pool	Fyke	1	29/06/2020	16:00	9:45	Pool	<i>Melanotaenia australis</i>	33	42
Cow Spring Pool	Fyke	1	29/06/2020	16:00	9:45	Pool	<i>Melanotaenia australis</i>	33	43

Site Name	Gear Type	Rep- licate	Date	Time In	Time Out	Habitat Type	Species	Standard Length (mm)	Total length (mm)
Cow Spring Pool	Fyke	1	29/06/2020	16:00	9:45	Pool	<i>Melanotaenia australis</i>	35	43
Cow Spring Pool	Fyke	1	29/06/2020	16:00	9:45	Pool	<i>Melanotaenia australis</i>	38	46
Cow Spring Pool	Fyke	1	29/06/2020	16:00	9:45	Pool	<i>Melanotaenia australis</i>	40	50
Cow Spring Pool	Fyke	1	29/06/2020	16:00	9:45	Pool	<i>Melanotaenia australis</i>	49	62
Cow Spring Pool	Fyke	1	29/06/2020	16:00	9:45	Pool	<i>Melanotaenia australis</i>	53	67
Cow Spring Pool	Fyke	1	29/06/2020	16:00	9:45	Pool	<i>Melanotaenia australis</i>	57	72
Cow Spring Pool	Fyke	1	29/06/2020	16:00	9:45	Pool	<i>Melanotaenia australis</i>	60	74
Cow Spring Pool	Fyke	1	29/06/2020	16:00	9:45	Pool	<i>Melanotaenia australis</i>	62	80
Cow Spring Pool	Fyke	1	29/06/2020	16:00	9:45	Pool	<i>Melanotaenia australis</i>	67	85
Cow Spring Pool	Fyke	1	29/06/2020	16:00	9:45	Pool	<i>Melanotaenia australis</i>	68	85
Cow Spring Pool	Fyke	1	29/06/2020	16:00	9:45	Pool	<i>Melanotaenia australis</i>	70	86
Cow Spring Pool	Fyke	1	29/06/2020	16:00	9:45	Pool	<i>Melanotaenia australis</i>	71	87
Cow Spring Pool	Fyke	1	29/06/2020	16:00	9:45	Pool	<i>Melanotaenia australis</i>	80	100
Cow Spring Pool	Fyke	1	29/06/2020	16:00	9:45	Pool	<i>Melanotaenia australis</i>	83	104
Cow Spring Pool	Fyke	1	29/06/2020	16:00	9:45	Pool	<i>Uperoleia sp.</i>	NA	24
Cow Spring Pool	Bait	1	29/06/2020	16:00	9:30	Marco/Edge	<i>Uperoleia sp.</i>	NA	29
Cow Spring Pool	Bait	2	29/06/2020	16:00	9:30	Reeds	<i>Uperoleia sp.</i>	NA	35
Cow Spring Pool	Fyke	1	29/06/2020	16:00	9:45	Pool	<i>Uperoleia sp.</i>	NA	36
Cow Spring Pool	Bait	1	29/06/2020	16:00	9:30	Marco/Edge	<i>Uperoleia sp.</i>	NA	40
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Leiopotherapon unicolor</i>	32	41
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Leiopotherapon unicolor</i>	38	50
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Leiopotherapon unicolor</i>	43	54
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Leiopotherapon unicolor</i>	44	55
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Leiopotherapon unicolor</i>	45	57
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Leiopotherapon unicolor</i>	46	57
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Leiopotherapon unicolor</i>	47	59

Site Name	Gear Type	Rep- licate	Date	Time In	Time Out	Habitat Type	Species	Standard Length (mm)	Total length (mm)
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Leiopotherapon unicolor</i>	49	61
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Leiopotherapon unicolor</i>	49	62
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Leiopotherapon unicolor</i>	52	63
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Leiopotherapon unicolor</i>	54	63
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Leiopotherapon unicolor</i>	54	67
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Leiopotherapon unicolor</i>	55	71
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Leiopotherapon unicolor</i>	58	73
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Leiopotherapon unicolor</i>	59	74
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Leiopotherapon unicolor</i>	64	79
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Leiopotherapon unicolor</i>	70	87
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Leiopotherapon unicolor</i>	78	92
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Leiopotherapon unicolor</i>	79	95
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Leiopotherapon unicolor</i>	104	122
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Leiopotherapon unicolor</i>	111	134
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Leiopotherapon unicolor</i>	148	162
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Leiopotherapon unicolor</i>	155	182
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Leiopotherapon unicolor</i>	166	199
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Melanotaenia australis</i>	45	56
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Melanotaenia australis</i>	46	57
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Melanotaenia australis</i>	46	58
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Melanotaenia australis</i>	46	58
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Melanotaenia australis</i>	47	59
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Melanotaenia australis</i>	47	59
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Melanotaenia australis</i>	47	60
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Melanotaenia australis</i>	48	60
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Melanotaenia australis</i>	48	60

Site Name	Gear Type	Rep- licate	Date	Time In	Time Out	Habitat Type	Species	Standard Length (mm)	Total length (mm)
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Melanotaenia australis</i>	48	61
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Melanotaenia australis</i>	48	61
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Melanotaenia australis</i>	49	61
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Melanotaenia australis</i>	50	61
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Melanotaenia australis</i>	49	62
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Melanotaenia australis</i>	49	62
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Melanotaenia australis</i>	51	64
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Melanotaenia australis</i>	51	64
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Melanotaenia australis</i>	52	64
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Melanotaenia australis</i>	53	64
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Melanotaenia australis</i>	52	66
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Melanotaenia australis</i>	53	66
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Melanotaenia australis</i>	53	66
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Melanotaenia australis</i>	54	66
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Melanotaenia australis</i>	53	67
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Melanotaenia australis</i>	54	67
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Melanotaenia australis</i>	54	67
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Melanotaenia australis</i>	54	69
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Melanotaenia australis</i>	59	75
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Melanotaenia australis</i>	68	76
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Melanotaenia australis</i>	58	77
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Neosilurus hyrtlilii</i>	55	63
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Neosilurus hyrtlilii</i>	54	69
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Neosilurus hyrtlilii</i>	67	75
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Neosilurus hyrtlilii</i>	70	76
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Neosilurus hyrtlilii</i>	65	77

Site Name	Gear Type	Rep- licate	Date	Time In	Time Out	Habitat Type	Species	Standard Length (mm)	Total length (mm)
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Neosilurus hyrtlilii</i>	70	80
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Neosilurus hyrtlilii</i>	72	80
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Neosilurus hyrtlilii</i>	72	81
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Neosilurus hyrtlilii</i>	73	82
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Neosilurus hyrtlilii</i>	74	84
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Neosilurus hyrtlilii</i>	75	84
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Neosilurus hyrtlilii</i>	76	85
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Neosilurus hyrtlilii</i>	75	86
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Neosilurus hyrtlilii</i>	76	86
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Neosilurus hyrtlilii</i>	79	87
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Neosilurus hyrtlilii</i>	79	88
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Neosilurus hyrtlilii</i>	80	90
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Neosilurus hyrtlilii</i>	80	91
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Neosilurus hyrtlilii</i>	82	91
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Neosilurus hyrtlilii</i>	80	92
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Neosilurus hyrtlilii</i>	84	94
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Neosilurus hyrtlilii</i>	92	104
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Neosilurus hyrtlilii</i>	95	105
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Neosilurus hyrtlilii</i>	95	106
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Neosilurus hyrtlilii</i>	97	110
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Neosilurus hyrtlilii</i>	101	111
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Neosilurus hyrtlilii</i>	102	113
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Neosilurus hyrtlilii</i>	105	117
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Neosilurus hyrtlilii</i>	105	120
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Neosilurus hyrtlilii</i>	110	120
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Neosilurus hyrtlilii</i>	107	122

Site Name	Gear Type	Rep- licate	Date	Time In	Time Out	Habitat Type	Species	Standard Length (mm)	Total length (mm)
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Neosilurus hyrtlilii</i>	110	123
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Neosilurus hyrtlilii</i>	110	125
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Neosilurus hyrtlilii</i>	115	126
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Neosilurus hyrtlilii</i>	125	144
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Neosilurus hyrtlilii</i>	129	144
Site 12 Pool	Fyke	1	28/06/2020	17:00	8:30	Pool	<i>Neosilurus hyrtlilii</i>	150	162
Mundagoora	Fyke	1	27/06/2020	16:00	8:30	Pool	<i>Leiopotherapon unicolor</i>	104	126
Mundagoora	Fyke	1	27/06/2020	16:00	8:30	Pool	<i>Melanotaenia australis</i>	21	26
Mundagoora	Fyke	1	27/06/2020	16:00	8:30	Pool	<i>Melanotaenia australis</i>	21	26
Mundagoora	Fyke	1	27/06/2020	16:00	8:30	Pool	<i>Melanotaenia australis</i>	23	26
Mundagoora	Fyke	1	27/06/2020	16:00	8:30	Pool	<i>Melanotaenia australis</i>	23	27
Mundagoora	Fyke	1	27/06/2020	16:00	8:30	Pool	<i>Melanotaenia australis</i>	23	30
Mundagoora	Fyke	1	27/06/2020	16:00	8:30	Pool	<i>Melanotaenia australis</i>	24	31
Mundagoora	Fyke	1	27/06/2020	16:00	8:30	Pool	<i>Melanotaenia australis</i>	25	31
Mundagoora	Fyke	1	27/06/2020	16:00	8:30	Pool	<i>Melanotaenia australis</i>	26	32
Mundagoora	Fyke	1	27/06/2020	16:00	8:30	Pool	<i>Melanotaenia australis</i>	26	33
Mundagoora	Fyke	1	27/06/2020	16:00	8:30	Pool	<i>Melanotaenia australis</i>	26	33
Mundagoora	Fyke	1	27/06/2020	16:00	8:30	Pool	<i>Melanotaenia australis</i>	41	53
Mundagoora	Fyke	1	27/06/2020	16:00	8:30	Pool	<i>Melanotaenia australis</i>	43	53
Mundagoora	Fyke	1	27/06/2020	16:00	8:30	Pool	<i>Melanotaenia australis</i>	46	55
Mundagoora	Fyke	1	27/06/2020	16:00	8:30	Pool	<i>Melanotaenia australis</i>	45	57
Mundagoora	Fyke	1	27/06/2020	16:00	8:30	Pool	<i>Melanotaenia australis</i>	46	57
Mundagoora	Fyke	1	27/06/2020	16:00	8:30	Pool	<i>Melanotaenia australis</i>	46	57
Mundagoora	Fyke	1	27/06/2020	16:00	8:30	Pool	<i>Melanotaenia australis</i>	46	58
Mundagoora	Fyke	1	27/06/2020	16:00	8:30	Pool	<i>Melanotaenia australis</i>	48	61
Mundagoora	Fyke	1	27/06/2020	16:00	8:30	Pool	<i>Melanotaenia australis</i>	50	62

Site Name	Gear Type	Rep- licate	Date	Time In	Time Out	Habitat Type	Species	Standard Length (mm)	Total length (mm)
Mundagoora	Fyke	1	27/06/2020	16:00	8:30	Pool	<i>Melanotaenia australis</i>	50	63
Mundagoora	Fyke	1	27/06/2020	16:00	8:30	Pool	<i>Melanotaenia australis</i>	54	66
Mundagoora	Fyke	1	27/06/2020	16:00	8:30	Pool	<i>Melanotaenia australis</i>	53	67
Mundagoora	Fyke	1	27/06/2020	16:00	8:30	Pool	<i>Melanotaenia australis</i>	55	69
Mundagoora	Fyke	1	27/06/2020	16:00	8:30	Pool	<i>Melanotaenia australis</i>	55	70
Mundagoora	Fyke	1	27/06/2020	16:00	8:30	Pool	<i>Melanotaenia australis</i>	57	70
Mundagoora	Fyke	1	27/06/2020	16:00	8:30	Pool	<i>Melanotaenia australis</i>	59	74
Mundagoora	Fyke	1	27/06/2020	16:00	8:30	Pool	<i>Melanotaenia australis</i>	63	80
Mundagoora	Fyke	1	27/06/2020	16:00	8:30	Pool	<i>Melanotaenia australis</i>	64	80
Mundagoora	Fyke	1	27/06/2020	16:00	8:30	Pool	<i>Melanotaenia australis</i>	63	81
Mundagoora	Fyke	1	27/06/2020	16:00	8:30	Pool	<i>Melanotaenia australis</i>	65	82

Table C-3:. Fish standard length (SL) and total length (TL) for Iron Bridge pools in the late dry season 2020

Site Name	Gear Type	Rep	Date	Time Out	Habitat Type	Species	SL	TL
Cow Spring Pool	Fyke	1	11/12/2020	9:37	Pool	<i>Melanotaenia australis</i>	25	33
Cow Spring Pool	Fyke	1	11/12/2020	9:37	Pool	<i>Melanotaenia australis</i>	28	37
Cow Spring Pool	Fyke	1	11/12/2020	9:37	Pool	<i>Melanotaenia australis</i>	30	39
Cow Spring Pool	Fyke	1	11/12/2020	9:37	Pool	<i>Melanotaenia australis</i>	30	38
Cow Spring Pool	Fyke	1	11/12/2020	9:37	Pool	<i>Melanotaenia australis</i>	30	39
Cow Spring Pool	Fyke	1	11/12/2020	9:37	Pool	<i>Melanotaenia australis</i>	31	40
Cow Spring Pool	Fyke	1	11/12/2020	9:37	Pool	<i>Melanotaenia australis</i>	32	41
Cow Spring Pool	Fyke	1	11/12/2020	9:37	Pool	<i>Melanotaenia australis</i>	34	42
Cow Spring Pool	Fyke	1	11/12/2020	9:37	Pool	<i>Melanotaenia australis</i>	36	46
Cow Spring Pool	Fyke	1	11/12/2020	9:37	Pool	<i>Melanotaenia australis</i>	37	47
Cow Spring Pool	Fyke	1	11/12/2020	9:37	Pool	<i>Melanotaenia australis</i>	38	50
Cow Spring Pool	Fyke	1	11/12/2020	9:37	Pool	<i>Melanotaenia australis</i>	39	51
Cow Spring Pool	Fyke	1	11/12/2020	9:37	Pool	<i>Melanotaenia australis</i>	39	50
Cow Spring Pool	Fyke	1	11/12/2020	9:37	Pool	<i>Melanotaenia australis</i>	40	51
Cow Spring Pool	Fyke	1	11/12/2020	9:37	Pool	<i>Melanotaenia australis</i>	40	51
Cow Spring Pool	Fyke	1	11/12/2020	9:37	Pool	<i>Melanotaenia australis</i>	40	50
Cow Spring Pool	Fyke	1	11/12/2020	9:37	Pool	<i>Melanotaenia australis</i>	42	53
Cow Spring Pool	Fyke	1	11/12/2020	9:37	Pool	<i>Melanotaenia australis</i>	43	56
Cow Spring Pool	Fyke	1	11/12/2020	9:37	Pool	<i>Melanotaenia australis</i>	45	57
Cow Spring Pool	Fyke	1	11/12/2020	9:37	Pool	<i>Melanotaenia australis</i>	47	61
Cow Spring Pool	Fyke	1	11/12/2020	9:37	Pool	<i>Melanotaenia australis</i>	48	60

Site Name	Gear Type	Rep	Date	Time Out	Habitat Type	Species	SL	TL
Cow Spring Pool	Fyke	1	11/12/2020	9:37	Pool	<i>Melanotaenia australis</i>	50	63
Cow Spring Pool	Fyke	1	11/12/2020	9:37	Pool	<i>Melanotaenia australis</i>	55	72
Cow Spring Pool	Fyke	1	11/12/2020	9:37	Pool	<i>Melanotaenia australis</i>	70	85
Cow Spring Pool	Fyke	1	11/12/2020	9:37	Pool	<i>Melanotaenia australis</i>	72	92
Cow Spring Pool	Fyke	1	11/12/2020	9:37	Pool	<i>Melanotaenia australis</i>	75	94
Cow Spring Pool	Fyke	1	11/12/2020	9:37	Pool	<i>Melanotaenia australis</i>	81	112
Cow Spring Pool	Fyke	1	11/12/2020	9:37	Pool	<i>Melanotaenia australis</i>	83	112
Cow Spring Pool	Fyke	1	11/12/2020	9:37	Pool	<i>Melanotaenia australis</i>	86	110
Cow Spring Pool	Fyke	1	11/12/2020	9:37	Pool	<i>Melanotaenia australis</i>	87	111
Mundagoora Pool	Fyke	1	9/12/2020	9:24	Pool	<i>Melanotaenia australis</i>	20	25
Mundagoora Pool	Fyke	1	9/12/2020	9:24	Pool	<i>Melanotaenia australis</i>	25	32
Mundagoora Pool	Fyke	1	9/12/2020	9:24	Pool	<i>Melanotaenia australis</i>	26	33
Mundagoora Pool	Fyke	1	9/12/2020	9:24	Pool	<i>Melanotaenia australis</i>	28	32
Mundagoora Pool	Fyke	1	9/12/2020	9:24	Pool	<i>Melanotaenia australis</i>	32	40
Mundagoora Pool	Fyke	1	9/12/2020	9:24	Pool	<i>Melanotaenia australis</i>	33	43
Mundagoora Pool	Fyke	1	9/12/2020	9:24	Pool	<i>Melanotaenia australis</i>	33	41
Mundagoora Pool	Fyke	1	9/12/2020	9:24	Pool	<i>Melanotaenia australis</i>	34	43
Mundagoora Pool	Fyke	1	9/12/2020	9:24	Pool	<i>Melanotaenia australis</i>	35	45
Mundagoora Pool	Fyke	1	9/12/2020	9:24	Pool	<i>Melanotaenia australis</i>	35	43
Mundagoora Pool	Fyke	1	9/12/2020	9:24	Pool	<i>Melanotaenia australis</i>	35	42
Mundagoora Pool	Fyke	1	9/12/2020	9:24	Pool	<i>Melanotaenia australis</i>	36	44
Mundagoora Pool	Fyke	1	9/12/2020	9:24	Pool	<i>Melanotaenia australis</i>	36	47

Site Name	Gear Type	Rep	Date	Time Out	Habitat Type	Species	SL	TL
Mundagoora Pool	Fyke	1	9/12/2020	9:24	Pool	<i>Melanotaenia australis</i>	37	74
Mundagoora Pool	Fyke	1	9/12/2020	9:24	Pool	<i>Melanotaenia australis</i>	37	46
Mundagoora Pool	Fyke	1	9/12/2020	9:24	Pool	<i>Melanotaenia australis</i>	38	50
Mundagoora Pool	Fyke	1	9/12/2020	9:24	Pool	<i>Melanotaenia australis</i>	39	51
Mundagoora Pool	Fyke	1	9/12/2020	9:24	Pool	<i>Melanotaenia australis</i>	40	51
Mundagoora Pool	Fyke	1	9/12/2020	9:24	Pool	<i>Melanotaenia australis</i>	43	55
Mundagoora Pool	Fyke	1	9/12/2020	9:24	Pool	<i>Melanotaenia australis</i>	50	61
Mundagoora Pool	Fyke	1	9/12/2020	9:24	Pool	<i>Melanotaenia australis</i>	57	70
Mundagoora Pool	Fyke	1	9/12/2020	9:24	Pool	<i>Melanotaenia australis</i>	58	71
Mundagoora Pool	Fyke	1	9/12/2020	9:24	Pool	<i>Melanotaenia australis</i>	60	74
Mundagoora Pool	Fyke	1	9/12/2020	9:24	Pool	<i>Melanotaenia australis</i>	62	76
Site 12 Pool	Fyke	1	10/12/2020	10:00	Pool	<i>Leiopotherapon unicolor</i>	34	41
Site 12 Pool	Fyke	1	10/12/2020	10:00	Pool	<i>Melanotaenia australis</i>	48	60
Site 12 Pool	Fyke	1	10/12/2020	10:00	Pool	<i>Melanotaenia australis</i>	49	63
Site 12 Pool	Fyke	1	10/12/2020	10:00	Pool	<i>Melanotaenia australis</i>	49	61
Site 12 Pool	Fyke	1	10/12/2020	10:00	Pool	<i>Leiopotherapon unicolor</i>	50	62
Site 12 Pool	Fyke	1	10/12/2020	10:00	Pool	<i>Melanotaenia australis</i>	50	61
Site 12 Pool	Fyke	1	10/12/2020	10:00	Pool	<i>Melanotaenia australis</i>	50	63
Site 12 Pool	Fyke	1	10/12/2020	10:00	Pool	<i>Melanotaenia australis</i>	53	66
Site 12 Pool	Fyke	1	10/12/2020	10:00	Pool	<i>Leiopotherapon unicolor</i>	53	67
Site 12 Pool	Fyke	1	10/12/2020	10:00	Pool	<i>Melanotaenia australis</i>	53	65
Site 12 Pool	Fyke	1	10/12/2020	10:00	Pool	<i>Melanotaenia australis</i>	55	70
Site 12 Pool	Fyke	1	10/12/2020	10:00	Pool	<i>Melanotaenia australis</i>	55	69
Site 12 Pool	Fyke	1	10/12/2020	10:00	Pool	<i>Melanotaenia australis</i>	55	69
Site 12 Pool	Fyke	1	10/12/2020	10:00	Pool	<i>Melanotaenia australis</i>	55	70

Site Name	Gear Type	Rep	Date	Time Out	Habitat Type	Species	SL	TL
Site 12 Pool	Fyke	1	10/12/2020	10:00	Pool	<i>Melanotaenia australis</i>	58	71
Site 12 Pool	Fyke	1	10/12/2020	10:00	Pool	<i>Melanotaenia australis</i>	62	76
Site 12 Pool	Fyke	1	10/12/2020	10:00	Pool	<i>Leiopotherapon unicolor</i>	62	75
Site 12 Pool	Fyke	1	10/12/2020	10:00	Pool	<i>Leiopotherapon unicolor</i>	67	81
Site 12 Pool	Fyke	1	10/12/2020	10:00	Pool	<i>Leiopotherapon unicolor</i>	71	84
Site 12 Pool	Fyke	1	10/12/2020	10:00	Pool	<i>Leiopotherapon unicolor</i>	72	85
Site 12 Pool	Fyke	1	10/12/2020	10:00	Pool	<i>Leiopotherapon unicolor</i>	75	90
Site 12 Pool	Fyke	1	10/12/2020	10:00	Pool	<i>Leiopotherapon unicolor</i>	75	92
Site 12 Pool	Fyke	1	10/12/2020	10:00	Pool	<i>Leiopotherapon unicolor</i>	80	98
Site 12 Pool	Fyke	1	10/12/2020	10:00	Pool	<i>Neosilurus hyrtlii</i>	80	89
Site 12 Pool	Fyke	1	10/12/2020	10:00	Pool	<i>Leiopotherapon unicolor</i>	81	96
Site 12 Pool	Fyke	1	10/12/2020	10:00	Pool	<i>Neosilurus hyrtlii</i>	81	90
Site 12 Pool	Fyke	1	10/12/2020	10:00	Pool	<i>Neosilurus hyrtlii</i>	83	93
Site 12 Pool	Fyke	1	10/12/2020	10:00	Pool	<i>Neosilurus hyrtlii</i>	87	96

Table C-4.: Fish standard length (SL) and total length (TL) for Iron Bridge pools in the Late Wet season 2021

Site Name	Gear Type	Rep	Date	Habitat Type	Species	SL	TL
Cent Creek	Fyke	1	23/05/2021	Pool	Rainbow	30	39
Cent Creek	Fyke	1	23/05/2021	Pool	Rainbow	38	50
Cent Creek	Fyke	1	23/05/2021	Pool	Rainbow	49	62
Cent Creek	Fyke	1	23/05/2021	Pool	Rainbow	49	65
Cent Creek	Fyke	1	23/05/2021	Pool	Rainbow	50	62
Cent Creek	Fyke	1	23/05/2021	Pool	Rainbow	79	96
Cent Creek	Fyke	1	23/05/2021	Pool	Rainbow	80	100
Cent Creek	Fyke	1	23/05/2021	Pool	Spangled	39	47
Cent Creek	Fyke	1	23/05/2021	Pool	Spangled	42	54
Cent Creek	Fyke	1	23/05/2021	Pool	Spangled	42	53

Site Name	Gear Type	Rep	Date	Habitat Type	Species	S L	TL
Cent Creek	Fyke	1	23/05/2021	Pool	Spangled	43	53
Cent Creek	Fyke	1	23/05/2021	Pool	Spangled	47	57
Cent Creek	Fyke	1	23/05/2021	Pool	Spangled	47	58
Cent Creek	Fyke	1	23/05/2021	Pool	Spangled	47	57
Cent Creek	Fyke	1	23/05/2021	Pool	Spangled	49	60
Cent Creek	Fyke	1	23/05/2021	Pool	Spangled	50	62
Cent Creek	Fyke	1	23/05/2021	Pool	Spangled	50	62
Cent Creek	Fyke	1	23/05/2021	Pool	Spangled	55	104
Cent Creek	Fyke	1	23/05/2021	Pool	Spangled	55	66
Cent Creek	Fyke	1	23/05/2021	Pool	Spangled	80	97
Mundagoora Pool	Fyke	1	22/05/2021	Pool	Rainbow	23	31
Mundagoora Pool	Fyke	1	22/05/2021	Pool	Rainbow	30	36
Mundagoora Pool	Fyke	1	22/05/2021	Pool	Rainbow	31	43
Mundagoora Pool	Fyke	1	22/05/2021	Pool	Rainbow	32	41
Mundagoora Pool	Fyke	1	22/05/2021	Pool	Rainbow	32	40
Mundagoora Pool	Fyke	1	22/05/2021	Pool	Rainbow	32	41
Mundagoora Pool	Fyke	1	22/05/2021	Pool	Rainbow	32	40
Mundagoora Pool	Fyke	1	22/05/2021	Pool	Rainbow	32	39
Mundagoora Pool	Fyke	1	22/05/2021	Pool	Rainbow	33	43
Mundagoora Pool	Fyke	1	22/05/2021	Pool	Rainbow	33	41
Mundagoora Pool	Fyke	1	22/05/2021	Pool	Rainbow	33	42
Mundagoora Pool	Fyke	1	22/05/2021	Pool	Rainbow	34	45
Mundagoora Pool	Fyke	1	22/05/2021	Pool	Rainbow	34	40
Mundagoora Pool	Fyke	1	22/05/2021	Pool	Rainbow	34	42
Mundagoora Pool	Fyke	1	22/05/2021	Pool	Rainbow	34	43
Mundagoora Pool	Fyke	1	22/05/2021	Pool	Rainbow	34	42
Mundagoora Pool	Fyke	1	22/05/2021	Pool	Rainbow	34	43
Mundagoora Pool	Fyke	1	22/05/2021	Pool	Rainbow	34	42
Mundagoora Pool	Fyke	1	22/05/2021	Pool	Rainbow	34	43

Site Name	Gear Type	Rep	Date	Habitat Type	Species	S L	TL
Mundagoora Pool	Fyke	1	22/05/2021	Pool	Rainbow	35	46
Mundagoora Pool	Fyke	1	22/05/2021	Pool	Rainbow	36	46
Mundagoora Pool	Fyke	1	22/05/2021	Pool	Rainbow	37	47
Mundagoora Pool	Fyke	1	22/05/2021	Pool	Rainbow	38	47
Mundagoora Pool	Fyke	1	22/05/2021	Pool	Rainbow	38	50
Mundagoora Pool	Fyke	1	22/05/2021	Pool	Rainbow	38	47
Mundagoora Pool	Fyke	1	22/05/2021	Pool	Rainbow	53	67
Mundagoora Pool	Fyke	1	22/05/2021	Pool	Rainbow	57	73
Mundagoora Pool	Fyke	1	22/05/2021	Pool	Rainbow	70	90
Site 12 Pool	Fyke	1	24/05/2021	Pool	Spangled	24	31
Site 12 Pool	Fyke	1	24/05/2021	Pool	Spangled	25	33
Site 12 Pool	Fyke	1	24/05/2021	Pool	Rainbow	26	34
Site 12 Pool	Fyke	1	24/05/2021	Pool	Rainbow	27	35
Site 12 Pool	Fyke	1	24/05/2021	Pool	Rainbow	28	36
Site 12 Pool	Fyke	1	24/05/2021	Pool	Rainbow	28	34
Site 12 Pool	Fyke	1	24/05/2021	Pool	Rainbow	29	38
Site 12 Pool	Fyke	1	24/05/2021	Pool	Rainbow	29	38
Site 12 Pool	Fyke	1	24/05/2021	Pool	Spangled	30	38
Site 12 Pool	Fyke	1	24/05/2021	Pool	Spangled	30	39
Site 12 Pool	Fyke	1	24/05/2021	Pool	Spangled	30	40
Site 12 Pool	Fyke	1	24/05/2021	Pool	Spangled	33	42
Site 12 Pool	Fyke	1	24/05/2021	Pool	Rainbow	34	44
Site 12 Pool	Fyke	1	24/05/2021	Pool	Rainbow	34	44
Site 12 Pool	Fyke	1	24/05/2021	Pool	Rainbow	34	43
Site 12 Pool	Fyke	1	24/05/2021	Pool	Rainbow	34	42
Site 12 Pool	Fyke	1	24/05/2021	Pool	Rainbow	34	43
Site 12 Pool	Fyke	1	24/05/2021	Pool	Rainbow	34	44

Site Name	Gear Type	Rep	Date	Habitat Type	Species	SL	TL
Site 12 Pool	Fyke	1	24/05/2021	Pool	Spangled	34	45
Site 12 Pool	Fyke	1	24/05/2021	Pool	Spangled	34	43
Site 12 Pool	Fyke	1	24/05/2021	Pool	Rainbow	35	46
Site 12 Pool	Fyke	1	24/05/2021	Pool	Spangled	36	47
Site 12 Pool	Fyke	1	24/05/2021	Pool	Rainbow	40	53
Site 12 Pool	Fyke	1	24/05/2021	Pool	Spangled	40	50
Site 12 Pool	Fyke	1	24/05/2021	Pool	Spangled	40	53
Site 12 Pool	Fyke	1	24/05/2021	Pool	Spangled	42	55
Site 12 Pool	Fyke	1	24/05/2021	Pool	Spangled	42	53
Site 12 Pool	Fyke	1	24/05/2021	Pool	Rainbow	43	55
Site 12 Pool	Fyke	1	24/05/2021	Pool	Rainbow	45	58
Site 12 Pool	Fyke	1	24/05/2021	Pool	Rainbow	57	72
Site 12 Pool	Fyke	1	24/05/2021	Pool	Rainbow	60	75
Site 12 Pool	Fyke	1	24/05/2021	Pool	Rainbow	62	77
Site 12 Pool	Fyke	1	24/05/2021	Pool	Spangled	70	85
Site 12 Pool	Fyke	1	24/05/2021	Pool	Catfish	70	80
Site 12 Pool	Fyke	1	24/05/2021	Pool	Spangled	75	92
Site 12 Pool	Fyke	1	24/05/2021	Pool	Spangled	81	100
Site 12 Pool	Fyke	1	24/05/2021	Pool	Spangled	87	106

Table C-5: Fish standard length (SL) and total length (TL) for Iron Bridge pools in the Late Dry season 2021

Site Name	Gear Type	Rep	Date	Time In	Time Out	Habitat Type	Species	Standard Length (mm)	Total Length (mm)
Cow Spring Pool	Fyke	1	7/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	62	79
Cow Spring Pool	Fyke	1	7/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	57	71
Cow Spring Pool	Fyke	1	7/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	35	45

Site Name	Gear Type	Rep	Date	Time In	Time Out	Habitat Type	Species	Standard Length (mm)	Total Length (mm)
Cow Spring Pool	Fyke	1	7/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	30	39
Cow Spring Pool	Fyke	1	7/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	36	47
Cow Spring Pool	Fyke	1	7/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	39	50
Cow Spring Pool	Fyke	1	7/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	30	39
Cow Spring Pool	Fyke	1	7/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	65	84
Cow Spring Pool	Fyke	1	7/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	68	83
Cow Spring Pool	Fyke	1	7/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	75	93
Cow Spring Pool	Fyke	1	7/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	33	43
Cow Spring Pool	Fyke	1	7/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	25	35
Cow Spring Pool	Fyke	1	7/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	74	92
Cow Spring Pool	Fyke	1	7/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	41	54
Cow Spring Pool	Fyke	1	7/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	22	27
Cow Spring Pool	Fyke	1	7/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	21	27
Cow Spring Pool	Fyke	1	7/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	26	34
Cow Spring Pool	Fyke	1	7/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	19	23
Cow Spring Pool	Fyke	1	7/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	24	31
Cow Spring Pool	Fyke	1	7/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	31	40
Cow Spring Pool	Fyke	1	7/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	68	86
Cow Spring Pool	Fyke	1	7/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	60	75
Cow Spring Pool	Fyke	1	7/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	38	50
Cow Spring Pool	Fyke	1	7/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	30	39
Cow Spring Pool	Fyke	1	7/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	40	51

Site Name	Gear Type	Rep	Date	Time In	Time Out	Habitat Type	Species	Standard Length (mm)	Total Length (mm)
Cow Spring Pool	Fyke	1	7/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	34	44
Cow Spring Pool	Fyke	1	7/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	52	63
Cow Spring Pool	Fyke	1	7/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	40	50
Cow Spring Pool	Fyke	1	7/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	38	47
Cow Spring Pool	Fyke	1	7/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	42	53
Mundagoora Pool	Fyke	1	7/10/2021	16:00	8:30	Pool	<i>Melanotaenia australis</i>	28	36
Mundagoora Pool	Fyke	1	7/10/2021	16:00	8:30	Pool	<i>Melanotaenia australis</i>	24	33
Mundagoora Pool	Fyke	2	8/10/2021	16:00	8:30	Pool	<i>Melanotaenia australis</i>	29	39
Mundagoora Pool	Fyke	3	9/10/2021	16:00	8:30	Pool	<i>Melanotaenia australis</i>	29	38
Mundagoora Pool	Fyke	1	7/10/2021	16:00	8:30	Pool	<i>Melanotaenia australis</i>	39	50
Mundagoora Pool	Fyke	1	7/10/2021	16:00	8:30	Pool	<i>Melanotaenia australis</i>	35	44
Mundagoora Pool	Fyke	1	7/10/2021	16:00	8:30	Pool	<i>Melanotaenia australis</i>	50	62
Mundagoora Pool	Fyke	1	7/10/2021	16:00	8:30	Pool	<i>Melanotaenia australis</i>	42	52
Mundagoora Pool	Fyke	1	7/10/2021	16:00	8:30	Pool	<i>Melanotaenia australis</i>	35	46
Mundagoora Pool	Fyke	1	7/10/2021	16:00	8:30	Pool	<i>Melanotaenia australis</i>	39	51
Mundagoora Pool	Fyke	1	7/10/2021	16:00	8:30	Pool	<i>Melanotaenia australis</i>	38	50
Mundagoora Pool	Fyke	1	7/10/2021	16:00	8:30	Pool	<i>Melanotaenia australis</i>	31	42
Mundagoora Pool	Fyke	1	7/10/2021	16:00	8:30	Pool	<i>Melanotaenia australis</i>	36	47
Mundagoora Pool	Fyke	1	7/10/2021	16:00	8:30	Pool	<i>Melanotaenia australis</i>	31	40
Mundagoora Pool	Fyke	1	7/10/2021	16:00	8:30	Pool	<i>Melanotaenia australis</i>	34	44
Mundagoora Pool	Fyke	1	7/10/2021	16:00	8:30	Pool	<i>Melanotaenia australis</i>	56	71
Mundagoora Pool	Fyke	1	7/10/2021	16:00	8:30	Pool	<i>Melanotaenia australis</i>	57	71

Site Name	Gear Type	Rep	Date	Time In	Time Out	Habitat Type	Species	Standard Length (mm)	Total Length (mm)
Mundagoora Pool	Fyke	1	7/10/2021	16:00	8:30	Pool	<i>Melanotaenia australis</i>	30	40
Mundagoora Pool	Fyke	1	7/10/2021	16:00	8:30	Pool	<i>Melanotaenia australis</i>	34	44
Mundagoora Pool	Fyke	1	7/10/2021	16:00	8:30	Pool	<i>Melanotaenia australis</i>	32	42
Mundagoora Pool	Fyke	1	7/10/2021	16:00	8:30	Pool	<i>Melanotaenia australis</i>	56	75
Mundagoora Pool	Fyke	1	7/10/2021	16:00	8:30	Pool	<i>Melanotaenia australis</i>	31	40
Mundagoora Pool	Fyke	1	7/10/2021	16:00	8:30	Pool	<i>Melanotaenia australis</i>	40	51
Mundagoora Pool	Fyke	1	7/10/2021	16:00	8:30	Pool	<i>Melanotaenia australis</i>	45	56
Mundagoora Pool	Fyke	1	7/10/2021	16:00	8:30	Pool	<i>Melanotaenia australis</i>	32	44
Mundagoora Pool	Fyke	1	7/10/2021	16:00	8:30	Pool	<i>Melanotaenia australis</i>	38	47
Mundagoora Pool	Fyke	1	7/10/2021	16:00	8:30	Pool	<i>Melanotaenia australis</i>	31	41
Mundagoora Pool	Fyke	1	7/10/2021	16:00	8:30	Pool	<i>Melanotaenia australis</i>	33	45
Mundagoora Pool	Fyke	1	7/10/2021	16:00	8:30	Pool	<i>Melanotaenia australis</i>	65	80
Mundagoora Pool	Fyke	2	8/10/2021	16:00	8:30	Pool	<i>Melanotaenia australis</i>	70	89
Mundagoora Pool	Fyke	1	7/10/2021	16:00	8:30	Pool	<i>Leiopotherapon unicolor</i>	95	115
Mundagoora Pool	Fyke	1	7/10/2021	16:00	8:30	Pool	<i>Leiopotherapon unicolor</i>	123	149
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Neosilurus hyrtlii</i>	106	117
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Neosilurus hyrtlii</i>	105	119
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Neosilurus hyrtlii</i>	112	120
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Neosilurus hyrtlii</i>	112	122
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Neosilurus hyrtlii</i>	119	134
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Neosilurus hyrtlii</i>	82	95

Site Name	Gear Type	Rep	Date	Time In	Time Out	Habitat Type	Species	Standard Length (mm)	Total Length (mm)
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Neosilurus hyrtlii</i>	120	134
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Neosilurus hyrtlii</i>	67	76
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Neosilurus hyrtlii</i>	84	92
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Neosilurus hyrtlii</i>	123	137
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Neosilurus hyrtlii</i>	90	99
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Neosilurus hyrtlii</i>	94	104
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Neosilurus hyrtlii</i>	96	108
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Neosilurus hyrtlii</i>	89	99
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Neosilurus hyrtlii</i>	90	100
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Neosilurus hyrtlii</i>	89	100
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Neosilurus hyrtlii</i>	120	134
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Neosilurus hyrtlii</i>	94	104
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Neosilurus hyrtlii</i>	92	103
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Neosilurus hyrtlii</i>	77	86
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Neosilurus hyrtlii</i>	74	84
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Neosilurus hyrtlii</i>	85	96
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	39	48
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	34	42
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	47	58
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	35	44
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	38	48
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	37	46

Site Name	Gear Type	Rep	Date	Time In	Time Out	Habitat Type	Species	Standard Length (mm)	Total Length (mm)
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	42	53
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	52	63
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	34	42
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	36	46
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	36	46
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	35	42
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	36	45
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	30	39
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	35	46
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	45	56
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	34	44
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	37	46
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	40	53
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	39	48
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	34	43
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	36	46
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	32	37
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	40	52
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	59	74
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	63	79
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	57	71
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	30	43

Site Name	Gear Type	Rep	Date	Time In	Time Out	Habitat Type	Species	Standard Length (mm)	Total Length (mm)
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	33	41
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Melanotaenia australis</i>	48	59
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Leiopotherapon unicolor</i>	155	182
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Leiopotherapon unicolor</i>	103	125
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Leiopotherapon unicolor</i>	90	105
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Leiopotherapon unicolor</i>	75	92
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Leiopotherapon unicolor</i>	57	71
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Leiopotherapon unicolor</i>	100	119
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Leiopotherapon unicolor</i>	72	89
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Leiopotherapon unicolor</i>	94	113
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Leiopotherapon unicolor</i>	48	56
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Leiopotherapon unicolor</i>	62	75
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Leiopotherapon unicolor</i>	60	75
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Leiopotherapon unicolor</i>	83	99
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Leiopotherapon unicolor</i>	62	78
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Leiopotherapon unicolor</i>	66	80
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Leiopotherapon unicolor</i>	59	71

Site Name	Gear Type	Rep	Date	Time In	Time Out	Habitat Type	Species	Standard Length (mm)	Total Length (mm)
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Leiopotherapon unicolor</i>	69	81
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Leiopotherapon unicolor</i>	59	71
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Leiopotherapon unicolor</i>	52	63
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Leiopotherapon unicolor</i>	67	81
Site 12 Pool	Fyke	1	8/10/2021	17:00	9:30	Pool	<i>Leiopotherapon unicolor</i>	63	76

Table C-6. Fish standard length (SL) and total length (TL) for Iron Bridge pools in the Late Wet 2022.

Site Name	Gear Type	Rep	Date	In	Out	Habitat	Common Name	Species	CL	TL
Mundagoora Pool	Fyke	1	21/06/2022	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	34	42
Mundagoora Pool	Fyke	1	21/06/2022	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	52	63
Mundagoora Pool	Fyke	1	21/06/2022	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	32	41
Mundagoora Pool	Fyke	1	21/06/2022	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	55	68
Mundagoora Pool	Fyke	1	21/06/2022	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	35	45
Mundagoora Pool	Fyke	1	21/06/2022	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	17	21
Mundagoora Pool	Fyke	1	21/06/2022	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	43	52
Mundagoora Pool	Fyke	1	21/06/2022	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	23	31
Mundagoora Pool	Fyke	1	21/06/2022	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	21	26
Mundagoora Pool	Fyke	1	21/06/2022	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	25	32
Mundagoora Pool	Fyke	1	21/06/2022	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	39	47

Site Name	Gear Type	Rep	Date	In	Out	Habitat	Common Name	Species	CL	TL
Mundagoora Pool	Fyke	1	21/06/2022	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	59	71
Mundagoora Pool	Fyke	1	21/06/2022	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	63	77
Mundagoora Pool	Fyke	1	21/06/2022	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	34	43
Mundagoora Pool	Fyke	1	21/06/2022	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	45	58
Mundagoora Pool	Fyke	1	21/06/2022	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	33	41
Mundagoora Pool	Fyke	1	21/06/2022	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	60	76
Mundagoora Pool	Fyke	1	21/06/2022	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	40	50
Mundagoora Pool	Fyke	1	21/06/2022	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	34	42
Mundagoora Pool	Fyke	1	21/06/2022	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	47	58
Mundagoora Pool	Fyke	1	21/06/2022	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	44	55
Mundagoora Pool	Fyke	1	21/06/2022	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	33	41
Mundagoora Pool	Fyke	1	21/06/2022	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	52	64
Mundagoora Pool	Fyke	1	21/06/2022	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	47	57
Mundagoora Pool	Fyke	1	21/06/2022	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	31	38
Mundagoora Pool	Fyke	1	21/06/2022	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	55	70
Mundagoora Pool	Fyke	1	21/06/2022	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	52	64
Mundagoora Pool	Fyke	1	21/06/2022	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	27	33
Mundagoora Pool	Fyke	1	21/06/2022	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	30	37
Mundagoora Pool	Fyke	1	21/06/2022	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	32	40
Mundagoora Pool	Fyke	1	21/06/2022	16:00	9:20	Pool	Spangled Perch	<i>Leiopotherapon unicolor</i>	51	64
Mundagoora Pool	Fyke	1	21/06/2022	16:00	9:20	Pool	Spangled Perch	<i>Leiopotherapon unicolor</i>	183	207
Mundagoora Pool	Fyke	1	21/06/2022	16:00	9:20	Pool	Spangled Perch	<i>Leiopotherapon unicolor</i>	140	170

Site Name	Gear Type	Rep	Date	In	Out	Habitat	Common Name	Species	CL	TL
Mundagoora Pool	Fyke	1	21/06/2022	16:00	9:20	Pool	Spangled Perch	<i>Leiopotherapon unicolor</i>	115	137
Mundagoora Pool	Fyke	1	21/06/2022	16:00	9:20	Pool	Spangled Perch	<i>Leiopotherapon unicolor</i>	125	-
Mundagoora Pool	Fyke	1	21/06/2022	16:00	9:20	Pool	Spangled Perch	<i>Leiopotherapon unicolor</i>	100	123
Mundagoora Pool	Fyke	1	21/06/2022	16:00	9:20	Pool	Spangled Perch	<i>Leiopotherapon unicolor</i>	90	110
Cow Spring	Fyke	1	23/06/2022	16:30	10:00	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	30	39
Cow Spring	Fyke	1	23/06/2022	16:30	10:00	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	44	54
Cow Spring	Fyke	1	23/06/2022	16:30	10:00	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	40	50
Cow Spring	Fyke	1	23/06/2022	16:30	10:00	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	43	52
Site 12 Pool	Fyke	1	24/06/2022	16:30	8:30	Pool	Spangled Perch	<i>Leiopotherapon unicolor</i>	62	77
Site 12 Pool	Fyke	1	24/06/2022	16:30	8:30	Pool	Spangled Perch	<i>Leiopotherapon unicolor</i>	66	77
Site 12 Pool	Fyke	1	24/06/2022	16:30	8:30	Pool	Spangled Perch	<i>Leiopotherapon unicolor</i>	73	85
Site 12 Pool	Fyke	1	24/06/2022	16:30	8:30	Pool	Spangled Perch	<i>Leiopotherapon unicolor</i>	58	69
Site 12 Pool	Fyke	1	24/06/2022	16:30	8:30	Pool	Spangled Perch	<i>Leiopotherapon unicolor</i>	55	65
Site 12 Pool	Fyke	1	24/06/2022	16:30	8:30	Pool	Spangled Perch	<i>Leiopotherapon unicolor</i>	47	57
Site 12 Pool	Fyke	1	24/06/2022	16:30	8:30	Pool	Spangled Perch	<i>Leiopotherapon unicolor</i>	52	63
Site 12 Pool	Fyke	1	24/06/2022	16:30	8:30	Pool	Spangled Perch	<i>Leiopotherapon unicolor</i>	51	61
Site 12 Pool	Fyke	1	24/06/2022	16:30	8:30	Pool	Spangled Perch	<i>Leiopotherapon unicolor</i>	86	102
Site 12 Pool	Fyke	1	24/06/2022	16:30	8:30	Pool	Spangled Perch	<i>Leiopotherapon unicolor</i>	91	109
Site 12 Pool	Fyke	1	24/06/2022	16:30	8:30	Pool	Spangled Perch	<i>Leiopotherapon unicolor</i>	59	71
Site 12 Pool	Fyke	1	24/06/2022	16:30	8:30	Pool	Spangled Perch	<i>Leiopotherapon unicolor</i>	52	65
Site 12 Pool	Fyke	1	24/06/2022	16:30	8:30	Pool	Spangled Perch	<i>Leiopotherapon unicolor</i>	46	56
Site 12 Pool	Fyke	1	24/06/2022	16:30	8:30	Pool	Spangled Perch	<i>Leiopotherapon unicolor</i>	54	63

Site Name	Gear Type	Rep	Date	In	Out	Habitat	Common Name	Species	CL	TL
Site 12 Pool	Fyke	1	24/06/2022	16:30	8:30	Pool	Spangled Perch	<i>Leiopotherapon unicolor</i>	53	66
Site 12 Pool	Fyke	1	24/06/2022	16:30	8:30	Pool	Spangled Perch	<i>Leiopotherapon unicolor</i>	53	60
Site 12 Pool	Fyke	1	24/06/2022	16:30	8:30	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	51	64
Site 12 Pool	Fyke	1	24/06/2022	16:30	8:30	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	53	65
Site 12 Pool	Fyke	1	24/06/2022	16:30	8:30	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	46	57
Site 12 Pool	Fyke	1	24/06/2022	16:30	8:30	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	50	63
Site 12 Pool	Fyke	1	24/06/2022	16:30	8:30	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	50	63
Site 12 Pool	Fyke	1	24/06/2022	16:30	8:30	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	43	55
Site 12 Pool	Fyke	1	24/06/2022	16:30	8:30	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	47	59

Table C-7.: Fish standard length (SL) and total length (TL) for Iron Bridge pools in the Late Dry 2022.

Site Name	Gear Type	Rep	Date	In	Out	Habitat	Common Name	Species	CL	TL
Mundagoora Pool	Fyke	1	22/10/22	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	41	48
Mundagoora Pool	Fyke	1	22/10/22	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	45	52
Mundagoora Pool	Fyke	1	22/10/22	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	47	55
Mundagoora Pool	Fyke	1	22/10/22	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	43	47
Mundagoora Pool	Fyke	1	22/10/22	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	45	52
Mundagoora Pool	Fyke	1	22/10/22	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	63	74
Mundagoora Pool	Fyke	1	22/10/22	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	55	64
Mundagoora Pool	Fyke	1	22/10/22	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	36	42
Mundagoora Pool	Fyke	1	22/10/22	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	47	53
Mundagoora Pool	Fyke	1	22/10/22	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	42	48

Site Name	Gear Type	Rep	Date	In	Out	Habitat	Common Name	Species	CL	TL
Mundagoora Pool	Fyke	1	22/10/22	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	42	50
Mundagoora Pool	Fyke	1	22/10/22	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	45	52
Mundagoora Pool	Fyke	1	22/10/22	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	44	52
Mundagoora Pool	Fyke	1	22/10/22	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	52	60
Mundagoora Pool	Fyke	1	22/10/22	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	47	55
Mundagoora Pool	Fyke	1	22/10/22	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	47	56
Mundagoora Pool	Fyke	1	22/10/22	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	63	74
Mundagoora Pool	Fyke	1	22/10/22	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	32	37
Mundagoora Pool	Fyke	1	22/10/22	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	52	60
Mundagoora Pool	Fyke	1	22/10/22	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	47	54
Mundagoora Pool	Fyke	1	22/10/22	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	67	77
Mundagoora Pool	Fyke	1	22/10/22	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	47	55
Mundagoora Pool	Fyke	1	22/10/22	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	34	43
Mundagoora Pool	Fyke	1	22/10/22	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	43	48
Mundagoora Pool	Fyke	1	22/10/22	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	67	80
Mundagoora Pool	Fyke	1	22/10/22	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	45	52
Mundagoora Pool	Fyke	1	22/10/22	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	52	60
Mundagoora Pool	Fyke	1	22/10/22	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	40	46
Mundagoora Pool	Fyke	1	22/10/22	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	67	76
Mundagoora Pool	Fyke	1	22/10/22	16:00	9:20	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	62	71
Mundagoora Pool	Fyke	1	22/10/22	16:00	9:20	Pool	Spangled Perch	<i>Leiopotherapon unicolor</i>	180	206
Mundagoora Pool	Fyke	1	22/10/22	16:00	9:20	Pool	Spangled Perch	<i>Leiopotherapon unicolor</i>	125	146

Site Name	Gear Type	Rep	Date	In	Out	Habitat	Common Name	Species	CL	TL
Mundagoora Pool	Fyke	1	22/10/22	16:00	9:20	Pool	Spangled Perch	<i>Leiopotherapon unicolor</i>	140	163
Cow Spring	Fyke	1	23/10/2022	16:30	10:00	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	52	68
Cow Spring	Fyke	1	23/10/2022	16:30	10:00	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	54	72
Cow Spring	Fyke	1	23/10/2022	16:30	10:00	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	52	68
Cow Spring	Fyke	1	23/10/2022	16:30	10:00	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	75	95
Cow Spring	Fyke	1	23/10/2022	16:30	8:30	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	63	78
Cow Spring	Fyke	1	23/10/2022	16:30	8:30	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	61	75
Cow Spring	Fyke	1	23/10/2022	16:30	8:30	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	43	54
Cow Spring	Fyke	1	23/10/2022	16:30	8:30	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	26	35
Cow Spring	Fyke	1	23/10/2022	16:30	8:30	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	62	75
Cow Spring	Fyke	1	23/10/2022	16:30	8:30	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	24	28
Cow Spring	Fyke	1	23/10/2022	16:30	8:30	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	46	59
Cow Spring	Fyke	1	23/10/2022	16:30	8:30	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	49	61
Cow Spring	Fyke	1	23/10/2022	16:30	8:30	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	25	32
Cow Spring	Fyke	1	23/10/2022	16:30	8:30	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	34	41
Cow Spring	Fyke	1	23/10/2022	16:30	8:30	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	33	41
Cow Spring	Fyke	1	23/10/2022	16:30	8:30	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	24	31
Cow Spring	Fyke	1	23/10/2022	16:30	8:30	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	28	35
Cow Spring	Fyke	1	23/10/2022	16:30	8:30	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	22	29
Cow Spring	Fyke	1	23/10/2022	16:30	8:30	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	38	47
Cow Spring	Fyke	1	23/10/2022	16:30	8:30	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	29	36
Cow Spring	Fyke	1	23/10/2022	16:30	8:30	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	23	27

Site Name	Gear Type	Rep	Date	In	Out	Habitat	Common Name	Species	CL	TL
Cow Spring	Fyke	1	23/10/2022	16:30	8:30	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	39	48
Cow Spring	Fyke	1	23/10/2022	16:30	8:30	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	39	5
Cow Spring	Fyke	1	23/10/2022	16:30	8:30	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	2	25
Cow Spring	Fyke	1	23/10/2022	16:30	8:30	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	32	41
Cow Spring	Fyke	1	23/10/2022	16:30	8:30	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	3	37
Cow Spring	Fyke	1	23/10/2022	16:30	8:30	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	35	5
Cow Spring	Fyke	1	23/10/2022	16:30	8:30	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	16	21
Cow Spring	Fyke	1	23/10/2022	16:30	8:30	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	3	37
Cow Spring	Fyke	1	23/10/2022	16:30	8:30	Pool	Rainbow Fish	<i>Melanotaenia australis</i>	24	31

APPENDIX D. MACROINVERTEBRATE DATA

Table D-1: Macroinvertebrate data for Late Wet 2020

			Site	Fig Pool	Fig Pool	Central Creek Pool	Central Creek Pool	South Star Pool	South Star Pool	Site 12	Site 12	Cow Spring Pool	Cow Spring Pool
			Habitat	Edge	Edge	Pool	Pool	Macrophyte	Macrophyte	Macrophyte	Edge	Macrophyte	Edge
			Replicate	1	2	1	2	1	2	1	2	1	2
			Date Sampled	24/06/2020	24/06/2020	25/06/2020	25/06/2020	26/06/2020	26/06/2020	28/06/2020	28/06/2020	29/06/2020	29/06/2020
			Sampled By	SK	SK	SK	SK	SK	SK	SK	SK	SK	SK
			Pick and ID By	SMJ	SMJ	SMJ	SMJ	SMJ	SMJ	SMJ	SMJ	SMJ	SMJ
			ID Date	27/07/2020	28/07/2020	28/07/2020	28/07/2020	29/07/2020	30/07/2020	30/07/2020	30/07/2020	30/07/2020	31/07/2020
SIGNAL2 Score	AusRivAS taxa code	Order	Family										
1		Hydrozoa	Hydrozoa										
3	IB029999	Hydrozoa	Oceaniidae										
2	IB019999	Hydrozoa	Hydridae									1	
		Hydrozoa	Olindiidae										
1	KG999999	Gastropoda	Gastropoda										
	-	Gastropoda	Ampullariidae										
4	KG069999	Gastropoda	Ancylidae					10				5	
3	KG039999	Gastropoda	Bithyniidae										
5	KG099999	Gastropoda	Glacidorbidae										
1	KG059999	Gastropoda	Lymnaeidae					12	4		1	7	
	KG109999	Gastropoda	Neritidae										
1	KG089999	Gastropoda	Physidae										
2	KG079999	Gastropoda	Planorbidae					3	8	3		3	
4	KG029999	Gastropoda	Tateidae										
4	KG049999	Gastropoda	Thiaridae										
4	KG019999	Gastropoda	Viviparidae										
2	QO219999	Oligochaeta	Oligochaeta				4	1	1	4	1	6	
	LP999999	Polychaeta	Polychaeta										
	-	Araneae	Araneae				1	1	1	2	1		
6	MM999999	Acarina	Acarina	10	3	2	2	5	21	14	14	11	8
		GROUP	Microcrustacea										
	OG999999	Cladocera	Cladocera					2	11			4	1
1	OF999999	Conchostraca	Conchostraca										

	OJ999999	Copepoda	Copepoda			1	5	6		3	4	2	2
	OH999999	Ostracoda	Ostracoda				1	15				16	
5	QCZZ9999	Coleoptera	Coleoptera										
3	QCAM9999	Coleoptera	Brentidae										
3	QC059999	Coleoptera	Carabidae										
2	QCAH9999	Coleoptera	Chrysomelidae										
2	QCAN9999	Coleoptera	Curculionidae										
2	QC099999	Coleoptera	Dytiscidae	9	6	2	7		2	2	3	2	
7	QC349999	Coleoptera	Elmidae										
2	QC119999	Coleoptera	Georissidae										
4	QC109999	Coleoptera	Gyrinidae										
2	QC069999	Coleoptera	Halplidae										
1	QC369999	Coleoptera	Heteroceridae										
3	QC139999	Coleoptera	Hydraenidae									1	
4	QCAO9999	Coleoptera	Hydrochidae			1	2	2				1	
2	QC119999	Coleoptera	Hydrophilidae	10	2	2	2			1	3		
1	QC079999	Coleoptera	Hygrobidae										
4	QC359999	Coleoptera	Limnichidae							1			
4	QC089999	Coleoptera	Noteridae										
6	QC379999	Coleoptera	Psephenidae										
10	QC399999	Coleoptera	Ptilodactylidae										
6	QC209999	Coleoptera	Scirtidae									4	
2	QC119999	Coleoptera	Spercheidae										
7	QC039999	Coleoptera	Sphaeriusidae										
3	QC189999	Coleoptera	Staphylinidae										
3	QDZZ9999	Diptera	Diptera										
8	QD229999	Diptera	Athericidae										
10	QD049999	Diptera	Blephariceridae										
4	QD099999	Diptera	Ceratopogonidae			7	9	3	2	4	2	10	
2	QD059999	Diptera	Chaoboridae										
3	QDAZ9999	Diptera	Chironomidae										
8	QDAA9999	Diptera	s-f Aphroteniinae										
3	QDAJ9999	Diptera	s-f Chironominae	23	25	16	26	9	20	21	3	25	22
6	QDAB9999	Diptera	s-f Diamesinae										
4	QDAF9999	Diptera	s-f Orthoclaadiinae			1						1	

6	QDAD9999	Diptera	s-f Podonominae										
4	QDAE9999	Diptera	s-f Tanypodinae			14	11	15	9	19	15	25	4
-		Diptera	Corethrellidae										
1	QD079999	Diptera	Culicidae	1	4				1			1	
7	QD069999	Diptera	Dixidae										
3	QD369999	Diptera	Dolichopodidae										
5	QD359999	Diptera	Empididae										
2	QD789999	Diptera	Ephydriidae			1	2						
1	QD899999	Diptera	Muscidae				1						
3	QD129999	Diptera	Psychodidae				1						
6	-	Diptera	Sciaridae										
2	QD459999	Diptera	Sciomyzidae									1	
5	QD109999	Diptera	Simuliidae										
2	QD249999	Diptera	Stratiomyidae			4	1			2	3	1	
2	QD439999	Diptera	Syrphidae										
3	QD239999	Diptera	Tabanidae				1						
6	QD039999	Diptera	Tanyderidae										
7	QD119999	Diptera	Thaumaleidae										
5	QD019999	Diptera	Tipulidae									1	
9	QE999999	Ephemeroptera	Ephemeroptera										
7	QE049999	Ephemeroptera	Ameletopsidae										
5	QE029999	Ephemeroptera	Baetidae					9	13	2	2	9	12
4	QE089999	Ephemeroptera	Caenidae			7	14	10	1	1		12	2
8	QE059999	Ephemeroptera	Coloburiscidae										
8	QE069999	Ephemeroptera	Leptophlebiidae										
10	-	Ephemeroptera	Nesameletidae										
8	QE039999	Ephemeroptera	Oniscigastridae										
4	QE099999	Ephemeroptera	Prosopistomatidae										
9	QE079999	Ephemeroptera	Teloganodidae										
2	QHZZ9999	Hemiptera	Hemiptera										
-		Hemiptera	Aphelocheiridae										
1	QH629999	Hemiptera	Belostomatidae									2	
2	QH659999	Hemiptera	Corixidae										
-		Hemiptera	Dipsocoridae										
5	QH649999	Hemiptera	Gelastocoridae										

4	QH579999	Hemiptera	Gerridae							2	2	2	
3	QH539999	Hemiptera	Hebridae		1						3		
3	QH549999	Hemiptera	Hydrometridae										
	QH589999	Hemiptera	Leptopodidae										
2	QH529999	Hemiptera	Mesoveliidae		1								1
2	QH659999	Hemiptera	Micronectidae					1			1		1
2	QH669999	Hemiptera	Naucoridae										
3	QH619999	Hemiptera	Nepidae		1	1							2
1	QH679999	Hemiptera	Notonectidae	2	3								
2	QH639999	Hemiptera	Ochteridae										
2	QH689999	Hemiptera	Pleidae			8	4	3		1	2	1	1
1	QH609999	Hemiptera	Saldidae										
3	QH569999	Hemiptera	Veliidae	1		4				1		1	
3	QO999999	Odonata	Odonata										
3	QO999997	Odonata	S.O. Zygoptera										
5	QO079999	Odonata	Argiolestidae										
	QO109999	Odonata	Calopterygidae										
	QO189999	Odonata	Chorismagrionidae										
2	QO029999	Odonata	Coenagrionidae	1	7			9	10	7	2	14	2
6	QO099999	Odonata	Diphlebiidae										
	QO019999	Odonata	Hemiphlebiidae										
9	QO069999	Odonata	Hypolestidae										
3	QO039999	Odonata	Isostictidae			3							
1	QO069999	Odonata	Lestidae										
4	QO049999	Odonata	Platycnemididae										
7	QO089999	Odonata	Synlestidae										
3	QO999998	Odonata	S.O. Epiproctiphora					1	1				
4	QO129999	Odonata	Aeshnidae	1						5		1	1
	QO199999	Odonata	Archipetaliidae										
10	QO279999	Odonata	Austrocorduliidae										
	QO209999	Odonata	Austropetaliidae										
9	QO219999	Odonata	Brachytronidae										
	QO289999	Odonata	Cordulephyidae										
5	QO169999	Odonata	Corduliidae					1				1	
5	QO139999	Odonata	Gomphidae										

	QO249999	Odonata	Gomphomacromiidae										
5	QO309999	Odonata	Hemicorduliidae										
4	QO179999	Odonata	Libellulidae	15	15		1	7	2			9	9
3	QO229999	Odonata	Lindeniidae										
8	QO269999	Odonata	Macromiidae										
	QO299999	Odonata	Oxygastridae										
	QO159999	Odonata	Petaluridae										
	QO259999	Odonata	Pseudocorduliidae										
2	QO239999	Odonata	Synthemistidae										
9	QO219999	Odonata	Telephlebiidae										
8	QT999999	Trichoptera	Trichoptera										
8	QT169999	Trichoptera	Antipodoeciidae										
7	QT239999	Trichoptera	Atriplectididae										
7	QT249999	Trichoptera	Calamoceratidae										
9	QT189999	Trichoptera	Calocidae										
7	QT159999	Trichoptera	Conoesucidae										
9	QT269999	Trichoptera	Dipseudopsidae										
4	QT089999	Trichoptera	Ecnomidae				3		7			2	1
9	QT029999	Trichoptera	Glossosomatidae										
10	QT199999	Trichoptera	Helicophidae										
8	QT179999	Trichoptera	Helicopsychidae										
10		Trichoptera	Heloccabucidae										
8	QT019999	Trichoptera	Hydrobiosidae										
6	QT069999	Trichoptera	Hydropsychidae										
4	QT039999	Trichoptera	Hydroptilidae			2	3		4	3		3	3
3	QT209999	Trichoptera	Kokiriidae										
6	QT259999	Trichoptera	Leptoceridae			2	6	4	2	5			5
8	QT109999	Trichoptera	Limnephilidae										
7	QT229999	Trichoptera	Odontoceridae										
8	QT129999	Trichoptera	Oeconesidae										
8	QT049999	Trichoptera	Philopotamidae										
8	QT219999	Trichoptera	Philorheithridae										
	QT119999	Trichoptera	Plectrotarsidae										
7	QT079999	Trichoptera	Polycentropodidae										
	QT099999	Trichoptera	Psychomyiidae										

	QT059999	Trichoptera	Stenopsychidae									
8	QT139999	Trichoptera	Tasimiidae									
3	QL019999	Lepidoptera	Crambidae					1	6			2

Table D-2 Macroinvertebrate taxa present at Iron Bridge pools in the Late Dry season (2020)

			Site		Cow spring		Fig pool		Site 12 Pool		Mundagoora Pool	
			Date sampled		11/12/2020		10/12/2020		9/12/2020		8/12/2020	
			Replicate		1	2	1	2	1	2	1	2
Order	Family	Signal2 score										
Nematoda	Nematoda	3								1		
Gastropoda	Gastropoda	1										
	Ancylidae	4	2	2						7	3	
	Lymnaeidae	1	6	9						8	12	
	Planorbidae	2	7	9					1	10	15	
Oligochaeta	Oligochaeta	2	2	2					2	4	3	
Araneae	Araneae											1
Acarina	Acarina	6	7	10	3				1	8	6	
Group	Microcrustacea											
Cladocera	Cladocera							9		5	1	
Copepoda	Copepoda		2	2					4	9	7	
Ostracoda	Ostracoda									11	11	
Coleoptera	Coleoptera	5										

	Site	Cow spring		Fig pool		Site 12 Pool		Mundagoora Pool	
	Dytiscidae	2	3	2	5	1		3	4
	Hydraenidae	3						1	
	Hydrochidae	4						18	2
	Hydrophilidae	2	2	1		7	1	1	2
	Scirtidae	6							5
Diptera	Diptera	3							
	Ceratopogonidae	4	4	8			7	5	4
	S-f chironominae	3	24	27	28	29	28	16	19
	S-f tanypodinae	4	10	11		6	12	16	7
	Culicidae	1		1	1	1			
	Stratiomyidae	2						5	
	Tabanidae	3						1	
Ephemeroptera	Ephemeroptera	9							
	Baetidae	5	9					3	5
	Caenidae	4		3				1	6
Hemiptera	Hemiptera	2							
	Belostomatidae	1	1						
	Gerridae	4		4		3			1
	Mesoveliidae	2						1	1
	Micronectidae	2							1
	Pleidae	2						3	1

	Site	Cow spring		Fig pool		Site 12 Pool		Mundagoora Pool		
	Veliidae	3			2	13			1	2
Odonata	Odonata	3								
	Coenagrionidae	2	12	16	13	23			6	15
	Gomphidae	5					3			
	Libellulidae	4	11	10	12	15		2	2	
Trichoptera	Trichoptera	8								
	Ecnomidae	4							1	
	Hydroptilidae	4					1			1
	Leptoceridae	6	1	1				2	22	22
Lepidoptera	Crambidae	3	7	3						

Table D-3: Macroinvertebrate data for the Late Wet Season 2021

	Site	Fig Pool	Fig Pool	Central Creek Pool	Central Creek Pool	South Star Pool	South Star Pool	Site 12	Site 12	Cow Spring Pool	Cow Spring Pool
	Replicate	1	2	1	2	1	2	1	2	1	2
	Date Sampled	24/06/2020	24/06/2020	25/06/2020	25/06/2020	26/06/2020	26/06/2020	28/06/2020	28/06/2020	29/06/2020	29/06/2020
Order	Family										
Hydrozoa	Hydridae									1	
Gastropoda	Ancylidae					10				5	

	Site	Fig Pool	Fig Pool	Central Creek Pool	Central Creek Pool	South Star Pool	South Star Pool	Site 12	Site 12	Cow Spring Pool	Cow Spring Pool
Gastropoda	Lymnaeidae					12	4		1	7	
Gastropoda	Planorbidae					3	8	3		3	
Oligochaeta	Oligochaeta				4	1	1	4	1	6	
Araneae	Araneae				1	1	1	2	1		
Acarina	Acarina	10	3	2	2	5	21	14	14	11	8
Cladocera	Cladocera					2	11			4	1
Copepoda	Copepoda			1	5	6		3	4	2	2
Ostracoda	Ostracoda				1	15				16	
Coleoptera	Dytiscidae	9	6	2	7			2	2	3	2
Coleoptera	Hydraenidae									1	
Coleoptera	Hydrochidae			1	2	2				1	
Coleoptera	Hydrophilidae	10	2	2	2				1	3	
Coleoptera	Limnichidae								1		
Coleoptera	Scirtidae									4	
Diptera	Ceratopogonidae			7	9	3	2	4	2	10	
Diptera	s-f Chironominae	23	25	16	26	9	20	21	3	25	22

	Site	Fig Pool	Fig Pool	Central Creek Pool	Central Creek Pool	South Star Pool	South Star Pool	Site 12	Site 12	Cow Spring Pool	Cow Spring Pool
Diptera	s-f Orthocladiinae			1						1	
Diptera	s-f Tanypodinae			14	11	15	9	19	15	25	4
Diptera	Culicidae	1	4				1			1	
Diptera	Ephydriidae			1	2						
Diptera	Muscidae				1						
Diptera	Psychodidae				1						
Diptera	Sciomyzidae									1	
Diptera	Stratiomyidae			4	1			2	3	1	
Diptera	Tabanidae				1						
Diptera	Tipulidae									1	
Ephemeroptera	Baetidae					9	13	2	2	9	12
Ephemeroptera	Caenidae			7	14	10	1	1		12	2
Hemiptera	Belostomatidae									2	
Hemiptera	Gerridae							2	2	2	
Hemiptera	Hebridae			1					3		
Hemiptera	Mesoveliidae			1						1	

	Site	Fig Pool	Fig Pool	Central Creek Pool	Central Creek Pool	South Star Pool	South Star Pool	Site 12	Site 12	Cow Spring Pool	Cow Spring Pool
Hemiptera	Micronectidae					1			1	1	
Hemiptera	Nepidae			1	1					2	
Hemiptera	Notonectidae	2	3								
Hemiptera	Pleidae			8	4	3		1	2	1	1
Hemiptera	Veliidae	1		4				1		1	
Odonata	Odonata										
Odonata	Coenagrionidae		1	7		9	10	7	2	14	2
Odonata	Isostictidae			3							
Odonata	S.O. Epiproctiphora				1	1					
Odonata	Aeshnidae		1				5			1	1
Odonata	Corduliidae					1				1	
Odonata	Libellulidae	15	15			1	7	2		9	9
Trichoptera	Ecnomidae					3		7		2	1
Trichoptera	Hydroptilidae			2	3		4	3	3	3	
Trichoptera	Leptoceridae			2	6	4	2	5		5	
Lepidoptera	Crambidae					1	6			2	

	Site	Fig Pool	Fig Pool	Central Creek Pool	Central Creek Pool	South Star Pool	South Star Pool	Site 12	Site 12	Cow Spring Pool	Cow Spring Pool
	Abundance	71	60	87	105	127	126	105	63	200	67
	Taxonomic Richness	8	9	21	22	24	18	20	19	39	13
	PET Richness	0	0	3	3	4	4	5	2	5	3
	Terrestrial insect	1					7	5	5		1

	Site	Fig Pool	Fig Pool	Central Creek Pool	Central Creek Pool	South Star Pool	South Star Pool	Site 12	Site 12	Cow Spring Pool	Cow Spring Pool
	SMI Comments		3 Chironominae and 2 Culicidae are pupa	1 Hydroptilidae is a very early instar.	1 Hydroptilidae is a very early instar. Oligochaeta very small and unidentified. Epiproctaphora too small to identify to family level. 1 Chironominae is a pupa.	1 Ceratopogonidae is a pupa. Label disintegrated when the sample was rinsed so I am unsure what habitat type sample was collected from. Unidentified Epiproctaphora too small to identify to family level.	1 Hydroptilidae, 1 Ceratopogonidae and 3 Chironominae are pupa. 1 Leptoceridae and Ecnomidae very small.	Partially live-picked sample. 1 Tanyptinidae and 1 Ceratopogonidae are pupa. Many very small Chironomids.	1 Chironominae and 1 Ceratopogonidae are pupa. Limnichidae is an adult, which are generally considered semi-aquatic / terrestrial.	Photo of specimen is an Aeshnidae (can just see bifid apex of epiproct) and this record has been included in this data. 1 Ceratopogonidae is a pupa.	Some very small Acarina.

Table D-4: Macroinvertebrate data for the Late Dry Season 2021

	Site	Cow Spring Pool	Cow Spring Pool	GV Pool	GV Pool	Mundagoora Pool	Mundagoora Pool	Site 12 Pool	Site 12 Pool	Fig Pool	Fig Pool
	Replicate	1	2	1	2	1	2	1	2	1	2
	Date Sampled	5/10/2021	5/10/2021	6/10/2021	6/10/2021	6/10/2021	6/10/2021	7/10/2021	7/10/2021	5/10/2021	5/10/2021
GROUP	Family										
Gastropoda	Planorbidae	4	18	34	1	13	161	1			
Araneae	Araneae	2	19			1					16
Acarina	Acarina			82	34	17	304	16			
Copepoda	Copepoda			32		16					
Coleoptera	Dytiscidae	1		9	3	22	1			3	2
Coleoptera	Hydrochidae			2		17					
Coleoptera	Hydrophilidae	1		1	1	1					9
Coleoptera	Staphylinidae					1					
Diptera	Ceratopogonidae	385	122		4	66	32		16		

	Site	Cow Spring Pool	Cow Spring Pool	GV Pool	GV Pool	Mundagoora Pool	Mundagoora Pool	Site 12 Pool	Site 12 Pool	Fig Pool	Fig Pool
Diptera	s-f Chironominae	137	32	49	97	156	17			18	148
Diptera	s-f Tanypodinae	153	3	44	104	98	7	1	3		
Diptera	Culicidae	2					17	16	2		
Diptera	Stratiomyidae			5	1	1	1				
Diptera	Tabanidae					1		1			
Diptera	Tipulidae					1					
Ephemeroptera	Baetidae	81	1	35	48	1	7				
Hemiptera	Hemiptera					16					
Hemiptera	Belostomatidae						2				
Hemiptera	Gerridae	1	2	1	1				3		
Hemiptera	Hydrometridae			1							
Hemiptera	Micronectidae			1			16				
Hemiptera	Naucoridae	1									

	Site	Cow Spring Pool	Cow Spring Pool	GV Pool	GV Pool	Mundagoora Pool	Mundagoora Pool	Site 12 Pool	Site 12 Pool	Fig Pool	Fig Pool
Hemiptera	Notonectidae									1	4
Hemiptera	Pleidae			4		22			3		
Hemiptera	Veliidae			23		18	1			28	
Odonata	S.O. Zygoptera	64	10								2
Odonata	Coenagrionidae	36				2	33			4	
Odonata	S.O. Eiproctiphora	64									
Odonata	Gomphidae					3					
Odonata	Libellulidae	16	3	3		2		1		6	34
Trichoptera	Ecnomidae	1			1	21		1			
Trichoptera	Leptoceridae	33				37	20				
Trichoptera	Polycentropodidae					2					
Lepidoptera	Crambidae	6	3				2				

Table D-5: Macroinvertebrate data for the Late Wet 2022 season.

	Site	Mundagoora	Mundagoora	NJA21-006-US	NJA21-006-US	Cow Spring	Cow Spring	Site12 Pool	Site12 Pool	Fig Pool	Fig Pool
	Replicate	1	2	1	2	1	2	1	2	1	2
	Date Sampled	22/06/2022	22/06/2022	21/05/2022	21/06/2022	23/06/2022	23/06/2022	24/06/2022	24/06/2022	23/06/2022	23/06/2022
GROUP	FAMILY										
Araneae	Araneae				2	1					
Coleoptera	Dytiscidae			14	8			1	2		1
Coleoptera	Elmidae								1		
Coleoptera	Hydrophilidae				1				1		
Coleoptera	Ptilodactylidae				2						
Diptera	Ceratopogonidae		16		3	3	33				3
Diptera	s-f Chironominae	1	20	149	15	172	143	4		13	52
Diptera	s-f Orthoclaadiinae					10					
Diptera	Stratiomyidae				20		1				
Diptera	s-f Tanypodinae	1	32	9	12	12	207	1		3	9
Ephemeroptera	Baetidae					2					

	Site	Mundagoora	Mundagoora	NJA21-006-US	NJA21-006-US	Cow Spring	Cow Spring	Site12 Pool	Site12 Pool	Fig Pool	Fig Pool
Gastropoda	Physidae	144	18	3	1	9	3				
Gastropoda	Planorbidae	298	71			5	3				
Hemiptera	Gerridae					1				3	
Hemiptera	Pleidae								4		
Hemiptera	Veliidae									16	5
Lepidoptera	Crambidae					10	6			1	
Odonata	Aeshnidae					1					
Odonata	Coenagrionidae	16	1	1	1	21	3				
Odonata	Corduliidae						5				
Odonata	Libellulidae						10				10
Trichoptera	Calamoceratidae		2								
Trichoptera	Ecnomidae						1				
Trichoptera	Hydrobiosidae		1								
Trichoptera	Leptoceridae						2				
Copepoda	Copepoda		16								

Table D-6: Macroinvertebrate data for the Late Dry 2022 season.

	Site	Mundagoora	Mundagoora	Cow Spring	Cow Spring	Site12 Pool	Fig Pool	Fig Pool
	Replicate	1	2	1	2	1	1	2
	Date Sampled	22/10/2022	22/10/2022	22/10/2022	22/10/2022	23/10/2022	23/10/2022	23/10/2022
GROUP	FAMILY							
Acarina	Acarina	1	3		1	13	1	
Araneae	Araneae			1				
Coleoptera	Dytiscidae			2				1
Coleoptera	Hydraenidae					3		
Coleoptera	Hydrochidae	1	1					
Coleoptera	Hydrophilidae	1	1	1	5			
Coleoptera	Scirtidae	2	3					
Coleoptera	Staphylinidae		1					
Diptera	Ceratopogonidae		1	3	5	5	2	
Diptera	s-f Chironominae	2	8	20	40	3	12	4
Diptera	Culicidae		2	9	6			

	Site	Mundagoora	Mundagoora	Cow Spring	Cow Spring	Site12 Pool	Fig Pool	Fig Pool
Diptera	Stratiomyidae	1	2			1		
Diptera	s-f Tanypodinae	2	9	26	28			1
Ephemeroptera	Baetidae	4	41	5	8			
Ephemeroptera	Caenidae			1				
Gastropoda	Physidae		9		2			
Gastropoda	Planorbidae	3	23	10	7			
Hemiptera	Gerridae			6	3	1	2	6
Hemiptera	Naucoridae			1				
Hemiptera	Nepidae				1			
Hemiptera	Notonectidae		1					1
Hemiptera	Veliidae				1		1	7
Lepidoptera	Crambidae		1	6	1			
Odonata	Gomphidae					1		
Odonata	Lestidae	1			1			
Odonata	Libellulidae	1	1	2	17		3	8

	Site	Mundagoora	Mundagoora	Cow Spring	Cow Spring	Site12 Pool	Fig Pool	Fig Pool
Odonata	S.O. Eiproctiphora			5	15			
Odonata	S.O. Zygoptera	2	4	5	1			1
Oligochaeta	Oligochaeta			5	7			
Trichoptera	Ecnomidae	1	1					
Trichoptera	Hydroptilidae		1			1		
Trichoptera	Leptoceridae		3					
Cladocera	Cladocera						2	
Copepoda	Copepoda	1		4	3			
Ostracoda	Ostracoda	2					2	3

APPENDIX E. DIATOM DATA

Table E-1: Diatom species and count data for the five surveyed pools – Late Wet 2020.

Taxon name		Fig Pool	Fig Pool	Central Ck Pool	Central Ck Pool	South Star Pool	South Star Pool	Site 12 Pool	Site 12 Pool	Cow Spring Pool	Cow Spring Pool
	Replicate Number	1	2	1	2	1	2	1	2	1	2
	Collection date	24/06/2020	24/06/2020	25/06/2020	25/06/2020	26/06/2020	26/06/2020	27/06/2020	27/06/2020	28/06/2020	28/06/2020
	Sample description	no valves	no valves					very sparse	very sparse. teratological forms	no valves	very sparse
Total Count		0	0	394	352	420	386	60	166	0	28
DSIAR Score		NA	NA	41.3	42.6	59.1	66.3	54.7	53.95	NA	64.25
<i>Achnanthes brevipes</i>		0	0	22	12	302	92	4	24	0	8
<i>Achnanthes impexa</i>		0	0	0	0	48	164	4	8	0	0
<i>Achnanthes subexigua</i>		0	0	4	0	14	70	8	10	0	8
<i>Achnantheidium exiguum</i>		0	0	2	0	12	24	0	0	0	0
<i>Achnantheidium kryophila</i>		0	0	0	0	8	4	0	0	0	0
<i>Achnantheidium lineare</i>		0	0	0	0	6	8	0	0	0	2
<i>Achnantheidium minutissimum</i>		0	0	0	0	6	0	0	0	0	0
<i>Achnantheidium minutissimum var affine</i>		0	0	0	2	4	4	0	0	0	4
<i>Achnantheidium spp.</i>		0	0	2	0	4	4	0	0	0	0
<i>Actinocyclus normanii</i>		0	0	0	0	4	0	0	0	0	0
<i>Adlafia aff bryophila</i>		0	0	0	0	4	0	0	0	0	0
<i>Adlafia minuscula v. muralis</i>		0	0	0	0	4	0	0	0	0	0

Taxon name	Fig Pool	Fig Pool	Central Ck Pool	Central Ck Pool	South Star Pool	South Star Pool	Site 12 Pool	Site 12 Pool	Cow Spring Pool	Cow Spring Pool
<i>Amphicampa mirabilis</i>		0	0	6	2	2	0	0	0	0
<i>Amphipleura pellucida</i>		0	0	0	0	2	0	0	0	0
<i>Amphora delicatissima</i>		0	0	0	4	0	0	0	0	2
<i>Amphora libyca</i>		0	0	0	0	0	0	0	0	2
<i>Amphora ovalis</i>		0	0	0	0	0	0	0	0	2
<i>Amphora pediculus</i>		0	0	0	2	0	0	42	112	0
<i>Amphora spp.</i>		0	0	0	0	0	0	0	6	0
<i>Aneumastus tuscula</i>		0	0	0	0	0	2	0	4	0
<i>Anomoneis spaerophora</i>		0	0	0	0	0	0	0	2	0
<i>Asterionella ralfsii var americana</i>		0	0	246	270	0	0	2	0	0
<i>Aulacoseira ambigua</i>		0	0	4	0	0	12	0	0	0
<i>Aulacoseira crenulata</i>		0	0	0	0	0	2	0	0	0
<i>Aulacoseira granulata</i>		0	0	40	16	0	0	0	0	0
<i>Bacillaria paxillifer</i>		0	0	10	8	0	0	0	0	0
<i>Brachysira brebissonii</i>		0	0	12	6	0	0	0	0	0
<i>Brachysira styriaca</i>		0	0	0	6	0	0	0	0	0
<i>Brachysira vitrea</i>		0	0	8	4	0	0	0	0	0
<i>Caloneis aerophila</i>		0	0	0	4	0	0	0	0	0
<i>Caloneis silicula</i>		0	0	0	4	0	0	0	0	0
<i>Chamaepinnularia brementis</i>		0	0	0	4	0	0	0	0	0
<i>Chamaepinnularia muscicola</i>		0	0	0	2	0	0	0	0	0

Taxon name	Fig Pool	Fig Pool	Central Ck Pool	Central Ck Pool	South Star Pool	South Star Pool	Site 12 Pool	Site 12 Pool	Cow Spring Pool	Cow Spring Pool
<i>Cocconeis pediculus</i>		0	0	0	2	0	0	0	0	0
<i>Cocconeis placentula</i>		0	0	0	2	0	0	0	0	0
<i>Cocconeis placentula</i> var. <i>euglypta</i>		0	0	0	2	0	0	0	0	0
<i>Cocconeis placentula</i> var. <i>lineata</i>		0	0	28	0	0	0	0	0	0
<i>Cocconeis pseudothumensis</i>		0	0	4	0	0	0	0	0	0
<i>Craticula accomoda</i>		0	0	2	0	0	0	0	0	0
<i>Craticula cuspidata</i>		0	0	2	0	0	0	0	0	0
<i>Craticula halophila</i>		0	0	2	0	0	0	0	0	0

Table E-2: Diatom species and count data - Late Wet 2021

Sample name:	Fig Pool	Fig Pool	Central Ck Pool	Central Ck Pool	South Star Pool	South Star Pool	Site 12 Pool	Site 12 Pool	Cow Spring Pool	Cow Spring Pool
Further sample details:	1 of 2	2 of 2	1 of 2	2 of 2	1 of 2	2 of 2	1 of 2	2 of 2	1 of 2	2 of 2
Date	24/06/2020	24/06/2020	25/06/2020	25/06/2020	26/06/2020	26/06/2020	27/06/2020	27/06/2020	28/06/2020	28/06/2020
Taxon name/Notes:	no valves	no valves					very sparse	very sparse and teratological forms	no valves	very sparse
Achnantheidium exiguum	0	0	246	270	0	0	2	0	0	0
Achnantheidium minutissimum	0	0	22	12	302	92	4	24	0	8

Sample name:	Fig Pool	Fig Pool	Central Ck Pool	Central Ck Pool	South Star Pool	South Star Pool	Site 12 Pool	Site 12 Pool	Cow Spring Pool	Cow Spring Pool
Amphora spp.	0	0	0	0	0	0	0	6	0	0
Brachysira brebissonii	0	0	0	2	0	0	0	0	0	0
Brachysira vitrea	0	0	0	0	48	164	4	8	0	0
Caloneis silicula	0	0	0	0	0	2	0	4	0	0
Craticula halophila	0	0	0	0	2	0	0	0	0	0
Cymbella affinis	0	0	0	0	6	8	0	0	0	2
Cymbella spp	0	0	0	2	4	4	0	0	0	4
Diploneis parma	0	0	6	2	2	0	0	0	0	0
Encyonema minutum	0	0	0	0	4	0	0	0	0	0
Eolimna minima	0	0	2	0	0	0	0	0	0	0
Eunotia bilunaris	0	0	4	0	14	70	8	10	0	8
Eunotia faba	0	0	0	0	0	0	0	0	0	2
Eunotia incisa	0	0	0	0	0	0	0	2	0	0
Fragilaria spp.	0	0	2	0	0	0	0	0	0	0
Hantzschia amphioxys	0	0	0	4	0	0	0	0	0	2
Luticola mutica	0	0	0	0	0	0	0	0	0	2

Sample name:	Fig Pool	Fig Pool	Central Ck Pool	Central Ck Pool	South Star Pool	South Star Pool	Site 12 Pool	Site 12 Pool	Cow Spring Pool	Cow Spring Pool
Mastogloia smithii	0	0	0	2	0	0	42	112	0	0
Navicula cryptocephala	0	0	0	0	6	0	0	0	0	0
Navicula cryptotenella	0	0	0	0	0	2	0	0	0	0
Navicula gregaria	0	0	0	0	4	0	0	0	0	0
Navicula lanceolata	0	0	2	0	4	4	0	0	0	0
Navicula menisculoides	0	0	0	0	8	4	0	0	0	0
Navicula menisculus	0	0	0	4	0	0	0	0	0	0
Navicula phyllepta	0	0	0	2	0	0	0	0	0	0
Navicula radiosa	0	0	2	0	12	24	0	0	0	0
Navicula recens	0	0	0	0	4	0	0	0	0	0
Navicula veneta	0	0	12	6	0	0	0	0	0	0
Nitzschia frustulum	0	0	10	8	0	0	0	0	0	0
Nitzschia graciliformis	0	0	4	0	0	0	0	0	0	0
Nitzschia gracilis	0	0	2	0	0	0	0	0	0	0
Nitzschia inconspicua	0	0	0	6	0	0	0	0	0	0
Nitzschia lacuum	0	0	8	4	0	0	0	0	0	0

Sample name:	Fig Pool	Fig Pool	Central Ck Pool	Central Ck Pool	South Star Pool	South Star Pool	Site 12 Pool	Site 12 Pool	Cow Spring Pool	Cow Spring Pool
Nitzschia microcephala	0	0	0	4	0	0	0	0	0	0
Nitzschia palea	0	0	40	16	0	0	0	0	0	0
Nitzschia suchlandii	0	0	0	2	0	0	0	0	0	0
Pinnularia legumen	0	0	0	2	0	0	0	0	0	0
Pinnularia spp.	0	0	0	4	0	0	0	0	0	0
Pleurosigma elongatum	0	0	28	0	0	0	0	0	0	0
Ulnaria ulna	0	0	4	0	0	12	0	0	0	0
Total	0	0	394	352	420	386	60	166	0	28

Table E-3: Diatom species and count data - Late Dry 2021

Site	Central Creek 1	Central Creek 2	GV Pool 1	GV Pool 2	Mundagoora Pool 2	Mundagoora Pool 2	Fig Pool	Cow Spring Pool	Site 12 Pool 1	Site 12 Pool 2
Date	5/10/2021	5/10/2021	6/10/2021	6/10/2021	6/10/2021	6/10/2021	5/10/2021	5/10/2021	7/10/2021	7/10/2021
Notes on counts (e.g. sparse, dissolved)					very sparse		no diatoms			broken, sparse, low diversity
Taxon name										
Achnanthes subexigua	6	14	4	0	0	0	0	0	0	0
Achnantheidium exiguum	88	0	14	0	0	0	0	0	0	0
Achnantheidium kryophila	0	48	0	0	0	0	0	0	0	0
Achnantheidium minutissimum	0	46	20	0	14	62	0	14	44	24
Brachysira styriaca	0	0	0	0	0	16	0	12	0	0
Brachysira vitrea	0	4	0	0	0	124	0	218	0	4

Site	Central Creek 1	Central Creek 2	GV Pool 1	GV Pool 2	Mundagoora Pool 2	Mundagoora Pool 2	Fig Pool	Cow Spring Pool	Site 12 Pool 1	Site 12 Pool 2
Diploneis parma	46	16	52	104	0	0	0	0	0	4
Encyonopsis microcephala	0	0	0	0	0	24	0	0	0	0
Epithemia gibba	0	18	0	0	0	2	0	0	0	8
Eunotia arcus	0	0	0	0	0	0	0	0	0	12
Eunotia bilunaris	0	0	0	0	0	102	0	62	18	0
Eunotia exigua	0	2	0	0	0	0	0	4	0	0
Eunotia incisa	0	0	0	0	0	6	0	6	0	0
Eunotia minor	0	4	0	0	0	0	0	0	0	0
Eunotia paludosa	0	0	0	0	0	0	0	4	0	0
Eunotia pectinalis	0	0	0	0	0	2	0	0	0	0
Fragilaria acus	0	0	0	0	0	0	0	16	22	0

Site	Central Creek 1	Central Creek 2	GV Pool 1	GV Pool 2	Mundagoora Pool 2	Mundagoora Pool 2	Fig Pool	Cow Spring Pool	Site 12 Pool 1	Site 12 Pool 2
Fragilaria capucina var gracilis	0	0	0	0	0	0	0	0	2	0
Fragilaria tenera	0	0	0	0	0	4	0	0	0	0
Fragilaria vaucheriae	0	0	0	2	0	0	0	0	0	0
Fragilariforma virescens	0	0	0	0	0	0	0	2	0	0
Frustulia rhomboides	0	0	0	0	0	0	0	2	0	0
Gomphonema affine	0	0	42	8	0	4	0	6	0	0
Gomphonema gracile	0	0	0	2	0	2	0	0	0	0
Gomphonema minutum	0	4	0	4	0	0	0	4	0	0
Hantzschia amphioxys	2	0	0	0	0	0	0	0	0	0
Haslea duerrenbergiana	2	0	0	0	0	0	0	0	0	0

Site	Central Creek 1	Central Creek 2	GV Pool 1	GV Pool 2	Mundagoora Pool 2	Mundagoora Pool 2	Fig Pool	Cow Spring Pool	Site 12 Pool 1	Site 12 Pool 2
Karayevia clevei	0	0	0	4	0	2	0	0	0	0
Luticola mutica	0	0	0	0	0	0	0	4	0	0
Mastogloia elliptica	0	0	0	0	0	0	0	0	12	0
Mastogloia smithii	2	0	0	0	0	0	0	2	232	116
Navicula cryptocephala	0	0	0	4	16	68	0	0	0	0
Navicula cryptotenella	0	0	0	0	0	8	0	0	0	0
Navicula erifuga	0	0	0	16	0	4	0	0	0	0
Navicula gregaria	0	0	0	0	0	2	0	0	2	0
Navicula lanceolata	0	0	0	4	0	2	0	0	2	0
Navicula leptostriata	0	0	0	0	0	4	0	0	0	0

Site	Central Creek 1	Central Creek 2	GV Pool 1	GV Pool 2	Mundagoora Pool 2	Mundagoora Pool 2	Fig Pool	Cow Spring Pool	Site 12 Pool 1	Site 12 Pool 2
Navicula menisculus	74	96	4	8	6	8	0	0	0	0
Navicula radiosa	0	0	0	0	0	24	0	0	0	0
Navicula radiosafallax	0	0	0	2	0	0	0	0	0	0
Navicula rhyngocephala	0	0	2	0	0	0	0	0	0	0
Navicula spp	0	0	0	0	2	0	0	0	0	0
Navicula tenelloides	0	0	4	0	0	0	0	0	0	0
Navicula veneta	0	0	4	0	2	0	0	0	0	0
Navicula viridula	0	0	16	42	0	0	0	0	0	0
Navicula viridula	0	0	0	0	12	0	0	0	0	0
Navicula viridula var. linearis	0	0	0	8	0	0	0	0	0	0
Nitzschia clausii	0	0	2	0	0	0	0	0	0	0

Site	Central Creek 1	Central Creek 2	GV Pool 1	GV Pool 2	Mundagoora Pool 2	Mundagoora Pool 2	Fig Pool	Cow Spring Pool	Site 12 Pool 1	Site 12 Pool 2
Nitzschia desertorum	0	0	0	2	0	0	0	0	0	0
Nitzschia filiformis	4	0	46	4	0	0	0	0	2	0
Nitzschia fonticola	0	4	22	46	4	0	0	0	0	0
Nitzschia frustulum	14	12	64	30	0	0	0	0	4	0
Nitzschia gracilis	0	0	14	0	0	0	0	0	0	0
Nitzschia inconspicua	0	0	0	6	4	0	0	0	0	0
Nitzschia lacuum	8	4	8	0	0	0	0	0	0	0
Nitzschia linearis	4	4	4	2	0	0	0	0	0	0
Nitzschia microcephala	0	0	14	8	0	0	0	0	0	0
Nitzschia palea	44	38	34	14	8	0	0	0	0	0

Site	Central Creek 1	Central Creek 2	GV Pool 1	GV Pool 2	Mundagoora Pool 2	Mundagoora Pool 2	Fig Pool	Cow Spring Pool	Site 12 Pool 1	Site 12 Pool 2
Nitzschia palea var debilis	0	0	2	0	0	0	0	0	0	0
Nitzschia paleaceae	10	8	0	96	0	0	0	0	0	0
Nitzschia pumilla	0	0	0	0	0	0	0	0	2	0
Pinnularia spp.	0	0	0	0	0	0	0	4	2	0
Planothidium frequentissimum	0	0	0	0	0	0	0	0	4	0
Pleurosigma elongatum	118	114	0	0	0	0	0	0	0	0
Surirella elegans	0	0	0	0	0	0	0	0	2	0
Tryblionella calida	0	0	0	0	0	0	0	0	2	0
Ulnaria ulna	0	0	6	0	0	0	0	22	18	34
Total	330	380	360	422	68	484	0	400	374	204

Table E-5: Diatom species and count data - Late Wet 2022

Species	Cow Spring Pool 1	Cow Spring Pool 2	Site 12 Pool 1	Site 12 Pool 2	Fig Pool 1	Fig Pool 2	Mundagoora Pool 1	Mundagoora Pool 2	NJA21-006-US 1	NJA21-006-US 2
Date	23/06/22	23/06/22	24/06/22	24/06/22	23/6/22	23/6/22	21/06/22	21/06/22	22/06/22	22/06/22
Notes on counts				lots of fragments						
Achnanthes exigua	0	0	0	4	0	0	0	0	0	0
Achnanthes sp.	0	0	0	1	0	0	0	0	0	0
Achnantheidium minutissimum	7	21	2	10	0	0	41	48	1	0
Adlafia spp.	0	19	2	8	0	0	0	0	0	0
Brachysira brebissonii	40	145	0	0	0	0	2	0	0	0
Brachysira styriaca	4	0	0	0	0	0	0	0	0	0
Brachysira vitrea	17	8	0	0	0	0	7	4	3	0
Caloneis 1	0	2	0	0	0	0	0	0	0	0
Caloneis clevei	0	2	0	4	0	0	0	0	2	0
Caloneis girdle	0	4	0	0	0	0	0	0	0	0
Caloneis silicula	0	0	0	0	0	0	0	0	4	0
Diploneis elliptica	0	4	0	0	0	0	0	0	2	0
Diploneis ovalis	0	0	3	3	0	0	0	0	0	0
Discostella stelligera	0	0	0	0	0	0	173	71	0	0
Encyonema gracile	0	0	0	0	0	0	1	0	0	0
Encyonema minutum	4	4	0	2	0	0	0	0	2	0

Species	Cow Spring Pool 1	Cow Spring Pool 2	Site 12 Pool 1	Site 12 Pool 2	Fig Pool 1	Fig Pool 2	Mundagoora Pool 1	Mundagoora Pool 2	NJA21-006-US 1	NJA21-006-US 2
Encyonema silesiacum	8	3	0	0	0	0	1	1	0	0
Encyonopsis cesatii	0	0	0	0	0	0	0	1	0	0
Encyonopsis spp.	0	0	0	0	0	0	16	5	1	0
Eolimna minima	0	3	0	0	0	0	0	0	0	0
Epithemia adnata	0	0	0	0	0	0	0	3	0	0
Epithemia cistula	0	0	0	0	0	0	0	9	0	0
Eunotia bilunaris	188	53	0	0	0	0	14	65	1	0
Eunotia girdle	0	2	0	0	0	0	0	0	0	0
Eunotia minor	0	2	0	0	0	0	0	2	0	0
Frustulia rhomboides	0	2	0	0	0	0	0	0	0	0
Girdle enc.	0	2	0	0	0	0	0	0	0	0
Gomphonema affine	0	4	0	4	0	0	0	0	0	0
Gomphonema angustum	0	2	3	3	0	0	0	0	3	0
Gomphonema girdle	0	2	0	0	0	0	0	8	0	0
Gomphonema gracile	0	9	0	0	0	0	1	0	0	0
Gomphonema pumilum	0	0	0	0	0	0	13	6	0	0
Gomphonema sp.	0	0	2	0	0	0	0	0	0	1
Gyrosigma acuminatum	0	0	0	0	0	0	1	0	0	0
Halamphora veneta	0	0	0	0	0	0	0	0	100	27

Species	Cow Spring Pool 1	Cow Spring Pool 2	Site 12 Pool 1	Site 12 Pool 2	Fig Pool 1	Fig Pool 2	Mundagoora Pool 1	Mundagoora Pool 2	NJA21-006-US 1	NJA21-006-US 2
<i>Hantzschia amphioxys</i>	0	0	0	0	0	0	0	0	1	0
<i>Mastogloia elliptica</i>	0	0	6	4	0	0	3	12	0	0
<i>Mastogloia elliptica</i> var. <i>dansei</i>	0	0	0	0	0	0	0	4	0	0
<i>Mastogloia smithii</i>	0	0	36	38	0	0	1	6	6	2
<i>Navicula cryptotenella</i>	0	0	0	0	0	0	7	16	0	0
<i>Navicula radiosa</i>	0	0	0	0	0	0	3	4	0	0
<i>Navicula schroeterii</i>	0	0	0	0	0	0	0	0	1	0
<i>Navicula tenelloides</i>	0	0	3	0	0	0	0	0	0	0
<i>Navicula veneta</i>	0	0	0	0	0	0	0	0	6	3
<i>Navicymbula pusilla</i>	0	0	27	20	0	0	0	0	2	2
<i>Nitzschia agnita</i>	0	0	0	6	0	0	0	0	0	12
<i>Nitzschia frustulum</i>	1	3	3	4	0	0	9	29	15	4
<i>Nitzschia girdle</i>	0	0	2	3	0	0	0	0	13	18
<i>Nitzschia gracilis</i>	0	0	14	17	0	0	0	0	11	80
<i>Nitzschia inconspicua</i>	0	0	0	2	0	0	0	0	0	0
<i>Nitzschia lacuum</i>	0	0	0	0	0	0	0	0	0	13
<i>Nitzschia liebetruthii</i>	0	0	0	0	0	0	0	0	1	1
<i>Nitzschia linearis</i>	0	0	2	0	0	0	1	0	1	0
<i>Nitzschia linearis subtilis</i>	0	0	0	0	0	0	0	0	2	0

Species	Cow Spring Pool 1	Cow Spring Pool 2	Site 12 Pool 1	Site 12 Pool 2	Fig Pool 1	Fig Pool 2	Mundagoora Pool 1	Mundagoora Pool 2	NJA21-006-US 1	NJA21-006-US 2
Nitzschia microcephala	0	0	55	21	0	0	0	0	16	11
Nitzschia palea	0	0	83	96	0	0	0	0	72	87
Nitzschia palea var debilis	0	0	10	2	0	0	0	0	20	18
Nitzschia paleacea	0	0	0	0	0	0	0	0	2	0
Nitzschia perminuta	0	0	11	5	0	0	0	0	8	7
Nitzschia pura	0	0	5	15	0	0	0	0	9	11
Nitzschia sp.	0	0	3	2	0	0	0	0	4	4
Nitzschia subacicularis	0	0	6	3	0	0	3	5	0	0
Pinnularia gibba	0	0	2	0	0	0	0	0	0	0
Pinnularia subcapitata	0	0	0	0	0	0	2	0	1	0
Pinnularia viridiformis	0	2	0	0	0	0	0	0	0	0
Planothidium delicatulum	0	0	0	2	0	0	0	0	2	0
Sellaphora seminulum	0	0	0	0	0	0	0	1	0	0
Tryblionella angustulata	5	0	0	0	0	0	0	2	0	0
Tryblionella apiculata	0	0	0	0	0	0	0	1	0	0
Ulnaria acus	0	0	18	28	0	0	4	2	0	0
Ulnaria girdle	0	0	2	0	0	0	0	0	0	0
Ulnaria ulna	27	2	2	0	0	0	0	1	1	0
Unknown girdle	0	2	0	0	0	0	0	0	4	0

Species	Cow Spring Pool 1	Cow Spring Pool 2	Site 12 Pool 1	Site 12 Pool 2	Fig Pool 1	Fig Pool 2	Mundagoora Pool 1	Mundagoora Pool 2	NJA21-006-US 1	NJA21-006-US 2
Total	301	300	300	305	0	0	301	305	314	300
DSIAR score	71	71	51	51	0	0	54	57	47	50
Species Richness	10	24	24	26	0	0	20	24	32	17

Table E-6: Diatom species and count data - Late Dry 2022

Species	Mundagoora Pool 1	Mundagoora Pool 2	Cow Springs Pool 1	Cow Springs Pool 2	Fig Pool 1	Fig Pool 2	Site 12 Pool 1	Site 12 Pool 2
Date	22/10/2022	22/10/2022	22/10/2022	22/10/2022	23/10/2022	23/10/2022	23/10/2022	23/10/2022
Notes on counts					Sparse. 10 transects counted	Barren		
Achnanthes brevipes	0	2	0	0	0	0	0	0
Achnantheidium exiguum	0	2	0	0	0	0	0	0
Achnantheidium exile	48	7						
Achnantheidium minutissimum	171	57	7	2	0	0	6	20
Brachysira styriaca	0	0	4	1	0	0	1	0
Brachysira vitrea	5	4	128	76	0	0	5	9
Caloneis bacillum	0	0	0	0	1	0	0	0
Cocconeis placentula	0	0	1	0	0	0	0	0

Species	Mundagoora Pool 1	Mundagoora Pool 2	Cow Springs Pool 1	Cow Springs Pool 2	Fig Pool 1	Fig Pool 2	Site 12 Pool 1	Site 12 Pool 2
Craticula halophila	0	0	0	0	0	0	4	0
Cyclotella meneghiniana	0	0	0	0	0	0	0	3
Cyclotella spp. (small)	9	26	0	0	0	0	0	0
Cymbella cistula	1	2	0	0	0	0	0	0
Encyonema mesianum	0	2	0	0	0	0	0	0
Encyonema silesiacum	0	0	10	2	0	0	2	0
Encyonopsis perborealis	4	27	0	0	0	0	0	18
Eolimna minima	0	0	0	0	8	0	0	0
Epithemia adnata	20	39	0	0	0	0	0	0
Epithemia gibba	0	0	0	0	1	0	0	0
Epithemia sorex	0	12	0	0	0	0	0	0
Eunotia bilunaris	21	23	136	246	0	0	0	0
Eunotia pectinalis	0	0	0	1	0	0	0	0
Eunotia spp.	2	10	0	0	0	0	0	0
Fragilaria acus	5	7	0	0	0	0	10	18
Frustulia rhomboides	0	0	0	0	17	0	0	0
Gomphonema affine	1	0	3	2	6	0	1	5
Gomphonema angustum	1	39	0	0	0	0	0	0
Gomphonema gracile	5	20	0	0	0	0	0	0

Species	Mundagoora Pool 1	Mundagoora Pool 2	Cow Springs Pool 1	Cow Springs Pool 2	Fig Pool 1	Fig Pool 2	Site 12 Pool 1	Site 12 Pool 2
Mastogloia elliptica	1	8	0	0	0	0	237	181
Mastogloia smithii	0	5	0	0	0	0	16	25
Navicula aff bryophila							3	8
Navicula radiosa	5	4	0	0	0	0	0	0
Navicymbula pusilla	0	0	0	0	0	0	11	19
Nitzschia amphibia	4	10	0	0	0	0	0	0
Nitzschia gracilis	1	0	0	0	0	0	0	0
Nitzschia liebetruthii	0	0	0	0	3	0	0	0
Nitzschia linearis	4	3	0	0	0	0	0	0
Nitzschia microcephala	0	0	0	0	0	0	0	1
Nitzschia palea	0	0	0	0	8	0	11	18
Nitzschia subacicularis	0	1	0	0	0	0	0	0
Pinnularia divergens					9			
Pinnularia microstauron	0	2	0	0	0	0	0	0
Pinnularia subcapitata	0	0	0	0	59	0	0	0
Rhopalodia brebissonii	1	0	0	0	1	0	0	0
Ulnaria ulna	0	0	26	4	0	0	0	6
Total	309	312	315	334	113	0	315	334
DSIAR score	18.4	16.4	20.7	21.5	47.0		17.7	16.2
Species Richness	19	23	8	8	10	0	12	13

APPENDIX F. PHYTOPLANKTON DATA

Table F-1.: Phytoplankton profile for the Iron Bridge Pools sampled in the late dry season (2020)

Taxon	F16 HB		SS Pool		S12 Pool		Cow Spring	
	DE01565.1		DE01565.2		DE01565.3		DE01565.4	
	10/12/2020		8/12/2020		09/12/2020		11/12/2020	
	Abund.	%	Abund.	%	Abund.	%	Abund.	%
Bacillariophyceae	200	8.00	80300	76.11	3200	2.27	7000	19.02
<i>Achnanidium minutissima</i>			35200	33.36			1400	3.80
<i>Amphora spp.</i>					400	0.28	200	0.54
<i>Cocconeis spp.</i>			700	0.66				
<i>Cymbella spp.</i>			300	0.28			400	1.09
<i>Lyrella spp.</i>			100	0.09				
<i>Microtabella spp.</i>	100	4.00						
<i>Navicula spp.</i>	100	4.00	19600	18.58				
<i>Navicula spp.</i>			19600	18.58	1200	0.85	2800	7.61
<i>Nitzschia spp.</i>			100	0.09	1200	0.85	400	1.09
<i>Pinnularia spp.</i>			200	0.19				
<i>Synedra spp. (O)</i>			4500	4.27	400	0.28	1800	4.89
Chlorophyceae	2200	88.00	900	0.85	3200	2.27	1400	3.80
<i>Closterium spp. (O)</i>					1200	0.85		
<i>Cosmarium spp. (O)</i>	2200	88.00	700	0.66	2000	1.42	1200	3.26
<i>Oocystis spp.</i>			200	0.19				
<i>Staurastrum spp. (O)</i>							200	0.54
Cryptophyceae			8800	8.34	24000	17.00	15000	40.76
<i>Chroomonas spp.</i>			800	0.76	2400	1.70	3000	8.15

Taxon	F16 HB		SS Pool		S12 Pool		Cow Spring	
	DE01565.1		DE01565.2		DE01565.3		DE01565.4	
	10/12/2020		8/12/2020		09/12/2020		11/12/2020	
	Abund.	%	Abund.	%	Abund.	%	Abund.	%
<i>Cryptomonas spp. (O)</i>			8000	7.58	21600	15.30	11800	32.07
<i>Plagioselmis spp.</i>							200	0.54
Cyanobacteria			8200	7.77	8000	5.67		
<i>Chroococcus spp.</i>					1600	1.13		
<i>Planktolyngbya spp.</i>					6400	4.53		
<i>Pseudoanabaena spp. (O) (PT)</i>			8200	7.77				
Dinophyceae			7200	6.82	102800	72.80	13200	35.87
<i>Gomphonema spp.</i>			500	0.47				
<i>Gonyaulax spp.</i>			800	0.76	42800	30.31	12200	33.15
<i>Gymnodinium spp.</i>			1400	1.33			600	1.63
<i>Peridinium spp. (O)</i>			4500	4.27	60000	42.49	400	1.09
Euglenophyceae	100	4.00	100	0.09			200	0.54
<i>Euglena spp. (O)</i>			100	0.09				
<i>Trachelomonas spp.</i>	100	4.00					200	0.54
<i>TOTAL (All Taxa)</i>	2500	100	105500	100	141200	100	36800	100

Table F-2: Phytoplankton profile for Iron Bridge pools sampled in the Late Wet season 2021

Taxon	Fig Pool		Central Creek		Site 12		Cow Spring		Gv Pool		Mundagoora Pool	
	DE01792.1		DE01792.2		DE01792.4		DE01792.5		DE01792.6		DE01792.3	
	24/05/2021		24/05/2021		24/05/2021		24/05/2021		24/05/2021		24/05/2021	
	Abund.	%	Abund.	%	Abund.	%	Abund.	%	Abund.	%	Abund.	%
Bacillariophyceae			460	93.88	20	100.00	20	100.00	860	98.85	70	63.64
Achnanidium sp.											10	9.09
Amphora sp.									40	4.60	10	9.09
Entomoneis			10	2.04								
Fragilaria sp. (O)			10	2.04								
Placoneis sp.									530	60.92		
Navicula capitata			10	2.04								
Navicula pupula capitata			10	2.04								
Navicula sp.			50	10.20	20	100.00	10	50.00	100	11.49	40	36.36
Nitzschia sp.			130	26.53					110	12.64		
Pleurosigma sp. (O)			220	44.90								
Rhopalodia gibba			10	2.04					60	6.90		
Stauroneis sp.			10	2.04								
Synedra sp. (O)							10	50.00	20	2.30	10	9.09
Chlorophyceae											40	36.36
Mougeotia sp.											40	36.36
Cryptophyceae			30	6.12					10	1.15		
Cryptomonas sp. (O)			30	6.12					10	1.15		
TOTAL (All Taxa)			490	100	20	100	20	100	870	100	110	100

Table F-3:. Phytoplankton profile for Iron Bridge pools sampled in the Late Dry season 2021

Taxon name	Fig Pool	Fig Pool	Cow Spring Pool	Cow Spring Pool	Mundagoora Pool	Mundagoora Pool	Site 12 Pool	Site 12 Pool	GV Pool	GV Pool
Replicates	1	2	1	2	1	2	1	2	1	2
Notes on counts (e.g. sparse, dissolved)	no diatoms	no diatoms								
Achnanidium minutissimum	0	0	36	268	94	144	0	0	182	54
Brachysira styriaca	0	0	12	0	0	0	0	0	0	0
Brachysira vitrea	0	0	284	46	12	0	0	0	0	0
Cymbella affinis	0	0	0	0	0	0	2	0	0	0
Diploneis parma	0	0	0	6	0	0	0	0	0	14
Encyonopsis microcephala	0	0	0	0	0	0	20	10	0	0
Eunotia bilunaris	0	0	32	94	46	0	4	0	0	0
Eunotia incisa	0	0	0	0	6	0	4	0	0	0
Fragilaria acus	0	0	0	0	0	0	12	0	14	14
Fragilaria spp.	0	0	0	0	0	0	0	0	2	0

Taxon name	Fig Pool	Fig Pool	Cow Spring Pool	Cow Spring Pool	Mundagoora Pool	Mundagoora Pool	Site 12 Pool	Site 12 Pool	GV Pool	GV Pool
<i>Gomphonema affine</i>	0	0	0	0	0	0	0	0	0	16
<i>Gomphonema angustum</i> var "subminutum"	0	0	0	0	102	38	0	0	0	0
<i>Gomphonema gracile</i>	0	0	0	0	0	4	0	0	2	0
<i>Gomphonema unknown</i>	0	0	0	0	0	4	0	0	0	2
<i>Mastogloia smithii</i>	0	0	0	0	0	0	98	274	82	224
<i>Navicula aff. bryophila</i>	0	0	0	0	0	0	0	18	0	0
<i>Navicula cryptocephala</i>	0	0	0	0	0	0	0	0	4	2
<i>Navicula erifuga</i>	0	0	0	0	0	0	0	0	2	0
<i>Navicula gregaria</i>	0	0	0	0	0	0	2	0	0	0
<i>Navicula leptostriata</i>	0	0	0	4	0	44	8	0	0	0
<i>Navicula menisculus</i>	0	0	0	0	0	0	8	0	4	0
<i>Navicula perminuta</i>	0	0	0	0	0	0	0	0	0	4
<i>Navicula radiosa</i>	0	0	0	2	8	98	0	0	0	2
<i>Navicula recens</i>	0	0	0	0	2	0	0	0	0	2
<i>Navicula rostellata</i>	0	0	0	0	2	0	0	0	0	0
<i>Navicula viridula</i>	0	0	0	0	4	0	0	0	0	0

Taxon name	Fig Pool	Fig Pool	Cow Spring Pool	Cow Spring Pool	Mundagoora Pool	Mundagoora Pool	Site 12 Pool	Site 12 Pool	GV Pool	GV Pool
<i>Navicula viridula</i>	0	0	0	0	0	0	0	0	0	8
<i>Navicymbula pusilla</i>	0	0	0	0	0	0	74	0	0	0
<i>Nitzschia acicularis</i>	0	0	0	0	0	0	2	0	0	0
<i>Nitzschia fonticola</i>	0	0	0	0	0	0	4	0	4	4
<i>Nitzschia frustulum</i>	0	0	0	0	0	0	0	0	2	0
<i>Nitzschia graciliformis</i>	0	0	0	0	0	0	2	0	0	0
<i>Nitzschia gracilis</i>	0	0	0	0	0	0	0	0	0	2
<i>Nitzschia inconspicua</i>	0	0	0	4	0	0	4	0	0	0
<i>Nitzschia intermedia</i>	0	0	0	0	0	0	4	0	0	0
<i>Nitzschia lacuum</i>	0	0	0	0	0	0	0	0	0	4
<i>Nitzschia linearis</i>	0	0	0	8	0	0	4	4	18	32
<i>Nitzschia microcephala</i>	0	0	0	0	0	0	14	0	24	10
<i>Nitzschia palea</i>	0	0	0	0	0	0	2	0	10	0
<i>Nitzschia paleaceae</i>	0	0	0	0	4	0	0	0	4	0
<i>Nitzschia perminuta</i>	0	0	4	0	4	0	2	0	0	0
<i>Nitzschia reversa</i>	0	0	0	0	0	0	4	0	0	0
<i>Nitzschia solita</i>	0	0	0	0	0	0	2	0	0	0

Taxon name	Fig Pool	Fig Pool	Cow Spring Pool	Cow Spring Pool	Mundagoora Pool	Mundagoora Pool	Site 12 Pool	Site 12 Pool	GV Pool	GV Pool
Nitzschia subacicularis	0	0	0	0	2	0	0	0	0	0
Nitzschia supralitorea	0	0	2	0	0	0	0	0	0	0
Nitzschia valdestriata	0	0	0	0	2	0	0	0	0	0
Pinnularia borealis	0	0	0	0	0	0	0	2	0	0
Pinnularia gibba	0	0	0	0	2	0	0	0	0	0
Pinnularia legumen	0	0	0	0	4	0	0	2	0	0
Stauroneis pachycephala	0	0	0	0	0	0	2	0	0	0
Stauroneis spp	0	0	0	0	0	0	0	0	0	4
Surirella brebissonii	0	0	0	0	0	0	2	2	0	0
Surirella minuta	0	0	0	0	4	0	0	0	0	0
Ulnaria ulna	0	0	8	6	6	0	16	8	74	22
Total	1	2	371	434	295	334	281	314	355	400

Table F-4:. Phytoplankton profile for Iron Bridge pools sampled in the Late Wet 2022 season.

Taxon	Fig pool		Mundagoora Pool		Site 12 Pool		Cow Spring Pool		NJA21-006-US Pool	
Sample Date	23/06/2022		21/06/2022		24/06/2022		23/06/2022		22/06/2022	
	Abund.	%	Abund.	%	Abund.	%	Abund.	%	Abund.	%
Amphora spp	0	0	0	0	0	0	0	0.00	0	0
Cyclotella spp (O)	0	0	480	14.95	0	0	0	0	20	0.00
Navicula spp	0	0	0	0	0	0	0	0	40	0.01
Synedra spp (O)	0	0	0	0	0	0	0	0.00	0	0
Acutodesmus spp	0	0	0	0	0	0	0	0	180	0.04
Chlorella spp	0	0	0	0	0	0	0	0	900	0.18
Chodatella spp	0	0	0	0	0	0	0	0	1000	0.21
Closteridium spp (O)	0	0	0	0	0	0	0	0	0	0
Desmodesmus spp	0	0	0	0	0	0	0	0	1600	0.33
Dictyosphaerium spp (O)	0	0	800	24.92	0	0	0	0	0	0
Monoraphidium contorta	0	0	60	1.87	0	0	0	0	0	0
Monoraphidium spp	0	0	0	0	0	0	0	0	480000	98.42
Mougeotia spp	0	0	0	0	0	0	0	0.00	0	0
Oocystis spp (O)	0	0	400	12.46	0	0	0	0.00	0	0

Taxon	Fig pool		Mundagoora Pool		Site 12 Pool		Cow Spring Pool		NJA21-006-US Pool	
	Abund.	%	Abund.	%	Abund.	%	Abund.	%	Abund.	%
Cryptomonas spp (O)	0	0	170	5.30	0	0	0	0	0	0
Cyanogranis spp	0	0	660	20.56	0	0	0	0	0	0
Pseudanabaena spp (O) (PT)	0	0	0	0	0	0	0	0.00	0	0
Synechococcus spp	0	0.00	0	0	0	0	0	0	0	0
Gymnodinioid Dinoflagellates (unknown)	0	0	0	0	0	0	0	0	50	0.01
Trachelomonas spp	0	0	20	0.62	0	0	0	0	0	0
Prasinophytes (unknown)	0	0	600	18.69	50	100.00	0	0.00	3900	0.80
Tetraselmis spp	0	0	20	0.62	0	0	0	0	0	0

Table F-6: Phytoplankton profile for Iron Bridge pools sampled in the Late Dry 2022 season.


Taxon	Fig pool		Mundagoora Pool		Site 12 Pool		Cow Spring Pool	
	Abund.	%	Abund.	%	Abund.	%	Abund.	%
Sample Date	24/11/2022		22/10/2022		22/10/2022		22/10/2022	
	Abund.	%	Abund.	%	Abund.	%	Abund.	%
Bacillariophyceae	0	0	1520	7.10	2220	9.44	340	9.44
Amphora spp	0	0	0	0	280	1.19	80	12.50
Cyclotella spp (O)	0	0	1500	7.00	0	0	0	0
Mastogloia spp	0	0	0	0	1140	4.85	0	0


Taxon	Fig pool		Mundagoora Pool		Site 12 Pool		Cow Spring Pool	
Navicula spp	0	0	10	0.05	470	2	110	17.19
Nitzschia spp	0	0	10	0.05	0	0	0	0
Synedra spp (O)	0	0	0	0	330	140	150	23.44
Chlorophyceae	0	0	6950	32.45	3570	15.18	30	4.69
Acutodesmus spp	0	0	0	0	0	0	0	0
Chlorella spp	0	0	0	0	0	0	0	0
Chodatella spp	0	0	0	0	0	0	0	0
Closteridium spp (O)	0	0	0	0	0	0	0	0
Cosmarium spp (O)	0	0	0	0	160	0.68	0	0
Crucigenia spp	0	0	450	2.1	0	0	0	0
Desmodesmus spp	0	0	0	0	0	0	0	0
Dictyosphaerium spp (O)	0	0	2480	11.58	80	0.34	0	0
Kirchneriella spp	0	0	240	1.12	0	0	0	0
Monoraphidium contorta	0	0	3400	15.87	420	1.79	0	0
Monoraphidium spp	0	0	20	0.09	0	0	0	0
Mougeotia spp	0	0	0	0	1900	8.08	0	0



Taxon	Fig pool		Mundagoora Pool		Site 12 Pool		Cow Spring Pool	
Oocystis spp (O)	0	0	40	0.19	380	1.62	30	4.69
Scenedesmus spp (O)	0	0	300	1.40	0	0	0	0
Spaerocystis spp	0	0	20	0.09	0	0	0	0
Staurastum spp (O)	0	0	0	0.00	10	0.04	0	0
Tetraedon spp	0	0	10	0.05	870	3.7	150	23.44
Cryptophyceae	0	0	0	0.00	550	2.34	0	0
Chroomonas spp	0	0	10	0.05	320	1.36	150	23.44
Cryptomonas spp (O)	0	0	11660	54.44	16420	69.81	0	0.00
Cyanobacteria	230	100.00	0	0.00	240	1.02	0	0
Beaded Cyanobacteria Filament	0	0	11600	54.15	0	0	0	0
Cyanogranis spp	0	0	0	0	320	1.36	0	0
Merismopedia spp	0	0	0	0	5440	23.13	0	0
Microcystis spp (O) (PT)	0	0	0	0	2240	9.52	0	0
Phormidium spp (O) (PT)	0	0	0	0	380	1.62	0	0
Planktolyngbya spp	0	0	60	0.28	1360	5.78	0	0
Pseudanabaena spp (O) (PT)	230	100	0	0	6440	27.38	0	0



Taxon	Fig pool		Mundagoora Pool		Site 12 Pool		Cow Spring Pool	
Synechococcus spp	0	0.00	300	1.40	0	0	0	0
Dinophyceae	0	0	20	0.09	0	0	0	0
Gymnodinioid Dinoflagellates (unknown)	0	0	0	0	0	0	0	0
Perdinium spp (O)	0	0	20	0.09	0	0	0	0
Euglenophyceae	0	0	60	0.28	70	0.3	10	1.56
Euglena spp	0	0	0	0	10	0.04	0	0
Phacus spp	0	0	0	0	40	0.17	0	0
Trachelomonas spp	0	0	60	0.28	20	0.09	10	1.56
Prasinophyceae	0	0	1200	5.60	370	1.57	110	17.19
Prasinophytes (unknown)	0	0	1200	5.60	370	1.57	110	17.19

APPENDIX G. MACROPHYTE TABLE

Name	Description	Image	Site 12	Cow	South	Central
Ribbon weed <i>(Vallisneria sp.)</i>	Bright green soft ribbon fronds which float and spread across the water surface. Fronds about 0.5 cm wide.		Y	Y	Y	

Name	Description	Image	Site 12	Cov	South	Central
<p>Charophytes (<i>Nitella sp.</i>, <i>Chara sp.</i>)</p>			Y			

Name	Description	Image	Site 12	Cow	South	Central
<p>Clubrush (<i>Schoenoplectus</i> sp.)</p>			Y	Y	Y	Y
<p>Sedges (<i>Cyperus</i> sp.)</p>			Y	Y	Y	Y

Name	Description	Image	Site 12	Cow	South	Central
Bulrush <i>(Typha sp.)</i>	Tall emergent ribbon like fronds with sharp margins.		Y	Y	Y	
Unidentified species 1				Y		

Name	Description	Image	Site 12	Cow	South	Central
Unidentified species 2				Y		



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