

2024 Monitoring Report for Ludmilla Wastewater Treatment Plant WDL 150-09

Reporting Period: 1 October 2023 to 30
September 2024

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Abbreviations and Glossary

Abbreviation	Definition
Al	Aluminium
ANZECC	Australian and New Zealand Environment and Conservation Council
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
BOD	Biochemical oxygen demand
BWSP	Berrimah Waste Stabilisation Ponds
Cfu	Colony forming units (expressed per unit of a specified volume of sample)
Chl-a	Chlorophyll-a, a photosynthetic pigment present in plants, algae and cyanobacteria that is used in oxygenic photosynthesis. It can be used as a measure of algal biomass and subsequently primary production
Cu	Copper
Cu-B	Bioavailable copper in sediment (estimated by dilute acid extraction)
Cu-F	Copper filtered (dissolved fraction)
Cu:Al	Total copper in sediment normalised to total aluminium content of the sediment
Cu-T	Total copper in sediment
DHWQO(s)	Darwin Harbour water quality objective(s)
DO	Dissolved oxygen
EC	Electrical conductivity
<i>E. coli</i>	<i>Escherichia coli</i>
EP	Equivalent population
ERA	Environmental risk assessment
FRP	Filterable reactive phosphorous (orthophosphate)
ISQG	Interim sediment quality guidelines

Kg	Kilograms
kL	Kilolitres
L	Litres
LOP	Level of species protection (%)
LOR	Limit of reporting for chemical analysis
µg	Micrograms
mg	Milligrams
ML	Mega-litres
N	Nitrogen
NATA	National Association of Testing Authorities in Australia
NH₃-N	Total ammonia as N (NH ₃ and NH ₄ ⁺ as N) as per ANZECC and ARMCANZ (2000) and ANZG (2018)
NHMRC	National Health and Medical Research Council
NO_x-N	Oxidised of nitrogen as N – the sum of nitrate and nitrite
NRETAS	Department of Natural Resources, Environment, The Arts and Sports, Northern Territory
NT	Northern Territory
NT DOH	Northern Territory Department of Health
NT EPA	Northern Territory Environment Protection Authority
NTU	Nephelometric turbidity units
Phaeo-a	Phaeophytin-a, a degradation product of chlorophyll-a
PWC	Power and Water Corporation
QA/QC	Quality assurance and quality control
SMD	A slightly-moderately disturbed aquatic ecosystem. This reflects both the management intent and subsequently the level of protection (ANZECC 95% Species Protection).
SMDZ	Slightly to moderately disturbed zone

SSTV(s)	Site specific trigger value(s)
TN	Total nitrogen
TN:TOC	Total nitrogen to total organic carbon ratio in sediment
TOC	Total organic carbon
TP	Total phosphorous
TSS	Total suspended solids
TV(s)	Trigger value(s)
WDL(s)	Waste discharge licence(s)
WQO(s)	Water quality objective(s)
WSP(s)	Waste stabilisation pond(s)
Zn	Zinc
Zn-B	Bioavailable zinc in sediment (estimated by dilute acid extraction)
Zn-F	Zinc filtered (dissolved fraction)
Zn:Al	Total zinc in sediment normalised to total aluminium content in sediment
Zn-T	Total zinc in sediment
ZOI	Zone of influence of the discharge (disturbed zone 90% species protection level or less)

Executive Summary

Power and Water Corporation (Power and Water) operates the Ludmilla Wastewater Treatment Plant (LWwTP) under Waste Discharge Licence WDL150-09. This report presents the annual monitoring required under this licence for the reporting period of 1 October 2023 to 30 September 2024. This report includes a long term analysis of monitoring data to demonstrate any environmental impact associated with the discharge over the preceding 3 year period; 1 October 2021 to 30 September 2024.

Data collected within the reporting period adhered to the prescribed schedules and Quality Assurance/Quality Control (QA/QC) criteria to ensure the accuracy and reliability of the monitoring data. With the exception of PFAS monitoring, which was an added requirement in the licence renewal, commencing 31 May 2024. This monitoring is scheduled to commence in the 2025 dry season. This report offers a comprehensive summary of monitoring data and assessments, emphasising the importance of trigger values in the assessment framework.

During this compliance period, an event-based assessment has shown that six site specific trigger values (SSTVs) were exceeded. Four exceedances of Dissolved Oxygen SSTVs, all occurring during the wet season months (November – April) and two exceedances of Total Suspended Solids in October 2023. None of these exceedance events were notifiable incidents, or non-compliances in accordance with Item 10 (WDL150-09) and Conditions 33 and 34 of the previous licence version WDL150-08. However, all SSTVs are considered compliant at the compliance points in accordance with Item 16 of the licence.

As seen in previous years, some pore water sample sites have shown elevated Total Phosphorus in comparison to reference values and some sediment samples have shown higher ratios of *Pheophytin-a*; though all sites remain under Default Guideline Values (DGVs) and comparable to results from previous reports. Therefore, there is little evidence to indicate increased environmental impact from the licenced activity over this reporting period.

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1. Introduction

Power and Water and its predecessor organisations has operated the Ludmilla Wastewater Treatment Plant (LWwTP) for over 40 years. The LWwTP is a primary sewage treatment plant utilising gross pollutant and grit screening, odour control through chlorination and chemically assisted sedimentation (CAS) to treat the sewage from the Central Darwin sewage catchment which comprises central Darwin and the inner suburbs.

The CAS tank supernatant is discharged to Darwin Harbour via the East Point Outfall (EPO). In periods of high inflow discharges can be made to Ludmilla Creek via a bypass drain.

The discharge of treated wastewater from the LWwTP is subject to requirements specified by the Controller of Water Resources as conditions associated with a Waste Discharge Licence (WDL150-09), issued under the Water Act 1992 (NT).

2. Report Scope

This report presents the results and assessment of monitoring completed for the reporting period of 1 October 2023 to 30 September 2024 and includes a long-term trend analysis for a 3-year period; 1 October 2021 to 30 September 2024. The results include surface water and sediment monitoring required under WDL 150-09.

This report is prepared in accordance with conditions in WDL 150-09 issued to Power and Water, pursuant to section 74 of the *Water Act 1992*. WDL 150-09 commenced on 31 May 2024. The licence can be accessed via the NT EPA website through; <https://ntepa.nt.gov.au/your-business/public-registers/licences-and-approvals-register/waste-discharge-licences/sewerage/power-and-water-ludmilla>

Specific licence conditions in WDL 150-09 that govern the requirements of this report are:

39. The Licensee must complete and provide to the Administering Agency a report of data and information obtained through the implementation and performance of the Monitoring Program (the Monitoring Report), as prescribed by this licence, on the dates specified in Item 13.

40. The Licensee must ensure that each Monitoring Report:

40.1. is prepared in accordance with the requirements of the Administering Agency 'Guideline for Reporting on Environmental Monitoring' (or any other guideline as adopted by the Administering Agency from time to time);

40.2. includes a tabulation, in Microsoft® Excel® format or another format requested by the Administering Agency, of all monitoring data required to be collected in accordance with this licence for the preceding 12 month period;

40.3. includes a tabulation of monthly and annual contaminant loads discharged from the authorised discharge point specified in Item 5 for the preceding 12 month period. Contaminant loads must be calculated for metals, metalloids, nutrients and other parameters (excluding field parameters) listed in the monitoring program specified in Item 11. The calculations must be based on the daily discharge volume and the concentration of contaminant present in the discharge on that day. On the days when a sample was not taken then the concentration of the contaminant must be estimated using Linear Interpolation methodology;

- 40.4. includes long term trend analysis of monitoring data to demonstrate any environmental impact associated with the Licensed Action over a minimum period of three years (of part thereof);*
- 40.5. includes a summary of any investigations undertaken by the Licensee in accordance with this licence for the preceding 12 month period; and*
- 40.6. includes an assessment of environmental impact from the Licensed Action.*

3. Monitoring Objective

The monitoring conducted in this reporting period including licence limits, SSTVs and site locations specified in the approved monitoring plans under WDL 150-09 can be found in Appendices 2,3,4 and 5 of the licence. Site maps and other pertinent information can be found in the licence document.

Specific licence conditions related to monitoring in WDL 150-09 include:

27. From the Commencement Date of this licence, the Licensee must implement and comply with the Monitoring Program specified in Item 11.

28. The Licensee must to the extent practicable collect samples that are representative of discharge conditions that maximises the ability to detect potential impact from the Licensed Action, including collecting samples at sampling points.

29. In implementing the Monitoring Program the Licensee must to the extent practicable that samples collected at the sampling points are collected:

29.1. on the same date as discharge event; and

29.2. from the part of the waterway that provides representative (well mixed) samples.

30. If a sample is missed or cannot be collected at a sampling point at a frequency set in the Monitoring Program for any reason, the Licensee must revisit the sampling point to collect a sample as soon as possible after the missed collection.

31. The Licensee must ensure that all samples and field environmental data are collected in accordance with recognised Australian Standards and guidelines (such as AS/NZS 5667.1 1998, ANZG (2018), as updated from time to time).

32. For the parameters that require analysis at a laboratory, the Licensee must ensure that:

32.1. all samples are analysed at a laboratory with current NATA accreditation or equivalent; and

32.2. detection and reporting limits are appropriate to determine compliance with this licence.

33. The Licensee must ensure any samples collected in accordance with the Monitoring Program or in connection with the Licensed Action or this licence, are obtained by, or under the supervision of a qualified sampler.

34. The Licensee must ensure any plant and equipment used by the Licensee in conducting the Monitoring Program:

34.1. is reasonably fit for the purpose and use to which it is put, including that it is properly calibrated;

34.2. is maintained and operational; and

34.3. is operated by a person trained to use the plant and equipment.

35. The Licensee must ensure that, for each sample collected in accordance with the Monitoring Program or the Licensed Action, the following information must be recorded and retained:

35.1. the date on which the sample was collected;

35.2. the time at which the sample was collected;

35.3. the location at which the sample was collected;

35.4. the name of the person who collected the sample;

35.5. the chain of custody forms relating to the sample;

35.6. the field measurements (if any) and analytical results (if any) relating to the sample; and

35.7. laboratory quality assurance and quality control documentation.

36. The Licensee must for all land based monitoring points specified in the Monitoring Program:

36.1. install and maintain appropriate identification signage so that they are reasonably identifiable at all times; and

36.2. maintain safe access and egress, as is reasonably practicable.

4. Monitoring Method

4.1 Sampling locations

The East Point outfall discharge location SLuEP01, Ludmilla Creek emergency weir location SLuLCDP (SLu080), Three Darwin Harbour sites (SLuEP02, SLuEP03, SLuEP04) and three Ludmilla Creek sites (SLuLC01, SLuLC03 and SLuL04). With the three compliance points being underlined.



Figure 1: Map of monitoring sites and authorised discharge point locations (discharge points in red) (source: NR maps, 2024).

4.1.1 Ludmilla Creek

The Ludmilla Creek riparian zone up and downstream of the Ludmilla WwTP is dominated by mangrove forest with tidal flats at the creek mouth. As an urban creek, Ludmilla Creek receives stormwater from the upstream and adjacent urban residential, infrastructure and open space environments surrounding the creek and the creek retains substantial environmental values as a mangrove ecosystem.

When inflow to the Ludmilla WwTP exceeds the plant's hydraulic capacity (typically during heavy wet season rainfall events) excess wastewater is directed via an open drain directly into Ludmilla Creek. Discharges into Ludmilla Creek during the dry season are limited to plant malfunctions and emergency shutdowns.

Other noteworthy discharges to Ludmilla Creek include storm water drains from the residential suburbs of Eaton, The Narrows and Ludmilla and runoff from the Darwin Turf Club and a small industrial area at Colivas Road which includes Spot on Marine (boat lifting, repairs and hard-stand storage).

4.1.2 East Point

The East Point outfall (EPO) is located in an intertidal area which increases the risk for humans though reduces the risk for flora and fauna as there is little to no permanent habitat in the direct vicinity of the outfall. There is an aquatic life reserve approx. 300m west of the EPO created in order to protect the ecology of the area by prohibiting the harvest of sedentary animals and juvenile fish within the reserve. The Darwin Harbour Water Quality Objectives apply to the environment surrounding this outfall to protect and maintain the beneficial uses of the harbour.

4.2 Sampling and analysis method

4.2.1 Surface water and discharge monitoring

The discharge samples were collected from the designated sample locations shown in Figure 1. All creek sampling was undertaken from a vessel on neap ebb tides in order to capture worst case scenario with regards to contamination of the receiving environment. At each water quality monitoring site, field readings (pH, temperature, electrical conductivity (EC), salinity, dissolved oxygen (DO), and turbidity) were measured *in-situ* using a handheld multi-probe, calibrated prior to each use. A sample pole was used to collect water and fill laboratory supplied sample bottles which were then kept chilled in an esky before being delivered to a NATA accredited laboratory for analysis on the day of sampling.

4.2.2 Sediment monitoring

All data was collected at the frequencies defined in the sediment monitoring schedule of WDL 150-09. The QA/QC criteria of sampling and data analysis (collection of blanks, duplicate and triplicate samples) as described in ANZG (2018) were met for sediment monitoring.

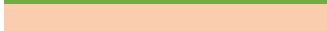
5. Monitoring Results and Analysis

All data associated with WDL150-09 and presented in this report has been collated and submitted to the Administering Agency in Excel Format ("WDL150-09 Ludmilla WwTP Monitoring Data 2024" – D2024-381916).

5.1 Compliance Points

Parameters at the compliance points (SLuEP02, SLuEP03 and SLuLC04) have been calculated in accordance with Item 16 (WDL150-09). All parameters were compliant with SSTVs during the reporting period (Table 1). An event-based assessment has shown six single events above the trigger values at compliance points over the reporting period (Table 2). None of which were considered notifiable incidents in accordance with Item 10 (WDL150-09).

Table 1: Compliance with trigger values at the compliance points 2023 – 2024.

Ludmilla 2023/2024 Monitoring Report Compliance Assessment Table							
				Compliance Points - ZOI			Compliance Points SMD
Year	Indicator	Units	SSTV - ZOI	SLuEP02	SLuEP03	SSTV - SMD	SLuLC04
2023/2024	pH - Median	pH Units	<7.0 - >8.5	8.2	8.2	<7.0 - >8.5	8.2
	DO% - Median	%	<80 - >110	88.9	86.5	<80 - >110	90.8
	TSS - Median	TSS	6.0	4.5	6.0	10.0	4.0
	BOD - 80th Percentile	mg/L	5.0	2.0	2.0	5.0	2.0
	Chlorophyll-a - 80th Percentile	µg/L	2.0	0.7	0.6	4.0	1.0
	Ammonia Nitrogen (NH3-N) - Median	µg/L	910.0	7.5	5.0	910.0	5.0
	Total Nitrogen - Median	µg/L	300.0	130.0	130.0	300.0	115.0
	NOx as N - Median	µg/L	20.0	6.0	7.0	20.0	4.0
	Total Phosphorus - Median	µg/L	30.0	7.5	5.0	30.0	5.0
	Filterable Reactive Phosphorus - Median	µg/L	10.0	1.0	1.0	10.0	1.0
	Copper (filtered) - 95th Percentile	µg/L	1.3	1.0	1.0	1.3	1.0
	Zinc (filtered) - 95th Percentile	µg/L	8.0	5.0	5.0	8.0	5.3
	E. coli - 80th Percentile	MPN/100ML	200 ^a	18.0	10.0	200 ^a	10.0
	Enterococci - 80th Percentile	MPN/100ml	50 ^a	10.0	10.0	50 ^a	18.0
ZOI: Zone of Influence SMD: slightly to moderately disturbed ^a Darwin Harbour Water Quality Objectives							
				 Compliant  Non-compliant  Compliance Points			

Note: E.coli and Enterococci SSTVs were sourced from Darwin Harbour Water Quality Objectives – Table 9 (NT Government, 2010).

Table 2: Event based assessment table at compliance points 2023 – 2024.

Ludmilla 2023/2024 Event Based Assessment Table							
				Compliance Points - East Point			Compliance Points Ludmilla Creek
Year	Indicator	Units	SSTV - ZOI	SLuEP02	SLuEP03	SSTV - SMD	SLuLC04
2023/2024	pH - Max	pH Units	>8.5	8.3	8.4	>8.5	8.3
	pH - Min	pH Units	<7.0	8.1	8.1	<7.0	8.1
	DO% - Max	%	>110	99.6	92.6	>110	113.3
	DO% - Min	%	<80	79.1	79.7	<80	77.8
	TSS - Max	mg/L	6.0	15.0	11.0	10.0	10.0
	BOD - Max	mg/L	5.0	2.0	2.0	5.0	2.0
	Chlorophyll-a - Max	µg/L	2.0	0.7	0.7	4.0	0.9
	Ammonia Nitrogen (NH3-N) - Max	µg/L	910.0	10.0	10.0	910.0	10.0
	Total Nitrogen - Max	µg/L	300.0	160.0	180.0	300.0	150.0
	NOx as N - Max	µg/L	20.0	10.0	12.0	20.0	7.0
	Total Phosphorus - Max	µg/L	30.0	12.0	8.0	30.0	6.0
	Filterable Reactive Phosphorus - Max	µg/L	10.0	2.0	1.0	10.0	2.0
	Copper (filtered) - Max	µg/L	1.3	1.0	1.0	1.3	1.0
	Zinc (filtered) - Max	µg/L	8.0	5.0	5.0	8.0	6.0
	E. coli - Max	MPN/100ML	200 ^a	74.0	73.0	200 ^a	185.0
	Enterococci - Max	MPN/100ml	50 ^a	10.0	10.0	50 ^a	20.0
ZOI: Zone of Influence SMD: slightly to moderately disturbed ^a Darwin Harbour Water Quality Objectives							
				 Within Trigger Value  Exceedance  Compliance Points			

Note: E.coli and Enterococci SSTVs were sourced from Darwin Harbour Water Quality Objectives – Table 9 (NT Government, 2010).

5.2 Wastewater Discharge and Mass Loading

Mass Load estimates are provided using data from inflow and discharge points (Table 3). It should be noted that reported values are subject to uncertainty due to laboratory analysis reporting limits. The method for calculating discharge loads was to multiply the reported analyte concentrations by inflow and discharge values volumes. In the event that reported analyte concentrations were below the limit of reporting (LOR), half the LOR value was used for the calculation. Below presents mass loads for selected parameters for the 2023 – 2024 reporting period.

Table 3: Estimated monthly and annual contaminant loads discharged from the authorised discharge points (SLuEP01 and SLuLCDP) during the 2023 – 2024 reporting period.

Mass Loads Estimates Ludmilla WWTP 2023/2024									
	Ammonia (NH ₃ -N)	Nitrate + Nitrite as N (NO _x -N)	Total Nitrogen	Phosphorus - Filterable Reactive as P	Phosphorus - Filterable Reactive as P	Total Suspended Solids	Biochemical Oxygen Demand	Copper	Zinc
	kg/month	kg/month	kg/month	kg/month	kg/month	kg/month	kg/month	kg/month	kg/month
Oct-23	10707.8	56.2	12678.0	229.5	460.2	8570.2	17271.7	12.3	1.1
Nov-23	9333.7	49.0	11051.1	200.0	401.1	7470.4	15055.3	10.7	0.9
Dec-23	13672.3	71.8	16188.0	293.0	587.6	10942.9	22053.5	15.7	1.4
Jan-24	29164.6	153.2	34530.7	625.0	1253.3	23342.4	47042.5	33.5	3.0
Feb-24	29504.7	155.0	34933.3	632.3	1267.9	23614.6	47591.1	33.9	3.0
Mar-24	26433.5	138.9	31297.1	566.4	1136.0	21156.6	42637.3	30.4	2.7
Apr-24	14402.3	75.7	17052.2	308.6	618.9	11527.1	23230.9	16.6	1.5
May-24	10633.7	55.9	12590.3	227.9	457.0	8510.9	17152.2	12.2	1.1
Jun-24	8418.7	44.2	9967.7	180.4	361.8	6738.1	13579.4	9.7	0.9
Jul-24	10322.0	54.2	12221.2	221.2	443.6	8261.4	16649.4	11.9	1.0
Aug-24	10414.7	54.7	12330.9	223.2	447.6	8335.6	16798.9	12.0	1.1
Sep-24	8725.5	45.8	10330.9	187.0	375.0	6983.6	14074.3	10.0	0.9
Tonnes/Year- 2023/2024	181.7	1.0	215.2	3.9	7.8	145.5	293.1	0.209	0.018

5.3 Surface water

5.3.1 Physio-chemical parameters

Physio-chemical parameters all met compliance with SSTVs for the 2023 – 2024 reporting period, in accordance with Item 16 of WDL150-09. However, the event-based assessment has shown four exceedances of Dissolved oxygen SSTVs at compliance points (SLuEP02, SLuEP03, SLuLC04) and two exceedances of Total Suspended solids (TSS) at SLuEP02 and SLuEP03 (Table 2). However, Ludmilla WwTP was not discharging to Ludmilla Creek during any of the sampling events, nor discharging within 10 days prior to the sampling events occurring. Also, the majority of events occurred during the wet season, except for the two TSS exceedances occurring 3 October 2023.

Figure 3 to Figure 5 presents a comparison of the median between all monitoring sites for pH, Dissolved oxygen and Total Suspended Solids from 2021 – 2024. Minimal change in pH and Dissolved oxygen can be seen at all sites over the previous three years. Over this time, TSS has shown some fluctuation, with a reduction at the Ludmilla Creek discharge point (SLuLCDP) and an increase from the EPO (SLuEP01) and monitoring sites in the East Point slightly-moderately disturbed (SMD) zone. An increase in TSS can also be seen at the Ludmilla Creek upstream monitoring site (SLuLC01), indicating that other urban sources likely contributed to the slight increase shown at SLuLC03 and SLuLC04 (Figure 5).

Previous reports have shown high variability of TSS over time and the risk to the receiving environment is considered low (PWC, 2022).

5.3.2 Biotic

There were no exceedances of SSTVs for Biochemical oxygen demand (BOD) or Chlorophyll-a during the reporting period (Table 2).

5.3.3 Nutrients

No non-compliances with SSTVs occurred for any nutrient parameters over the reporting period (Table 2). Total Ammonia Nitrogen (Figure 8) and Oxides of Nitrogen (Figure 10) remained below SSTVs. Total Nitrogen, Total Phosphorus and Filterable Reactive (FR) Phosphorus were above the SSTV at the Ludmilla Creek upstream SLuLC01 monitoring site (Figure 9, Figure 11, Figure 12). However, not considered exceedances due to Chlorophyll-a values being below SSTVs. This result was not unexpected when compared to previous year's results and due to the location of the site likely having multiple sources of urban and industrial runoff.

Chlorophyll-a is considered the primary indicator in measuring the environmental impact nutrient loads are having on algal abundance and eutrophication in the aquatic ecosystem. Chlorophyll-a has remained under SSTVs over the last three years assessed (Figure 7) and shown a decrease at SLuLC01 over this reporting period in comparison to previous years, indicating that there were no nutrient-related eutrophication issues over this period.

5.3.4 Metals

There were no exceedances of SSTVs for Copper or Zinc over the reporting period (Table 1).

Copper levels have consistently remained below the detection limit of 1 µg/L during the assessment period 2021 – 2024 (Figure 13). Zinc remained below the detection limit for the reporting (LOR), which increased in 2023 from 3 µg/L to 5 µg/L, this change in LOR can be seen in Figure 14.

Contamination events have been removed from the Zinc dataset from October 2022 – March 2023. An investigation was undertaken into these contamination events and provided to the Administering Agency (ALS, 2023).

5.3.5 Pathogen indicators

There were no exceedances of SSTVs for *E.coli* or *Enterococci* for the reporting period (Table 1).

The 2021 – 2024 assessment has shown *E.coli* has stayed stable or decreased across all sites in comparison to the previous reporting period, with the highest concentration observed at the upstream (SLuLC01) monitoring point (Figure 15). *Enterococci* has shown some seasonal fluctuation, with the highest concentrations being recorded at SLuLC01 (Figure 16), upstream of the licenced activity and likely originating from multiple sources.

5.3.6 Endocrine Disrupting Chemicals

All endocrine disrupting chemicals (EDCs) required to be sampled under WDL150-09 were collected for the reporting period. 4-t-octylphenol and Bisphenol-A have remained under LOR for the for the past two years, while Nonylphenol, Androsterone and Etiocholanolone have all fluctuated over the last 10 years of assessment, with all EDCs being relatively low over this reporting period in comparison to previous years (Figure 2).

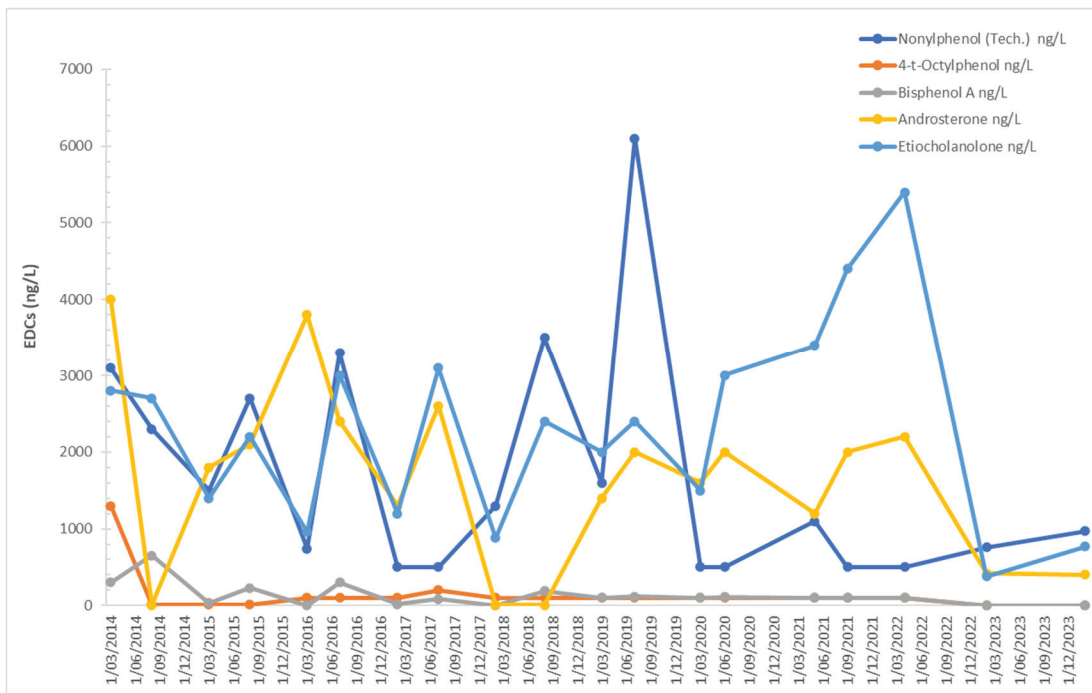


Figure 2: Long-term endocrine disrupting chemical results (SLuLCDP) 2014 – 2024.

5.4 Sediment

Sediment samples were collected in the dry season in accordance with the Sediment Monitoring Plan (Appendix 5, WDL150-09), with the exception of PFAS monitoring as mentioned in the QA/QC evaluation in section 6 of this report.

Table 10 and Table 11 provide values for the sediment and pore water data collected in the 2024 dry season.

All sites remained under the default guideline values (DGVs) for the 2023 – 2024 period. However, sediment samples from East Point monitoring sites SLuEP02, SLuEP03 and SLuEP04 measured above the “>2 x Reference site 80th Percentile” threshold for Ratios of *Pheophytin a*, as did two of the Ludmilla Creek sites (SLuLC01, SLuLC04) (Table 10).

The pore water analysis has shown that all four East Point sample sites (SLuEP01, SLuEP02, SLuEP03, SLuEP04) and associated triplicate samples all measured higher than the reference value for Total Phosphorus (TP). Along with, Ludmilla Creek sites SLuLC01 and SLuLC04 and one of the triplicate samples (Triplicate 10A) taken in the vicinity of the SLuLC03 sample site (Table 11). The upstream Ludmilla Creek site (SLuLC01) measured above the reference guide for Ammonia nitrogen and two triplicate samples exceeded the reference sites for metals; SLuLC03/triplicate 10A was above the Copper reference and SLuEP01/triplicate 12A above the guideline for Zinc (Table 11).

5.5 Summary of trigger value exceedances during reporting period

Table 4: Trigger value exceedances for the 2023 – 2024 reporting period.

Indicator	Site	Zone	Date	Reporting statistic	Reporting value	Reporting limit	significance
Dissolved Oxygen	SLuLC04	SMD	02/11/2023	Individual Value	113.3 DO%	>110 DO%	Non-reportable incident.
Dissolved Oxygen	SLuEP02 SLuEP03	SMD	26/09/2024 04/12/2023	Individual Value	79.1 DO% 79.7 DO%	<80 DO%	Non-reportable incident.
Dissolved Oxygen	SLuLC04	SMD	04/12/2024	Individual Value	77.8 DO%	<80 DO%	Non-reportable incident.
Total Suspended Solids	SLuEP02 SLuEP03	SMD	03/10/2023	Individual Value	15.0 mg/L 11.0 mg/L	6.0 mg/L	Non-reportable incident.

6. Quality assurance/ quality control (QA/QC) evaluation

Data was collected at the frequencies defined in the Surface Water Monitoring Schedule and Sediment Monitoring Schedule of WDL150-09 and the QA/QC criteria of sampling and data analysis (collection of blanks, duplicate and triplicate samples) were met. With the exception of annual dry season sampling of PFAS from the authorised discharge points (Appendix 4, WDL150-09) and sediment sampling for PFAS (Appendix 5, WDL150-09). This was due to changes in the monitoring requirements, with the licence renewal commencing 31 May 2024. However, monitoring contracts have been updated and PFAS monitoring is scheduled to commence in the 2024 – 2025 monitoring period, fulfilling the requirements of the required Annual – Dry Season monitoring.

The EPBC Approval 2009/5113 monitoring required under the Benthic Infauna Monitoring Management Plan (BIMMP) was not carried out during the reporting period, due to ongoing negotiations with the Department of Climate Change, Energy, the Environment and Water (DCCEEW). The department issued Power and Water an exemption for completing the dry season BIMMP monitoring while Approval variations are under assessment. However, the monitoring required under the associated Water Quality Monitoring and Management Plan (WQMMP) was completed for this period and is available upon request.

The QA/QC protocol incorporates an approach that includes z-score flagging to identify potential outliers and anomalies in the data. Additionally, the protocol utilises duplicate samples and field blanks to ensure the accuracy, precision, and reliability of the monitoring results. Duplicate samples are employed to assess the consistency of the data, while field blanks are used to detect any contamination that might occur during sample collection or analysis. Together, these methods provide a framework for maintaining high data quality and integrity throughout the monitoring process.

7. Conclusion

This report summarises monitoring and results of sampling undertaken in accordance with WDL150-09 and fulfils the reporting requirements to the Administering Agency. A detailed summary of all the results for the 2023 – 2024 reporting period has been presented in an excel spreadsheet and provided to the Administering Agency alongside this monitoring report (“WDL150-09 – Ludmilla WwTP Monitoring Data 2024” – D2024/381916).

Regarding environmental impact from the licenced activity, there were no non-compliances with SSTVs during the reporting period and minimal change seen from last reporting period. Indicating the licenced activity has not increased any negative environmental impacts during the 2023 – 2024 reporting period. Some pore water sites have shown elevated levels of Total Phosphorus, in comparison to reference values; along with some sediment sites having higher ratios to *Pheophytin-a*. These results are comparable to previous years and based on chlorophyll-a concentrations, elevated nutrients in sediments and pore water at some sites does not appear to be translating to eutrophication.

The event-based assessment found six non-reportable exceedances of the SSTVs during the 2023-2024 reporting period, presented in Table 4. Four exceedances of the dissolved oxygen SSTVs during wet season and two exceeding the Total Suspended Solids SSTVs occurring in October 2023. None of these single exceedance events were considered notifiable incidents or a non-compliance in accordance with Item 16 of WDL150-09 or Conditions 33 and 34 of the previous licence version (WDL150-08). Therefore, compliance with trigger values has been met for this reporting period.

8.Certification

I, Tahlia Kemp Manager Assurance, have reviewed this report and I confirm that to the best of my knowledge and ability all the information provided in the report is true and accurate.

(being a person authorised to legally represent the holder of the licence)

Signature:.......... Date:.....31/10/2024.....

Please note that:

- Significant penalties may apply where it is demonstrated that false or misleading information has been supplied to the NT EPA.

References

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Australian Standard/New Zealand Standard on Water Quality Sampling – *Part 12: Guidance on sampling of bottom sediments* (AS NZS 5667.12:1999), Standards Australia, New South Wales.

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Appendices

Number	Title
Appendix 1	Long term analysis tables and graphs
Appendix 2	Sediment and Porewater Result Tables

Appendix 1 – Long term analysis tables and graphs

Physico-chemical

Table 5: pH, Dissolved Oxygen and Total Suspended Solids results 2021 – 2024.

	pH Units Median		Sample Locations^							
			Ludmilla WwTP Discharge Point	East Point Outfall				Ludmilla Creek		
				Zol	SMD Zone			Zol	Upstream (SMD)	Downstream (SMD)
				SLuEP01	SLuEP02	SLuEP03	SLuEP04	SLuLC03	SLuLC01	SLuLC04
Year	Indicator	Units								
2021/2022	pH	pH Units	8.1	8.1	8.1	8.1	8.1	7.9	7.4	8.1
2022/2023			8.3	8.2	8.2	8.2	8.2	8.1	7.3	8.1
2023/2024			8.5	8.2	8.2	8.2	8.2	8.0	7.5	8.2
	DO% Median		Sample Locations^							
			Ludmilla WwTP Discharge Point	East Point Outfall				Ludmilla Creek		
				Zol	SMD Zone			Zol	Upstream (SMD)	Downstream (SMD)
				SLuEP01	SLuEP02	SLuEP03	SLuEP04	SLuLC03	SLuLC01	SLuLC04
	Indicator	Units								
2021/2022	DO%	%	40.9	85.6	86.7	91.6	88.8	70.0	43.7	91.9
2022/2023			55.5	83.0	85.0	82.3	83.3	76.6	42.3	83.4
2023/2024			46.6	89.5	88.9	86.5	87.8	77.6	47.4	90.8
	TSS mg/L Median		Sample Locations^							
			Ludmilla WwTP Discharge Point	East Point Outfall				Ludmilla Creek		
				Zol	SMD Zone			Zol	Upstream (SMD)	Downstream (SMD)
				SLuEP01	SLuEP02	SLuEP03	SLuEP04	SLuLC03	SLuLC01	SLuLC04
	Indicator	Units	SSTV							
2021/2022	TSS	TSS	33.0	1.0	2.0	1.0	1.0	8.0	3.5	2.5
2022/2023			29.0	6.0	4.0	3.0	3.0	15.0	14.0	4.0
2023/2024			25.0	6.0	4.5	6.0	6.5	8.5	19.0	4.0

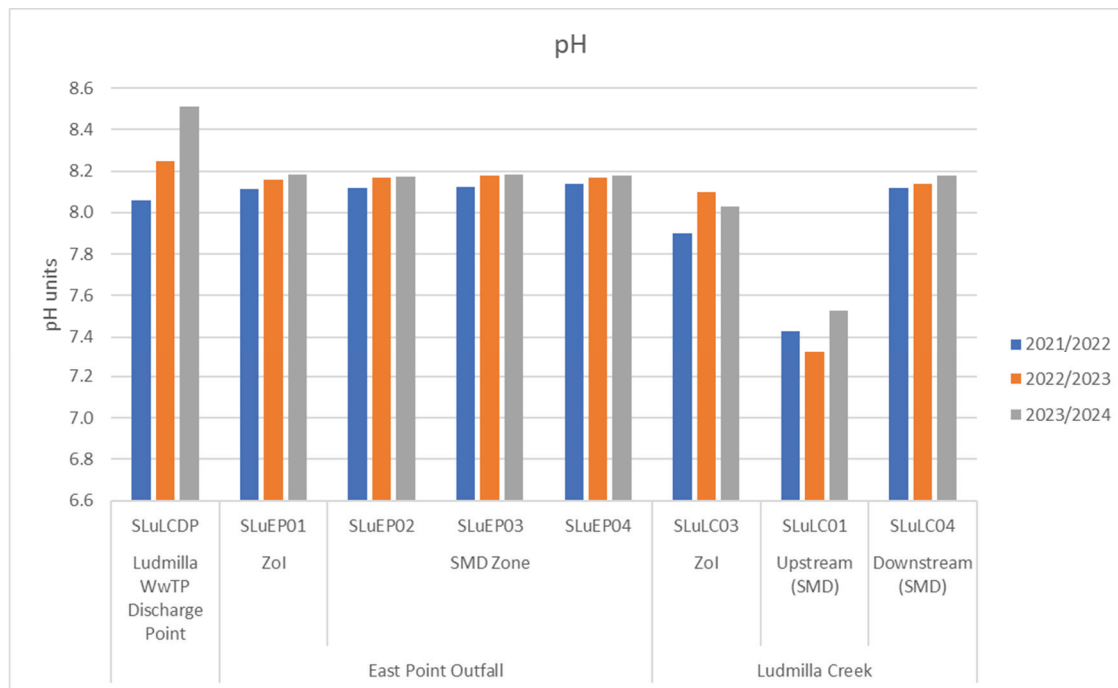


Figure 3: Median pH 2021 - 2024.

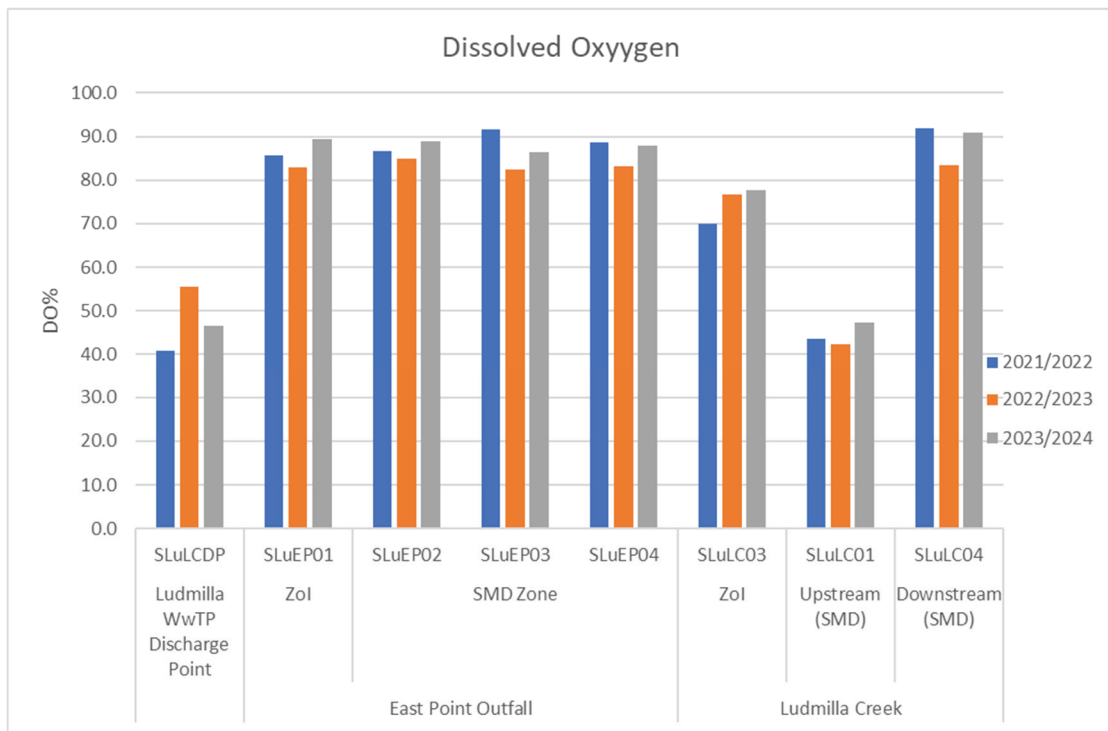


Figure 4: Median Dissolved Oxygen 2021 - 2024.

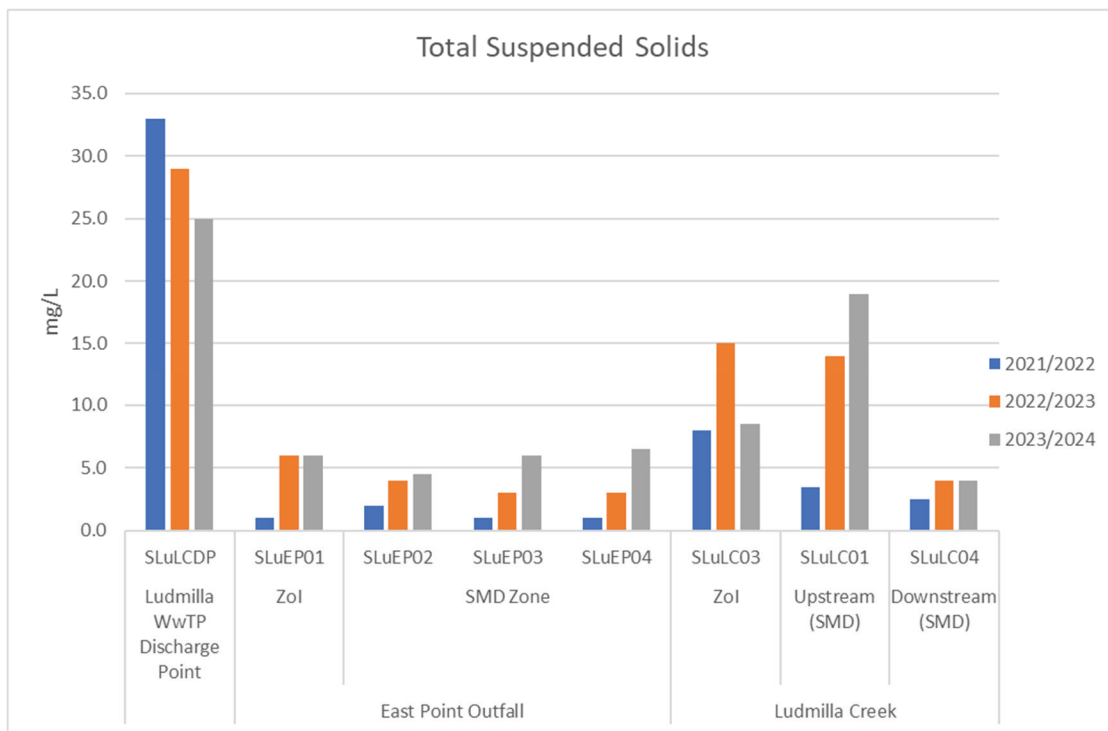


Figure 5: Median Total Suspended 2021 - 2024.

Biotic

Table 6: Biochemical Oxygen Demand and Chlorophyll-a results 2021 - 2024.

	BOD mg/L 80th Percentile		Sample Locations^							
			Ludmilla WwTP Discharge Point	East Point Outfall				Ludmilla Creek		
				Zol	SMD Zone			Zol	Upstream (SMD)	Downstream (SMD)
				SLuEP01	SLuEP02	SLuEP03	SLuEP04	SLuLC03	SLuLC01	SLuLC04
	Indicator	Units								
2021/2022	BOD	mg/L	113.2	2.0	2.0	2.0	2.0	2.0	2.0	
2022/2023			104.4	5.0	5.0	5.0	5.0	5.0	5.0	
2023/2024			80.0	4.0	2.0	2.0	3.0	2.0	1.6	2.0

	Chlorophyll-a µg/L 80th Percentile		Sample Locations^							
			Ludmilla WwTP Discharge Point	East Point Outfall				Ludmilla Creek		
				Zol	SMD Zone			Zol	Upstream (SMD)	Downstream (SMD)
				SLuEP01	SLuEP02	SLuEP03	SLuEP04	SLuLC03	SLuLC01	SLuLC04
	Indicator	Units								
2021/2022	Chlorophyll-a	µg/L	0.9	0.9	0.9	1.1	0.8	2.2	2.6	1.3
2022/2023			0.6	0.8	0.7	0.7	1.2	2.2	2.8	0.9
2023/2024			1.0	0.5	0.7	0.6	0.7	1.0	1.0	1.0

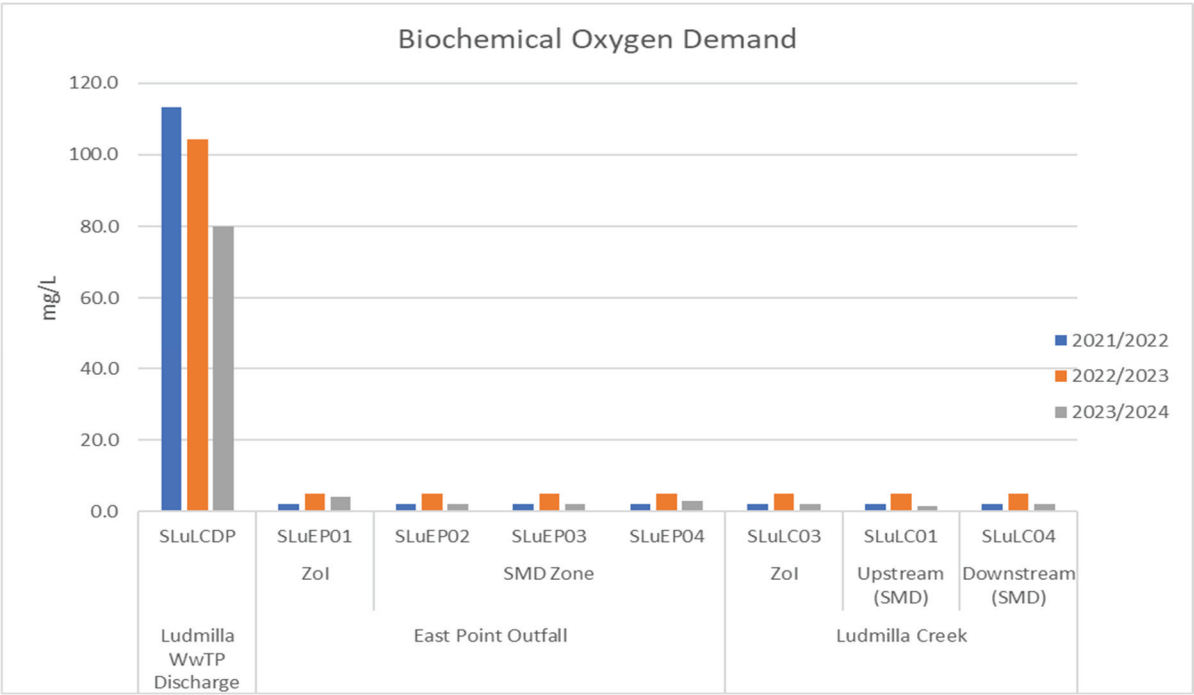


Figure 6: Biochemical Oxygen Demand (80th Percentile) 2021 - 2024.

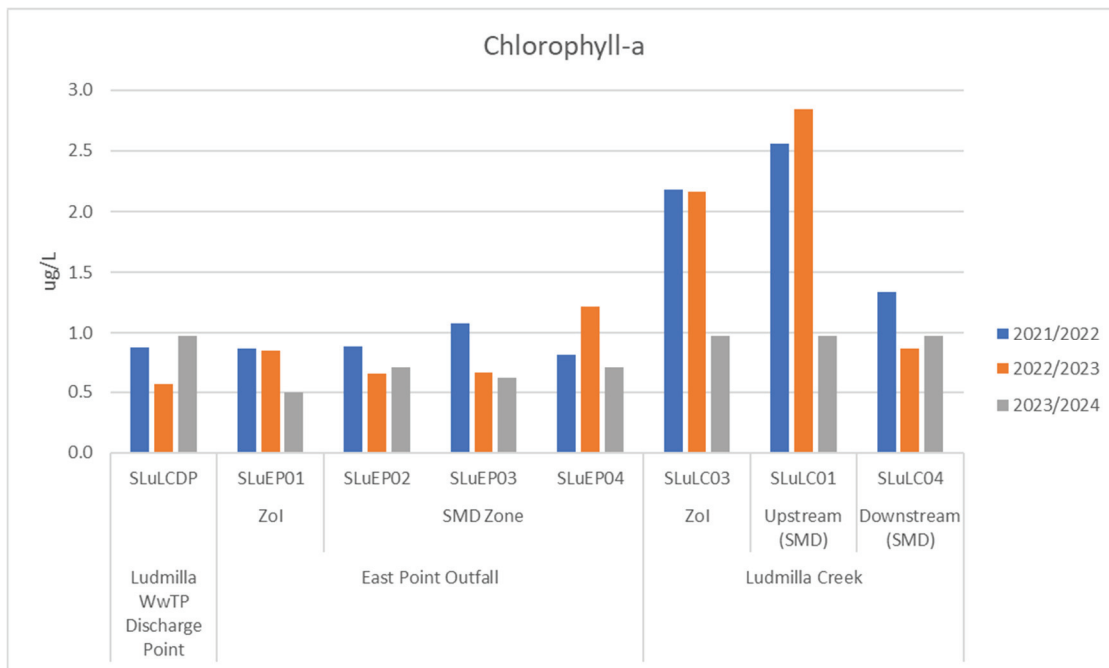


Figure 7: Chlorophyll-a (80th Percentile) 2021 – 2024.

Nutrients

Table 7: $\text{NH}_3\text{-N}$, Total Nitrogen, NOx as N , Total Phosphorus and Filterable Reactive Phosphorus results 2021 – 2024.

Nutrients										
	Ammonia Nitrogen (NH ₃ -N) µg/L Median		Sample Locations ^							
			Ludmilla WwTP Discharge Point	East Point Outfall				Ludmilla Creek		
				Zol	SMD Zone			Zol	Upstream (SMD)	Downstream (SMD)
				SLuLCDP	SLuEP01	SLuEP02	SLuEP03	SLuEP04	SLuLC03	SLuLC01
	Indicator	Units								
2021/2022	monia Nitrogen (NH ₃ -N)	µg/L	34400.0	168.0	5.0	5.0	5.0	5.0	5.0	5.0
2022/2023			36900.0	83.5	5.0	5.0	5.0	5.0	18.0	5.0
2023/2024			37300.0	362.0	7.5	5.0	5.0	5.0	10.0	5.0
	Total Nitrogen µg/L Median		Sample Locations ^							
			Ludmilla WwTP Discharge Point	East Point Outfall				Ludmilla Creek		
				Zol	SMD Zone			Zol	Upstream (SMD)	Downstream (SMD)
				SLuLCDP	SLuEP01	SLuEP02	SLuEP03	SLuEP04	SLuLC03	SLuLC01
	Indicator	Units								
2021/2022	Total Nitrogen	µg/L	46930.0	240.0	80.0	80.0	80.0	80.0	470.0	80.0
2022/2023			40200.0	835.0	140.0	115.0	140.0	130.0	270.0	120.0
2023/2024			44100.0	320.0	130.0	130.0	140.0	170.0	390.0	115.0
	NOx as N µg/L Median		Sample Locations ^							
			Ludmilla WwTP Discharge Point	East Point Outfall				Ludmilla Creek		
				Zol	SMD Zone			Zol	Upstream (SMD)	Downstream (SMD)
				SLuLCDP	SLuEP01	SLuEP02	SLuEP03	SLuEP04	SLuLC03	SLuLC01
	Indicator	Units								
2021/2022	NOx as N	µg/L	238.0	8.0	3.0	3.0	3.0	3.0	3.0	3.0
2022/2023			192.0	3.0	5.0	4.5	5.0	5.0	9.0	3.0
2023/2024			105.0	3.0	6.0	7.0	6.5	5.0	7.0	4.0
	Total Phosphorus µg/L Median		Sample Locations ^							
			Ludmilla WwTP Discharge Point	East Point Outfall				Ludmilla Creek		
				Zol	SMD Zone			Zol	Upstream (SMD)	Downstream (SMD)
				SLuLCDP	SLuEP01	SLuEP02	SLuEP03	SLuEP04	SLuLC03	SLuLC01
	Indicator	Units								
2021/2022	Total Phosphorus	µg/L	2020.0	40.0	31.0	37.0	32.0	36.0	64.5	34.0
2022/2023			1780.0	32.0	5.0	5.0	5.0	14.0	41.0	6.0
2023/2024			1690.0	9.0	7.5	5.0	7.0	10.0	55.0	5.0
	Filterable Reactive Phosphorus µg/L Median		Sample Locations ^							
			Ludmilla WwTP Discharge Point	East Point Outfall				Ludmilla Creek		
				Zol	SMD Zone			Zol	Upstream (SMD)	Downstream (SMD)
				SLuLCDP	SLuEP01	SLuEP02	SLuEP03	SLuEP04	SLuLC03	SLuLC01
	Indicator	Units								
2021/2022			794.0	3.0	3.0	4.0	3.0	4.0	16.0	3.0
2022/2023			913.0	3.5	1.0	1.0	2.0	2.0	8.0	1.0
2023/2024			818.0	1.0	1.0	1.0	1.0	1.0	26.0	1.0

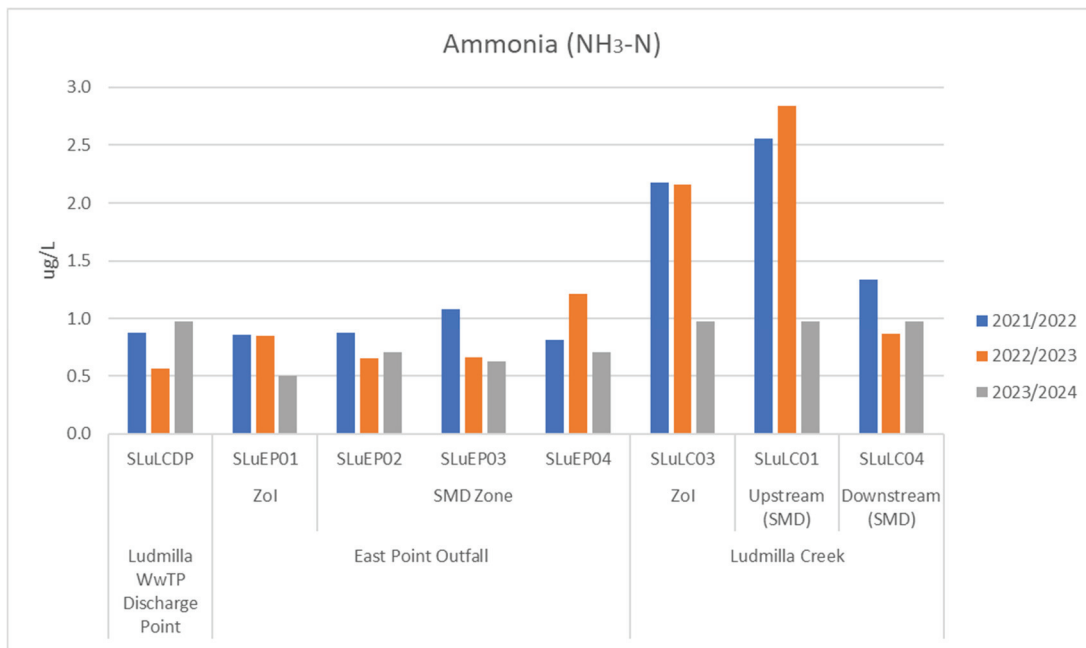


Figure 8: Median Total Ammonia Nitrogen 2021 – 2024.

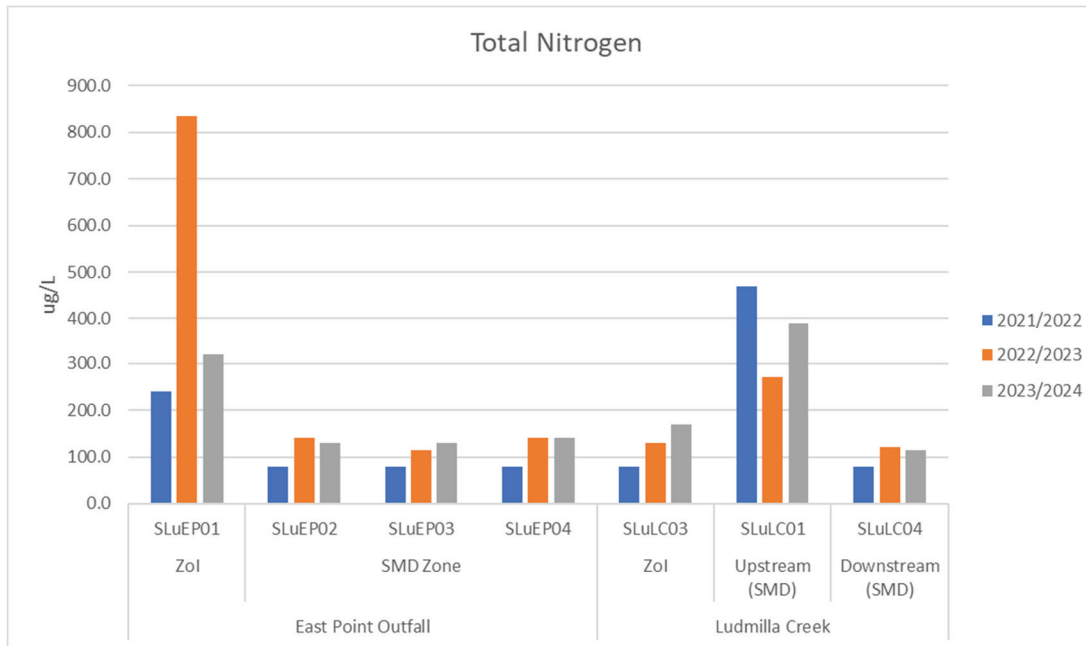


Figure 9: Median Total Nitrogen 2021 – 2024.

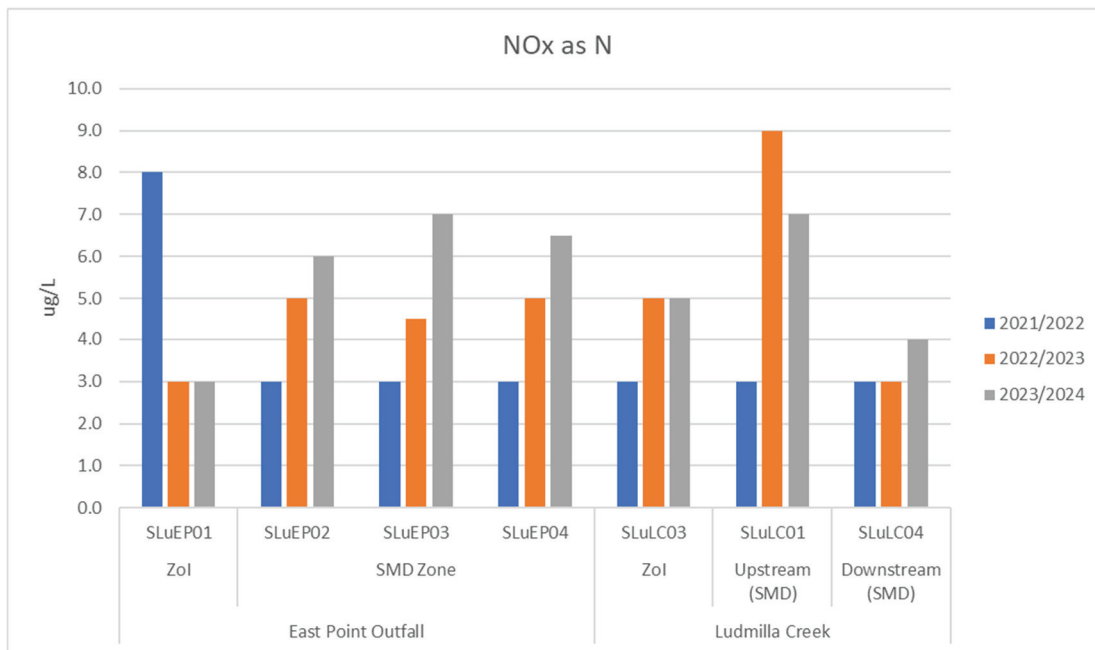


Figure 10: Median NOx an N 2021 – 2024.

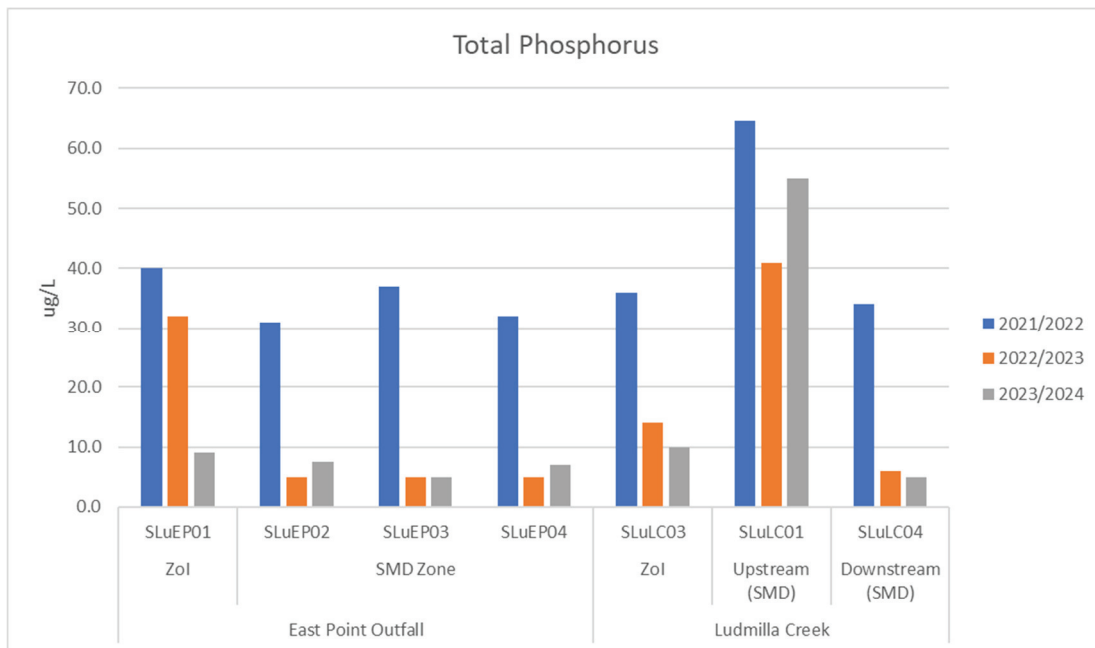


Figure 11: Median Total Phosphorus 2021 – 2024.

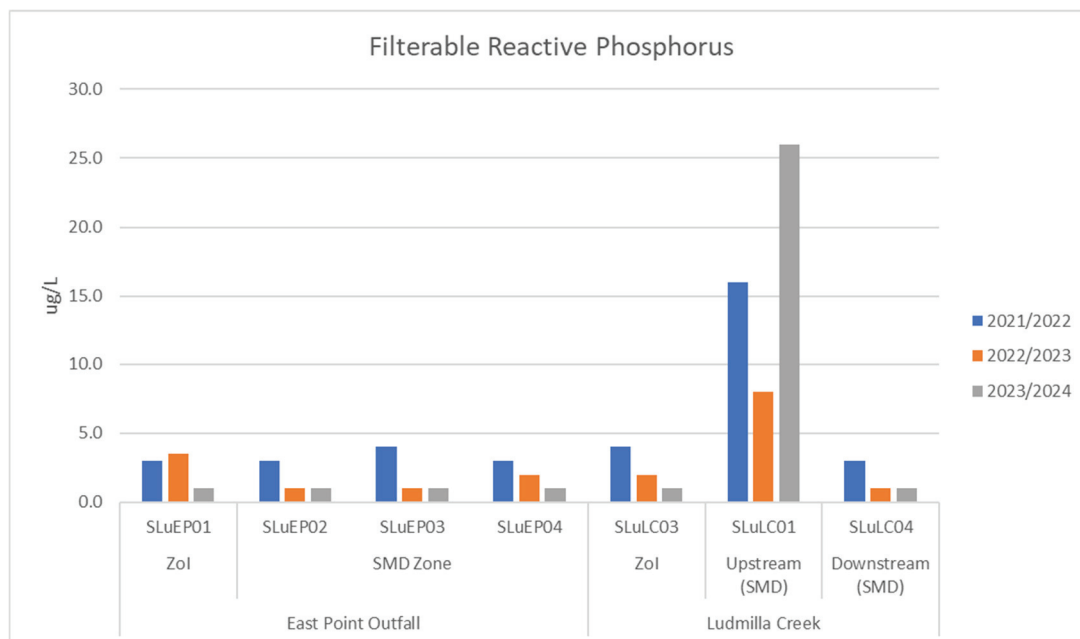


Figure 12: Median Filterable Reactive Phosphorus 2021 – 2024.

Metals

Table 8: Copper and Zinc results 2021 – 2024.

Metals										
	Copper (filtered) µg/L 95th Percentile		Sample Locations^							
			Ludmilla WwTP Discharge Point	East Point Outfall				Ludmilla Creek		
				Zol	SMD Zone			Zol	Upstream (SMD)	Downstream (SMD)
				SLuLCPD	SLuEP01	SLuEP02	SLuEP03	SLuEP04	SLuLC03	SLuLC01
	Indicator	Units								
2021/2022	Copper (filtered)	µg/L	89.1	1.0	1.0	1.0	1.0	1.0	1.0	
2022/2023			63.5	1.0	1.0	1.0	1.0	1.0	1.0	
2023/2024			58.5	1.0	1.0	1.0	1.0	1.0	1.0	
	Zinc (filtered) µg/L 95th Percentile		Sample Locations^							
			Ludmilla WwTP Discharge Point	East Point Outfall				Ludmilla Creek		
				Zol	SMD Zone			Zol	Upstream (SMD)	Downstream (SMD)
				SLuLCPD	SLuEP01	SLuEP02	SLuEP03	SLuEP04	SLuLC03	SLuLC01
	Indicator	Units								
2021/2022	Zinc (filtered)	µg/L	8.2	3.0	3.0	3.5	3.0	3.5	3.0	
2022/2023			5.0	5.0	5.0	5.0	5.0	5.0	5.0	
2023/2024			5.5	5.0	5.0	5.0	5.0	5.0	5.3	



Figure 13: 95th Percentile of Copper (filtered) 2021 – 2024.

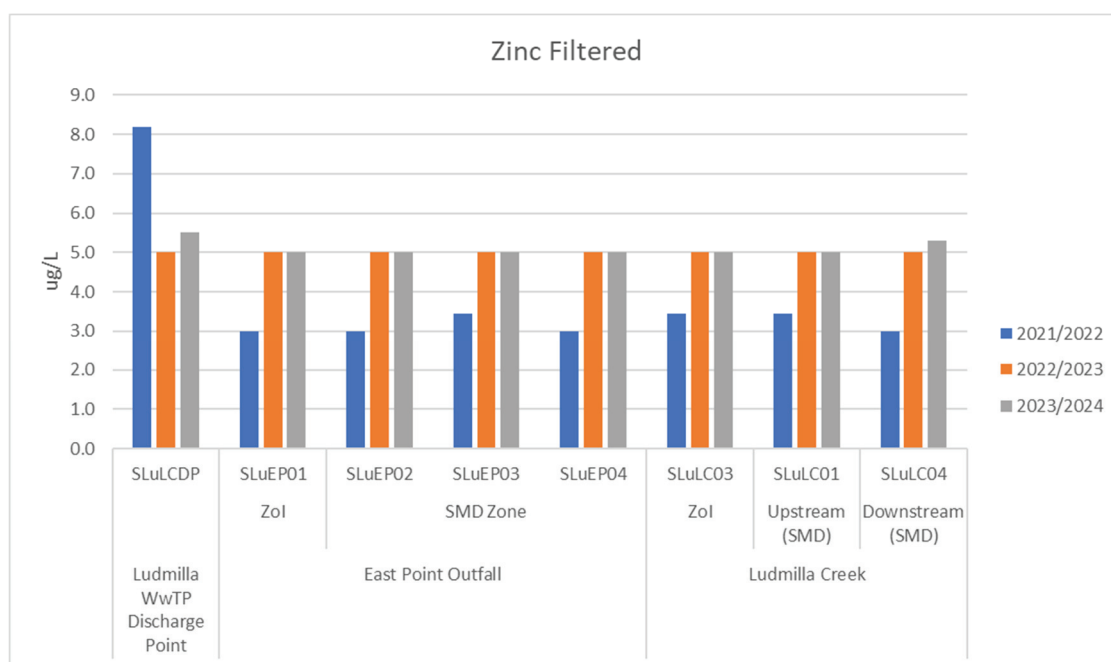


Figure 14: 95th Percentile of Zinc (filtered) 2021 – 2024.

Bacteriological

Table 9: *E.coli* and Enterococci results 2021 – 2024.

Bacteriological										
<i>E. coli</i> MPN/100ML 80th Percentile			Sample Locations^							
			Ludmilla WwTP Discharge Point	East Point Outfall				Ludmilla Creek		
				Zol	SMD Zone			Zol	Upstream (SMD)	Downstream (SMD)
				SLuEP01	SLuEP02	SLuEP03	SLuEP04	SLuLC03	SLuLC01	SLuLC04
	Indicator	Units								
2021/2022	E. coli	MPN/100M L	63.6	39.4	0.0	0.8	0.0	58.2	110.0	7.8
2022/2023			530.0	10.0	10.0	10.0	10.0	309.6	1470.0	57.4
2023/2024			74.0	10.0	18.0	10.0	10.0	188.6	546.0	10.0
	<i>Enterococci</i> MPN/100ml 80th Percentilae		Sample Locations^							
			Ludmilla WwTP Discharge Point	East Point Outfall				Ludmilla Creek		
				Zol	SMD Zone			Zol	Upstream (SMD)	Downstream (SMD)
				SLuEP01	SLuEP02	SLuEP03	SLuEP04	SLuLC03	SLuLC01	SLuLC04
	Indicator	Units								
2021/2022	Enterococci	MPN/100ml	5.6	176.4	0.0	2.4	0.0	36.8	63.0	5.6
2022/2023			10.0	25.0	10.0	10.0	10.0	54.6	109.0	16.0
2023/2024			52.0	40.0	10.0	10.0	10.0	20.0	148.0	18.0

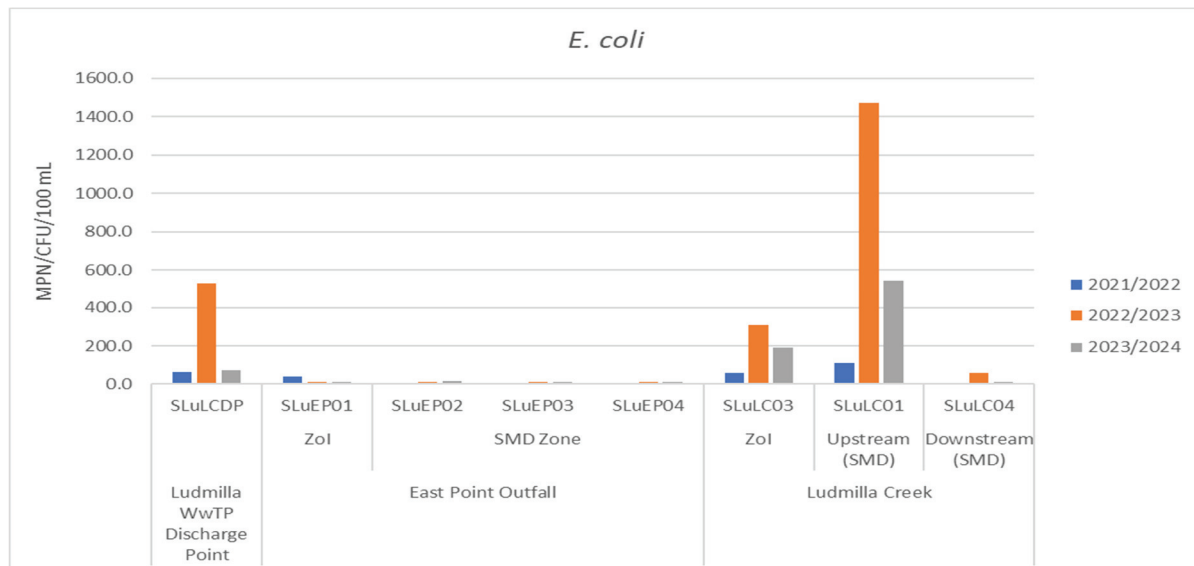


Figure 15: *E.coli* (80th Percentile) 2021 – 2024.

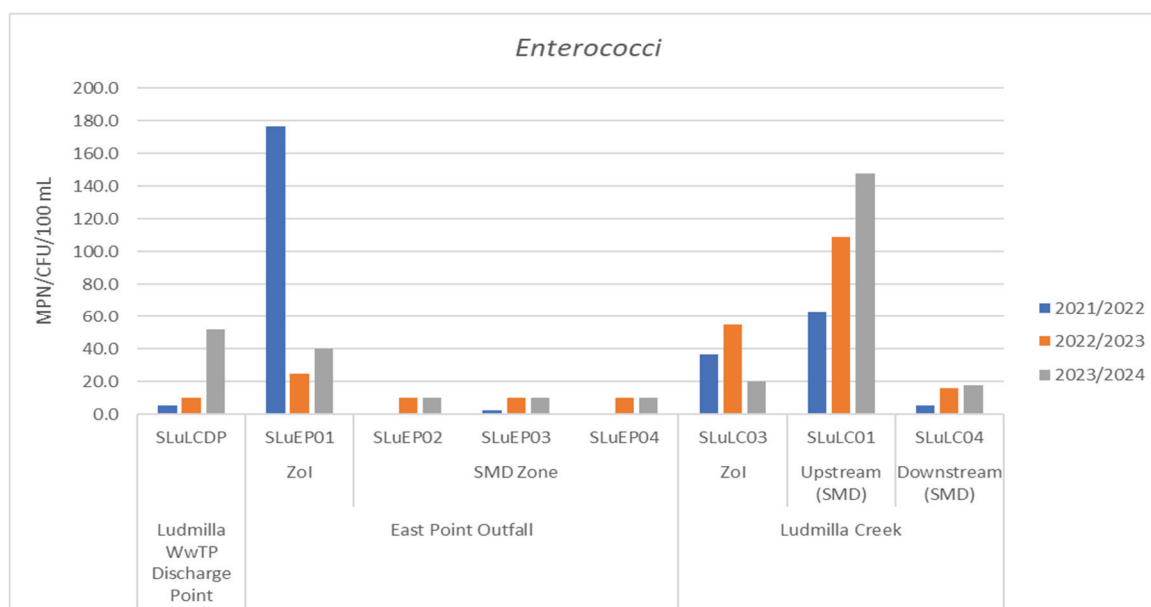


Figure 16: *Enterococci* (80th Percentile) 2021 – 2024.

Appendix 2 – Sediment and Porewater Result Tables

Table 10: Sediment assessment of East Point and Ludmilla Creek monitoring sites and a comparison to the Short Creek reference site.

PWC DHSWMP 2024 - Ludmilla WWTP		Analyte	Sediments														
			Moisture Content	Aluminium		Copper	Zinc	AI normalisation of Total Copper	AI normalisation of Total Zinc	Total Kjeldahl Nitrogen as N	Total Nitrogen as N	Total Phosphorus as P	Total Organic Carbon	C:N Ratios	Chlorophyll a mg/kg (dry weight)	Pheophytin a mg/kg (dry weight)	Ratios to Pheophytin-a
			Unit LOR	%	mg/kg		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%				
Sample Date:	Client sample ID (1st):		1.0	50		1.0	1.0			20	20	2	0.02				
East Point																	
3/06/2024	SLUEP01		32.5	2220	<	1	7.8	0.00045	0.0035	170	170	645	0.14	12.35	0.1600	1.4500	0.1103
3/06/2024	SLUEP02		26.6	1790	<	1	6.7	0.00056	0.0037	210	210	740	0.6	42.86	1.1900	0.4800	2.4792
3/06/2024	SLUEP03		32.6	1800	<	1	6.4	0.00056	0.0036	180	180	742	0.1	8.33	1.1200	0.4500	2.4889
3/06/2024	SLUEP04		30.5	1580	<	1	4.1	0.00063	0.0026	240	240	502	0.17	10.63	1.6000	0.7000	2.2857
3/06/2024	SLUEP01/Triplicate 12A		26.0	1820	<	1	5.6	0.00055	0.0031	180	180	724	0.12	10.00	1.5200	0.5000	3.0400
3/06/2024	SLUEP01/Triplicate 12B		28.3	1820	<	1	6.3	0.00055	0.0035	190	190	647	0.14	11.05	1.1000	0.2200	5.0000
3/06/2024	SLUEP02/Triplicate 13A		28.3	1700	<	1	6	0.00059	0.0035	180	180	641	0.42	35.00	0.8800	0.6900	1.2754
3/06/2024	SLUEP02/Triplicate 13B		30.1	1810	<	1	6.2	0.00055	0.0034	170	170	641	0.13	11.47	1.2000	0.3100	3.8710
3/06/2024	SLUEP03/Triplicate 14A		29.4	1900	<	1	6.6	0.00053	0.0035	200	200	621	0.11	8.25	1.1200	0.4500	2.4889
3/06/2024	SLUEP03/Triplicate 14B		31.0	1810	<	1	6.3	0.00055	0.0035	200	200	629	0.11	8.25	0.9800	0.3300	2.9697
Ludmilla Creek																	
23/05/2024	SLULC01		46.1	12700		10	45.6	0.00079	0.0036	1740	1740	480	2.87	24.74	0.9500	2.0800	0.4567
23/05/2024	SLULC03		43.8	12000		9.9	40.2	0.00083	0.0034	1720	1720	506	2.32	20.23	2.5200	10.5100	0.2398
23/05/2024	SLULC04		51.6	8580		7.4	23.8	0.00086	0.0028	860	860	557	1.32	23.02	1.2800	2.6400	0.4848
23/05/2024	SLULC03/TRIPLICATE 10A		53.3	12000		9.7	41	0.00081	0.0034	1780	1780	621	2.12	17.87	0.9500	5.6500	0.1681
23/05/2024	SLULC03/TRIPLICATE 10B		49.6	10400		11	39.4	0.00106	0.0038	1460	1460	559	2.27	23.32	0.7900	3.5500	0.2225
23/05/2024	SLULC04/TRIPLICATE 11A		48.3	8060		6.6	23.3	0.00082	0.0029	1020	1020	524	1.37	20.15	1.3700	3.7100	0.3693
23/05/2024	SLULC04/TRIPLICATE 11B		38.9	7200		5.6	20.3	0.00078	0.0028	720	720	744	1.16	24.17	1.5100	0.9400	1.6064
Short Creek																	
4/06/2024	SPASC01		60.3	12500		8.6	32	0.00069	0.0026	1550	1550	384	2.87	27.77	0.7100	3.4000	0.2088
4/06/2024	SPASC02		63.7	13500		10.2	36	0.00076	0.0027	1910	1910	511	3.29	25.84	1.1200	5.1400	0.2179
4/06/2024	SPASC03		66.8	12500		8.2	35	0.00066	0.0028	1750	1750	480	3.33	28.54	2.8600	9.3100	0.3072
4/06/2024	SPASC04		58.5	12300		7.8	29.7	0.00063	0.0024	1380	1380	450	2.46	26.74	0.7900	3.6600	0.2158
4/06/2024	SPASC02/TRIPLICATE 7A		61.6	11800		8.2	28.7	0.00069	0.0024	1720	1720	452	3	26.16	1.4400	8.2500	0.1745
4/06/2024	SPASC02/TRIPLICATE 7B		60.7	11500		8.2	29.1	0.00071	0.0025	1490	1490	404	3.74	37.65	1.2200	6.5400	0.1865
						Reference Site 2 x 80th Percentile	Reference Site 2 x 80th Percentile	Reference Site 2 x 80th Percentile	Reference Site 2 x 80th Percentile	Reference Site 2 x 80th Percentile	Reference Site 2 x 80th Percentile	Reference Site 2 x 80th Percentile	Reference Site 2 x 80th Percentile	Reference Site 2 x 80th Percentile			Reference Site 2 x 80th Percentile
						17.2000	70.0000	0.0014	0.0053	3500.0000	3500.0000	960.0000	6.6600	57.0857			0.4358
						DGV	DGV										
						65	200										
						GV-High	GV-High										
						270	410										

Above reference site

Above DGV (Default Guideline Values)

Above GV-High (Guideline Vaule High)

<https://www.waterquality.gov.au/anz-guidelines/guideline-values/default/sediment-quality-toxicants>

Table 11: Porewater assessment of East Point and Ludmilla Creek monitoring sites and a comparison to the Short Creek reference site.

			Analyte grouping/Analyte	pH Value	Copper	Zinc	Ammonia as N	Total Nitrogen as N	Total Phosphorus as P	Ammonia as N - pH adjusted ANZG 2018 SMD Trigger Valuesa	Nitrite + Nitrate as N	Organic Nitrogen as N	Total Kjeldahl Nitrogen as N	Dissolved Reactive Phosphorus as P
Unit			Limit of reporting	0.01	1	5	0.01	0.1	0.01		0.01	0.1	0.10	0.01
PWC DHSWMP 2024 - Ludmilla WwTP														
East Point	Sample Date:	Site Code	Matrix											
	03/06/2024	SLUEP01	POREWATER	7.61	< 1	< 5	1.19	1.5	0.31	0.03	0.14	0.2	1.40	0.03
	03/06/2024	SLUEP02	POREWATER	7.82	< 1	< 5	0.87	1	0.28	0.03	<0.01	0.1	1.00	0.03
	03/06/2024	SLUEP03	POREWATER	7.8	< 1	< 5	1.61	1.9	0.33	0.06	0.36	<0.1	1.50	0.03
	03/06/2024	SLUEP04	POREWATER	7.8	< 1	< 5	1	1	0.3	0.03	<0.01	<0.1	1.00	0.02
	03/06/2024	SLUEP01/Triplicate 12A	POREWATER	7.85	< 1	< 25	0.31	0.7	0.27	0.01	0.02	0.4	0.70	0.02
	03/06/2024	SLUEP01/Triplicate 12B	POREWATER	7.8	< 1	< 5	0.6	0.8	0.34	0.02	<0.01	0.2	0.80	0.03
	03/06/2024	SLUEP02/Triplicate 13A	POREWATER	7.8	< 1	< 5	1.28	1.4	0.33	0.04	0.01	0.1	1.40	0.03
	03/06/2024	SLUEP02/Triplicate 13B	POREWATER	7.78	< 1	< 5	1.37	1.6	0.3	0.04	<0.01	0.2	1.60	0.02
	03/06/2024	SLUEP03/Triplicate 14A	POREWATER	7.82	< 1	< 5	0.74	0.9	0.28	0.03	<0.01	0.2	0.90	0.02
	03/06/2024	SLUEP03/Triplicate 14B	POREWATER	7.81	< 1	< 5	1.61	1.7	0.28	0.06	<0.01	<0.1	1.70	0.03
Ludmilla Creek														
	23/05/2024	SLULC01	POREWATER	7.87	< 1	< 5	4.16	5.4	0.18	0.17	0.04	1.2	5.40	0.02
	23/05/2024	SLULC03	POREWATER	7.61	< 1	< 5	1.56	2.4	0.13	0.03	0.08	0.7	2.30	<0.01
	23/05/2024	SLULC04	POREWATER	7.61	< 2	< 5	1.36	2.4	0.18	0.03	0.03	1	2.40	0.04
	23/05/2024	SLULC03/TRIPPLICATE 10A	POREWATER	7.55	< 3	< 5	1.76	5.9	0.17	0.03	0.2	3.9	5.70	<0.01
	23/05/2024	SLULC03/TRIPPLICATE 10B	POREWATER	7.51	< 1	< 5	1.78	5.5	0.14	0.03	0.08	3.6	5.40	<0.01
	23/05/2024	SLULC04/TRIPPLICATE 11A	POREWATER	7.59	< 1	< 5	1.21	2.2	0.14	0.03	0.02	1	2.20	0.01
	23/05/2024	SLULC04/TRIPPLICATE 11B	POREWATER	7.54	< 2	< 5	2.16	3.7	0.15	0.04	0.03	1.5	3.70	<0.01
Short Creek														
	4/06/2024	SPASC01	POREWATER	7.67	< 2	< 11	0.9	4.3	0.08	0.02	1.38	2	2.90	0.02
	4/06/2024	SPASC02	POREWATER	7.62	< 1	< 5	1.06	2.1	0.07	0.02	0.09	0.9	2.00	0.01
	4/06/2024	SPASC03	POREWATER	7.69	< 1	< 5	3.04	3.8	0.07	0.08	0.13	0.7	3.70	0.01
	4/06/2024	SPASC04	POREWATER	7.66	< 1	< 5	1.4	1.5	0.06	0.04	0.08	<0.1	1.40	<0.01
	4/06/2024	SPASC02/TRIPPLICATE 7A	POREWATER	7.64	< 1	< 5	1.3	1.6	0.07	0.03	0.02	0.3	1.60	0.02
	4/06/2024	SPASC02/TRIPPLICATE 7B	POREWATER	7.67	< 1	< 5	1.24	1.6	0.07	0.03	0.04	0.4	1.60	<0.01
				Reference Site 2 x 80th Percentile	Reference Site 2 x 80th Percentile		Reference Site 2 x 80th Percentile	Reference Site 2 x 80th Percentile	Reference Site 2 x 80th Percentile					
				2.00	10.00		7.60	0.14	0.07					

Above reference site
<https://www.waterquality.gov.au/anz-guidelines/guideline-values/default/sediment-quality-toxicants>

The "Reference Site 2 x 80th Percentile" method is effective for environmental assessments because it accounts for natural variability at a reference site, provides a conservative threshold to identify potential contamination, and is adaptable to different sites and conditions. This approach is supported by environmental guidelines like those from ANZECC/ARMCANZ, which recommend using site-specific data to create relevant guideline values. The method acts as an early warning system, alerting managers to potential risks, making it a robust tool for protecting ecosystems.

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