EPL239 Annual Monitoring Report

Reporting period: 1 April 2023 – 31 March 2024

Humpty Doo Barramundi Pty Ltd

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ACRONYMS

AI	Adelaide Intake – water intake point from Adelaide River
ANZECC	Australian and New Zealand Environment and Conservation Council
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
AQIS	Australian Quarantine and Inspection Service
ASS	acid sulfate soils
BAP	Best Aquaculture Practices program
BOD	biochemical oxygen demand
Chl-a	chlorophyll-a
DPWS	Department of Environment, Parks and Water Security (Northern Territory)
DO	dissolved oxygen
DP	Development Permit
DP1	Discharge Point 1 – Authorised Discharge Point 1 in EPL239
DP2	Discharge Point 2 - Authorised Discharge Point 1 in EPL239
EC	electrical conductivity
EMP	Environmental Management Plan
EPL	Environment Protection Licence
FRP	filterable reactive phosphorus
HDB	Humpty Doo Barramundi Pty Ltd
HDPE	High Density Polyethylene
LOR	limit of reporting
NATA	National Association of Testing Authorities
NOx	nitrate NO_3 + nitrite NO_2
NT	Northern Territory
NT EPA	Northern Territory Environment Protection Authority
NOI	Notice of Intent
PASS	potential acid sulfate soils
QA/QC	quality assurance, quality control
RPD	relative percentage difference
S1N	Stage 1 Nursery
S2N	Stage 2 Nursery
SOCS	Sites of Conservation Significance
SSTV	site specific trigger value
TN	total nitrogen
TP	total phosphorus
TSS	total suspended solids
WMPC Act	*Waste Management and Pollution Control Act* (Northern Territory)
WQMP	Water Quality Monitoring Plan

1 EXECUTIVE SUMMARY

Humpty Doo Barramundi Pty Ltd (HDB) operates a barramundi farm near the Adelaide River in the Northern Territory. Water quality monitoring is undertaken to safeguard downstream water quality, ecosystems, and water users and to ensure compliance with the Environment Protection Licence 239 currently in its 4th revision (EPL239-04). This Monitoring Report covers the period from April 2023 to March 2024, serving as the sixth and final report under EPL239.

HDB conduct all water quality monitoring in accordance with their WQMP and EPL239 which includes five authorised discharge point and 12 designated monitoring points including 3 sites on the Adelaide River which serve as their 'compliance points' depending on tidal flow. Monitoring must be conducted weekly when discharge is occurring, or at least once per discharge event if the discharge is less than one week. All three Adelaide River compliance points as well as respective discharge monitoring points must be sampled during every discharge monitoring event. Water quality at the three Adelaide River compliance points are assessed against SSTVs derived from 2 years of baseline data collected from 2016 to 2018.

During the 2023-24 reporting period, higher than average rainfall including a January record, resulted in a significant increase in the total water discharged (2,208ML) compared to the previous year (308ML). All weekly discharge monitoring was conducted, and all start/stop dates and flow volumes were recorded in accordance with EPL239. Three non-compliances notifications were sent to the EPA as per condition 36 and 37. A further 3 non-compliances were missed and have been reported here. The combined total Nitrogen and Phosphorous load discharge into the Adelaide River was 18,205kg, significantly more than the previous reporting period (2,320kg), accounting for 0.59% of the total discharge by the Adelaide River catchment as calculated by upstream N+P data. Discharge volumes are heavily dependent on rainfall volumes and accumulation periods and such fluctuation between years is not unexpected.

Physical parameters measured during all monitoring events exhibited naturally fluctuating results consistent with historical recordings. pH recorded values just below the SSTV on four occasions while all farm discharges remained within the SSTVs. EC fluctuated significantly with changes in seasonal rainfall with the lowest values recorded in January 2024 and the highest values recorded in December 2023. Dissolved oxygen and Turbidity also showed natural seasonal fluctuations consistent with historic values with little to no difference between upstream and downstream sites.

Non compliance notifications reported to the EPA were with regards to BOD, ammonia, Total Nitrogen and Total Phosphorus concluded risks and impacts to the Adelaide River from elevated ammonia in farm discharges remain very low for several reasons; TN and TP concentrations only exceeded SSTV following initial wet season rainfalls that resulted in the upstream site ARUS1 also exceeding the natural background levels. Similarly, three out of four BOD exceedances occurred when the upstream site ARUS1 was higher than the downstream compliance point. All other parameters did not and have never exceed relative trigger values including chlorophyll-a, indicating that no algal blooms have occurred and that farm discharges do not reduce dissolved oxygen levels within the river.

Despite increases in TN and TP in discharge water due to expansions in farm size long term trends within the river do not show any current increasing trends of concern with discharge water quality increasing slightly on the previous reporting period.

2 INTRODUCTION

Humpty Doo Barramundi Pty Ltd (HDB) operate a barramundi farm located approximately 58 km east of Darwin near the Middle Point locality on the Adelaide River (Figure 2-1). Water quality monitoring is undertaken by HDB to ensure that operations do not impact downstream Adelaide River water quality, ecosystems, or water users. This monitoring is also a requirement of the Environment Protection Licence 239 (EPL239), issued to HDB by the Northern Territory Environment Protection Authority (NT EPA) under the *Waste Management and Pollution Control Act.*

Monitoring Reports are required annually, as per Condition 41 of EPL239 (see latest version EPL239-04 issued 25th of July 2023). This Monitoring Report covers all water quality monitoring undertaken for the reporting period starting 1 April 2023 and ending 31 March 2024 (herein referred to as the 'reporting period'). This is the sixth and last Monitoring Report under EPL239 (first version) commenced on 6 June 2018.

2.1 Purpose and scope

This Monitoring Report is prepared in accordance with the following EPL239-04 conditions:

Condition 41

The licensee must complete and provide to the NT EPA a Monitoring Report, as prescribed by this licence, by April 30 each year.

Condition 42

The licensee must ensure that each Monitoring Report:

42.1 is prepared in accordance with the requirements of the NT EPA 'Guideline for Reporting on Environmental Monitoring';

42.2 includes a tabulation of all monitoring data required as a condition of this licence, in Microsoft (R) Excel format;

42.3 includes a discharge summary for each discharge event, which consists of the:

42.3.1 water quality data for all authorised monitoring points in accordance with Attachment C;

42.3.2 flow data, discharge volumes and discharge times; and

42.3.3 a tabulation of monthly and annual contaminant loads discharged from the authorised discharge points specified in condition 19 for the preceding 12-month period. Contaminant loads must be calculated for metals, metalloids, nutrients and other parameters (excluding field parameters) listed Appendix A. The calculations must be based on the daily discharge volume and the concentration of contaminant present in the discharge on that day. On the days when a sample was not taken then the concentration of the contaminant must be estimated using Linear Interpolation methodology; and

42.3.4 a summary of exceedances of trigger values in accordance with condition 37.

42.4 includes long term trend analysis of monitoring data to demonstrate any environmental impact associated with the activity over a minimum period of three years (where the data is available); and

42.5 includes an assessment of environmental impact from the activity.

2.2 EPL239-04 compliance monitoring and reporting

Table 2-2-1 below lists the farm's authorised discharge points into the Adelaide River as listed in Table 3 of EPL239-04. See Figure 2-2 for a map of authorised discharge point locations.

Table 2-2-1. Authorised discharge points as listed in EPL239-04

Authorised Discharge Point	Source of Discharge Water	Location
DP1	Discharge Point 1. Receives wastewater from the North Farm wetland treatment system.	Latitude: -12.54778 Longitude:131.37553
DP2	Discharge Point 2. Receives wastewater from the Stage 1 Nursery and the Stage 2 Nursery.	Latitude: -12.55530 Longitude: 131.37485
AI	Adelaide River Intake. Receives wastewater from the South Farm wetland treatment system. This is also the intake channel used to deliver water to the farm when pumping from Adelaide River.	Latitude: -12.55416 Longitude: 131.37390
EF DP	East Farm Discharge Point. Receives wastewater from the East Farm wetland treatment system.	Latitude: -12.55690 Longitude: 131.37500
EF CE DP	East Farm Controlled Emergency Discharge Point. Receives wastewater from the East Farm wetland treatment system.	Latitude: -12.55740 Longitude: 131.37800

Water quality monitoring at HDB is undertaken in accordance with Attachment C of EPL239-04 and all water monitoring related conditions of the licence, i.e. Conditions 24 to 33. HDB's *Water Quality Monitoring Plan* (WQMP) details the monitoring sites, physical (field) and laboratory parameters measured, sampling methods and procedures.

Monitoring site locations are shown in Figure 2-2 and detailed in Table 5-5-1. Water quality sampling at these sites is to be undertaken weekly when discharging, or at least once per discharge event, if the event is less than one week.

The 'compliance point', where the water quality assessment criteria (trigger values) listed in Attachment C of EPL239-04 are applied during a discharge, is the downstream Adelaide River sampling site ARDS1. All sampling must be undertaken on an outgoing tide. Table 5-5-2 lists the required water quality parameters to be measured and the trigger values for determining compliance.

The following conditions apply to the water quality monitoring results recorded at the ARDS1 compliance point during a discharge:

Condition 22

The licensee must ensure that the discharge from all discharge events does not cause exceedances of trigger values in the Adelaide River at the compliance point, in accordance with Attachment C.

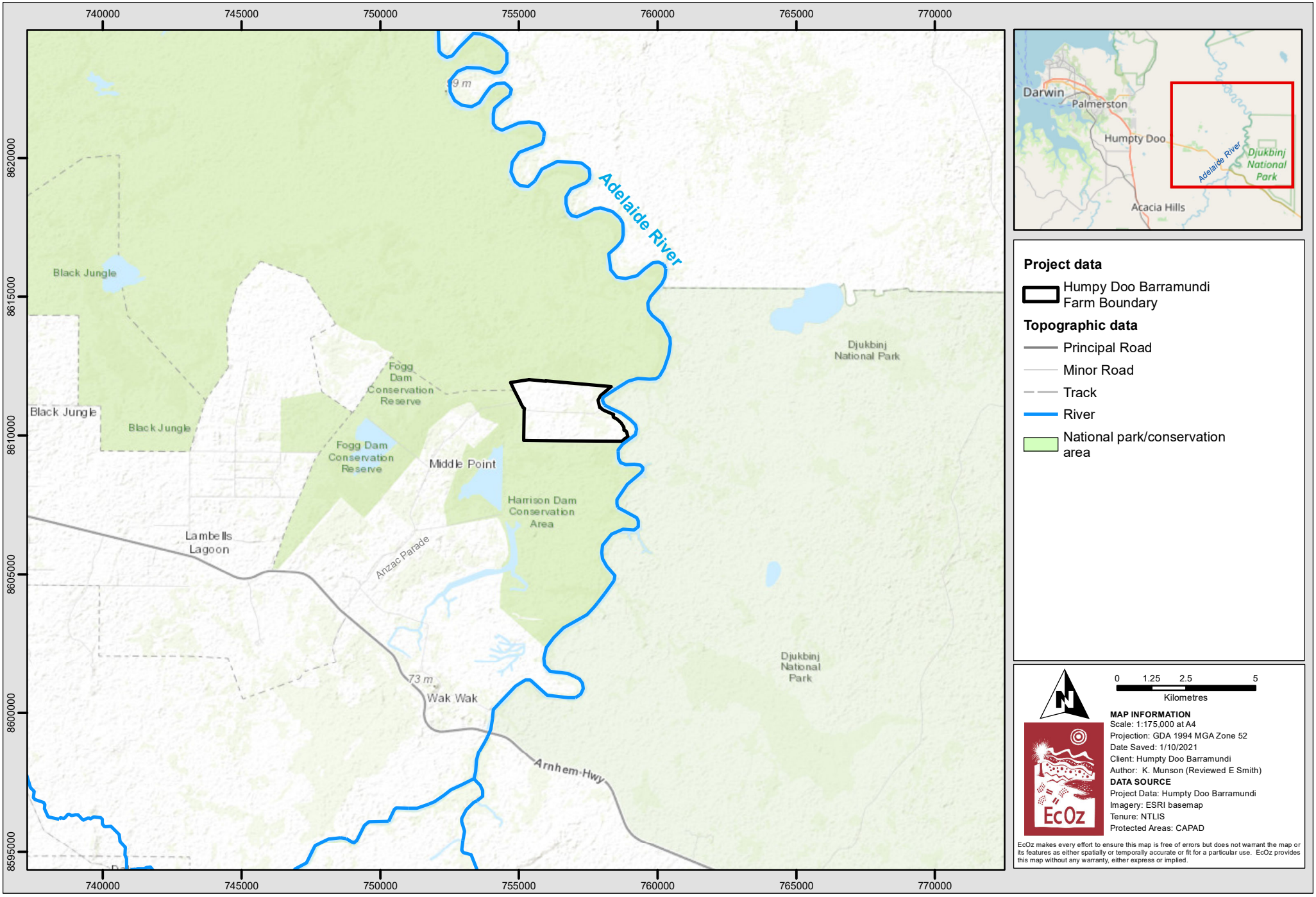

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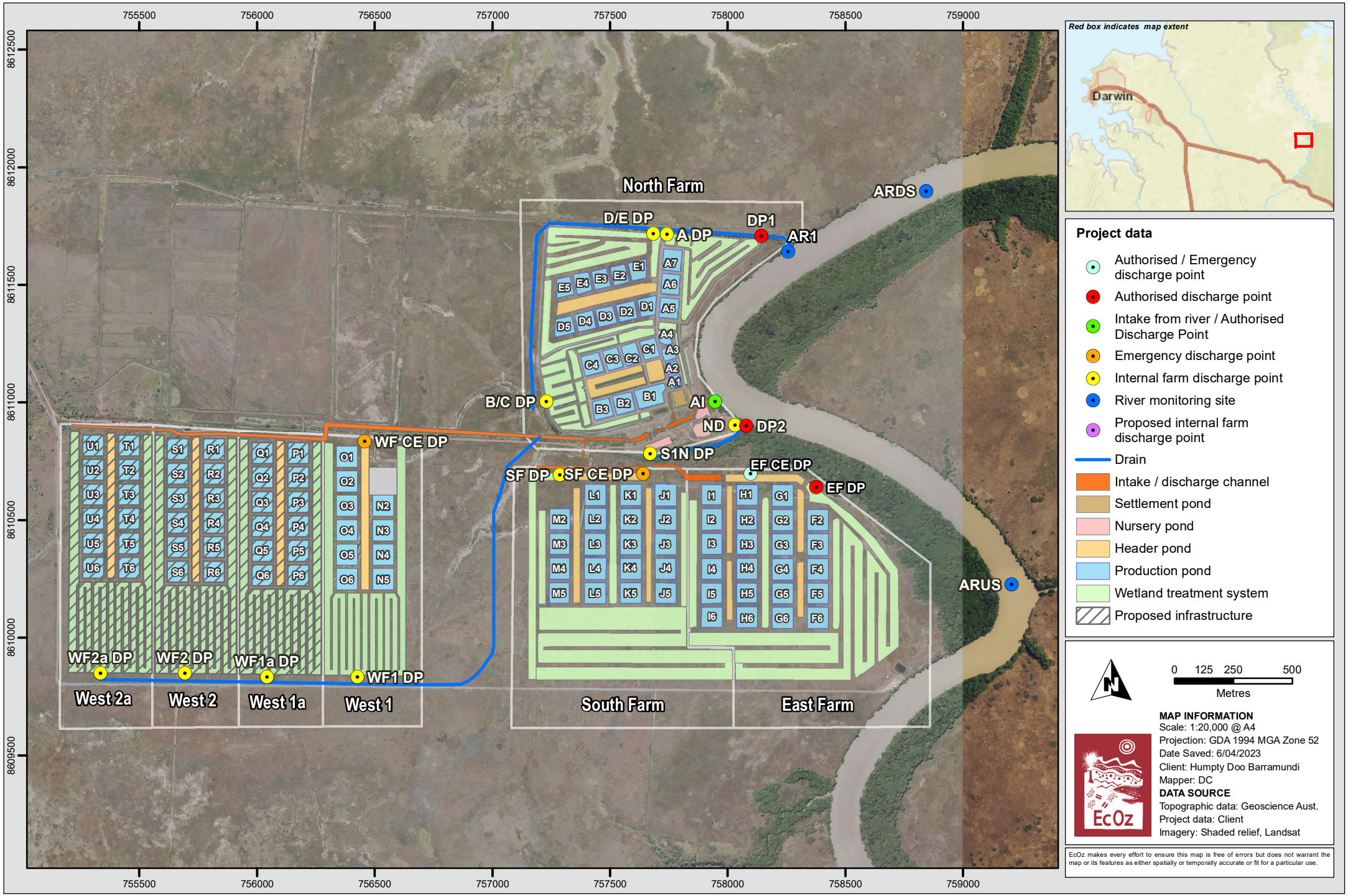
Figure 2-1. Location map of Humpty Doo Barramundi farm



Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\EZ21225 - EPL Amendment\01 Project Files\Report maps\West Farm Site Layout with all of HDB Farm.mxd

Figure 2-2. Map of farm pond layout, discharge monitoring points and receiving waterways

3 HDB FARM BACKGROUND

3.1 Farm operations

Figure 2-2 shows the HDB farm layout. This currently includes the:

- **North Farm** covering an area of approximately 60 ha, comprising 20 production (grow-out) ponds, 4 broodstock ponds, 3 associated header ponds (for gravity flows), and 3 wetland treatment systems.
- **South Farm** covering an area of approximately 70 ha, comprising 19 production ponds, 3 associated header ponds, and a very large dedicated wetland treatment system.
- **East Farm** covering an area of approximately 68 ha, which currently includes 23 production ponds, 3 header ponds, and a very large dedicated wetland treatment system.
- **West Farm – Stage 1** covering an area of approximately 33 ha, which currently includes 10 productions ponds 1 header pond and a large dedicated wetland treatment system.

The flow system design of all four farms is essentially the same, where water flows from the header ponds, to the production ponds, then through the wetland treatment system. Once treated through the wetlands, the water is of sufficient quality for return to the header ponds for reuse in the production ponds. This minimises the need for discharge to, or refilling from, the Adelaide River. Water can be recirculated indefinitely, and discharge to the Adelaide River is usually limited to the wet season to prevent ponds overtopping, occasionally during the dry season when topping-up the ponds to maintain optimal salinity for fish health, or to allow for pond maintenance and upgrades to infrastructure.

The flow system design at HDB also means that all discharges (when required) are via the wetland treatment systems; no wastewater is discharged direct from the production ponds into the Adelaide River.

The HDB farm includes a Stage 1 Nursery (fingerlings up to 1 g), Stage 2 Nursery (fish between 1 and 30 g), and Stage 3 Nursery (fish between 30 and 200 g). Once juvenile fish are large enough, they are transferred to the production ponds for grow out. Each of these nurseries utilises a wetland treatment system; the Stage 1 Nursery and 2 Nursery each have their own wetland treatment ponds, and the Stage 3 Nursery utilises the South Farm wetland treatment system.

Water required to top-up farm ponds and nursery tanks is pumped from the Adelaide River from the point shown in Figure 2-2 as 'AI' (Adelaide Intake).

Other supporting farm infrastructure includes a packing shed, feed storage shed, workshop, office building, back-up generators, fuel storage and a small staff accommodation block.

3.2 Discharge points

There are five authorised discharge points where water from the farm's wetland treatment systems enter the Adelaide River (see Table 2-2-1). The source of discharge to each of these points is explained below.

Discharge from the North Farm is via 'Discharge Point 1' (DP1); see Figure 2-2. When any of the three wetland treatment systems of the North Farm overflow, they release water into a perimeter drain that then flows to DP1.

Discharge from the South Farm is via 'Adelaide Intake' (AI). All South Farm production ponds flow into a single large wetland water treatment system. The Stage 3 Nursery also utilises this wetland treatment system. When discharging, an operator-controlled valve at 'South Farm Discharge Point' (SF DP) is opened, and water is released through a pipe in the earthen bank into a channel. This channel then flows to discharge point AI where it enters the Adelaide River. An additional discharge point, 'South Farm Controlled Emergency

Discharge Point' (SF CE DP), is located where the wetland treatment system for the South Farm discharges into the drainage channel (leading to AI) during extreme flood events, if required, when the capacity of SF DP is exceeded.

Discharge from the East Farm is via 'East Farm Discharge Point' (EF DP). When discharging, an operator-controlled valve at EF DP is opened, and water is released through a pipe in the earthen bank into the mangroves lining the Adelaide River. An additional discharge point EF CE DP, is located where the wetland treatment system for the East Farm discharges during extreme flood events into the mangroves lining the Adelaide River, if required, when the capacity of EF DP is exceeded.

Discharges from the Stage 1 Nursery and Stage 2 Nursery report to DP2 prior to flowing into the Adelaide River. Water from the Stage 2 Nursery is released via a PVC pipe connected directly to the nursery into the drainage line just upstream of where it meets the Adelaide River (i.e. discharge point ND). Water from the Stage 1 Nursery wetland treatment system discharges into the drainage line at S1N DP, from where it flows down to DP2, and into the Adelaide River.

Discharge from the West Farm currently occurs via a controlled valve at WF DP1. When the valve is opened water runs through a pipe in the earthen bank and into a drainage channel that crosses underneath and runs parallel to the main access road into site finally entering the Adelaide River at discharge point AI

3.3 Environmental setting

The Adelaide River is a major NT river system. It lies within a very large, seasonally-inundated freshwater floodplain comprising a mix of tidal and seasonal wetland habitats dominated by grass and sedge communities, and fringed by open woodland with pockets of monsoon forest (see *Adelaide River coastal floodplain, Sites of Conservation Significance Factsheet* (DEPWS, previously known as DENR)). The main land use within the floodplain is pastoral operations, with other uses including conservation, recreation, tourism, Indigenous, horticulture and aquaculture. Approximately 25% of the area is managed as conservation reserves.

The Adelaide River mouth is a tide-dominated estuary (see www.ozcoasts.gov.au and Ryan et al 2003). The tidal limit is located at Marrakai Crossing, approximately 150 km upstream of the river mouth tracing the river channel including meanders (~100 km direct along general river course). HDB is located approximately 77 km upstream including meanders (45 to 50 km direct). The tidal range where the HDB farm is situated, is typically around 3 m during spring tides, and 2 m during neap tides; as measured at the nearest river level gauge, which is approximately another 20 km further upstream of the farm, at the Arnhem Highway crossing (NT Government Gauge Station No. G8170021). At this point, the river is mangrove-lined, and brackish to saline; salinity ranging from over 16 ppt during the dry season, to less than 1 ppt during the wet season. The strong tidal currents, and resuspension of fine sediments, also mean the river water is highly turbid; typically ranging between 60 NTU and 200 NTU depending on the tide, season, rainfall and river flows.

The region has a tropical monsoonal climate with distinct wet and dry seasons, and little variation in temperature. The wet season is characterised by higher humidity and rainfall, and occurs between October and April. The dry season extends from May to September, and is characterised by lower humidity and very little rainfall. Average annual rainfall is 1,420 mm, taken from the Middle Point Rangers Bureau of Meteorology (BoM) weather station No. 14090. Over 86% of annual average rainfall falls between November and March.

4 RAINFALL AND DISCHARGES

4.1 Rainfall

Figure 4-1 shows monthly rainfall totals taken from the Middle Point BoM station No. 14041 from April 2023 to March 2024 (orange bars). Mean monthly rainfall totals are also shown for comparison (blue bars). Total rainfall for the 12-month reporting period was 1,548.6mm, 167mm above the annual average of 1,380 mm.

Rainfall in all months prior to January 2024 was below average, with January, February and March 2024 well above average, January recording its highest total ever at 555mm.

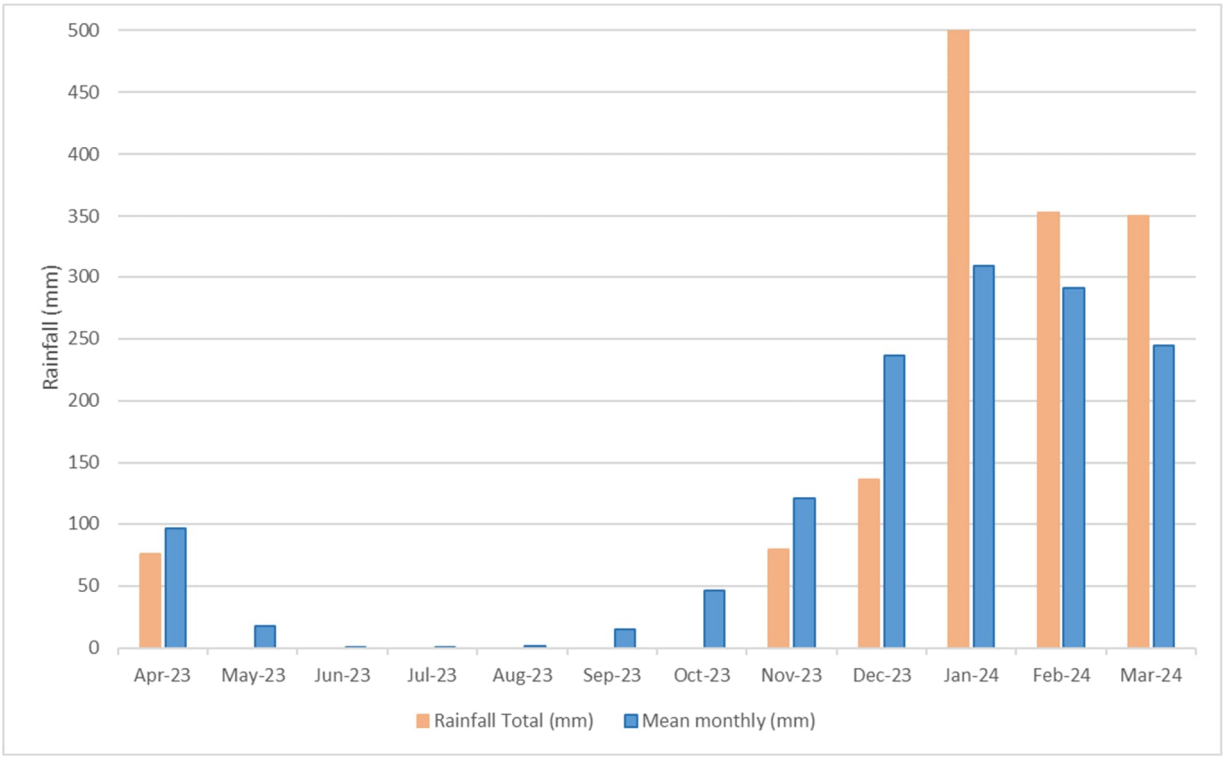


Figure 4-1. Monthly rainfall totals April 2023 to March 2024 (Middle Point BoM station No. 14041)

4.2 Reporting period discharge details

Table 4-4-1 outlines the discharges that occurred during the reporting period. All discharges occurred between December 2023 and March 2024 and were to prevent over topping of ponds due to rainfall.

Total discharge volume this reporting period was 2,208ML significantly more than the previous two reporting periods of 308 ML last year and 1,319.4 ML before that. Discharge volumes vary greatly, dependant not only the total volume of rainfall but the accumulation rate over time. 2023-24 saw above average rainfall however 81% of this fell between January and February with January recording 50% of the annual total alone.

Table 4-4-1. Discharges during Reporting Period 1 April 2023 – 31 March 2024

Discharge Source	Discharge Point	Dates		Duration	Volume (ML)	Purpose	Monitoring dates
South Farm	SF DP > AI	06/12/2023	09/12/2023	3 days	23.4	Rainfall	6/12/2023
West Farm	WF DP1 > AI	06/12/2023	09/12/2023	3 days	51.5	Rainfall	6/12/2023
East Farm	EF DP	16/01/2024	2/02/2024	17 days	160.5	Rainfall	17/01/2024 24/01/2024 31/01/2024
West Farm	WF DP1 > AI	16/01/2024	3/02/2024	18 days	223.2	Rainfall	17/01/2024 24/01/2024 31/01/2024
South Farm	SF DP > AI	16/01/2024	22/01/2024	6 days	131.1	Rainfall	17/01/2024
North Farm	BC DP > DP1	16/01/2024	22/01/2024	6 days	96.6	Rainfall	17/01/2024
North Farm	DE DP > DP1	16/01/2024	22/01/2024	6 Days	145	Rainfall	17/01/2024
Nursery	ND > DP2	17/01/2024	21/01/2024	4 days	1.8	Rainfall	17/01/2024
South Farm	SF DP > AI	27/01/2024	1/02/2024	5 days	112.3	Rainfall	31/01/2024
Stage 1 Nursery	S1N DP > DP2	30/01/2024	1/02/2024	6 days	2.3	Rainfall	31/01/2024
Nursery	ND > DP2	30/01/2024	1/02/2024	2 days	1.8	Rainfall	31/01/2024
East Farm	EF DP	12/02/2024	19/02/2024	7 days	158.016	Rainfall	14/02/2024
West Farm	WF DP1 > AI	11/02/2024	18/02/2024	7 days	72.325	Rainfall	14/02/2024
South Farm	SF DP > AI	13/02/2024	19/02/2024	6 days	64.398	Rainfall	14/02/2024
North Farm	BC DP > DP1	11/02/2024	18/02/2024	7 days	13.468	Rainfall	14/02/2024
North Farm	DE DP > DP1	12/02/2024	19/02/2024	7 days	83.641	Rainfall	14/02/2024
Nursery	ND > DP2	12/02/2024	15/02/2024	3 days	2.382	Rainfall	14/02/2024
Stage 1 Nursery	S1N DP > DP2	14/02/2024	15/02/2024	1 days	0.612	Rainfall	14/02/2024
East Farm	EF DP	1/03/2024	22/03/2024	22 days	396.58	Rainfall	7/03/2024 12/03/2024
West Farm	WF DP1 > AI	9/03/2024	16/03/2024	7 days	276.359	Rainfall	12/03/2024
South Farm	SF DP > AI	9/03/2024	16/03/2024	7 days	122.175	Rainfall	12/03/2024
North Farm	BC DP > DP1	10/03/2024	16/03/2024	6 days	52.383	Rainfall	12/03/2024
North Farm	DE DP > DP1	9/03/2024	16/03/2024	7 days	15.768	Rainfall	12/03/2024

5 MONITORING UNDERTAKEN

During the reporting period, monitoring was undertaken as per EPL239-04 requirements using the methods outlined in HDB's *Water Quality Monitoring Plan* (WQMP). This WQMP is the guidance document for ensuring all monitoring is consistent, complies with the relevant Australian Standards, and meets the monitoring specifications of EPL239-04 i.e. Conditions 24 to 33 and Attachment C. Below is an outline of the monitoring undertaken during the reporting period.

5.1 Monitoring sites

Monitoring points as per EPL239-04 Attachment C comprise the following:

- Discharge points i.e. DP1, ND, S1N DP, SF DP, and EF DP.
- On-site Monitoring Point i.e. A DP, B/C DP, D/E DP, S1N DP1, ND, SF DP, CE DP, EF DP, EF CE DP, WF1 DP, WF CE DP.
- Adelaide River water quality locations (i.e. ARUS1 and ARDS1), used for determining any impacts on river water quality during discharge events.

EPL239-0 was approved on the 14th February 2023 and requires monitoring of an additional Adelaide River location AR1.

Monitoring point locations are shown in Figure 2-2 and detailed below in Table 5-5-1.

Table 5-5-1. Monitoring location details

Site ID	Site Name	Location	GPS Coordinates	
			Latitude	Longitude
A DP	North Farm A Ponds Discharge Point	North Farm Discharge Point at the end of the treatment channel for A ponds	-12.547750	131.371990
B/C DP	North Farm B&C Ponds Discharge Point	North Farm Discharge Point at the end of the treatment channel for B and C ponds	-12.556170	131.367310
D/E DP	North Farm D&E Ponds Discharge Point	North Farm Discharge Point at the end of the treatment channel for D and E ponds	-12.547700	131.371000
SF DP	South Farm Discharge Point Note: Previously 'K/J DP'	Where South Farm treatment system discharges into channel that flows to AI and into Adelaide River.	-12.55694	131.37109
CE DP	South Farm Controlled Emergency Discharge Point	South Farm Discharge Point at the end of the header channel	-12.556940	131.371090
EF DP	East Farm Discharge Point	Where East Farm treatment system discharges into mangroves lining Adelaide River.	-12.55693	131.37530
EF CE DP	East Farm Controlled Emergency Discharge Point	East Farm Discharge Point in the middle of the header channel	-12.556900	131.375000

Site ID	Site Name	Location	GPS Coordinates	
			Latitude	Longitude
S1N DP	Stage 1 Nursery Discharge Point	Discharge point from Stage 2 Nursery treatment ponds into drainage line that flows into Adelaide River via DP2	-12.55617	131.37137
ND	Stage 2 Nursery Discharge Point	Stage 2 Nursery water prior to discharge into drainage line that flows into Adelaide River via DP2.	-12.55530	131.37485
ARUS1	Adelaide River Upstream	On Adelaide River, approx. 350 m upstream of DP2.	-12.55527	131.37810
ARDS1	Adelaide River Downstream	On Adelaide River, approx. 150 m downstream of DP1.	-12.54811	131.37802
AR1	Adelaide River 1	On Adeliade river at the mouth of the creek where DP1 dischage meets the main river.	-12.548383	131.37668

5.2 Monitoring frequency

Monitoring must be conducted weekly when discharge is occurring, or at least once per discharge event if the discharge is less than one week. EPL 239-04 required the Adelaide River sites ARUS1, AR1 and ARDS1 to be sampled during each discharge monitoring event. The point/s where discharge is occurring must also be sampled e.g. if the North Farm is discharging, DP1 must be sampled. If the South Farm, East Farm and Stage 2 Nursery are all discharging, then SF DP, EF DP and ND must all be sampled.

Table 5-5-2 lists the parameters that are measured at each site, and the assessment criteria currently specified in EPL239-04 Attachment C.

Table 5-5-2. Water quality parameters and assessment criteria
AR – assess against the quality of Adelaide River upstream location at time of sampling
**for assisting with determining EPL239-04 Condition 36 non-compliance*

Parameters	Units	Assessment Criteria	3x Assessment Criteria*
Physical (field) parameters			
Flow	kL/day	N/A	N/A
pH	pH units	7.2 – 8.2	N/A
Electrical Conductivity (EC)	µS/cm	AR	3xAR
Dissolved Oxygen (DO)	% saturation	AR	3xAR
Turbidity	NTU	AR	3xAR
Temperature	°C	N/A	N/A
Laboratory parameters			
Biochemical Oxygen Demand (BOD)	mg/L	1.00	3.00
Filterable Reactive Phosphorus (FRP) as P	mg/L	0.04	0.12
Total Phosphorus (TP) as P	mg/L	0.13	0.39
Ammonia (NH_3) as N	mg/L	0.06	0.18
Total Nitrogen (TN) as N	mg/L	1.00	3.00
Nitrogen Oxides NO_3 + NO_2 (NOx) as N	mg/L	0.41	1.23
Nitrate (NO_3) as N	mg/L	0.41	1.23
Nitrite (NO_2) as N	mg/L	0.005	0.015

Total Kjeldahl Nitrogen (TKN) as N	mg/L	N/A	N/A
Chlorophyll-a	µg/L	2	6
Other information recorded			
Site Name, Date, Time and Sampler/s name			
Tide (high/low/spring/neap/incoming/outgoing)			
If discharge is occurring and any comments relating to site condition – e.g. any visible pollutants, scum, water colour, clarity, water plants/algae, dead fish, any odours			

5.3 Sampling procedures

All sampling is undertaken in accordance with the WQMP and the following standards and guidelines:

Australian/New Zealand Standard on Water Quality Sampling - *Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples* (AS/NZS 5667.1:1998), Standards Australia, New South Wales.

Australian Standard/New Zealand Standard on Water Quality Sampling - *Part 4: Guidance on sampling from lakes, natural and manmade* (AS/NZS 5667.4:1998), Standards Australia, New South Wales.

Australian/New Zealand Standard on Water Quality Sampling - *Part 6: Guidance on sampling of rivers and streams* (AS/NZS 5667.6:1998), Standards Australia, New South Wales.

Australian Standard/New Zealand Standard on Water Quality Sampling – *Part 10: Guidance on sampling of waste waters* (AN/NZS 5667.10:1998), Standards Australia, New South Wales.

ANZECC & AMRCANZ 2000, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality, National Water Quality Management Strategy Paper No 4,* Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ), Canberra.

ANZECC & AMRCANZ 2000, *Australian Guidelines for Water Quality Monitoring and Reporting, National Water Quality Management Strategy Paper No 7*, Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ), Canberra.

All sampling was carried out by Kirsten Beames from HDB, who has received on-site training in sampling methods from EcOz Senior Environmental Consultant Emma Smith, as well as on-going guidance from EcOz.

All laboratory samples are collected into ALS Laboratory-supplied sample bottles; some of which contain preservative where required.

The Adelaide River sites ARUS1, ARDS1 and AR1 are accessed using a boat in order to gain a representative sample from the middle of the river. River samples are ideally collected during an outgoing tide to ensure ARDS1 is 'downstream' of the farm and ARUS1 is 'upstream' of the farm. This is sometimes not possible due to short sample holding times dictating when samples must be collected for submission cut off meaning samples have to be collected on an incoming tide. The river can only be safely accessed from the farm at high tide. At low tide, the crocodile risk is too great, as the boat would need to be dragged across the mud bank to get to the water.

All discharge point monitoring sites are sampled from the land using a long pole, with a lab-supplied sample bottle on the end, in order to gain a sample a few metres from the bank. Sample is decanted from this bottle into bottles that contain preservative.

All field parameters are recorded on a dedicated *Field Data Sheet*, developed to ensure all EPL239-04 information requirements are collected. The field parameter meter is calibrated immediately prior to each sampling round.

All field and laboratory results are stored in an Excel database maintained by EcOz.

All field data sheets (scanned copies) and laboratory documentation are stored in an online filing system maintained by EcOz (M-Files). HDB also maintain copies of all laboratory documentation.

5.4 Assessment criteria and non-compliance reporting

Table 5-5-2 lists the assessment criteria to be applied to water quality monitoring results for the downstream compliance point ARDS1, as taken from EPL239-04 Attachment C. Site-specific trigger values (SSTVs) are applied to most parameters. These SSTVs were derived based on calculating the 80th percentile of background Adelaide River water quality during times when no discharge was occurring at monthly intervals for at least a two-year period (August 2016 to August 2018).

SSTVs are applied to all parameters except for electrical conductivity (EC), dissolved oxygen (DO), and turbidity, as, given the highly seasonal variability in these parameters, it is more appropriate to assess these against the water quality of the upstream Adelaide River site (ARUS1) at the time of sampling.

EPL239-04 Condition 36 states the following, in relation to the assessment criteria listed in Table 5-5-2:

Condition 36

A non-compliance with this licence includes:

34.1 an exceedance of a trigger value at the compliance point, as specified in Attachment C, on three consecutive sampling occasions;

34.2 an exceedance of three times or more a trigger value at the compliance point, as specified in Attachment C, on a single sampling occasion;

34.3 when Electrical Conductivity, Turbidity or Dissolved Oxygen measured at the compliance point exceed the ambient water quality of the Adelaide River upstream monitoring point on three consecutive sampling occasions, in accordance with Attachment C;

34.4 when Electrical Conductivity, Turbidity or Dissolved Oxygen measured at the compliance point exceed three times or more the ambient water quality of the Adelaide River upstream monitoring point on a single occasion, in accordance with Attachment A.

When any of the above scenarios occur, the NT EPA must be notified within 24 hours of becoming aware of the non-compliance, as per Conditions 37 and 38.

5.5 Monitoring undertaken during the reporting period

All weekly monitoring during discharges was undertaken as per EPL239-04 requirements (see Table 4-4-1).

All start and finish dates for all discharges were recorded.

All discharge volumes for all discharges were recorded. This was via the permanently installed automated flow gauges at A DP, B/C DP, D/E DP, SF DP, EF DP and WF1 DP, and by manual flow measurements at the discharge points CE DP, EF CE DP, S1N DP and ND.

6 RESULTS AND DISCUSSION

Discharge water quality data and Adelaide River monitoring site data for the 1 April 2023 to 31 March 2024 reporting period is provided in Appendix A. As explained in Section 4 above, during each discharge monitoring round, the Adelaide River sites ARUS1, ARDS1 and, as of March 2023, AR1 must be sampled along with the site/s discharging at the time i.e. either one or a combination of A DP. B/C DP, D/E DP, SF DP, CE DP EF DP, EF CE DP, S1N DP, WF1 DP, WF CE DP and/or ND.

The complete HDB water quality monitoring database containing the results of all samples collected since March 2015 is also provided as an Excel spreadsheet, submitted to the NT EPA via email along with this Monitoring Report.

The sections below present and discuss:

- The water quality of each discharge that occurred during the reporting period
- The nutrient load of each discharge into the Adelaide River during the reporting period
- Compliance of water quality with SSTV's at the downstream compliance point (ARDS1) during the reporting period and any potential impacts on Adelaide River water quality
- Long term trends in discharge water quality and Adelaide River water quality

6.1 Discharge water quality

Table 6-6-1 provides the summary statistics for all monitoring sites calculated using all data collected during the reporting period. These statistics are discussed below. For the raw data see Appendix A.

The temperature and DO of all discharge sites (A DP, B/C DP, D/E DP, EF DP, EF CE DP, WF1 DP, SF DP, CE DP, ND and S1N DP) remained within the same range as the upstream Adelaide River site (ARUS1). There is also no significant difference in these parameters between the upstream and downstream (ARDS1) site, indicating no impacts to these water quality parameters from discharge.

pH values of all discharge sites during all monitoring rounds remained within the SSTV of the compliance point with farm discharge pH always higher than the river sites.

The EC/TDS/salinity in the Adelaide River varies significantly from very high at the end of the dry season (over 20 ppt) to lower during the wet season (down to 0.02 ppt). The salinity at all discharge sites during all monitoring rounds never exceeded the natural river levels varying within this range from 4 and 12 ppt.

Turbidity and TSS in the Adelaide River sites was commonly higher than in the discharge waters.

BOD measured at the discharge sites is generally slightly higher than the Adelaide River sites, ranging from 1 to 11mg/L, with the highest median value recorded for SF DP of 8 mg/L. SF DP and WF DP1 consistently produced the highest BOD values during all monitoring rounds.

Chlorophyll-a measured at the discharge sites is high compared to the Adelaide River sites, with the with median concentrations ranging from 6ug/L (EF DP) to 33.5ug/L (S1NDP) and maximums of up to 80ug/L.

Ammonia concentrations in the discharge waters are consistently higher than the Adelaide River sites, with the highest median concentration recorded for WF DP1 (2.74 mg/L). There is however no significant difference between the ammonia measured at the downstream Adelaide River site (ARDS1) compared to the upstream site (ARUS1), recording medians of 0.06 and 0.07 mg/L respectively.

Similarly for NOx, TKN, TN, TP and FRP, discharge water quality values are always higher than the Adelaide River sites.

Table 6-6-1. Summary statistics for all monitoring sites for the Reporting Period 1 April 2023 – 31 March 2024

	Temp	pH	EC	TDS	Sal	DO	Turbidity	BOD	Chl a	TSS	NH3 as N	NO2 as N	NO3 as N	NOx as N	TKN as N	TN as N	TP as P	FRP as P
	°C	pH units	µS/cm	mg/L	ppt	%sat	NTU	mg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
ARDS																		
Max	32.1	8.14	23178	13436	12.26	73.1	159.18	4	2	205	1.21	0.01	0.1	0.1	3	3	0.41	0.018
Min	27.4	6.21	41.3	27	0.02	51.3	20.87	1	0.5	14	0.03	0.0025	0.0025	0.005	0.04	0.04	0.02	0.0005
Median	29.85	7.11	81.8	53	0.04	62.1	48.3	3	0.5	36	0.06	0.005	0.005	0.01	0.5	0.61	0.06	0.004
SSTV		**7.2-8.2**						**1**	**2**		**0.06**	**0.005**	**0.41**	**0.41**	**1**	**1**	**0.13**	**0.04**
ARUS																		
Max	32.1	8.08	21719	12578	11.41	70.2	168.48	9	0.5	262	0.6	0.01	0.42	0.42	1.4	1.4	0.14	0.014
Min	27.4	6.28	37.2	24	0.02	50.4	24.79	1	0.5	16	0.01	0.0025	0.005	0.005	0.4	0.4	0.03	0.001
Median	29.85	7.42	75.2	49	0.03	62.9	53.17	1	0.5	37	0.07	0.005	0.005	0.005	0.7	0.7	0.06	0.005
AR1																		
Max	31.5	7.73	23693	13752	12.58	68	154.13	3	0.5	206	1.26	0.005	0.43	0.43	2.8	2.8	0.28	0.007
Min	27.4	6.22	41.1	27	0.02	50.3	24.67	1	0.5	15	0.04	0.005	0.005	0.005	0.04	0.04	0.04	0.001
Median	29.8	7.28	79.5	52	0.04	63.55	41.74	1.5	0.5	43	0.11	0.005	0.0075	0.0075	0.6	0.6	0.065	0.003
BC DP																		
Max	30.7	7.87	17499	11374	10.28	71	21.76	4	46	30	2.18	0.63	1.05	1.68	6.3	7.5	1.18	0.853
Min	27.5	7.25	12024	7816	6.81	32.5	12.63	3	4	14	0.98	0.52	0.11	0.63	4.2	5.4	0.83	0.566
Median	27.7	7.75	13400	8715	7.7	53.1	17.84	3	29	16	1.24	0.57	0.62	1.19	4.8	5.9	0.99	0.667
DE DP																		
Max	31.5	8.03	19408	12615	11.49	101.2	54.3	10	26	55	2.04	1.66	0.81	2.34	8.4	10	1.64	1.1
Min	27.9	7.6	14395	9357	8.27	38.1	15.35	3	10	10	1.79	1.53	0.44	1.65	5.8	7.9	1.13	0.838
Median	27.9	8	16378	10643	9.56	74.6	22.81	5	23	15	1.95	1.62	0.625	2.06	6.4	8.7	1.32	0.984
EF DP																		
Max	31.5	8.15	17471	11356	10.25	123.3	17.73	7	71	41	2.9	0.92	1.53	1.74	6.2	7.6	1.15	0.867
Min	27.9	7.13	7792	5065	4.28	15.9	9.36	1	3	8	0.12	0.15	0.005	0.19	3.7	4.6	0.78	0.453
Median	29.5	7.77	13684	8895	7.29	64.8	11.2	4	6	12	1.47	0.3	0.58	1.35	4.4	5.4	0.97	0.574
SF DP																		
Max	31.4	7.67	24175	13993	12.81	69.4	26.5	11	46	22	2.56	1.13	0.71	1.83	8.4	9.7	3.03	2.65
Min	27	7.08	12453	8095	7.09	39	14.31	5	7	10	1.14	0.62	0.005	0.52	5.6	6.9	2.23	1.8
Median	28.4	7.56	15732	10225	9.14	51.3	16.32	8	12	16	1.9	0.74	0.18	1.31	6.4	7.4	2.39	1.95
WF DP																		
Max	30.8	7.86	23273	13617	12.45	88.2	93.19	9	80	391	3.23	6.2	2.7	3.8	6.4	9.7	0.44	0.067
Min	28.1	7.28	13371	8691	7.64	35.7	24.08	1	11	21	0.84	1.34	0.005	1.42	2.6	6.6	0.066	0.0005
Median	29.05	7.45	16328	10613	9.52	60.2	31.68	5	26	32	2.74	2.08	0.7	3.32	5.8	7.7	0.19	0.003
NDP																		
Max	28.1	8.12	18266	11873	10.77	98	77.77	4	32	102	0.58	0.49	1.72	2.03	6.8	8.8	1.28	0.374
Min	26.9	7.72	17939	11660	10.55	91.3	64.15	4	27	61	0.17	0.19	1.02	1.21	3.2	4.4	0.56	0.295
Median	27.7	7.85	18087	11756	10.65	92.9	75.94	4	28	78	0.19	0.21	1.54	1.93	3.5	5.4	0.61	0.339
S1NDP																		
Max	28.1	7.84	19237	12504	11.38	87.8	85.93	5	35	84	0.56	0.14	1.33	1.47	4.1	5.3	1.05	0.544
Min	26.9	7.79	19195	12477	11.37	87.6	52.28	5	32	76	0.39	0.05	0.12	0.17	3.8	4.3	0.78	0.383
Median	27.5	7.815	19216	12490.5	11.375	87.7	69.105	5	33.5	80	0.475	0.095	0.725	0.82	3.95	4.8	0.915	0.4635

6.2 Discharge contaminant loads

The nutrient load (i.e. TN and TP) discharged into the Adelaide River during each discharge during the reporting period has been calculated using the method prescribed in Section 2.2.5 in *Load Calculation Protocol*, June 2009, (NSW EPA 2009). The total load of TN+TP into the river for the entire reporting period was 18,205 kg comprising 15,753 kg of TN and 2,452 kg of TP.

The Adelaide River catchment is approximately 7,462 km^2, with a mean annual discharge into the sea of 2,693 GL (Hughes et al 2018). Based on the median TN and TP concentrations in the Adelaide River measured at ARUS1, this equates to around 3,043 tonnes of TN+TP. Expansions to the farm have seen increases to the annual contamination loads, when compared to the natural inputs HDB only adds a negligible amount i.e. 0.59% and unlikely to have an impact. This does not take into consideration higher than average rainfall conditions during this reporting period with natural discharge number likely much higher.

Table 6-6-2. Contaminant loads into the Adelaide River during the Reporting Period 1 April 2023 – 31 March 2024

					C_d					V_d	L_d		Sum of L_d		Flow weighted conc.		Total volume	
Farm/Nursery Discharging	Monitoring Point	Sampling Dates	TN as N	TP as P	Average TN as N	Average TP as P	Discharge Vol.	Duration	Flow rate	Flow rate	TN as N	TP as P	TN as N	TP as P	TN as N	TP as P	TN as N	TP as P
			mg/L	mg/L	mg/L	mg/L	kL	days	L/s	kL/day	kg/day	kg/day	kg	kg	kg/kL	kg/kL	kg	kg
South Farm	SF DP	6/12/2023	6.9	3.03	6.90	3.03	23466	9	30	2607	18.0	7.9	161.9	71.1	0.0069	0.0030	162	71
West Farm	WF DP	6/12/2023	9.2	0.19	9.20	0.19	51586	21	28	2456	22.6	0.5	474.6	9.8	0.0092	0.0002	475	10
East Farm	EF DP	17/01/2024	7.6	1.15	6.13	0.97	120378	17	82	7081	43.4	6.9	738.3	117.2	0.0061	0.0010	738	117
		24/01/2024	5.4	0.99														
		31/01/2024	5.4	0.78														
West Farm	WF DP	17/01/2024	9.7	0.44	8.40	0.24	223269	18	144	12404	104.2	3.0	1875.5	54.3	0.0084	0.0002	1875	54
		24/01/2024	7.7	0.15														
		31/01/2024	7.8	0.14														
South Farm	SF DP	17/01/2024	9.7	2.8	9.70	2.80	131159	6	253	21860	212.0	61.2	1272.2	367.2	0.0097	0.0028	1272	367
North Farm	BC DP	17/01/2024	7.5	1.18	7.50	1.18	96682	6	187	16114	120.9	19.0	725.1	114.1	0.0075	0.0012	725	114
North Farm	DE DP	17/01/2024	10	1.64	10.00	1.64	145023	6	280	24171	241.7	39.6	1450.2	237.8	0.0100	0.0016	1450	238
Nursery	ND	17/01/2024	8.8	1.28	8.80	1.28	1836	4	5	459	4.0	0.6	16.2	2.4	0.0088	0.0013	16	2
East Farm	EF CE DP	31/01/2024	5.4	0.88	5.40	0.88	9259	4	27	2315	12.5	2.0	50.0	8.1	0.0054	0.0009	50	8
South Farm	SF DP	31/01/2024	7.4	2.39	7.40	2.39	112376	5	260	22475	166.3	53.7	831.6	268.6	0.0074	0.0024	832	269
Stage 1 Nursery	S1N DP	31/01/2024	5.3	0.78	5.30	0.78	2295	2	13	1148	6.1	0.9	12.2	1.8	0.0053	0.0008	12	2
Nursery	NDP	31/01/2024	4.4	0.61	4.40	0.61	1836	2	11	918	4.0	0.6	8.1	1.1	0.0044	0.0006	8	1
East Farm	EF DP	14/02/2024	5.4	1.11	5.40	1.11	158016	7	261	22574	121.9	25.1	853.3	175.4	0.0054	0.0011	853	175
West Farm	WF DP	14/02/2024	7.4	0.22	7.40	0.22	72325	7	120	10332	76.5	2.3	535.2	15.9	0.0074	0.0002	535	16
South Farm	SF DP	14/02/2024	7.4	2.39	7.40	2.39	64398	6	124	10733	79.4	25.7	476.5	153.9	0.0074	0.0024	477	154
North Farm	BC DP	14/02/2024	5.4	0.99	5.40	0.99	13468	7	22	1924	10.4	1.9	72.7	13.3	0.0054	0.0010	73	13
North Farm	DE DP	14/02/2024	7.9	1.32	7.90	1.3	83641	7	138	11949	94.4	15.8	660.8	110.4	0.0079	0.0013	661	110
Nursery	NDP	14/02/2024	5.4	0.56	5.40	0.56	2382	3	9	794	4.3	0.4	12.9	1.3	0.0054	0.0006	13	1
Stage 1 Nursery	S1N DP	14/02/2024	4.3	1.05	4.30	1.05	612	1	7	612	2.6	0.6	2.6	0.6	0.0043	0.0011	3	1
East Farm	EF DP	7/03/2024	4.6	0.97	5.57	0.85	396580	21	219	18885	105.1	16.1	2207.6	338.4	0.0056	0.0009	2208	338
		12/03/2024	6.2	0.8														
		20//03/2024	5.9	0.79														
West Farm	WF DP	12/03/2024	7.2	0.2	7.20	0.2	276359	7	457	39480	284.3	7.9	1989.8	55.3	0.0072	0.0002	1990	55
South Farm	SF DP	12/03/2024	7.2	2.23	7.20	2.23	122175	7	202	17454	125.7	38.9	879.7	272.5	0.0072	0.0022	880	272
North Farm	BC DP	12/03/2024	5.9	0.83	5.90	0.83	52383	6	101	8731	51.5	7.2	309.1	43.5	0.0059	0.0008	309	43
North Farm	DE DP	12/03/2024	8.7	1.13	8.70	1.13	15768	7	26	2253	19.6	2.5	137.2	17.8	0.0087	0.0011	137	18
															Total (kg):		15753	2452
															Total TN+TP (k		18205	
															Total TN+TP (tor		18.205	

6.3 Assessment of impacts during discharges April 2023 – March 2024

6.3.1 Physical parameters

Table 6-3 presents an assessment of impacts on Adelaide River water quality for physical parameters during the discharges that occurred during the reporting period. Appendix A provides the raw water quality parameter concentrations measured during the discharge periods.

The assessment criteria listed in Table 5-5-2 for physical parameters provide a SSTV range for pH, but for EC, DO and turbidity, concentrations are assessed against the upstream Adelaide River location at the time of sampling. All monitoring rounds during the reporting period, except for 12th March 2024, were undertaken during an outgoing tide, as such, ARDS1 was always the downstream compliance point, and ARUS1 the upstream reference site. During the March round of sampling tide timing/ sample submission cut off meant sampling could only occur during the incoming tide. In this scenario ARUS1 should be assessed as the compliance point however, with the large volume of freshwater flowing down the river, changes in flow direction at this time of year do not happen with tide changes. With this in mind both ARDS1 and ARUS1 are assessed for compliance.

The assessment of impacts in Table 6-3 also determines whether any of the non-compliance scenarios listed in EPL239-04 Condition 34 (see Section 5.4 above) have occurred.

6.3.2 Laboratory Parameters

Table 6-4 presents an assessment of impacts on Adelaide River water quality for laboratory parameters during the discharges that occurred during the reporting period. Appendix A provides the raw water quality parameter concentrations measured during the discharge periods.

The assessment criteria listed in Table 5-5-2 provide SSTVs for all laboratory parameters. All monitoring rounds during the reporting period were undertaken during an outgoing tide, as such, ARDS1 was always the downstream compliance point. Table 6-4 also determines whether any of the non-compliance scenarios listed in EPL239-04 Condition 36 (see section 5.4 above) have occurred.

Table 6-3. Assessment of physical parameter water quality impacts on the Adelaide River from discharges during the reporting period

Parameter	Discussion	Impact assessment
pH	pH was recorded below the SSTV range (7.2) at the downstream compliance point (ARDS1) during the monitoring on the 17th 24th and 31st of January, the 14th of February and the 7th March. All other monitoring rounds were within the SSTV. The lowest pH recorded was 6.21 on the 7th March. While there are several exceedances they are all within 1 pH unit of the SSTV with 3 of them within 0.2. These numbers are not outside of the natural seasonal variations and are not expected to have any impact on the river. Further to that pH values of all discharge sites during all monitoring rounds was within the compliance point SSTV indicating low river pH values are attributed to naturally high pH of rainfall and natural river levels.	No Impact

EC	EC at the Adelaide River sites varied widely according to the seasons over the course of the reporting period, ranging from 41.3µS/cm during the wet season (31/01/2024) to 23,178 µS/cm after the dry season (6/12/2023) and prior to significant wet season rainfall. EC does not have SSTV and is assessed against the upstream Adelaide river sample point. The relative percentage difference (RPD) between EC concentrations measured at the upstream (ARUS) and downstream (ARDS1) river sites remained below 15 % for all discharge monitoring rounds during the reporting period with all but one (17/01/2024) below 10%. This also coincided with record breaking January rainfalls.	No Impact
DO	DO at the Adelaide River sites varied little over the reporting period, ranging between 50 % saturation and 73 % saturation, with an average of 62 % saturation. The largest difference between DO concentrations measured at the upstream (ARUS) and downstream (ARDS1) river sites for all discharge monitoring rounds during the reporting period was 9 % saturation on 7/03/2024 i.e. ARDS1 was 56 % sat and ARUS1 was 65 % sat. This is a relative percentage difference of 15% and is not indicative of an impact on DO from any of the discharges.	No impact
Turbidity	The Adelaide River sites are highly turbid compared to the discharge monitoring sites. This is generally always the case based on the long-term monitoring record commencing in 2015 (see excel database provided along with this report) due to suspended sediments in the strong tidal currents of the Adelaide River. Turbidity at the Adelaide River sites during the reporting period ranged from 20 NTU on 20/03/2024 to 168 NTU on 17/01/2024. Given the turbidity of the discharge waters is generally always less than river, any differences between the upstream and downstream turbidity in the river are attributed to localised differences in tidal currents and degree of sediment resuspension in the river and would not be indicating an impact from discharge.	No impact

Table 6-4. Assessment of laboratory parameters water quality impacts on the Adelaide River from discharges during the reporting period

Parameter	Discussion	Impact assessment
BOD	BOD was equal to or below the laboratory limit of reporting (LOR) at the downstream compliance point (ARDS1) during all discharges for the reporting period with four exceptions on the 31/01/2024, 7/3/2024, 13/03/2024 and 20/03/2024 with the highest value being 4mg/L. During all of these exceedances the AR1 site, closer to farm discharges, was lower than the ARDS1 site and during three of these exceedances the upstream site ARUS1 recoded higher values. It should also be noted that during the exceedance on the 07/03/2024 discharge from EF DP (the only site discharging) recoded a lower BOD (4 mg/L) than the ARUS1 site (8mg/L). A single non-compliance notification regarding BOD was sent to the NT EPA to cover incidences where the non-compliance criteria, as per condition 36.2 of EPL239-04, had been breached (‘*an exceedance of three times or more a trigger value at the compliance point, as specified in Attachment C, on a single sampling occasion’)*. This non-compliance occurred on the 12/3/2024 and was reported the NT EPA on the 27th March. On review of data during the process of this report, the three other BOD exceedance were also non-compliant of condition 36.2 (‘*an exceedance of three times or more a trigger value at the compliance point, as specified in Attachment C, on a single sampling occasion’)* and notification to the NT EPA was missed. While a result of 4mg/L being twice the LOR is above the SSTV of 1mg/L, it should be noted that the SSTV of 1 mg/L for BOD is an artefact of how the SSTV was calculated. Background (reference site) BOD concentrations measured monthly in the river for over 2 years were mostly always below the LOR and recorded as <2 mg/L. In order to calculate the 80th percentile, all <2 mg/L values needed to be changed to a number value, nominally half the LOR i.e. 1 mg/L. Since then there have been instances where river water quality has recorded exceedances of this SSTV during periods where no farm discharge is occurring. Humpty Doo Barramundi is currently investigating discrepancies in laboratory results regarding BOD and other parameters with alternative analysing laboratories being looked at.	No impact
Chlorophyll-a	Chlorophyll-a was below the SSTV at the downstream compliance point (ARDS1) during all discharges for the reporting period.	No impact

Parameter	Discussion	Impact assessment
Ammonia (NH_3 as N)	Ammonia concentrations at the downstream compliance point (ARDS1) were above the SSTV for 3 out of the 8 total discharge monitoring rounds undertaken during the reporting period. One of the 3 exceedances required a non-compliance notification submitted to the NT EPA to cover incidences where the non-compliance criteria, as per condition 36.2 of EPL239-04 ('*an exceedance of three times or more a trigger value at the compliance point, as specified in Attachment C, on a single sampling occasion')*, had been breached. Non-compliance notifications for these exceedances were submitted to the NT EPA as follows: • *Non-compliance notification – Humpty Doo Barramundi EPL239-04: ammonia exceedance, 6th December 2023*, submitted to the NT EPA on 22 January 2024 The notification concluded the exceedances, while high pose only slight risk to impact on the Adelaide River environment for the following reasons: • TN concentrations, while elevated above the SSTV at the downstream compliance point during 5 of 11 sampling rounds, similar results or even high values were recorded at the upstream site indicating current natural levels.. • No other parameters have consistently exceeded their respective SSTVs at the compliance point. This includes chlorophyll-a, which has always remained close to the laboratory detection limit, providing evidence that no algae blooms have occurred. Similarly, DO levels rained relatively unchanged between upstream and downstream sites with BOD also remaining close to the laboratory detection limit at the compliance point indicating that discharge from the farm is not causing an increased risk of low dissolved oxygen levels in the river. • The risk of an algae bloom in the river is low given the river is naturally very turbid and light is limited preventing algae growth. Nutrients are most likely to be washed out to sea rather than be utilised for algae growth. Stream flow and tidal currents moving past the farm are extremely large in comparison to discharge volume.	Slight risk to impact.
NO_x as N and NO_3 as N	NO_x and NO_3 concentrations were below the SSTV at the downstream compliance point (ARDS1) during all discharges for the reporting period.	No impact
NO_2 as N	NO_2 concentrations at the downstream compliance point (ARDS1) were all below the LOR during all discharges for the reporting period. Note that for the same reason as explained above for BOD, the SSTV for NO_2 is half the LOR.	No impact

Parameter	Discussion	Impact assessment
TN as N	TN concentrations recorded exceedances of the SSTV during out of 8 sample rounds at the downstream compliance point. Both instances saw the upstream site ARUS1 also exceed the SSTV. A single non-compliance notification was sent to the NT EPA to cover incidences where the non-compliance criteria, as per condition 36.2 of EPL239-04, had been breached (‘*an exceedance of three times or more a trigger value at the compliance point, as specified in Attachment C, on a single sampling occasion’)*. This monitoring round was also the 3rd consecutive breach for TN however the first of the three was 9 month prior at the end of last years wet season. Non-compliance notifications for these exceedances were submitted to the NT EPA as follows: • *Non-compliance notification – Humpty Doo Barramundi EPL239-04: ammonia exceedance, 17th January 2024*, submitted to the NT EPA on 25th January 2024 The notification concluded the exceedances posed a low risk to impact on the Adelaide River environment for the following reasons: • Total Nitrogen concentrations at upstream site ARUS1 also exceeded the SSTV. Historically TN concentrations are always elevated during the first few monitoring rounds due to flushing. TN concentrations throughout the remainder of the wet season are consistent with this theory with no further exceedances. • The risk of eutrophication in the river is low given the river is naturally very turbid and light is limited preventing algae growth. Nutrients are most likely to be washed out to sea rather than be utilised for algae growth. Stream flow and tidal currents moving past the farm are extremely large in comparison to discharge volume	Slight to no impact
TP as P	TP concentrations were all below the SSTV of 0.13 mg/L at the downstream compliance point (ARDS1) during all discharges for the reporting period. This was except for one incidence 17/01/2024. This exceedance triggered a non compliance notification to the NT EPA to cover incidences where the non-compliance criteria, as per condition 36.2 of EPL239-04, had been breached (‘*an exceedance of three times or more a trigger value at the compliance point, as specified in Attachment C, on a single sampling occasion’).* •*Non-compliance notification – Humpty Doo Barramundi EPL239-04: Total Phosphorus exceedance, 17th January 2024,* submitted to the NT EPA on 25th January 2024 The notification concluded the exceedances posed a low risk to impact on the Adelaide River environment for the following reasons: • Similarly to TN, TP results at the upstream site during this sample round also exceeded the site specific trigger value. TP also follows a similar seasonal fluctuation with elevated levels always recorded during the first few monitoring rounds with levels stabilizing throughout the wet season.	Slight to no impact
FRP as P	FRP concentrations were all below the SSTV at the downstream compliance point (ARDS1) during all discharges for the reporting period.	No impact

6.4 Long-term trend analysis

The key contaminants of concern in discharge from the farm are the nutrients nitrogen (N) and phosphorus (P). These can exist in various forms (ammonia, nitrate, nitrite, organic nitrogen, filterable reactive phosphorus etc) but their total amounts are represented by the laboratory parameters TN and TP. Other parameters are also measured in farm discharge, and in the Adelaide River, that are indicators of the effects of excess, nutrients, e.g. excessive plant growth (algae, phytoplankton, cyanobacteria) and subsequent breakdown of these plants. This process is referred to as eutrophication and indicators of eutrophication are increasing BOD and chlorophyll-a, and large diurnal swings in DO, which can become very low during the night / early morning.

Concentrations of BOD and chlorophyll-a in the Adelaide River have historically remained very low, rarely being detected above the laboratory limit of reporting. This remains the case for chlorophyll-a with no detection over the LOR during this reporting period. BOD was detected above the SSTV at the downstream compliance point during four monitoring rounds this reporting period. While this is the most exceedances of BOD during a single reporting period there are several discrepancies detailed in Table 6-4 above regarding several instances where the upstream site recorded higher BOD values and farm discharges recording lower BOD than the river samples. The DO concentrations in the river vary seasonally (see Figure 6-1), with the highest concentrations during the dry season and lowest concentrations during the wet season. It is difficult to discern any impacts from farm discharge on DO in the river with little or no difference in results between upstream and downstream readings during discharge sampling events. As such, the remainder of this trend analysis focuses on the key contaminants of concern TN and TP.

The long-term trends in TN and TP concentrations measured in the Adelaide River at sites ARUS1 and ARDS1, and at each discharge monitoring site, have been reviewed. Graphs of TN and TP concentrations measured since monitoring began in 2015 are provided in Figure 6-2 to Figure 6-5.

The concentrations of TN in the Adelaide River have remained largely consistent with the SSTV of 1 mg/L, whereby the majority (i.e. 80%) of concentrations remain less than the SSTV (Figure 6-2). Similarly, the concentrations of TP in the Adelaide River have remained largely consistent with the SSTV of 0.13 mg/L (Figure 6-3). Seasonal fluctuations also remain consistent with higher values recorded in the first few monitoring events following flushing rainfalls with concentrations stabilizing throughout the wet season.

The concentrations of TN and TP in discharge are highly variable (Figure 6-4). Most concentrations are less than 8 mg/L for TN and less than 2mg/L for TP, with occasional spikes above this. The lowest concentrations generally occur during the wet season (December to March). This is also when the highest volumes of discharge occur.

Improvements to farm infrastructure and farming techniques have resulted in more overall consistent TN and TP concentrations in discharge water with fewer high value outliers (Figure 6-4 and Figure 6-5. Discharges from Nursery sites ND and S1NDP have seen the greatest improvements in consistency and discharge water quality since monitoring began.

Since commissioning of the East Farm in 2019 and the West Farm in early 2023 significant increases in TN and TP were observed in discharge which is to be expected with increases in farm capacity. Data has shown that it can take several years for wetland treatment systems to mature and perform at optimum functionality which is evident in SF DP and EF DP in Figure 6-4 and Figure 6-5 with general TN and TP increases in the initial few years of production and then a stabilising or decreasing trend that follows. WF DP1 has seen a sharp increase in TN and TP concentrations since production began however this is also expected to stabilise as wetland treatment systems mature. Despite these increases in discharge TN and TP no discernible trends can be seen in Adelaide River water quality.

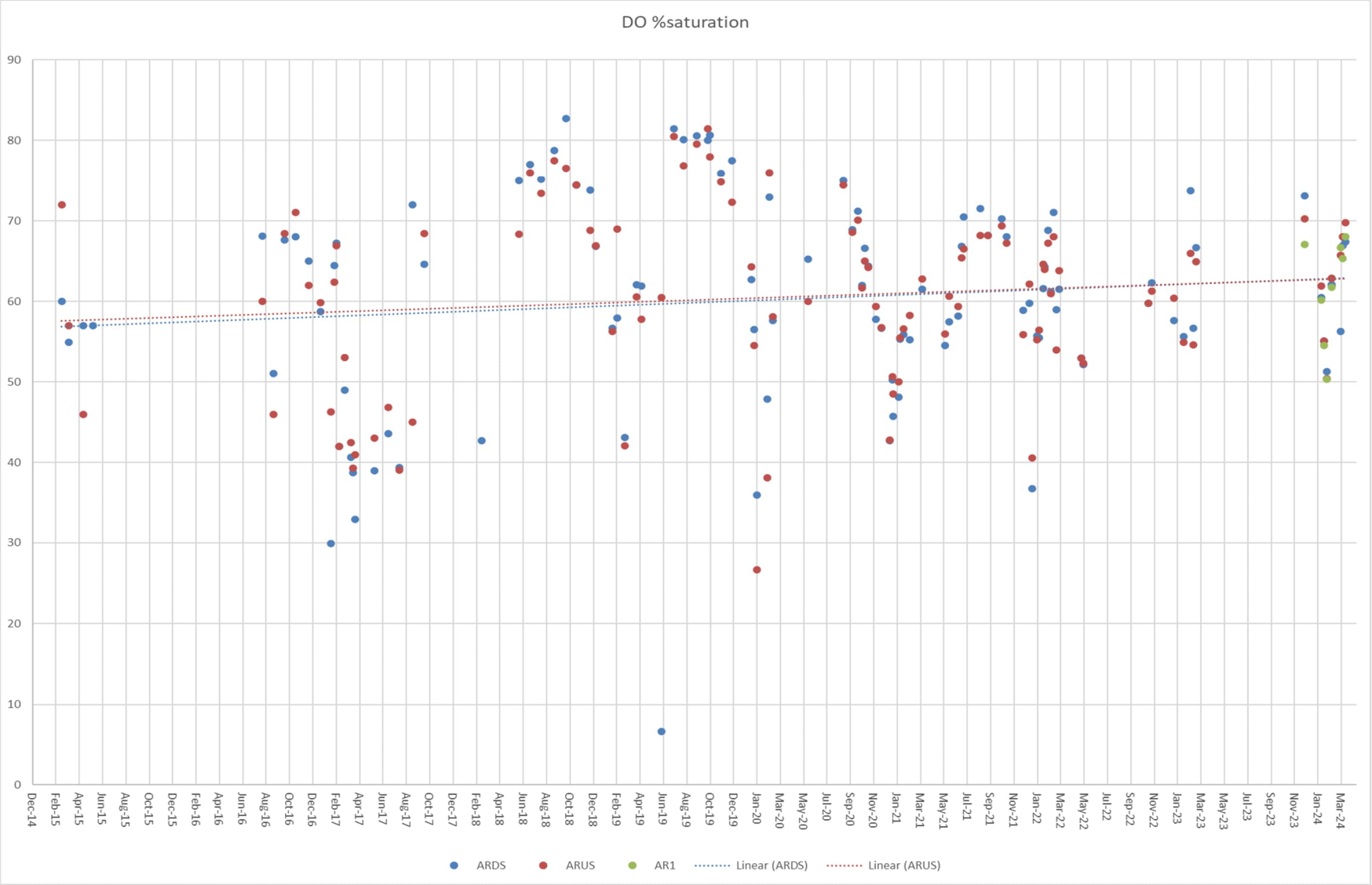


Figure 6-1. Graph of DO concentrations at the Adelaide River monitoring sites since monitoring began in 2015

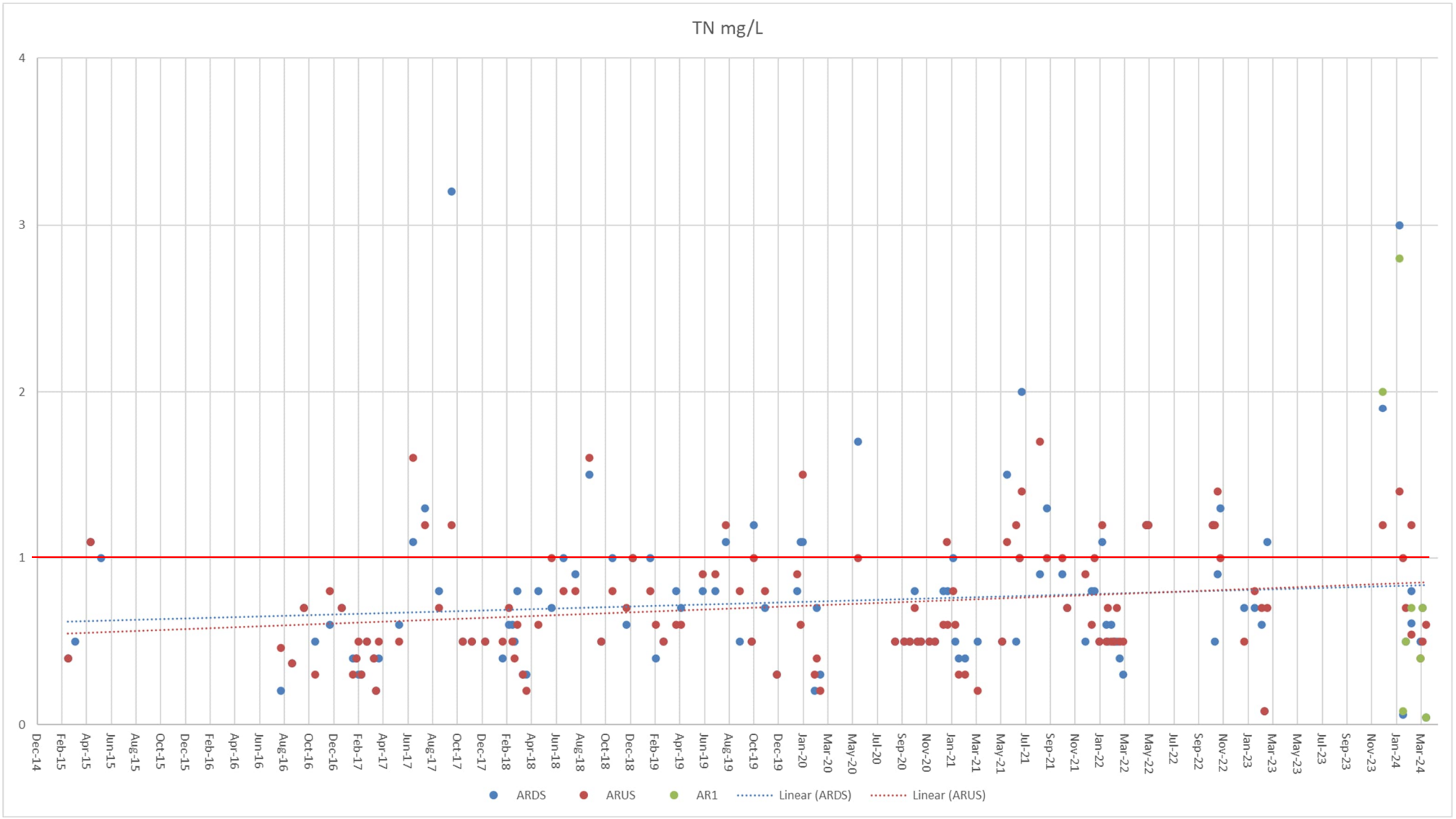


Figure 6-2. Graph of TN concentrations at the Adelaide River monitoring sites since monitoring began in 2015. SSTV shown as red line

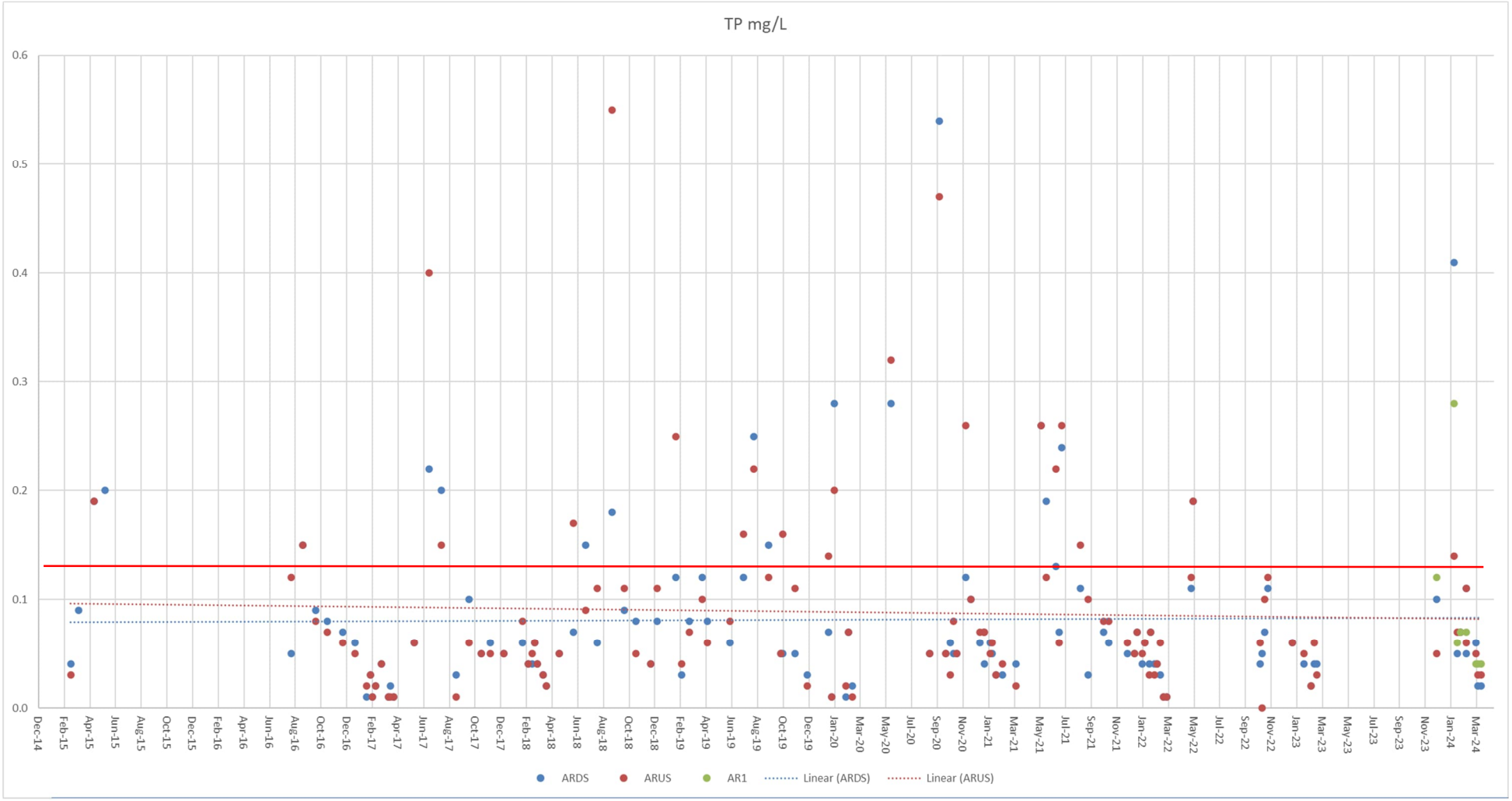


Figure 6-3. Graph of TP concentrations at the Adelaide River monitoring sites since monitoring began in 2015. SSTV shown as red line.

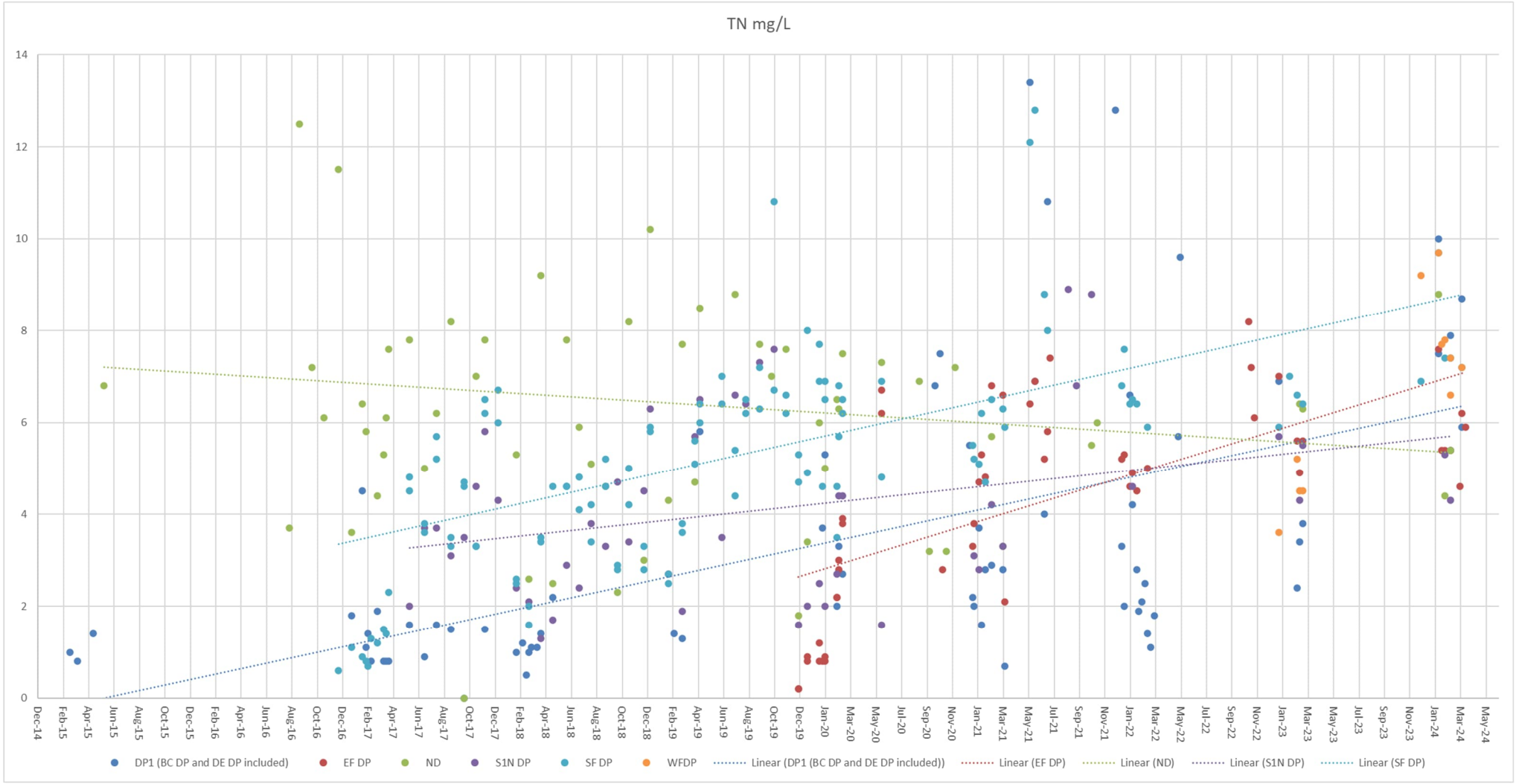


Figure 6-4. Graph of TN concentrations at the discharge monitoring sites since monitoring began in 2015

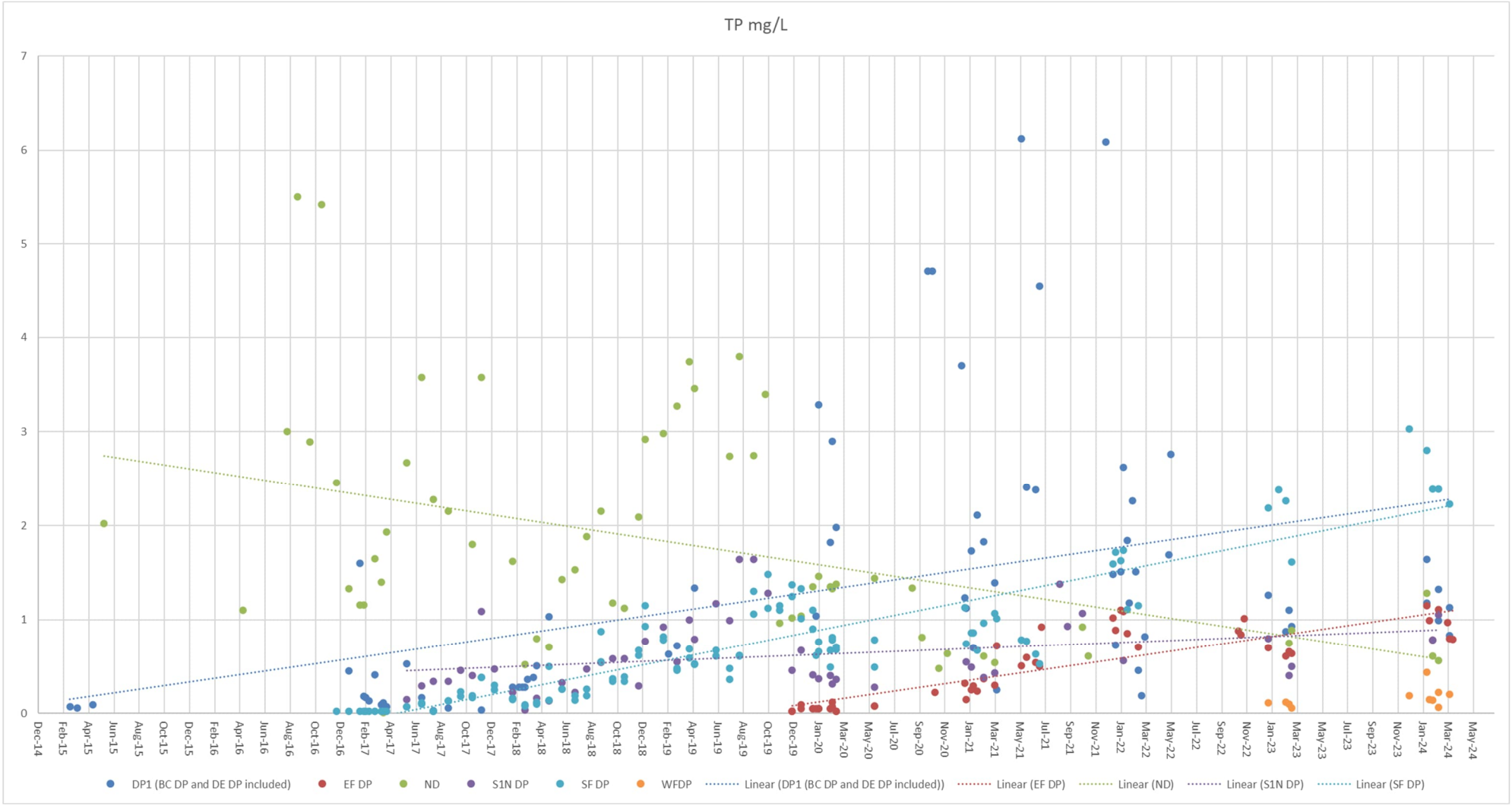


Figure 6-5. Graph of TP concentrations at the discharge monitoring sites since monitoring began in 2015

7 CONCLUSIONS

During the 1 April 2023 to 31 March 2024 reporting period, all discharge monitoring was undertaken in accordance with all EPL239-04 conditions.

All discharge volumes and the start and finish times of all discharges were recorded. The load of TN and TP into the Adelaide River during the reporting period was also calculated and shown to be very small in relation to the existing loads in the river from the catchment i.e. 0.47% and it is considered a low risk to impact to the river.

Three non-compliance notifications were sent to the NT EPA as per EPL239-04 Condition 36 detailed below.

- *Non-compliance notification – Humpty Doo Barramundi EPL239-04: Ammonia exceedance of condition 36.2 'an exceedance of three times or more a trigger value at the compliance point, as specified in Attachment A, on a single sampling occasion',* 6th December, sent to the EPA 22nd January.
- Non-compliance notification – Humpty Doo Barramundi EPL239-04: Total Phosphorus exceedances of condition 36.2 *an exceedance of three times or more a trigger value at the compliance point, as specified in Attachment A, on a single sampling occasion,* also Total Nitrogen exceedance of condition 36.1 *'an exceedance of a trigger value at the compliance point, as specified in Attachment A, on three consecutive sampling occasions'* 17th January, submitted to the NT EPA on 26th January 2024
- Non-compliance notification – Humpty Doo Barramundi EPL239-04, BOD non compliance of condition 36.2 *an exceedance of three times or more a trigger value at the compliance point, as specified in Attachment A, on a single sampling occasion,* 12 March, submitted to the NT EPA 27th March.

During the process of this writing this report three additional non-compliances was picked up all pertaining to BOD concentrations and are detailed below.

- On 31st January BOD concentrations were non compliant of condition 36.2 *an exceedance of three times or more a trigger value at the compliance point, as specified in Attachment A, on a single sampling occasion.* Value was 3mg/L, SSTV is 1mg/L.
- On 7th March BOD concentrations were non compliant of condition 36.2 *an exceedance of three times or more a trigger value at the compliance point, as specified in Attachment A, on a single sampling occasion.* Value was 3mg/L, SSTV is 1mg/L.
- On 20th March 2024 BOD concentrations were non compliant of condition 36.2 *an exceedance of three times or more a trigger value at the compliance point, as specified in Attachment A, on a single sampling occasion,* and condition 36.1 '*an exceedance of a trigger value at the compliance point, as specified in Attachment C, on three consecutive sampling occasions'.* Value was 4mg/L, SSTV is 1mg/L.

With the exception of the ammonia exceedance all exceedances detailed above are expected to have had very minimal impact on the Adelaide River environment for the following reasons:

- TN concentrations at the downstream compliance point have generally remained below the SSTV with exceedances always occurring following initial wet season rainfall likely related flushing of the greater catchment. It is also often the case during exceedances that the upstream site also exceeds the SSTV. The compliant TN concentrations indicate that the total amount of nitrogen available to cause environmental problems such as algal blooms has not changed from background levels.

- Despite ammonia concentrations recording elevated levels during three monitoring rounds other indicator parameters like BOD, Chlorophyll-a and DO remained very low during these events.
- No other parameters have consistently exceeded their respective SSTVs at the compliance point. This includes chlorophyll-a, which has always remained close to the laboratory detection limit, providing evidence that no algae blooms have occurred. Similarly, BOD has historically remained close to the laboratory detection limit at the compliance point with recent exceedances coinciding with elevated upstream results and lower discharge water quality.
- The risk of an algae bloom in the river is low given the river is naturally very turbid and light is limited preventing algae growth. Nutrients are most likely to be washed out to sea rather than be utilised for algae growth. Stream flow and tidal currents moving past the farm are extremely large in comparison to discharge volume.

Long-term trend analysis of the key parameters TN and TP in the river did not show any current increasing trends of concern. Increasing TN and TP concentrations in discharge in the past have been addressed by making improvements to the wetland treatment systems. These improvements have so far appeared to have been effective is reducing large variations in discharge water quality.

This reporting period saw an increase in BOD concentrations in the river. This could be attributed to the introduction of the west farm inputs however due to discrepancies discussed above more data is required before being able to draw conclusions on these increases. Humpty Doo Barramundi is also conducting investigations into discrepancies in laboratory data quality following inconsistencies with internal results.

8 REFERENCES

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APPENDIX A RAW WATER QUALITY DATA

Site ID	Date	Time	Field Parameters							Laboratory Parameters:									
		24 hr	Temp °C	pH pH units	EC µS/cm	TDS mg/L	Sal ppt	DO %sat	Turbidity NTU	BOD mg/L	Chl a µg/L	TSS mg/L	NH_3 as N mg/L	NO_2 as N mg/L	NO_3 as N mg/L	NO_x as N mg/L	TKN as N mg/L	TN as N mg/L	TP as P mg/L	FRP as P mg/L
Limit of Reporting			0.1	0.01	0.01	0.01	0.1	1	1	2	1	5	0.01	0.01	0.01	0.01	0.1	0.1	0.01	0.001
SSTV as per EPL239-02			-	7.2-8.2	AR	-	-	AR	AR	1.0	2	-	0.06	0.005	0.41	0.41	-	1.0	0.13	0.04
AR1	6/12/2023	947	31.3	7.35	23693	13752	12.58	67	114.33	<2	<1	206.00	1.26	<0.01	0.43	0.4	1.6	2	0.120	<0.001
ARDS1	6/12/2023	941	31.3	7.50	23178	13436	12.26	73	125.67	<2	<1	139	1.21	<0.01	0.4	0.4	1.5	1.9	0.100	0.004
ARUS1	6/12/2023	955	31.4	7.39	21719	12578	11.41	70	82.71	<2	<1	27	0.6	<0.01	0.42	0.4	0.8	1.2	0.050	0.001
SFDP	6/12/2023	1131	31.4	7.67	24175	13993	12.81	69	26.5	8	26	17	1.93	0.74	<0.01	0.5	6.4	6.9	3.030	2.65
WFDP	6/12/2023	1119	30.8	7.45	23273	13617	12.45	51	39.87	9	80	26	2.74	3.58	<0.01	3.4	5.8	9.2	0.190	0.003
AR1	17/01/2024	810	27.4	7.24	149.9	97	0.07	60	154.13	2	<1	181	0.12	<0.01	0.01	0.0	2.8	2.8	0.280	0.002
ARDS1	17/01/2024	815	27.4	7.03	158.6	103	0.1	60.5	159.18	<2	<1	205	0.03	0.01	<0.01	0.01	3	3	0.41	0.009
ARUS1	17/01/2024	803	27.4	8.08	135.6	88	0.1	62	168.48	<2	<1	262	0.07	0.01	<0.01	0.01	1.4	1.4	0.14	0.006
BCDP	17/01/2024	932	27.5	7.87	17499	11374	10.3	71	17.84	3	29	30	0.98	0.57	0.62	1.19	6.3	7.5	1.18	0.667
DEDP	17/01/2024	1020	27.9	8.03	19408	12615	11.5	101	22.81	10	26	55	2.04	1.66	<0.01	1.65	8.4	10	1.64	0.984
EFDP	17/01/2024	1001	28.0	7.72	17471	11356	10.3	65	17.73	<2	3	41	0.78	0.54	0.81	1.35	6.2	7.6	1.15	0.713
ND	17/01/2024	950	27.7	8.12	18087	11756	10.65	98	75.94	4	32	102	0.19	0.49	1.54	2.0	6.8	8.80	1.28	0.374
SFDP	17/01/2024	855	27	7.26	17962	11675	10.58	63	14.31	8	7	16	1.8	1.13	0.18	1.3	8.4	9.70	2.8	2.53
WFDP	17/01/2024	914	28.1	7.86	18144	11793	10.68	88	93.19	6	11	391	0.84	2.4	0.92	3.3	6.4	9.70	0.44	0.014
AR1	24/01/2024	917	29.6	7.32	84.2	55	0.04	55	28.65	<2	<1	52	0.08	<0.01	<0.01	<0.01	0.08	0.08	0.06	0.003
ARDS1	24/01/2024	921	29.6	7.03	84	55	0.04	55	56.71	<2	<1	56	0.06	<0.01	<0.01	<0.01	0.06	0.06	0.05	0.004
ARUS1	24/01/2024	912	29.6	7.59	83.8	54	0.04	55	50.73	<2	<1	47	0.04	<0.01	<0.01	<0.01	1	1	0.07	0.005
EFDP	24/01/2024	943	29.5	7.8	17029	11069	9.95	88	11.2	3	17	19	0.13	0.21	1.53	1.74	3.7	5.4	0.99	0.657
WFDP	24/01/2024	1008	29.6	7.78	17871	11616	10.49	77	31.48	<2	14	40	1.31	2.08	1.54	3.62	4.1	7.7	0.15	0.002
AR1	31/01/2024	700	28.5	6.62	41.1	27	0.02	50	64.02	<2	<1	58	0.04	<0.01	<0.01	<0.01	0.5	0.5	0.07	0.003
ARDS1	31/01/2024	702	28.5	6.22	41.3	27	0.02	51	61.33	3	<1	84	0.04	<0.01	<0.01	<0.01	0.5	0.5	0.07	0.002
ARUS1	31/01/2024	655	28.5	7.31	37.2	24	0.02	50	55.07	9	<1	76	0.04	<0.01	<0.01	<0.01	0.7	0.7	0.07	0.001
EFCEDP	31/01/2024	833	28.5	7.94	15487	10066	8.99	93	14.71	4	45	17	0.07	0.14	1.62	1.76	3.6	5.4	0.88	0.538
EFDP	31/01/2024	841	28.9	8.15	7792	5065	4.28	123	17.14	7	71	12	0.12	0.15	1.41	1.56	3.8	5.4	0.78	0.488
N1DP	31/01/2024	824	28.1	7.84	19237	12504	11.38	88	52.28	5	35	76	0.39	0.14	1.33	1.47	3.8	5.3	0.78	0.383
ND	31/01/2024	815	28.1	7.85	17939	11660	10.55	93	77.77	4	27	78	0.17	0.19	1.02	1.21	3.2	4.4	0.61	0.295
SFDP	31/01/2024	740	28.4	7.08	15732	10225	9.14	51	15.72	11	46	22	1.14	1.12	0.71	1.83	5.6	7.4	2.39	1.95
WFDP	31/01/2024	756	28.2	7.31	16328	10613	9.52	60	26.12	6	28	35	2.76	1.91	0.7	2.61	5.2	7.8	0.14	<0.001
AI	14/02/2024	732	27.3	7	10345	6724	5.82	31	22.14	4	11	30	0.99	0.3	0.1	0.4	3.6	4	1.4	1.18
AR1	14/02/2024	713	28.3	7.21	80.9	53	0.04	62	52.87	2	<1	34	0.1	<0.02	0.01	0.01	0.7	0.7	0.07	0.004
ARDS1	14/02/2024	718	28.3	7.11	81.8	53	0.04	62	48.3	<2	<1	36	0.12	<0.01	0.01	0.01	0.8	0.8	0.05	0.003
ARUS1	14/02/2024	704	28.3	7.74	75.2	49	0.03	63	53.17	<2	<1	37	0.43	<0.01	<0.01	<0.01	1.2	1.2	0.06	0.003
BCDP	14/02/2024	812	27.7	7.25	13400	8715	7.7	33	21.76	4	4	14	2.18	0.52	0.11	0.63	4.8	5.4	0.99	0.853
DEDP	14/02/2024	757	27.9	7.6	16378	10643	9.56	38	54.3	5	23	10	1.79	1.62	0.44	2.06	5.8	7.9	1.32	1.1
EFDP	14/02/2024	826	27.9	7.42	14356	9331	8.29	28	12.09	3	5	10	2.9	0.26	<0.01	0.26	5.1	5.4	1.11	0.867
N1DP	14/02/2024	747	26.9	7.79	19195	12477	11.37	88	85.93	<2	32	84	0.56	0.05	0.12	0.17	4.1	4.3	1.05	0.544
ND	14/02/2024	739	26.9	7.72	18266	11873	10.77	91	64.15	4	28	61	0.58	0.21	1.72	1.93	3.5	5.4	0.56	0.339
SFDP	14/02/2024	840	27.1	7.56	14221	9244	8.21	39	22.68	5	12	10	2.56	0.62	0.13	0.75	6.7	7.4	2.39	1.83
WFDP	14/02/2024	854	28.5	7.28	14910	9691	8.62	36	31.68	3	26	27	3.23	1.69	<0.01	1.46	5.9	7.4	0.22	0.037
WFDP	14/02/2024			7.28	14910	9691	8.62	36	31.68	<7	34	21	2.5	6.2	2.7	3.8	2.6	6.6	0.066	0.067
AR1	7/03/2024	748	30	6.22	78.1	51	0.04	67	30.61	2	<1	19	0.14	<0.01	0.01	0.01	0.4	0.4	0.04	0.007
ARDS1	7/03/2024	745	30.1	6.21	77.2	50	0.03	56	26.71	3	<1	26	0.06	<0.01	0.1	0.1	0.5	0.5	0.06	0.018
ARUS1	7/03/2024	752	30.1	6.28	75.3	49	0.03	66	30.47	8	<1	22	0.03	<0.01	0.01	0.01	0.4	0.4	0.05	0.014
EFDP	7/03/2024	820	31	7.13	13684	8895	7.13	16	11.09	4	6	21	1.66	0.3	<0.01	0.19	4.4	4.6	0.97	0.531
AR1	12/03/2024		31.5	7.73	75.7	49	0.03	65	28.29	<2	<1	15	0.18	<0.01	<0.01	<0.01	0.7	0.7	0.04	0.005
ARDS1	12/03/2024		32.1	8.14	78.1	51	0.03	66.9	28.08	4	<1	14	0.15	<0.01	<0.01	<0.01	0.7	0.7	0.02	0.004
ARUS1	12/03/2024		32.1	7.42	73.2	48	0.03	68	25.58	<2	<1	16	0.01	<0.01	<0.01	<0.01	0.5	0.5	0.03	0.005
BCDP	12/03/2024		30.7	7.75	12024	7816	6.81	53.1	12.63	3	46	16	1.24	0.63	1.05	1.68	4.2	5.9	0.83	0.566
DEDP	12/03/2024		31.5	8	14395	9357	8.27	74.6	15.35	3	10	15	1.95	1.53	0.81	2.34	6.4	8.7	1.13	0.838
EFDP	12/03/2024		31.5	7.89	12815	8330	7.29	68.5	9.36	4	48	8	2.1	0.46	0.22	0.68	5.5	6.2	0.8	0.574
SFDP	12/03/2024		29.6	7.63	12453	8095	7.09	47.6	16.32	6	10	14	1.9	0.67	0.65	1.32	5.9	7.2	2.23	1.8
WFDP	12/03/2024		30.7	7.79	13371	8691	7.64	80.6	24.08	5	26	32	2.77	1.34	0.08	1.42	5.8	7.2	0.2	0.002
AR1	20/03/2024		30.8	7.63	47.5	31	0.02	68	24.67	3	<1	24	0.05	<0.01	<0.01	<0.01	0.04	0.04	0.04	0.001
ARDS1	20/03/2024		30.7	8.01	49.1	32	0.02	67.4	20.87	4	<1	23	0.05	<0.01	<0.01	<0.01	0.04	0.04	0.02	<0.001
ARUS1	20/03/2024		30.8	7.36	45.5	30	0.02	69.8	24.79	6	<1	24	0.08	<0.01	<0.01	<0.01	0.6	0.6	0.03	0.002
EFDP	20/03/2024		29.6	7.77	12548	8156	7.15	49.9	10.23	7	6	10	1.47	0.92	0.58	1.5	4.4	5.9	0.79	0.453

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