BLACKTIP ANNUAL ENVIRONMENTAL MONITORING REPORT 2020

								
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CERTIFICATION

I, Teresa Lui Yuen, Senior Environment Advisor, 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.

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1. EXECUTIVE SUMMARY

The Blacktip Annual Environmental Performance Report 2020 summarises the environmental performance of the Blacktip Yelcherr Gas Plant (YGP) for the reporting period 1 January 2020 to 31 December 2020 as required by the Environment Protection Licence EPL230-01, which is currently in force. EPL230 remained in force between 1 January 2020 to 30 August 2020. EPL230-01 (the current license) was issued to Eni on 31 August 2020 as the most recent amendment to the EPL.

The Report accompanies the Annual Return, which provides a summary of the compliance against the EPL.

Below is a summary of each section of the report and key findings.

Production

- Gas production was 947 MSCM.
- Condensate production was 10,615 tonnes.

Atmospheric Emissions

- Total greenhouse gas emissions from Yelcherr Gas Plant calculated in the latest NGER reporting period were 56,503 tCO2-e.
- Total volume of gas flared was 4,261 KSCM, with an average daily rate of 11.6 KSCM/d, compared with 12.3 KSCM/d in 2019.
- All pollutant emissions were within the EPL limits.
- No visible smoke was reported (visible for more than 5 minutes in any 2 hours) during the last 12 months.

Liquid waste discharges – produced water

- Annual shellfish and sediment monitoring and offshore produced water monitoring (for model validation) were conducted in November 2020.
- Non-compliances with trigger values, as defined under Condition 55 in EPL230, occurred an various occasions.
- Produced water limits for OIW, Mn and BTEX (as stipulated in EPL230-01) were exceeded on one, two and four occasions respectively.
- There is no available technology to reduce BTEX to meet the EPL230-01 limits.
- All other parameters were below their respective limits and trigger values, and total poly-aromatic hydrocarbon (PAH) was consistently below 0.04 mg/L.

Liquid waste discharges – treated wastewater

- A total of 2.2 ML of treated wastewater effluent was reused for irrigation.
- August 2020 wastewater sample was received out of holding time for bacteriological analysis due to COVID impacts.
- Non-compliances with trigger values for oil in water, TSS and ammoniacal N, as defined under Condition 55 in EPL230, occurred on various occasions.

- E.Coli and TSS were measured above the EPL limit on 23 September 2020 and 25 November 2020 (E.Coli only).
- All other measurements were within the EPL limits.

Liquid waste discharges – stormwater

- Non-compliances with the trigger value for oil in water, as defined under Condition 55 in EPL230, occurred an various occasions.
- Oil in water ranged between 0 – 3.9 mg/L, with four occurrences above 4 mg/L.
- Annual chemical characterisation was undertaken in January 2021.

Solid waste

- Blacktip operations generated an approximate total of 84 t of waste, of which approximately 80 t was taken to Darwin.

Groundwater

- A total of 16.5 ML was abstracted for potable water use, a reduction of over 50% from the previous year.
- All quarterly monitoring results were within the Australian Drinking Water Guidelines and ANZECC guidelines, except one minor instance where Dissolved Oxygen was estimated at 77%, below the ADW guideline of 85%.

Incidents and non-conformances

The following non-compliances were identified:

Date	Condition	Non-compliance
19 August 2020	EPL 230 Condition 41	Wastewater analysis not valid due to the sample being received out of holding time for bacteriological analysis, due to changes in the flight schedule due to COVID travel restrictions.
30 August 2020	EPL 230 Condition 35	Mid-year air emissions sampling was deferred due to COVID travel restrictions.
30 August 2020	EPL 230 Condition 55	Exceedance of the trigger value on three or more consecutive occasions: • Stormwater oil in water • Wastewater effluent oil in water and Total Suspended Solids (TSS) • Produced water oil in water Exceedance of three times the relevant trigger value: • Produced water oil in water • SW-01 Stormwater oil in water • SW-03 Stormwater oil in water, toluene and zinc • Wastewater TSS Exceedance of three times the relevant ANZECC 80% species level of protection trigger value:

Date	Condition	Non-compliance
30 August 2020	EPL 230 Condition 55	• Produced water ammoniacal N, toluene, ethylbenzene, xylene • Wastewater ammoniacal N • SW-03 Stormwater toluene and zinc.
7 Sep 2020	EPL 230-01 Condition 28	Produced water BTEX and Mn were measured above the EPL limits. Action: investigate treatment options to reduce BTEX
23 Sep 2020	EPL 230-01 Condition 28	Wastewater E.Coli and TSS were measured above the EPL limit.
31 October 2020	EPL 230-01 Condition 41	Produced water sampling did not cover the full suite of parameters required for October 2020. SAP work orders have been created for monthly PW sampling (complete).
11 November 2020	EPL 230-01 Condition 28	Produced water BTEX and oil in water was measured above the EPL limits. Note: the oil in water analysis did not include a silica-gel cleanup to remove non-petrogenic compounds.
25 Nov 2020	EPL 230-01 Condition 28	The following were detected above the relevant EPL limit: • Produced water BTEX and Mn; • Wastewater E.Coli
25 Dec 2020	EPL 230-01 Condition 28	The following were detected above the relevant EPL limit: • Produced water BTEX.

Continuous improvement

- Corrosion inhibitor change, which has contributed to improved produced water treatment.
- Potable water tank upgrade, to replace a leaking tank with a more durable polyethylene tank.
- Site investigation into wastewater treatment plant operation to improve treatment.
- Fugitive emissions survey, to monitor for gas leaks across YGP.
- Investigation into reduction of BTEX in produced water.

Community initiatives

- In 2020, Eni partnered with the Australian Institute of Marine Science (AIMS) and Parks Australia to train Thamarrur Rangers in baited video monitoring techniques and to collect ecological data at Emu Reef at Wadeye, NT.

Summary of environmental impact

- Ongoing monitoring continues to indicate no adverse impact from Blacktip operations.
- Eni will continue to monitor its activities and apply continual improvement measures to ensure the impacts from Blacktip operations are continually maintained as ALARP and acceptable.

2. INTRODUCTION

2.1 Project background

Eni Australia Limited (Eni) is operator of the Blacktip Gas Project in the Northern Territory. The development consists of a small unmanned offshore wellhead platform, a subsea pipeline bringing whole well stream fluid, (i.e. gas, condensate and produced water) to Yelcherr Beach and the Yelcherr Gas Plant (YGP) near Wadeye (Figure 2.1 and Figure 2.2). The processed gas is exported via an onshore export pipeline, by Australian Pipeline Trust, to the customer, Power and Water Corporation.

Blacktip YGP commenced production on 26 August 2009. The operation of the YGP is licensed under the Environmental Protection Licence (EPL), EPL57, issued by the former Department of Natural Resources, Environment, The Arts and Sport (NRETAS) (now Northern Territory Environment Protection Authority (NT EPA)) on 11 August 2009.

EPL230 was issued to Eni on 21 May 2018 and remained in force until 31 August 2020, when EPL230-01 (the current license) was issued to Eni as the most recent amendment to the EPL.

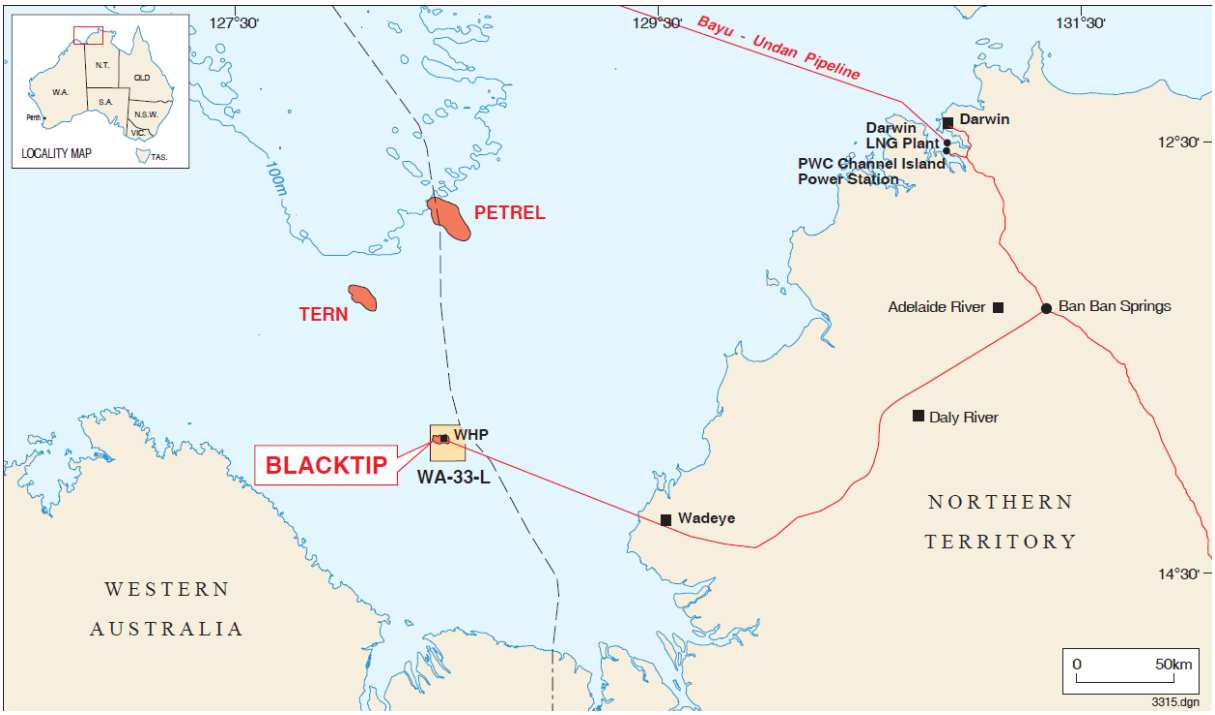


Figure 2.1: Blacktip Field location

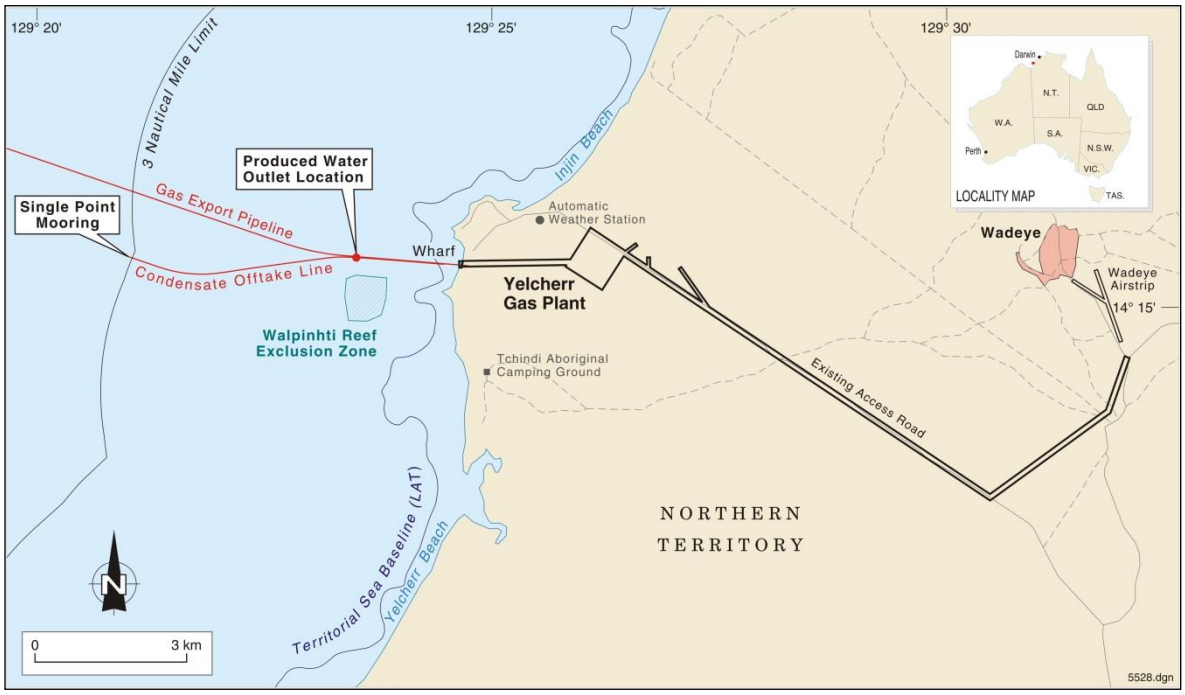


Figure 2.2: Yelcherr Gas Plant and Offshore Pipeline Facilities

2.2 Purpose of the report

This report summarises the environmental performance of the Blacktip YGP for the reporting period 1 January 2020 to 31 December 2020, as required by condition 62 of the EPL.

This report has been prepared in accordance with NT EPA 'Guidance for Reporting on Environmental Monitoring' and the requirements under condition 64 of the EPL, outlined below.

Clause	EPL condition	Section in this report
64.1	include an updated description of gas plant infrastructure and processes	3
64.2	reports on total condensate produced and total gas processed by the gas plant;	4
64.3	reports on the quality of gas received by the plant;	4.4
64.4	includes a tabulation of all monitoring data required as a condition of this licence;	Appendices
64.5	includes a trend analysis and interpretation of all monitoring data required as a condition of this licence;	Various sections and appendices
64.6	includes a long term trend analysis of monitoring data to demonstrate any environmental impact associated with the activity over a minimum period of three years;	Various sections and appendices

Clause	EPL condition	Section in this report
64.7	reports the total annual emissions for each emission point, as well as for condensate tanks and fugitive emissions.	Appendix A
64.8	reports the frequency and volume of wastewater discharges for the reporting period;	6
64.9	identifies the number of exceedances of trigger values and limits that have occurred during the reporting period, which includes a record of trigger value exceedances in accordance with condition 61;	9
64.10	is prepared in accordance with the requirements of the NT EPA *Guideline for Reporting on Environmental Monitoring;* and	2.2
64.11	demonstrates continuous improvement in air emissions from the authorised air emissions points identified in Attachment 4; and;	10
64.12	demonstrates continuous improvement in wastewater quality from the authorised discharge points identified in Attachment 2.	10

3. OVERVIEW OF YELCHERR GAS PLANT

3.1 General overview

In accordance with condition 64.1 of EPL230-01, this section provides a description of the gas plant infrastructure and processes.

Infrastructure at the YGP includes:

- a gas processing plant consisting of separation, gas dehydration, compression, condensate storage and produced water treatment facilities
- the onshore portion of an 18" carbon steel, multi-phase pipeline bringing produced fluids from the offshore gas field to the YGP, starting from the shore crossing
- the onshore portion of a condensate export pipeline from the condensate storage facilities at the YGP to the shore crossing
- a portion of the onshore gas export pipeline that runs from the gas processing plant to a custody transfer meter at the boundary of the YGP site.

3.2 Plant configuration

After processing, un-odorised natural gas at agreed specifications is delivered to the customer via an onshore export pipeline to a custody transfer meter at the boundary of the YGP, at a maximum delivery rate of 191 TJ/day.

Stabilised condensate is stored on site at the YGP before being exported to the SPM for offload via tankers.

The production life of the field is planned to be 25 years based on initial gas sales contract. The design life of the Blacktip YGP is 30 years.

The entire YGP site occupies an area of 750 m by 750 m, with the main process facility located to the south of the site (occupying an area of approximately 250 m by 380 m) and the accommodation, warehouse, offices and control room to the north (see Figure 3.1). The coordinates of the YGP are shown in Table 3.1.

Table 3.1: YGP Coordinates

Corner	GDA 1994		GDA 1994 MGA Zone 52	
	East	North	mE	mN
W	129°25'52.09"	14°14'33.60"	546 510	8 425 393
N	129°26'05.87"	14°14'13.22"	546 924	8 426 018
E	129°26'26.77"	14°14'26.66"	547 549	8 425 604
S	129°26'12.99"	14°14'47.04"	547 135	8 424 979

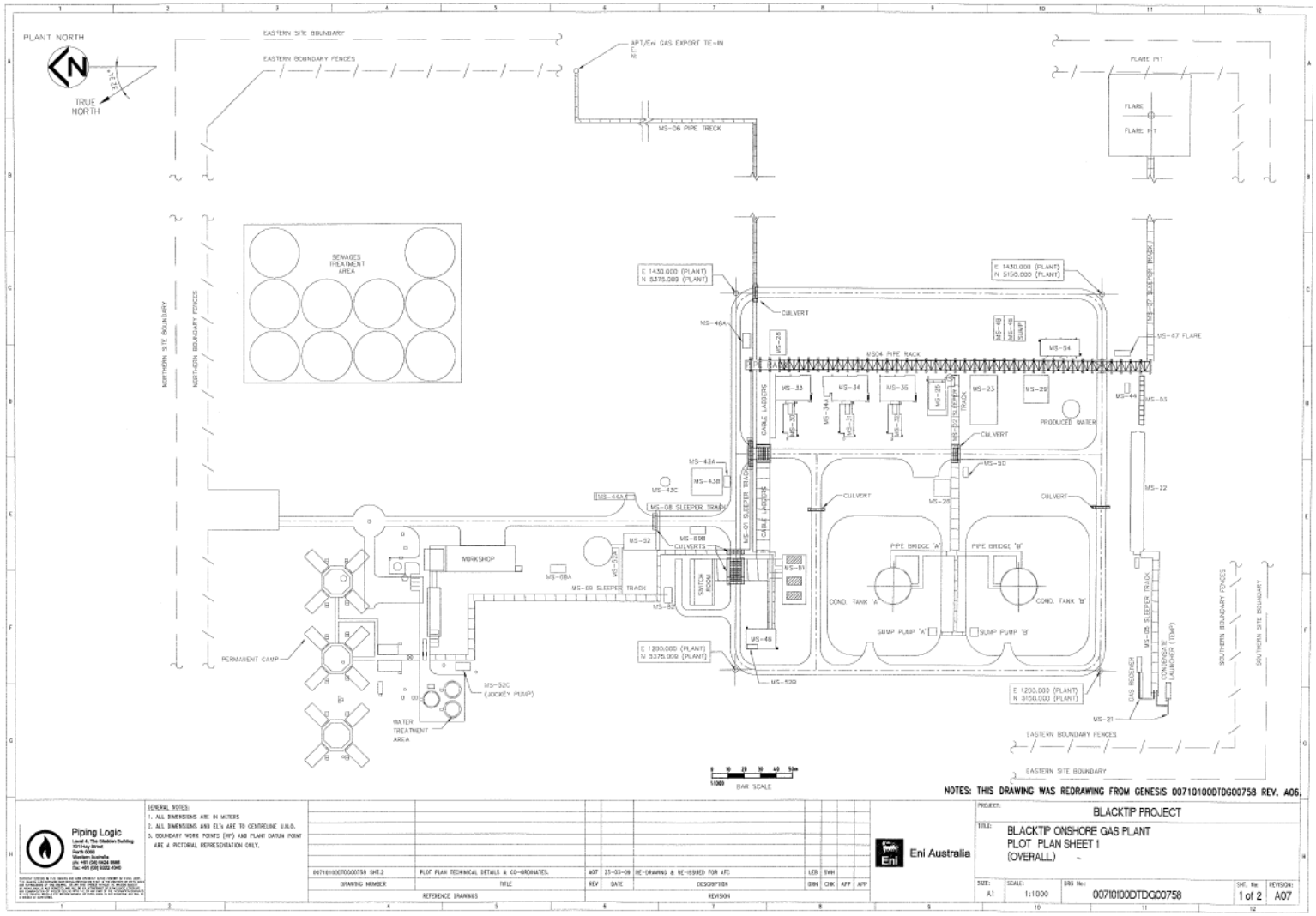


Figure 3.1: Blacktip YGP layout

3.3 Other facilities

Other key facilities on site include:

- Utilities system – including:
  - Power generation;
  - Compressed air system;
  - Potable water system;
  - Chemical injection;
  - Stormwater drainage;
  - Sewage treatment plant and effluent reuse;
  - Firewater.
- Ancillary buildings – including:
  - Accommodation;
  - Laboratory, workshop and stores;
- Hazardous chemicals storage; and
- Lighting and security.

4. PRODUCTION

4.1 Overview

The annual production is provided in Table 4.1.

Blacktip is licensed for a maximum scale of 1,055,300 tonnes of gas and 50,900 tonnes of condensate per annum.

Table 4.1: Overview of production

	2018[1]	2019[1]	2020[1]
Annual gas production (KSCM)	663,167	1,031,440	946,762
Annual gas production (t)	508,568	790,083	723,326
Condensate production (t)	8,912	11,927	10,615
Total production (t)	517,480	802,010	733,941

Notes:
[1] Reporting period is from 1 January – 31 December

4.2 Condensate

Three condensate offtakes occurred in April and September 2020, of 38,104 bbl and 33,344 bbl respectively.

4.3 Gas production

Daily gas production typically ranged between 2.5 and 3.0 MSCM, with a total of 947 MSCM being produced in 2020, a slight decrease from 2019.

4.4 Gas composition

The reservoir fluid properties and contaminants are shown in Table 4.2 and Table 4.3.

Table 4.2: Blacktip reservoir fluid properties

Component	Percentage
CO_2	0.62 mol%
N2	5.88 mol%
Methane	89.06 mol%
Ethane	2.82 mol%
Propane	1.00 mol%
Ibutane	0.12 mol%
Butane	0.23 mol%
Ipentane	0.06 mol%
Pentane	0.05 mol%

Component	Percentage
Hexanes	0.02 mol%
Heptanes	0.01 mol%
Octanes	0.02 mol%
Nonanes	0.03 mol%
Decanes	0.04 mol%
Undecanes	0.02 mol%
C_{12+}	0.01 mol%

Source: Ref. [3], [5]

Table 4.3: Contaminants in Blacktip Gas

Component	Maximum measured
H_2S	3.0 ppmv
Mercaptan	<0.5 ppmv
Mercury	0.2 µg/m³
Radon	222 Bq/m³
Argon	0.01 mol%
Oxygen	<0.01 mol%
Helium	0.06 mol%
Hydrogen	0.01 mol%
Benzene	0.002 mol%
Toluene	0.002 mol%
Ethyl Benzene	<0.001 mol%
Xylenes	0.001 mol%

Source: Ref. [3], [5]

5. ATMOSPHERIC EMISSIONS

5.1 Overview of atmospheric emissions

Major sources of atmospheric emissions from the Blacktip YGP are:

- Export gas turbine compressors;
- Gas engine power generators;
- Flaring; and
- Diesel usage.

Fuel usage for the compressors and gas engines is monitored continuously, as are gas quantities flared. Table 5.1 lists the flow meters used for measuring the various gas streams.

Table 5.1: Gas flow meters

Emission Source	Gas Flow Meter	Reference Number
Turbine Compressor	Compressor A Compressor B Compressor C	420.1 FIT 161 420.1 FIT 261 420.1 FIT 361
Engine Generators	LP Fuel Gas	420.1 FIT 004
Flare	HP Flare	230.1 FQI 008
	LP Flare	230.1 FQI 002
	Fuel Gas Distribution	420.1 FQI 007

Total greenhouse gas emissions from Yelcherr Gas Plant calculated in the latest NGER reporting period were 56,503 tCO_2-e (Ref. [2]).

The GHG intensities for flaring and total emissions, calculated as the ratio of tCO_2-e emitted to tonnes hydrocarbon produced, are 0.013 and 0.073, respectively as reported via NGER. This compares with industry averages of 0.068 and 0.353, respectively (Ref. [6]).

A summary of GHG emissions from the Blacktip YGP is provided in Table 5.2.

Table 5.2: Greenhouse gas emissions as reported via NGER

Production for NGER reporting period[1]	2017-2018	2018-2019	2019-2020
Condensate (t)	**8,753**	**11,418**	**11,753**
Natural Gas (t)	**469,015**	**625,453**	**761,069**
Total hydrocarbons (t)	**477,768**	**636,871**	**772,822**

Key sources[2]	Emissions (t CO_2-e)			GHG Intensity (emissions/total HC)			
	2017-2018	2018-2019	2019-2020	2017-2018	2018-2019	2019-2020	Industry average
Flaring	8,994	8,298	10,180	0.019	0.013	0.013	0.068
Compressors	24,843	35,254	42,496	0.052	0.055	0.055	-
Generators – Gas	3,134	3,663	3,670	0.007	0.006	0.005	-
Generators - Diesel	117	160	97	-	-	-	-
Kerosene and other petroleum based oils or greases	5	4	3	-	-	-	-
Diesel	53	71	41	-	-	-	-
Fugitive emissions	562	13[(3)]	14	0.001	0.000	0.000	
Wastewater	2	2	2	-	-	-	--
Total YGP emissions	37,710	47,460	56,503	0.079	0.075	0.073	0.353

Notes:
[1] As reported via NGERS for the period July – June.
[2] For a complete inventory of GHG sources and emissions from other Eni Australia operations and facilities, refer to the NGER report.
[3] Reduction in reported fugitive emissions due to change in estimation methodology.

5.2 Fuel gas consumption

The two main consumers of high pressure (HP) and low pressure (LP) fuel gas are the gas turbine compressors and power generators. The volume of gas consumed as fuel during the reporting period is summarised in Table 5.3.

Table 5.3: Gas consumption at YGP

	2018	2019	2020
Daily fuel gas consumption (KSCM)	50.2	77.7	71.8
Total annual fuel gas consumption (MSCM)	18.3	28.4	26.3
Emissions (tCO_2-e)	37,100	57,200	53,200

Notes:
[1] Reporting period is from 1 January – 31 December

Total equivalent greenhouse gas (GHG) emissions were calculated using equations provided by the *National Greenhouse Accounts Factors for Stationary Energy Emissions* (Ref. [1]), as follows:

$$E_{ij} = \frac{Q_i \times EC_i \times EF_{ijoxec}}{1000}$$

Where:

- Eij is the emissions of gas type (j), (carbon dioxide, methane or nitrous oxide), from the fuel type (i), i.e. unprocessed natural gas;
- Qi is the quantity of fuel type (i) (m3);
- ECi is the energy factor of the fuel type (i), which is given as 39.3 x 10-3 GJ/m3 for natural gas;
- $EF_{ijoxecis}$ the emission factor for each gas type (j), measured in kilograms CO2-e per gigajoule of fuel type (i).

Gas type	Emission factor (Kg CO_2^{-e}/GJ)
CO_2	51.4
CH_4	0.1
N_2O	0.03

5.3 Flaring

The annual volume of gas flared from the past three years is summarised in Table 5.4. The following are noted for the reporting period:

- Pigging in October 2020;
- HP flare meter was returning erroneous values. Following delay due to COVID travel restrictions, the meter was repaired in November 2020.

Table 5.4: Gas flared at YGP

	2018	2019	2020
Daily volume of gas flared (KSCM/d)	10.3	12.3	11.6
Total volume of gas flared (KSCM)	3,756	4,484	4,261
Estimated emissions (t CO_2-e)[2]	9,848[(3)]	9,700	9,200

Notes:
[1] Estimate to nearest 100 tonnes.
[2] Reporting period is from 1 January – 31 December
[3] 2018 emissions estimate was calculated using the emission factors which were current at the time, i.e. from National Greenhouse Accounts Factors For Stationary Energy Emissions August 2018.

Total equivalent greenhouse gas (GHG) emissions for flaring were calculated using equations provided by the *National Greenhouse Accounts Factors for Stationary Energy Emissions* (Ref. [1]), as follows:

$$E_{ij} = Q_i \times EF_{ij}$$

Where:

- Eij is the emissions of gas type (j), (carbon dioxide, methane or nitrous oxide) flared (CO2-e tonnes);
- Qi is the quantity of fuel type (i) flared (tonnes);
- EFij is the emission factor for each gas type (i) flared.

Gas type	Emission factor (tonnes CO_2^{-e}/tonnes of fuel flared)
CO_2	2.7
CH_4	0.1
N_2O	0.03

5.4 Diesel usage

Diesel usage over the reporting period was 37.7 m^3, of which 2.7 m^3 was used for mobile plant, 3.7 m^3 for transport purposes and 31.2 m^3 of which was used for stationary energy purposes. This equates to GHG emissions of approximately 114 tonnes CO_2-e.

Table 5.5: Annual diesel consumption and GHG emissions

	2018	2019	2020
Diesel – stationary energy (m^3)	67	27	32
Diesel – mobile plant and transport (m^3)	11	7	6
Emissions (t CO_2-e)	212	92	114

Notes:
Reporting period is from 1 January – 31 December

Total equivalent greenhouse gas (GHG) emissions for diesel consumption was calculated using equations provided by the *National Greenhouse Accounts Factors for Stationary Energy Emissions* (Ref. [1]), as follows:

$$E_{ij} = \frac{Q_i \times EC_i \times EF_{ijoxec}}{1000}$$

Where:

- Eij is the emissions of gas type (j), (carbon dioxide, methane or nitrous oxide) from fuel type (i) (CO2-e tonnes);
- Qi is the quantity of fuel type (i) (kilolitres);
- ECi is the energy content factor of fuel type (i) (GJ/kL)
- EFijoxec is the emission factor for each gas type (j) for fuel type (i).

Gas type	Emission factor (kg CO_2-e/GJ)	
	Diesel fuel combusted for transport energy purposes	Diesel fuel combusted for stationary energy purposes
CO_2	69.9	69.9
CH_4	0.1	0.1
N_2O	0.5	0.2

Energy content factor for diesel	38.6 GJ/kL

5.5 Stack emission monitoring

Emissions from the export gas turbine compressors and gas engine power generators are sampled and analysed for a number of air emission parameters.

Stack emission monitoring was undertaken on 5 November 2020. Monitoring scheduled for June 2020 was deferred due to travel restrictions associated with COVID-19.

A summary of the results is provided in Appendix A. Key results during the reporting period are as follows:

- All pollutant emissions measured were within the EPL limits.
- No visible smoke was reported (visible for more than 5 minutes in any 2 hours) during the last 12 months.

5.6 Fugitive emission monitoring

On 10th and 11th of December 2020, a fugitive emissions survey was undertaken at the Blacktip Yelcherr Gas Plant, which identified five fugitive emission sources, three of which were repaired immediately upon identification. Work orders have been raised for inspection and repair of remaining fugitive emission sources.

5.7 Pollutant inventory reporting

Eni reports emissions to atmosphere and the environment via the National Pollutant Inventory (NPI) and the National Greenhouse and Energy Reporting Scheme (NGERS).

Eni submitted the annual NPI reporting figures via the NPI Online Reporting System on 17 September 2020.

The annual NGERS reporting figures were submitted to the Department of Climate Change on 5 October 2020. Total emissions from Yelcherr Gas Plant during the 2019-2020 NGER reporting period were 56,503 tCO_2-e.

6. LIQUID WASTE DISCHARGES

6.1 Produced water

Produced water discharge in this reporting period was 6 ML.

The corrosion inhibitor (injected at the offshore wellhead platform) was changed in 2020 following extensive review and has resulted in increased efficiencies in the treatment of produced water. It is suspected that residual amounts of the previous corrosion inhibitor in produced water interfered with oil removal.

Annual shellfish and sediment monitoring and offshore produced water monitoring (for model validation) were conducted in November 2020. The final reports are pending.

Key findings from produced water monitoring:

- Non-compliances with trigger values, as defined under Condition 55 in EPL230, occurred an various occasions;
- Produced water limits for OIW, Mn and BTEX (as stipulated in EPL230-01) were exceeded on one, two and four occasions respectively;
- There is no available technology to reduce BTEX to meet the EPL230-01 limits;
- All other parameters were below their respective limits and trigger values;
- Total poly-aromatic hydrocarbon (PAH) was consistently below 0.04 mg/L.

Table 6.1 presents the annual produced water discharges for the past three years.

Table 6.1: Produced water discharge annually

	2018	2019	2020
Volume of PW discharged (m^3)	1,899	6,039	5,787
Number of discharge days	5	25	22

Notes:
[1] Reporting period is from 1 January – 31 December

6.1.1 Discharge and routine monitoring

Produced water is sampled and tested on site prior to discharge to ensure parameters are within the limits stipulated in the EPL

Samples are then taken every 1-2 hours to ensure water quality remains within the licence limits. These samples are tested in the site laboratory.

Non-compliances identified against Condition 55 of EPL230:

- Oil in water was recorded above three times the oil in water trigger value of 6 mg/L on various occasions.
- Oil in water was recorded above the trigger value on three or more consecutive sampling occasions.

Key results are as follows:

- All oil in water readings were below the oil in water limit stipulated in the EPL.
- Following change in the corrosion inhibitor used at the offshore wellhead platform, a reduction in the average routine site oil in water readings has been observed, from 14 mg/L in H1 to 10 mg/L in H2.
- Oil in water ranged between 1.6 and 23 mg/L.
- pH ranged between 6.55 and 8.5;
- EC ranged between 2.6 and 999 µs/cm;
- Dissolved oxygen ranged between 0.33 and 6.2 mg/L;
- Turbidity ranged between 1 and 84 NTU.

6.1.2 Chemical characterisation

EPL230 required quarterly characterisation of PW. Sampling was undertaken on 17 February 2020, 4 May 2020 and 18 August 2020.

The new EPL230-01 requires monthly characterisation for the majority of analysis suites. Sampling was undertaken on 7 September 2020, 7 October 2020, 21 November 2020 and 12 December 2020. The new EPL230-01 also introduced a number of new limits based on the ANZECC 80% species level of protection trigger value, as a conservative measure until the mixing zone is validated.

ANZECC trigger values are default guidelines for physical or chemical stressors in waterways (i.e. in the receiving environment) as opposed to discharge streams, and thus direct comparison of discharge water quality with the guideline values does not consider the mitigating effects of dilution, dispersion and/or biodegradation.

Key results from the chemical characterisation throughout 2020:

- With the exception of BTEX, OIW and Mn (see non-compliances outlined below), all measured readings were below the limits stipulated in the EPL.
- Benzene ranged between 0.5-3.3 mg/L.
- Toluene ranged between 1.4 – 5.3 mg/L.
- Ethylbenzene ranged between 0.16 – 0.55 mg/L.
- Xylene ranged between 0.65 – 2.2 mg/L
- Manganese ranged between 0.052 – 0.320 mg/L.
- Total poly-aromatic hydrocarbon (PAH) was consistently below 0.04 mg/L.

The results are presented in Appendix B. Non-compliances are summarised below and detailed in Section 9.

Non-compliances identified against Condition 55 of EPL230:

- Oil in water was recorded above three times the oil in water trigger value of 6 mg/L on various occasions.
- Oil in water was recorded above the trigger value on three or more consecutive sampling occasions.

- Ammoniacal N, BTEX and Mn were recorded above three times the ANZECC 80% species level of protection trigger value on various occasions.

Non-compliances identified against EPL230-01:

- BTEX and Mn were measured above the EPL limits on 7 September 2020.
- Sampling in October 2020 did not cover the full suite of parameters required;
- BTEX and OIW were measured above the EPL limits on 10 November 2020, although it is noted that the OIW analysis did not include a silica-gel cleanup to remove non-petrogenic compounds.
- BTEX and Mn were measured above the EPL limits on 25 November 2020.
- BTEX were measured above the EPL limits on 25 December 2020.

6.1.3 Annual Marine Monitoring

Eni has an annual commitment, set out in *Produced Water Management Plan* 000036_DV_EX.HSE.0381.000_A02, to undertake sediment and shellfish sampling in the vicinity of the produced water pipeline to monitor any impacts on sediment and biota.

Sampling was undertaken on 24 November 2020 in accordance with the *Australian Government National Assessment Guidelines*. Sampling is typically undertaken at the end of the wet season in May when shellfish are still relatively abundant, however in 2020 the survey was postponed during the COVID lockdown to protect the local community.

Laboratory results are not yet available at the time of writing, however the report will be submitted to NTEPA by 30 October in accordance with Condition 66 of EPL230-01.

Historical results to date indicate no adverse impacts from produced water discharge.

6.1.4 Produced water model validation

Eni has a commitment in the Produced Formation Water Plan (000036_DV_PR.HSE.1056.000_04) to validate the near field and far field produced water dispersion model.

Offshore monitoring at the produced water outfall was undertaken in November 2020, for the purposes of validating the produced water dispersion model in accordance with the Produced Formation Water Plan. The study report is under preparation, however preliminary laboratory results indicate compliance with the proposed 50m mixing zone.

6.2 Treated Wastewater Effluent

Wastewater generated at Blacktip YGP is treated in an ABCO Water System 150 EP. Effluent is reused through an irrigation system to land and a total of 2.2 ML was discharged over the reporting period.

Table 6.2: Treated wastewater effluent reuse

	2018	2019	2020
Effluent reuse (ML)	3.0	2.9	2.2

Notes:
Reporting period is from 1 January to 31 December.

In accordance with the EPL, treated discharged wastewater is sampled and analysed for constituents on a monthly basis by an external laboratory to verify compliance against the contaminant limits. The results are presented in Appendix C.

Non-compliances identified against EPL230:

- Wastewater effluent oil in water, Total Suspended Solids (TSS) were measured above the trigger value on three or more consecutive occasions; and
- Wastewater effluent TSS and ammoniacal N were measured above three times above the relevant trigger value on one occasion each; and
- August 2020 wastewater sample was received out of holding time for bacteriological analysis due to COVID impacts.

Non-compliances identified against EPL230-01:

- E.Coli and TSS were measured above the EPL limit on 23 September 2020 and 25 November 2020 (E.Coli only).

Key results are as follows:

- Oil in water was measured between 1.8 and 8.7 mg/L.
- Hydrocarbon analysis using GC-FID and GC-MS consistently detected no hydrocarbons, except:
    - April 2020 where GC-MS detected recoverable hydrocarbons ($TRHC_6$-C_{10}) at 0.015 mg/L and Toluene at 0.001 mg/L;
- pH measurements ranged between 6.5 and 7.1.
- TSS ranged from <10 mg/L to 60 mg/L, with one occurrence of 650 mg/L in April 2020.
- BOD ranged from 5.1 mg/L to 26 mg/L.
- E.Coli levels typically ranged from 54/100mL MPN to 365/100mL MPN, with two occurrences above 1730/100ml MPN.

6.3 Stormwater

Stormwater discharge to the environment includes cooling water from the fire pump testing and stormwater collected from the process skids. Fire pump cooling water is potable water used in a tubular design heat exchanger, where the other medium is coolant. The cooling water does not come into direct contact with the coolant or any other contamination sources and is discharged to grade at SW-01.

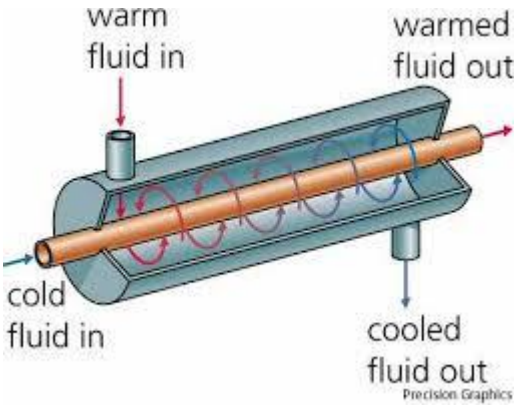


Figure 6.1: Tubular heat exchanger

Process skid stormwater is collected in the Open Drain Sump (ODS) for treatment and sampling prior to manual discharge to grade at SW-03. The ODS typically remains closed for the majority of the dry season and is only opened to grade when rainfall increases during the wet season. Stormwater was discharged from the ODS on only nine occasions in the reporting period.

The results are presented in Appendix D.

The following non-compliances were identified against EPL230:

- Oil in water was measured above trigger value of 1 mg/L on three or more consecutive occasions (Condition 55.1)
- Oil in water was measured above three times the trigger value (Condition 55.2) on various occasions.
- Benzene, toluene and zinc measured above the 80% species level of protection (Condition 55.3) in January 2020.

Key results are as follows:

- Results of stormwater from utilities (SW-01) are as follows:
  - pH ranged between 5.1 – 7;
  - electrical conductivity ranged between 89-300 µs/cm; and
  - oil in water generally ranged between 0-3.3 mg/L, with three occurrences above 4 mg/L.
- Results of stormwater from the open drains sump (SW-03) are as follows:
  - pH ranged between 5.2 – 6.6;
  - electrical conductivity ranged between 75-232 µs/cm; and
  - oil in water generally ranged between 0-3.9 mg/L, with one occurrence at 5.8 mg/L.

7. SOLID WASTE

Solid waste is managed onsite according the Blacktip Waste Management Plan (000036_DV_PR.HSE.0832.000).

Domestic waste from the accommodation village and crib room is taken to the local West Daly Regional Shire Council Landfill. General industrial waste and hazardous waste from the plant is transported by a licensed contractor to Darwin for disposal, treatment, recycling or destruction.

Table 7.1: Waste disposal

	2018	2019	2020
Domestic waste to local landfill (t) • Kitchen waste • Accommodation waste • Office waste	6	7	4
Darwin recycling (t) E.g. Scrap metal	2	6	3
Darwin disposal – non-hazardous (t) E.g. spent chemicals, cooking oil	15	17	21
Darwin disposal – hazardous (t) E.g. waste oil, oily rags, chemical drums and filters	153	86	54

Notes:
Reporting period is from 1 January to 31 December.

8. GROUND WATER

8.1 Ground water use

Groundwater is abstracted for potable water use and ancillary equipment at Yelcherr Gas Plant. The annual groundwater abstraction volumes are summarised in Table 8.1.

There are also two monitoring bores, BH5 and BH7, located at YGP. The location of the abstraction and monitoring bores are shown in Figure 8.1.

Table 8.1: Total annual volume of groundwater abstracted

	2018	2019	2020
Groundwater use (ML)	54.9	35.6	16.5

Notes:
Reporting period is from 1 January to 31 December.

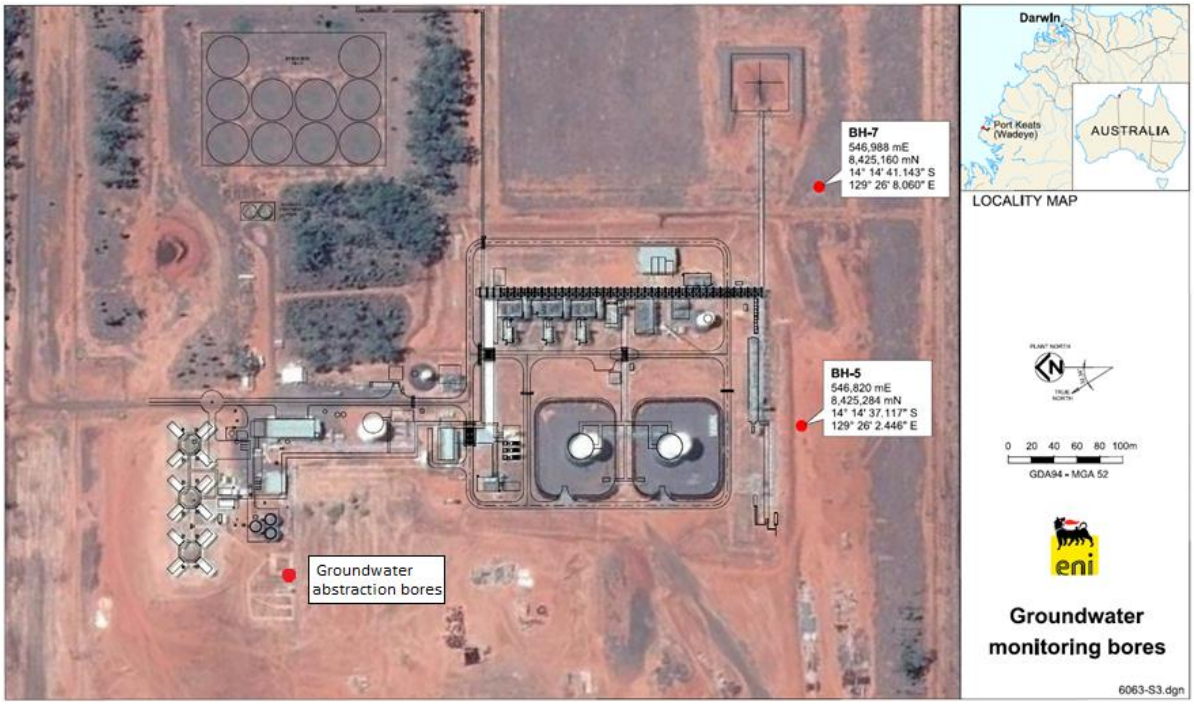


Figure 8.1: Groundwater abstraction and monitoring bores

8.2 Ground water monitoring

Groundwater monitoring was conducted on 12 February 2020, 18 May 2020, 16 August 2020 and 24 November 2020. The results and trend analysis are presented in Appendix E.

All results were within the Australian Drinking Water Guidelines and ANZECC guidelines for 80% species protection, except one instance where the DO was estimated at 77%, below the ADW guideline level of 85%. Quarterly monitoring at both bores measured pH between 4.8 and 5.9.

Weekly field measurements are also recorded at each groundwater monitoring bore by the Thamarrurr Ranger local indigenous group. The Rangers measure the pH, water level, and electrical conductivity.

8.3 Potable water system upgrade

In June 2019, the potable water system at the accommodation village was upgraded, including laying of new PVC pipework. This resulted in over 60% reduction in groundwater consumption from an average of 150kL/day in 2018 to 45kL/day in 2020.

8.4 Potable water tank replacement

In October 2020, a polyethylene tank was installed to replace the existing leaking potable water tank. The polyethylene tank is expected to be more durable than the existing tank and provide better reliability against leaks and wear and tear.

9. INCIDENTS AND NON-COMPLIANCES

The Waste Management and Pollution Control Act (NT) and EPL require all non-compliances with the EPL and any potential or actual environmental harm or pollution event to be recorded and reported to NT EPA.

Pollution is defined in the Waste Management and Pollution Control Act (NT) as:

- A contaminant or waste that is emitted, discharged, deposited or disturbed or that escapes; or
- A contaminant or waste, effect or phenomenon, that is present in the environment as a consequence of an emission, discharge, deposition or escape or disturbance of a contaminant or waste.

9.1 Incidents and non-compliances

The Annual Return outlines the compliance assessment against the Environment Licence EPL230 and EPL230-01 as per the Environmental Management Compliance Report 2020 (000036_DV_PR.HSE.1139.000).

Table 9.1 lists the environmental non-compliances recorded between 1 January 2020 and 31 December 2020. These have been raised in the non-compliance register and will be tracked to closure.

Table 9.1: Environmental non-compliances

Date	Condition	Non-compliance
19 August 2020	EPL 230 Condition 41	Wastewater analysis not valid due to the sample being received out of holding time for bacteriological analysis, due to changes in the flight schedule due to COVID travel restrictions. *The event was reported to NTEPA on 18 September 2020.*
30 August 2020	EPL 230 Condition 35	Mid-year air emissions sampling was deferred due to COVID travel restrictions. *The events were reported to NTEPA on 3 February 2021.*
30 August 2020	EPL 230 Condition 55	In 2020, the following were measured above the trigger value on three or more consecutive occasions: • Stormwater oil in water • Wastewater effluent oil in water • Wastewater effluent Total Suspended Solids (TSS) • Produced water oil in water The following were measured above three times the relevant trigger value: • Produced water oil in water (17 February 2020, 8 April 2020, 4 May 2020, 24 June 2020, 21 August 2020) • SW-01 Stormwater oil in water (14 January 2020, 16 February 2020, 29 February 2020, 20 April 2020, 7 June 2020, 22 July 2020).

Date	Condition	Non-compliance
30 August 2020	EPL 230 Condition 55	• SW-03 Stormwater oil in water (9 January 2020, 21 January 2020, 27 February 2020, 29 February 2020, 25 March 2020). • SW-03 Stormwater toluene and zinc (10 January 2020). • Wastewater TSS (15 April 2020) In 2020, the following were measured above three times the relevant ANZECC 80% species level of protection trigger value: • Produced water ammoniacal N (31 December 2019, 17 February 2020, 4 May 2020, 18 August 2020) • Produced water toluene (31 December 2019, 17 February 2020, 4 May 2020, 18 August 2020) • Produced water ethylbenzene (18 August 2020) • Produced water xylene (17 February 2020, 4 May 2020, 18 August 2020) • Wastewater ammoniacal N (14 January 2020) • SW-03 Stormwater toluene and zinc (10 January 2020). *The events were reported to NTEPA on 3 February 2021.*
7 September 2020	EPL 230-01 Condition 28	Produced water BTEX and Mn were measured above the EPL limits. Action: investigate treatment options to reduce BTEX (in progress) *The event was reported to NTEPA on 23 December 2020.*
23 September 2020	EPL 230-01 Condition 28	Wastewater E.Coli and TSS were measured above the EPL limit. *The event was reported to NTEPA on 13 November 2020.*
31 October 2020	EPL 230-01 Condition 41	Produced water sampling did not cover the full suite of parameters required for October 2020. SAP work orders have been created for monthly PW sampling (complete). *The event was reported to NTEPA on 23 December 2020.*
11 November 2020	EPL 230-01 Condition 28	Produced water BTEX and oil in water was measured above the EPL limits. Note: the oil in water analysis did not include a silica-gel cleanup to remove non-petrogenic compounds. *This event was reported to NTEPA on 18 December 2020.*
25 Nov 2020	EPL 230-01 Condition 28	The following were detected above the relevant EPL limit: • Produced water BTEX and Mn; • Wastewater E.Coli *This event was reported to NTEPA on 5 February 2021.*
25 Dec 2020	EPL 230-01 Condition 28	The following were detected above the relevant EPL limit: • Produced water BTEX. *This event was reported to NTEPA on 5 February 2021.*

*Note: EPL230-01 was issued and came into effect on 31 August 2020, until which time EPL230 remained in force

Table 9.2: Trigger value exceedances after 31 August 2020 under EPL230-01

Exceedance	Trigger value	Date and time of occurrence	Date detected and by whom	Actual and potential causes / factors	Risk of environmental harm	Actions undertaken	If no action, why no action was taken
Produced water OIW measured at 21.2 mg/L	6 mg/L	7 Sep 2020, 7:00 CST	1 Feb 2021, Teresa Lui Yuen	Treatment process not designed to treat hydrocarbons to below 6 mg/L.	Intermittent discharge, below OSPAR recommended standard of 30 mg/L and rapid predicted dilution - LOW	Investigate options to further reduce oil in water with treatment vendor - Ongoing	n/a
Stormwater (SW-01) OIW measured at 3.1 mg/L	1 mg/L	13 Sep 2020, 7:00 CST	1 Feb 2021, Teresa Lui Yuen	Unknown – firewater pump cooling water does not come into contact with hydrocarbons	Intermittent discharge, clean source, low volume - LOW	n/a	Firewater pump cooling water does not come into contact with hydrocarbons. No actions identified.
Produced water OIW measured at 7.4 mg/L	6 mg/L	19 Sep 2020, 7:00 CST	1 Feb 2021, Teresa Lui Yuen	Treatment process not designed to treat hydrocarbons to below 6 mg/L.	Intermittent discharge, well below OSPAR recommended standard of 30 mg/L and rapid predicted dilution - LOW	Investigate options to further reduce oil in water with treatment vendor - Ongoing	n/a
Wastewater effluent E.Coli measured at 194 / 100 mL MPN	100 / 100 mL MPN	21 Oct 2020, 7:00 CST	1 Feb 2021, Teresa Lui Yuen	Recent issues related to DAT tank pumping and chlorine dosing	Low volume of effluent produced, intermittent discharge and ongoing groundwater monitoring - LOW	Review WWTP operation with vendor - Ongoing	n/a
Wastewater effluent BOD measured at 15.3 mg/L	10 mg/L						
Produced water OIW measured at 8.7 mg/L	6 mg/L	10 Nov 2020, 7:00 CST	1 Feb 2021, Teresa Lui Yuen	Treatment process not designed to treat hydrocarbons to below 6 mg/L.	Intermittent discharge, well below OSPAR recommended standard of 30 mg/L and rapid predicted dilution - LOW	Investigate options to further reduce oil in water with treatment vendor - Ongoing	n/a
Stormwater (SW-03) OIW measured at 1.6 mg/L	1 mg/L	19 Nov 2020, 7:00 CST	1 Feb 2021, Teresa Lui Yuen	Treatment process (under/over weir) not designed to treat hydrocarbons to below 1 mg/L.	Intermittent discharge, very low OIW level - LOW	n/a	Oil level (1.6 mg/L) is only slightly above the trigger value (1 mg/L). No actions identified that can achieve further reduction.
Produced water OIW measured at 21.3 mg/L	6 mg/L	21 Nov 2020, 7:00 CST	1 Feb 2021, Teresa Lui Yuen	Treatment process not designed to treat hydrocarbons to below 6 mg/L.	Intermittent discharge, below OSPAR recommended standard of 30 mg/L and rapid predicted dilution - LOW	Investigate options to further reduce oil in water with treatment vendor - Ongoing	n/a
Wastewater effluent BOD measured at 11.2 mg/L	10 mg/L	25 Nov 2020, 7:00 CST	5 Feb 2021, Teresa Lui Yuen	Recent issues related to DAT tank pumping and chlorine dosing	Low volume of effluent produced, intermittent discharge and ongoing groundwater monitoring - LOW	Review WWTP operation with vendor - Ongoing	n/a
Stormwater (SW-01) OIW measured at 1.4 mg/L	1 mg/L	29 Nov 2020, 7:00 CST	1 Feb 2021, Teresa Lui Yuen	Unknown – firewater pump cooling water does not come into contact with hydrocarbons	Intermittent discharge, clean source, low volume - LOW	n/a	Firewater pump cooling water does not come into contact with hydrocarbons. No actions identified.

Exceedance	Trigger value	Date and time of occurrence	Date detected and by whom	Actual and potential causes / factors	Risk of environmental harm	Actions undertaken	If no action, why no action was taken
Produced water OIW measured at 10 mg/L	6 mg/L	5 Dec 2020, 7:00 CST	1 Feb 2021, Teresa Lui Yuen	Treatment process not designed to treat hydrocarbons to below 6 mg/L.	Intermittent discharge, well below OSPAR recommended standard of 30 mg/L and rapid predicted dilution - LOW	Investigate options to further reduce oil in water with treatment vendor - Ongoing	n/a
Produced water OIW measured at 12.5 mg/L	6 mg/L	10 Dec 2020, 7:00 CST	1 Feb 2021, Teresa Lui Yuen	Treatment process not designed to treat hydrocarbons to below 6 mg/L.	Intermittent discharge, well below OSPAR recommended standard of 30 mg/L and rapid predicted dilution - LOW	Investigate options to further reduce oil in water with treatment vendor - Ongoing	n/a
Produced water OIW measured at 18.9 mg/L	6 mg/L	12 Dec 2020, 7:00 CST	5 Feb 2021, Teresa Lui Yuen	Treatment process not designed to treat hydrocarbons to below 6 mg/L.	Intermittent discharge, below OSPAR recommended standard of 30 mg/L and rapid predicted dilution - LOW	Investigate options to further reduce oil in water with treatment vendor - Ongoing	n/a
Produced water TSS measured at 40 mg/L	10 mg/L	12 Dec 2020, 7:00 CST	5 Feb 2021, Teresa Lui Yuen	Potentially lack of settling time with flocculant	Intermittent discharge, well-mixed and open receiving environment - LOW	Continue to monitor	n/a
Produced water OIW measured at 6.7 mg/L	6 mg/L	25 Dec 2020, 7:00 CST	1 Feb 2021, Teresa Lui Yuen	Treatment process not designed to treat hydrocarbons to below 6 mg/L.	Intermittent discharge, well below OSPAR recommended standard of 30 mg/L and rapid predicted dilution - LOW	Investigate options to further reduce oil in water with treatment vendor - Ongoing	n/a

9.2 Complaints

No complaints were received during the reporting period.

9.3 Audits and inspections

In September 2020, Eni Australia underwent a surveillance audit for ISO14001:2015.

10. CONTINUOUS IMPROVEMENT AND OTHER ACTIVITIES

During the reporting period, Eni engaged in a number of continuous improvement activities including:

- Corrosion inhibitor change (March 2020) – following extensive review of a number of options, the corrosion inhibitor (injected at the offshore wellhead platform) was changed in 2020 and has resulted in increased efficiencies in the treatment of produced water. It is suspected that residual amounts of the previous corrosion inhibitor in produced water interfered with oil removal.
- Potable water tank upgrade (October 2020) – a polyethylene tank was installed to replace the existing leaking potable water tank. The polyethylene tank is expected to be more durable than the existing tank and provide better reliability against leaks and wear and tear.
- Site investigation ongoing into WWTP operation (November 2020) – Eni consulted with the WWTP vendor, ABCO, to review the operation of the WWTP plant. A number of recommendations for improving bacteriological treatment and solids removal have been identified for consideration and to trial.
- Fugitive emissions survey (December 2020) – a fugitive emissions survey was undertaken to monitor for leaks across the YGP. The survey identified six minor leaks, four of which were repaired immediately.
- Investigation into PW BTEX reduction (December 2020) – Eni consulted with its water treatment vendor to investigate methods to improve the treatment of oil in water and BTEX in produced water. YGP has conducted a trial using sparging with N_2 and using clean oil sorb filters and the laboratory results are pending. However, the vendor has indicated that treating to <1-2 mg/L oil in water will be a challenge.

11. COMMUNITY INITIATIVES

Eni continues to maintain a positive and engaging relationship with the Thamarrurr Rangers, who deliver local environmental monitoring services including

- offshore monitoring of the Single Point Mooring (SPM);
- turtle monitoring
- marine monitoring;
- controlled burning;
- groundwater sampling, and
- weed monitoring and spraying.

The SPM monitoring conducted by the Rangers includes inspection of the SPM equipment as well as inspection of the surrounding waters for surface sheen and possible spills. This provides a valuable contribution to the safe offtake of condensate and is an important part of Eni's scheduled maintenance. The Rangers also support the YGP groundwater monitoring, marine monitoring and weed management programs.

The regular monitoring by the rangers allows our site-based personnel to engage with local indigenous community members, providing a greater appreciation of the region and the importance of caring for country.

In 2020, due to the COVID pandemic, Thamarrurr Ranger monitoring activities were suspended between April and November 2020, with some of the monitoring activities being carried out instead by YGP personnel where possible. In November 2020, following government advice and in agreement with the Thamarrurr Rangers, monitoring activities resumed in accordance with Eni's Pandemic Management Plan.

Eni and the Thamarrurr Rangers continue to work closely to identify opportunities for local engagement and achieve positive environmental outcomes.

11.1 BRUV and Drop Camera training and ecological data collection

In 2020, Eni partnered with the Australian Institute of Marine Science (AIMS) and Parks Australia to train Thamarrur Rangers in baited video monitoring techniques and to collect ecological data at Emu Reef at Wadeye, NT. Fieldwork was conducted by the Australian Institute of Marine Science, in collaboration with the Thamarrurr Ranger Group, during two fieldtrips between 26-30 October and 9-13 November 2020.

The initiative included a one-day workshop to train the Rangers in the setup and use of AIMS Baited Remote Underwater remote station (BRUVS) equipment for marine monitoring. Surveys were conducted in October and November 2020 and collected 30 hours of BRUVS footage. Twenty six drop camera tows were conducted in the November field trip.

The final study report is under preparation, however preliminary feedback indicated high level of interest and engagement from the Thamarrurr Rangers, and footage indicates a diverse fish and benthic habitat community around Emu Reef.

12. SUMMARY OF ENVIRONMENTAL IMPACT

This section summarises the environmental impact from the activity during this reporting period. Blacktip Yelcherr Gas Plant has been in operation since 2009. During this time the plant has mostly operated below its full capacity with no major changes to the operations.

Flora and fauna

A firebreak is maintained around the perimeter and the grounds are maintained within the facility. Weed management is ongoing, with monthly weed monitoring and spraying/slashing as required. Otherwise there have been no changes to the overall facility footprint. During the reporting period there have been no reports of injury or death of any fauna.

Marine environment

Annual marine monitoring was conducted in November 2020 and the results are pending.

Offshore sampling at the produced water outfall was also conducted in November 2020. Preliminary results indicate compliance with a 50 m mixing zone and that the ANZECC water quality guideline values for 99% species protection are being met at the mixing zone boundary.

Groundwater

Groundwater monitoring indicates no adverse impact from stormwater discharge and groundwater abstraction. The upgrade of the potable water system in 2019 has resulted in dramatic reduction in water consumption of over 50%. Eni will continue to consider measures to use and manage water more efficiently.

Visual amenity and community disturbance

Blacktip has not received any complaints and continues to engage closely with the local community. Eni continues to observe the Land Use agreement and personnel are prohibited from entering culturally sensitive areas.

Atmospheric emissions

Emissions monitoring indicates all emissions concentration limits are within the specified limits. Atmospheric dispersion modelling of NOx and CO, two exhaust pollutants, predicted concentrations at identified receivers to be very low compared to health-based assessment criteria designed to protect the sensitive receivers in our community. Therefore, the environmental impact associated with emissions is considered low to negligible.

ALARP and acceptable

Eni will continue to monitor its activities and apply continual improvement measures to ensure the impacts from Blacktip operations are continually maintained as ALARP and acceptable.

13. REFERENCES

[1] COMMONWEALTH OF AUSTRALIA (DEPARTMENT OF THE ENVIRONMENT AND ENERGY) (2019). NATIONAL GREENHOUSE ACCOUNTS FACTORS. AUGUST 2019.

[2] ENI AUSTRALIA BV (2020). NATIONAL GREENHOUSE AND ENERGY REPORTING SECTION 19 - ENERGY AND EMISSIONS REPORT FOR THE REPORTING YEAR 2019-2020. 5 OCTOBER 2020.

[3] PREMIER'S COLLABORATIVE RESEARCH PROGRAM (PCRP) (2009). CHARACTERISING TREATED WASTEWATER FOR DRINKING PURPOSES FOLLOWING REVERSE OSMOSIS TREATMENT: TECHNICAL REPORT.

[4] WEATHERFORD LABORATORIES (AUSTRALIA) PTY LTD (2009A). PVT ANALYSIS - FINAL REPORT 1288-06 FOR BLACKTIP-P2. DOCUMENT NUMBER BT-P2_A2. UNPUBLISHED REPORT PREPARED FOR ENI AUSTRALIA LTD.

[5] WEATHERFORD LABORATORIES (AUSTRALIA) PTY LTD (2009B). COMPOSITIONAL ANALYSIS - FINAL REPORT 1300-06 BLACKTIP-P1 (3RD BATCH). DOCUMENT NUMBER BT-P1_A4. UNPUBLISHED REPORT PREPARED FOR ENI AUSTRALIA LTD.

[6] WOODSIDE (2007). BLACKTIP DRAFT ENVIRONMENTAL IMPACT STATEMENT.

[7] WORLD HEALTH ORGANISATION (2003). HETEROTROPHIC PLATE COUNTS AND DRINKING-WATER SAFETY: THE SIGNIFICANCE OF HPCS FOR WATER QUALITY AND HUMAN HEALTH. AVAILABLE ONLINE AT: <HTTP://WWW.WHO.INT/WATER_SANITATION_HEALTH/DWQ/HPCFULL.PDF>. PUBLISHED ON BEHALF OF THE WORLD HEALTH ORGANISATION BY IWA PUBLISHING, ALLIANCE HOUSE, UK.

[8] WORLEY PARSONS (2011). GREENHOUSE GAS EMISSIONS: STUDY OF AUSTRALIAN CSG TO LNG. PREPARED BY WORLEY PARSONS FOR APPEA.

APPENDICES

APPENDIX A:

AIR EMISSIONS MONITORING PROGRAMME

Appendix A.1: Summary of stack emission monitoring results from the compressors

	CO	NOx[1]	SOx	Solid particles	VOCs
EPL limit	**100 mg/m³**	**350 mg/m³**	**100 mg/m³**	**-**	**40 mg/m³**
9-12 December 2017					
Compressor A	<3	220	<6	<2	0.27
Compressor B	<3	190	<6	<2	<4
Compressor C	*NT*	*NT*	*NT*	*NT*	*NT*
23 August 2018					
Compressor A	<2	340	*NT*	*NT*	<0.08
Compressor B	2.5	330	*NT*	*NT*	2.1
Compressor C	*NT*	*NT*	*NT*	*NT*	*NT*
1 April 2019					
Compressor A	<2	290	7.6	<2	<3
Compressor B	2.9	250	9.1	<3	<4
Compressor C	3.5	250	<6	<2	<3
17 November 2019					
Compressor A	<8	220	<7	7.2	0.48
Compressor B	<8	250	<8	6.9	<4
Compressor C	<8	230	<7	5.6	<3

	CO	NOx[1]	SOx	Solid particles	VOCs
EPL limit	**100 mg/m³**	**350 mg/m³**	**100 mg/m³**	**-**	**40 mg/m³**
June 2020[6]					
Compressor A	*NT[6]*	*NT[6]*	*NT[6]*	*NT[6]*	*NT[6]*
Compressor B	*NT[6]*	*NT[6]*	*NT[6]*	*NT[6]*	*NT[6]*
Compressor C	*NT[6]*	*NT[6]*	*NT[6]*	*NT[6]*	*NT[6]*
5 November 2020					
Compressor A	<3	230	*NT*	*NT*	<0.2
Compressor B	<3	210	*NT*	*NT*	<0.2
Compressor C	<3	240	*NT*	*NT*	0.56

Notes:
[1] NOx presented as NO_2 equivalent.
[2] SOx presented as the cumulative concentration of SO_2 and SO_3.
[3] All measurements reported on a dry basis at NTP and corrected to 15% O_2 in accordance with the EPL.
[4] Measurements above the EPL limit are indicated in red, and measurements above the trigger value are indicated in orange.
[5] NT = Not tested.
[6] June 2020 emissions testing was deferred due to COVID travel restrictions.

Appendix A.2: Summary of stack emission monitoring results from the generators

	CO	NOx[1]	SOx	PM	VOCs
EPL limit	**1600 mg/m³**	**2000 mg/m³**	**100 mg/m³**	**-**	**40 mg/m³**
9-12 December 2017					
Generator A	1200	1500	1.5	<0.6	0.53
Generator B	1200	1500	<1	<0.5	0.23
Generator C	920	1500	<1	<0.5	0.23
23 August 2018					
Generator A	900	1500	*NT*	*NT*	1.6
Generator B	1200	1400	*NT*	*NT*	2.7
Generator C	380	1700	*NT*	*NT*	1.9
30 March 2019					
Generator A	1100	1500	100[(5)]	<0.7	3.7
Generator B	830	1700	50[(5)]	<0.7	6
Generator C	760	1700	28[(5)]	<0.7	10
17 November 2019					
Generator A	1000	1500	<2	2.1	16
Generator B	760	1400	<2	2.5	21
Generator C	760	1500	<2	7.6	20

	CO	NOx[1]	SOx	PM	VOCs
EPL limit	**1600 mg/m³**	**2000 mg/m³**	**100 mg/m³**	**-**	**40 mg/m³**
June 2020[7]					
Generator A	*NT[7]*	*NT[7]*	*NT[7]*	*NT[7]*	*NT[7]*
Generator B	*NT[7]*	*NT[7]*	*NT[7]*	*NT[7]*	*NT[7]*
Generator C	*NT[7]*	*NT[7]*	*NT[7]*	*NT[7]*	*NT[7]*
5 November 2020					
Generator A	690	1500	*NT*	*NT*	0.56
Generator B	680	1500	*NT*	*NT*	1.8
Generator C	740	1500	*NT*	*NT*	1

Notes:
[1] NOx presented as NO_2 equivalent.
[2] SOx presented as the cumulative concentration of SO_2 and SO_3.
[3] All measurements reported on a dry basis at NTP and corrected to 15% O_2 in accordance with the EPL.
[4] Measurements above the EPL limit are indicated in red, and measurements above the trigger value are indicated in orange.
[5] Emissions sampling provider advised that levels of methane (160-200mg/m³) can cause an interference with the SO_2 cell of the analyser
[6] NT = Not tested.
[7] June 2020 emissions testing was deferred due to COVID travel restrictions.

Appendix A.3: Air emissions annual pollutant mass inventory

Atmospheric Emission Points			Annual Pollutant Mass (t)								
Point ID	**Description**		**SO_2**	**NOx**	**CO**	**VOC**	**PM_{10}**	**CO_2**	**CH_4**	**N_2O**	**CO_2-e**
A01	**High Pressure Flare**	2017-2018	0.07	4.7	28	47	0	8,580	12.7	0.3	8,994
A02	**Low Pressure Flare**	2018-2019	0.06	4.4	26	44	0	7,917	11.7	0.3	8,298
	Flare Fuel Gas	2019-2020	0.08	5.4	32	54	0	9,712	14.4	0.4	10,180
A03	**Gas Compressor A**	2017-2018	0.2	91	28	-	1	24,780	2	0.05	24,843
A04	**Gas Compressor B**	2018-2019	0.2	125	40	1	0.9	35,165	3	0.07	35,254
A05	**Gas Compressor C**	2019-2020	0.3	160	48	1	1.1	42,388	3	0.08	42,496
A06	**Engine Generator A**	2017-2018	0.02	242	16	0.7	<0.003	3,126	0.24	0.006	3,134
A07	**Engine Generator B**	2018-2019	0.03	347	19	4	<0.003	3,653	0.28	0.007	3,663
A08	**Engine Generator C**	2019-2020	0.02	191	19	4	<0.003	3,661	0.28	0.007	3,670
A09	**Emergency Diesel Generator limits**	2017-2018	<0.001	2.3	0.6	0.06	0.01	117	0.007	0.001	118
		2018-2019	<0.001	3.1	0.8	0.08	0.01	159	0.009	0.002	160
		2019-2020	<0.001	1.9	0.5	0.05	0.06	97	0.006	0.001	97
-	**Condensate Tank vents limits**	2017-2018	-[2]	-[2]	-[2]	-[2]	0	-	0.42	-	10.5
		2018-2019	-[2]	-[2]	-[2]	-[2]	0	-	-	-	-
		2019-2020	-[2]	-[2]	-[2]	-[2]	0	-	-	-	-

[1] SOx, NOx and CO figures are as per the NPI reports and associated estimation techniques, and CH_4, N_2O and CO_2 are as per NGER reports and associated estimation techniques.

[2] Not available or below threshold (i.e. for NPI substances, SO_2, NOx, CO).

APPENDIX B:

PRODUCED WATER MONITORING

Routine produced water discharge sampling and analysis

	Volume	pH	EC	DO	Temp	Turbidity	OIW
Equipment	Flowmeter	PC2700	PC2700	HACH DR900	PC2700	HACH 2100Q	Horiba
Units	m^3	pH	µs/cm	mg/L	°C	NTU	mg/L
EPL Trigger Value	**-**	**-**	**-**	**-**	**-**	**-**	**6**
EPL Limit	**-**	**6.5-8.5**	**-**	**-**	**-**	**-**	**25**
17 February 2020	219.5	7.5	95.4	3.7	30.9	61	6.2
26 February 2020	137.5	7.3	999	0.9	25.7	25.3	15
26 March 2020	349.6	7.87	755	5.4	31.6	9.22	10.7
31 March 2020	404.5	6.55	748	4.8	29.7	83.8	15.1
8 April 2020	372	6.6	627	5.6	29.3	29.4	20.6
4 May 2020	345.6	7.03	487.4	5.4	29.3	2.7	22.8
4 June 2020	272.1	7.02	485.8	5.6	24.3	8.6	13
6 June 2020	287.1	7.76	311.7	4.4	25.4	7.5	5.3
25 June 2020	188.7	7.4	811	0.33	25.8	38	18.7
7 July 2020	265.4	6.8	806.7	4.8	25.2	8.6	15.7
23 July 2020	84.2	7.4	363.5	3.1	23.2	9.2	3.3
28 July 2020	58.1	6.97	383.3	5.5	27.5	20.6	3.4
21 August 2020	426.7	6.85	115.3	2.2	25.3	62.3	21.8
7 September 2020	217	7.2	2.6	0.8	24.6	18.9	21.2
19 September 2020	244.7	7.28	3.16	1.11	29	2.63	7.4
2 October 2020	123.5	7.25	109.5	6.1	32.7	8	3.2
7 October 2020	159	8.35	87.5	6.2	27.9	1	1.6
10 November 2020	466.6	8.16	489	2.1	27.7	4.05	8.7
21 November 2020	271	7.3	19.7	3.6	27.9	3.94	21.3
5 December 2020	244	8.5	20.5	4.6	27	4.85	10
10 December 2020	120	8.4	22.8	0.41	33	35.1	12.5
25 December 2020	177	8.3	24.1	4.1	28.4	1.7	6.7
Total	5433						

Notes:
[1] This table lists the discharges between 1 January– 31 December.
[2] Values above the EPL limit are shown in red text. Values above the trigger value are shown in orange text.
[3] All routine analyses conducted in the site laboratory
[4] Invalid value recorded

Produced water sampling and analysis

	Unit	Frequency EPL230-01[6]	ANZECC 80%	EPL230-01 limit	Trigger value	31 Dec 2019	17 Feb 2020	4 May 2020	18 Aug 2020	7 Sep 2020	7 Oct 2020	21 Oct 2020[(5)]	10 Nov 2020	25 Nov 2020	25 Dec 2020
ENVIRONMENTAL PARAMETERS															
pH	-	On discharge	-	6.5-8.5	-	8.2	8.0	7.7	6.85	7.5	8.35	8.6[(5)]	8.2	7.3	8.5
EC	µs/cm	On discharge	-	-	-	1610	981	803	1430	2570	87.5	6240[(5)]	489	19.7	23400
Turbidity	NTU	On discharge	-	-	-	23	6	10	5	1	1	<1[(5)]	4.05	3.94	17
DO	mg/L	On discharge	-	-	-	5	8	11	10	6	6.2	11[(5)]	2.1	3.6	9
OIW	mg/L	On discharge	-	25	6	11.8	19.1	12.5	10.2	19.6	1.6	15.4[(5)]	8.7	21.3	18.9
TSS	mg/L	Monthly	-	50	10	<10	20	<10	<10	<10	*NT*	<10[(5)]	5.6	*NT*	40
TDS	mg/L	Quarterly	-	-		1460	800	350	790	1780	*NT*	3350[(5)]	6500	*NT*	14700
BOD	mg/L	Quarterly	-	-	-	>90	<90	>90	15.3	15.7	*NT*	13.5[(5)]	*NR*	*NT*	13.2
TOC	mg/L	Quarterly	-	-	-	2480	1620	2010	1120	896	*NT*	549[(5)]	1500	*NT*	532
COD	mg/L	Quarterly	-	-	-	7740	5320	6720	7040	2500	*NT*	2040[(5)]	*NR*	*NT*	2040
NUTRIENTS															
NOx-N	mg/L	Quarterly	-	-	-	<0.05	0.04	<0.005	<0.005	*NT*	*NT*	*NT*	*NT*	0.009	*NT*
NO3-N	mg/L	Quarterly	-	-	-	<0.05	0.008	<0.005	<0.005	*NT*	*NT*	*NT*	*NT*	0.006	*NT*
NO2-N	mg/L	Quarterly	-	-	-	<0.05	0.035	<0.005	<0.005	*NT*	*NT*	*NT*	*NT*	<0.005	*NT*
Ammoniacal N	mg/L	Quarterly	1.7	-	-	5.9	5.9	6.83	7.15	*NT*	*NT*	*NT*	8.4	9.0	*NT*
TP	mg/L	Quarterly	-	-	-	<0.05	<0.05	0.005	0.105	*NT*	*NT*	*NT*	*NT*	<0.05	*NT*
TN	mg/L	Quarterly	-	-	-	9.0	9.6	1.61	0.10	*NT*	*NT*	*NT*	*NT*	16	*NT*
HYDROCARBONS															
vTRH(C6-10)/BTEX															
TRH C6-C9	µg/L	-	-	-	-	7100	5100	8900	16000	14000	*NT*	13000[(5)]	-	12000	12000
TRH C6-C10	µg/L	-	-	-	-	8800	8500	11000	35000	16000	*NT*	15000[(5)]	21000	13000	15000
TRH C6-C10 less BTEX	µg/L	-	-	-	-	5400	5500	4700	23000	5700	*NT*	9600[(5)]	10000	4300	4800
Benzene	µg/L	Monthly	1300	2000[(6)]	1300	1400	480	1400	3300	2800	*NT*	-	2600	2500	2500
Toluene	µg/L	Monthly	330	330[(6)]	-	1400	1400	3000	5300	4500	*NT*	-	4900	4300	4700

	Unit	Frequency EPL230-01[6]	ANZECC 80%	EPL230-01 limit	Trigger value	31 Dec 2019	17 Feb 2020	4 May 2020	18 Aug 2020	7 Sep 2020	7 Oct 2020	21 Oct 2020[5]	10 Nov 2020	25 Nov 2020	25 Dec 2020
Ethylbenzene	µg/L	Monthly	160	160[6]	-	83	160	310	550	400	NT	-	480	280	500
m+p-xylene	µg/L	Monthly	150	150[6]	-	290	650	1200	2200	2000	NT	-	2200	1100	1900
o-xylene	µg/L	Monthly	-	-	-	200	270	460	770	570	NT	350[5]	760	490	700
napththalene	µg/L	Monthly	120	120[6]	-	17	70	79	100	55	NT	41[5]	<100	25	68
svTRH (C10-C40)															
TRH C10-C14	µg/L	-	-	-	-	55000	3700	110000	130000	290000	NT	45000[5]	98000	60000	64000
TRH C15-C28	µg/L	-	-	-	-	3200	2100	5500	10000	14000	NT	6200[5]	18000	12000	9100
TRH C29-C36	µg/L	-	-	-	-	220	<1000	230	130	240	NT	<100[5]	600	120	<100
TRH >C10-C16	µg/L	-	-	-	-	8900	4600	13000	118000	21000	NT	9200[5]	21000	18000	15000
TRH >C10-C16 less Napth	µg/L	-	-	-	-	8900	4500	13000	18000	21000	NT	9200[5]	21000	18000	15000
TRH >C16-C34	µg/L	-	-	-	-	1200	750	2100	3600	4100	NT	1800[5]	6400	34000	2600
TRH >C34-C40	µg/L	-	-	-	-	130	<1000	200	<100	130	NT	<100[5]	200	<100	<100
Aromatic & Aliphatic TPH															
TPH >C16-C35 Aliphatic	µg/L	Monthly	-	-	-	<100	<100	<100	<100	<50	NT	<100[5]	NT	<100	120
TPH >C35 Aliphatic	µg/L	Monthly	-	-	-	<100	<100	<100	<100	<100	NT	<100[5]	NT	<100	<100
TPH C16-C35 Aromatic	µg/L	Monthly	-	-	-	<50	<50	<50	<20	<50	NT	60[5]	NT	<50	80
Polycyclic Aromatic Hydrocarbons															
Naphthalene	µg/L	Monthly	120	120[6]	-	10	13	35	35	18	NT	22[5]	<100	18	45
Acenaphthylene	µg/L	-	-	-	-	<1	<1	<1	<1	<1	NT	<1	NT	<1	<1
Acenaphthene	µg/L	-	-	-	-	<1	<1	<1	<1	<1	NT	<1	NT	<1	<1
Fluorene	µg/L	-	-	-	-	2	1	2	2	<1	NT	<1	NT	<1	2
Phenanthrene	µg/L	-	-	-	-	1	<1	1	1	1	NT	<1	NT	<1	<1
Anthracene	µg/L	Monthly	7	7[6]	-	<1	<1	<1	<1	<1	NT	<1	<1	<1	<1
Fluoranthene	µg/L	Monthly	2	2[6]	-	<1	<1	<1	<1	<1	NT	<1	<1	<1	<1
Pyrene	µg/L	-	-	-	-	<1	<1	<1	<1	<1	NT	<1	NT	<1	<1

	Unit	Frequency EPL230-01[6]	ANZECC 80%	EPL230-01 limit	Trigger value	31 Dec 2019	17 Feb 2020	4 May 2020	18 Aug 2020	7 Sep 2020	7 Oct 2020	21 Oct 2020[(5)]	10 Nov 2020	25 Nov 2020	25 Dec 2020
Benzo(a)anthracene	µg/L	-	-	-	-	<1	<1	<1	<1	<1	*NT*	<1	*NT*	<1	<1
Chrysene	µg/L	-	-	-	-	<1	<1	<1	<1	<1	*NT*	<1	*NT*	<1	<1
Benzo(b,j+k)fluoranthene	µg/L	-	-	-	-	<2	<2	<2	<2	<2	*NT*	<2	*NT*	<2	<2
Benzo(a)pyrene)	µg/L	Monthly	0.7	0.7[(7)]	-	<1	<1	<1	<1	<1	*NT*	<1	<1	<1	<1
Indeno(1,2,3-c,d)pyrene	µg/L	-	-	-	-	<1	<1	<1	<1	<1	*NT*	<1	*NT*	<1	<1
Dibenzo(a,h)anthracene	µg/L	-	-	-	-	<1	<1	<1	<1	<1	*NT*	<1	*NT*	<1	<1
Benzo(g,h,i)perylene	µg/L	-	-	-	-	<1	<1	<1	<1	<1	*NT*	<1	*NT*	<1	<1
Benzo(a)pyrene TEQ	µg/L	-	-	-	-	<5	<5	<5	<5	<5	*NT*	<5	*NT*	<5	<5
Total +ve PAHs	µg/L	Monthly	-	-	-	9.8	14	37	37	18	*NT*	22	*NT*	19	46
PHENOLS															
Phenol	µg/L	Monthly	1200	1200[(7)]	-	530	750	660	480	440	*NT*	980[(5)]	800	260	960
2-Chlorophenol	µg/L	Quarterly	-	-	-	<100	<100	<10	<10	<10	*NT*	<10	<3	<10	<10
4-Chloro-3-Methylophenol	µg/L	Quarterly	-	-	-	<500	<500	<50	<50	<50	*NT*	<50	<10	<50	<50
2-Methylphenol (O-Cresol)	µg/L	Quarterly	-	-	-	840	940	910	1400	900	*NT*	840[(5)]	1200	540	1200
3/4-Methylphenol(m/p-Cresol)	µg/L	Quarterly	-	-	-	620	470	680	840	1000	*NT*	4800[(5)]	960	300	860
2-Nitrophenol	µg/L	Quarterly	-	-	-	<100	<100	<10	<10	<10	*NT*	<10	<10	<10	<10
2,4-Dimethylphenol	µg/L	Quarterly	-	-	-	520	810	560	940	500	*NT*	1000[(5)]	0.63	1000	720
2,4-Dichlorophenol	µg/L	Quarterly	-	-	-	<100	<100	<10	<10	<10	*NT*	<10	<3	<10	<1
2,6-Dichlorophenol	µg/L	Quarterly	-	-	-	<100	<100	<10	<10	<10	*NT*	<10	<3	<10	<1
2,4,5-Trichlorophenol	µg/L	Quarterly	-	-	-	<100	<100	<10	<10	<10	*NT*	<10	<10	<10	<1
2,4,6-Trichlorophenol	µg/L	Quarterly	-	-	-	<100	<100	<10	<10	<10	*NT*	<10	<10	<10	<1

	Unit	Frequency EPL230-01[6]	ANZECC 80%	EPL230-01 limit	Trigger value	31 Dec 2019	17 Feb 2020	4 May 2020	18 Aug 2020	7 Sep 2020	7 Oct 2020	21 Oct 2020[5]	10 Nov 2020	25 Nov 2020	25 Dec 2020
2,4-Dinitrophenol	µg/L	Quarterly	-	-	-	<2000	<2000	<200	<200	<200	*NT*	<200	<3	<200	<20
4-Nitrophenol	µg/L	Quarterly	-	-	-	<2000	<2000	<200	<200	<200	*NT*	<200	<10	<200	<20
2,3,4,6-Tetrachlorophenol	µg/L	Quarterly	-	-	-	<100	<100	<10	<10	<10	*NT*	<10	<3	<10	<1
2-methyl-4,6-Dinitrophenol	µg/L	Quarterly	-	-	-	<1000	<1000	<100	<100	<100	*NT*	<100	<3	<100	<10
Pentachlorophenol	µg/L	Quarterly	55	55[7]	-	<500	<500	<50	<50	<50	*NT*	<50	<10	<50	<5
MBA	µg/L	Quarterly	-	-	-	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*
METALS															
Al	µg/L	Quarterly	-	-	-	160	1000	1500	1500	4000	*NT*	360[5]	*NT*	20	10
Ar	µg/L	Quarterly	-	-	-	<1	<1	<1	<1	<1	*NT*	7[5]	*NT*	<!	<1
Ba	µg/L	Quarterly	-	-	-	400	87	95	96	1800	*NT*	2800[5]	9200	14000	38000
Be	µg/L	Quarterly	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	*NT*	<0.5[5]	*NT*	<0.5	<0.5
B	µg/L	Quarterly	-	-	-	100	70	50	50	70	*NT*	200[5]	*NT*	480	670
Cd	µg/L	Quarterly	36	-	-	<0.1	<0.1	<0.1	<0.3	<0.1	*NT*	<0.1[5]	*NT*	<0.1	<0.1
Co	µg/L	Quarterly	150	-	-	<1	<1	<1	<1	<1	*NT*	<1[5]	*NT*	<1	<1
Cu	µg/L	Quarterly	8	8[7]	2[7]	<1	<1	<1	<1	<1	*NT*	3[5]	*NT*	<1	<1
Cr	µg/L	Quarterly	176	-	-	3	2	1	1	2	*NT*	<1[5]	*NT*	<1	<1
Fe	µg/L	Quarterly	-	-	-	5500	14000	19000	19000	11000	*NT*	30[5]	50	630	1500
Hg	µg/L	Quarterly	1.4	-	-	1.2	0.2	0.17	0.17	0.36	*NT*	0.26[5]	*NT*	0.14	0.42
Mg	µg/L	Quarterly	-	-	-	<0.5[4]	<0.5[4]	<0.5[4]	7.2[4]	7.2[4]	*NT*	*NT*	*NT*	47[4]	*NT*
Mn	µg/L	Monthly	80	80[7]	-	150	280	320	320	180	*NT*	30[5]	54	110	52
Mo	µg/L	Quarterly	-	-	-	<1	<1	<1	<1	<1	*NT*	<1[5]	*NT*	<1	<!
Pb	µg/L	Quarterly	12	-	-	<1	<1	<1	<1	<1	*NT*	<1[5]	*NT*	<1	<1
Ni	µg/L	Quarterly	560	-	-	8	12	12	12	6	*NT*	4[5]	6	4	4
Se	µg/L	Quarterly	-	-	-	<1	<1	<1	<1	<1	*NT*	<1[5]	*NT*	<1	<1
Sn	µg/L	Quarterly	-	-	-	<1	<1	<1	<1	<1	*NT*	<1[5]	*NT*	<1	<1
Zn	µg/L	Monthly	43	43[7]	23[7]	4	17	36	36	27	*NT*	37[5]	6	14	14

	Unit	Frequency EPL230-01[6]	ANZECC 80%	EPL230-01 limit	Trigger value	31 Dec 2019	17 Feb 2020	4 May 2020	18 Aug 2020	7 Sep 2020	7 Oct 2020	21 Oct 2020(5)	10 Nov 2020	25 Nov 2020	25 Dec 2020
RADIUM															
Ra-226	mBq/L	Annual	-	-	-	*NT*	*NT*	*NT*	30	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*
Ra-228	mBq/L	Annual	-	-	-	*NT*	*NT*	*NT*	40	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*

[1] Trigger value for 80% species protection from the Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 1. Updated values (2018) have been used where available.
[2] Values above the EPL limit are shown in red text. Values above the trigger value or ANZECC 80% species protection guideline value are shown in orange text.
[3] All analyses conducted at an external laboratory with NATA accreditation or to NATA standards.
[4] Sample taken from slugcatcher sample point.
[5] Sample taken on 21 October 2020 but no produced water discharge.
[6] In force from 31 August 2020. EPL230-01 was issued on 31 August 2020. The previous EPL230 limits and monitoring requirements remained in force until EPL230-01 was issued.

APPENDIX C:

WWTP SAMPLING

Treated wastewater effluent monitoring results

Date sampled	Unit	ANZECC[1]	EPL limit	Trigger value	14 Jan 2020	12 Feb 2020	10 Mar 2020	15 Apr 2020	18 May 2020	15 Jun 2020	16 Jul 2020	18 Aug 2020†	23 Sep 2020	21 Oct 2020	25 Nov 2020	12 Dec 2020
BACTERIOLOGICAL																
Total coliforms	/100mL MPN	-	-	-	2420†	>2419.8	1300	1010	2420†	>2420†	>2420	>2420†	>2420	>242	96	488
E Coli	/100mL MPN	-	1000	100	10†	345	54	365	26†	68†	517	1550†	1730	194	>2420	6
Enterococci	/100mL MPN				24†	146	42	1010	1550†	>2420†	*NT*	*NT*	*NT*	*NT*	>2420	>2420
ENVIRONMENTAL PARAMETERS																
pH	-	-	6.5-8.5	-	6.9	6.9	7.0	6.5	6.9	6.8	7.1	6.6	6.7	6.9	7.0	6.9
EC	µs/cm	-	-	-	472	481	491	642	640	629	708	696	804	876	709	754
Turbidity	NTU	-	-	-	13	8	4	110	12	12	10	40	21	4	5	2
DO	mg/L	-	-	-	7	4	5	5	7	8	8	10	2	6	6	9
OIW	mg/L	-	10	6	8.7	3.6	3.5	1.8	4.5	3.1	2.2	3.4	3.0	4.2	5.1	4.1
TSS	mg/L	-	30	10	30	<10	10	650	50	60	20	30	60	<10	<10	10
TDS	mg/L	-	-	-	260	270	280	370	390	360	410	340	470	450	370	420
BOD	mg/L	-	20	10	20.2	5.1	20.8	51.5	13	16.4	3.2	26	7.3	15.3	11.2	7.1
TOC	mg/L	-	-	-	9	7	9	8	2	11	15	14	16	13	12	9
COD	mg/L	-	-	-	40	40	40	700	60	40	60	240	60	80	40	40
NUTRIENTS																
NOx-N	mg/L	-	-	-	2.9	1.9	2.9	13	2.8	4.6	2.1	4.6	1.5	0.82	1.4	14
NO3-N	mg/L	-	-	-	2.8	1.9	2.9	13	2.8	4.6	2.0	4.6	1.5	0.77	1.3	14
NO2-N	mg/L	-	-	-	0.14	0.011	0.046	<0.005	0.044	0.01	0.08	0.03	<0.005	0.052	0.028	0.061
Ammoniacal N	mg/L	1.7	-	-	3.5	1.7	1.7	0.54	2.1	1.3	1.5	1.6	3.7	3.8	1.4	1.3
TP	mg/L	-	-	-	1.8	<0.05	0.8	20	1.3	0.8	1.1	1.5	1.7	0.9	0.8	0.6
TN	mg/L	-	-	-	5.7	5.0	5.8	14	6.6	7.3	5.3	8.1	7.2	6.3	4.3	14
HYDROCARBONS																
TRHC6-C9	µg/L	-	-	-	<10	<10	<10	10	<10	<10	<10	<10	*NT*	*NT*	<10	*NT*

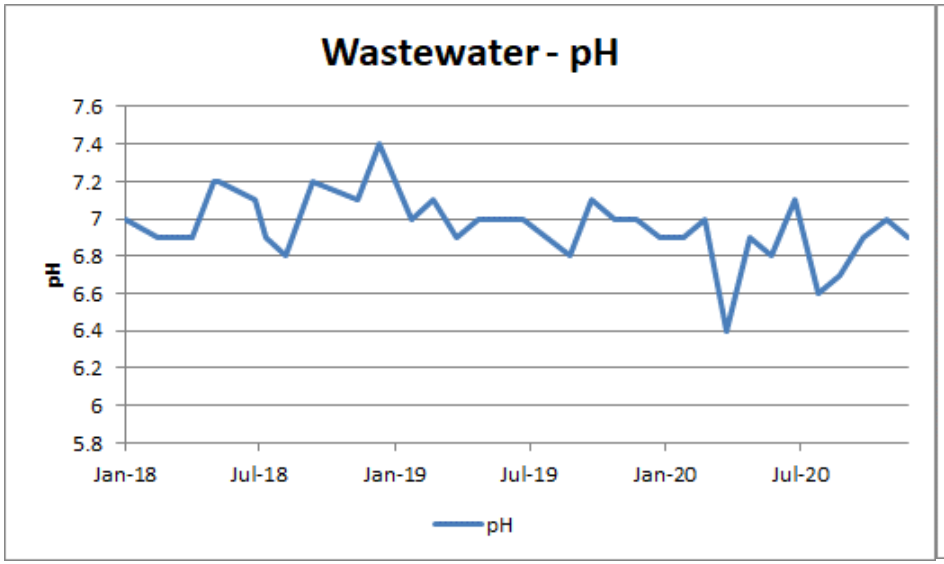
Date sampled	Unit	ANZECC[1]	EPL limit	Trigger value	14 Jan 2020	12 Feb 2020	10 Mar 2020	15 Apr 2020	18 May 2020	15 Jun 2020	16 Jul 2020	18 Aug 2020†	23 Sep 2020	21 Oct 2020	25 Nov 2020	12 Dec 2020
TRHC6-C10	µg/L	-	-	-	<10	<10	<10	15	<10	<10	<10	<10	*NT*	*NT*	<10	*NT*
TRHC6-C10 less BTEX (F1)	µg/L	-	-	-	<10	<10	<10	13	<10	<10	<10	<10	*NT*	*NT*	<10	*NT*
Benzene	µg/L	1300	-	-	<1	<1	<1	<1	<1	<1	<1	<1	*NT*	*NT*	<1	*NT*
Toluene	µg/L	330	-	-	<1	<1	<1	1	<1	<1	<1	<1	*NT*	*NT*	<1	*NT*
Ethylbenzene	µg/L	160	-	-	<1	<1	<1	<1	<1	<1	<1	<1	*NT*	*NT*	<1	*NT*
m+p xylene	µg/L	150	-	-	<2	<2	<2	<2	<2	<2	<2	<2	*NT*	*NT*	<2	*NT*
o-xylene	µg/L	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	*NT*	*NT*	<1	*NT*
Naphthalene	µg/L	120	-	-	<1	<1	<1	<1	<1	<1	<1	<1	*NT*	*NT*	<1	*NT*
TRH C10-C14	µg/L	-	-	-	<50	<50	<50	<50	<50	<50	<50	<50	*NT*	*NT*	<50	*NT*
TRH C15-C28	µg/L	-	-	-	<100	<100	<100	<100	<100	<100	<100	<100	*NT*	*NT*	<100	*NT*
TRH C29-C36	µg/L	-	-	-	<100	<100	<100	<100	<100	<100	<100	<100	*NT*	*NT*	<100	*NT*
TRH >C10-C16	µg/L	-	-	-	<50	<50	<50	<50	<50	<50	<50	<50	*NT*	*NT*	<50	*NT*
TRH >C10-C16 less Napth	µg/L	-	-	-	<50	<50	<50	<50	<50	<50	<50	<50	*NT*	*NT*	<50	*NT*
TRH >C16-C34	µg/L	-	-	-	<100	<100	<100	<100	<100	<100	<100	<100	*NT*	*NT*	<100	*NT*
TRH >C34-C40	µg/L	-	-	-	<100	<100	<100	<100	<100	<100	<100	<100	*NT*	*NT*	<100	*NT*
>C16-C35 Aliphatic	µg/L	-	-	-	<100	<100	<100	n/a	<100	n/a	n/a	n/a	*NT*	*NT*	<100	*NT*
>C35 Aliphatic	µg/L	-	-	-	<100	<100	<100	n/a	<100	n/a	n/a	n/a	*NT*	*NT*	<100	*NT*
C16-C35 Aromatic	µg/L	-	-	-	<50	<50	<50	n/a	<50	n/a	n/a	n/a	*NT*	*NT*	<50	*NT*
Total PAH	µg/L	-	-	-	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	*NT*	*NT*	NIL	*NT*

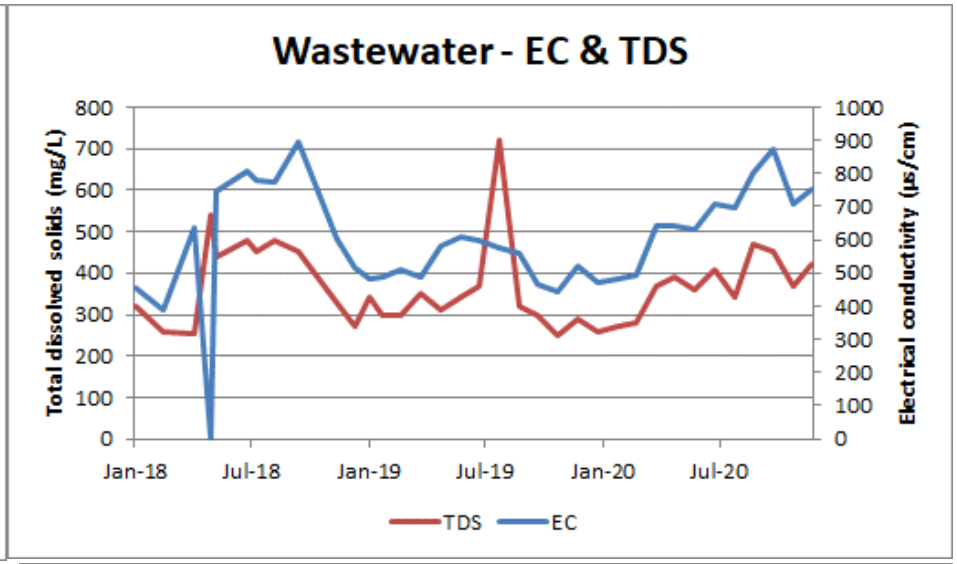
Date sampled	Unit	ANZECC[1]	EPL limit	Trigger value	14 Jan 2020	12 Feb 2020	10 Mar 2020	15 Apr 2020	18 May 2020	15 Jun 2020	16 Jul 2020	18 Aug 2020†	23 Sep 2020	21 Oct 2020	25 Nov 2020	12 Dec 2020
METALS																
Al	µg/L	-	-	-	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	910	*NT*	*NT*	*NT*	*NT*
Ar	µg/L	-	-	-	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	<1	*NT*	*NT*	*NT*	*NT*
Ba	µg/L	-	-	-	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	3	*NT*	*NT*	*NT*	*NT*
Be	µg/L	-	-	-	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	<0.5	*NT*	*NT*	*NT*	*NT*
B	µg/L	-	-	-	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	70	*NT*	*NT*	*NT*	*NT*
Cd	µg/L	36	-	-	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	0.3	*NT*	*NT*	*NT*	*NT*
Co	µg/L	150	-	-	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	<1	*NT*	*NT*	*NT*	*NT*
Cu	µg/L	8	-	-	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	9	*NT*	*NT*	*NT*	*NT*
Cr	µg/L	176	-	-	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	<1	*NT*	*NT*	*NT*	*NT*
Cr III	µg/L	91	-	-	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*
Cr IV	µg/L	85	-	-	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*
Fe	µg/L	-	-	-	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	110	*NT*	*NT*	*NT*	*NT*
Hg	µg/L	1.4	-	-	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	<0.05	*NT*	*NT*	*NT*	*NT*
Mg	µg/L	-	-	-	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*
Mn	µg/L	80	-	-	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	15	*NT*	*NT*	*NT*	*NT*
Mo	µg/L	-	-	-	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	<1	*NT*	*NT*	*NT*	*NT*
Pb	µg/L	12	-	-	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	<1	*NT*	*NT*	*NT*	*NT*
Ni	µg/L	560	-	-	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	7	*NT*	*NT*	*NT*	*NT*
Se	µg/L	-	-	-	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	<1	*NT*	*NT*	*NT*	*NT*
Sn	µg/L	-	-	-	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	<1	*NT*	*NT*	*NT*	*NT*
Zn	µg/L	43	-	-	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	40	*NT*	*NT*	*NT*	*NT*
Sr	µg/L	-	-	-	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*	*NT*

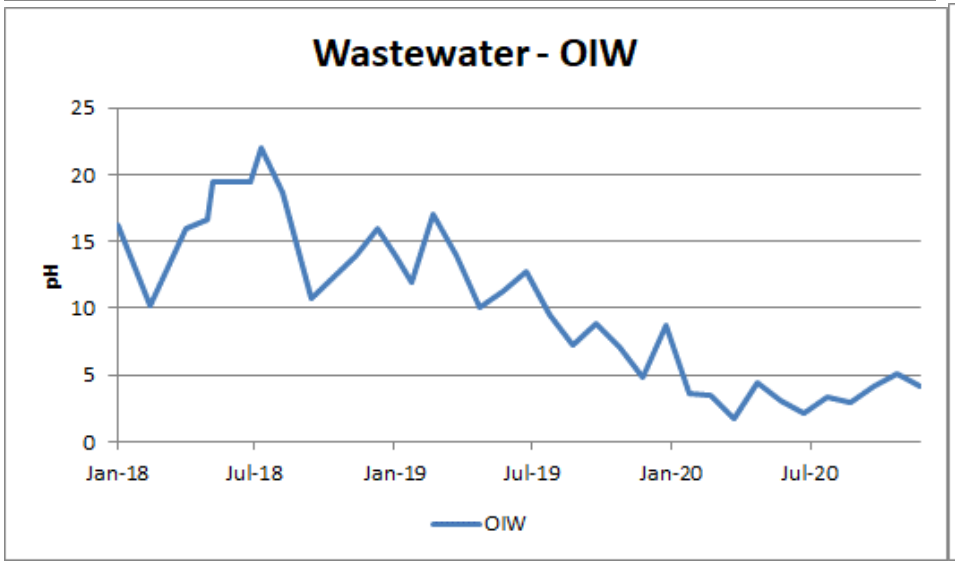
† Out of holding time for bacteriological analysis. Note: COVID travel restrictions from May – September 2020 resulted in temporary changes to the site charter flight schedule and samples could not be transported to the laboratory within the holding time. This could result in elevated bacteriological levels. Where samples outside of holding time but with results within the EPL limits, the original bacteriological level is assumed to be also within the EPL limits.

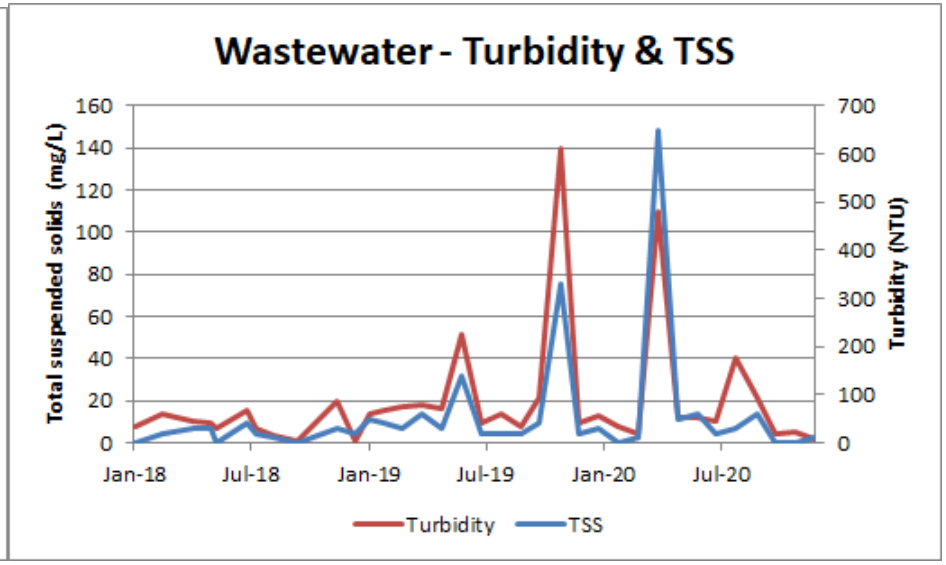
[1] Trigger value for 80% species protection from the Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 1. Updated values (2018) have been used where available. Exceedance of three times or more the ANZECC 80% species level of protection trigger value was a non-compliance under EPL230 Condition 55.

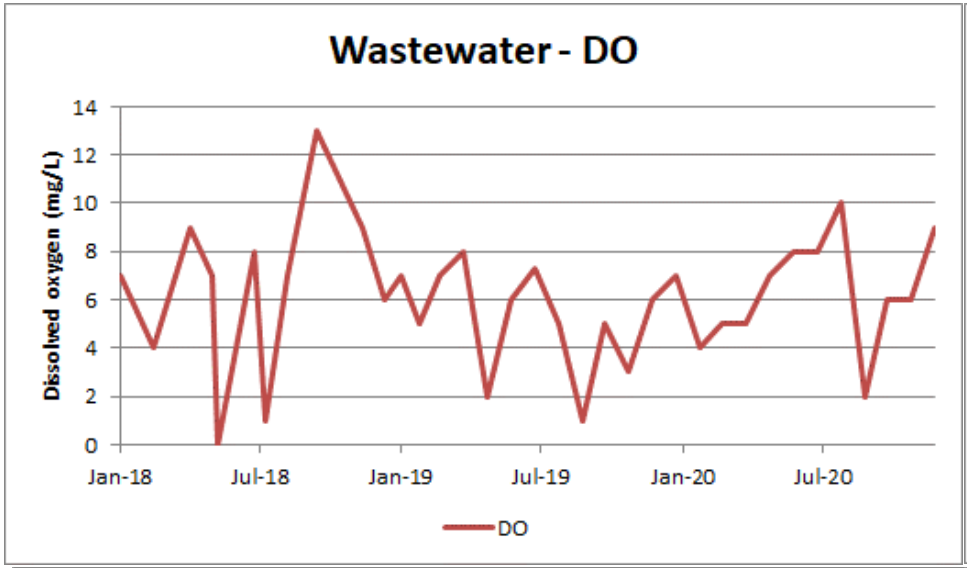
[2] Values above the EPL limit are shown in red text. Values above the trigger value or ANZECC 80% species protection guideline value are shown in orange text.

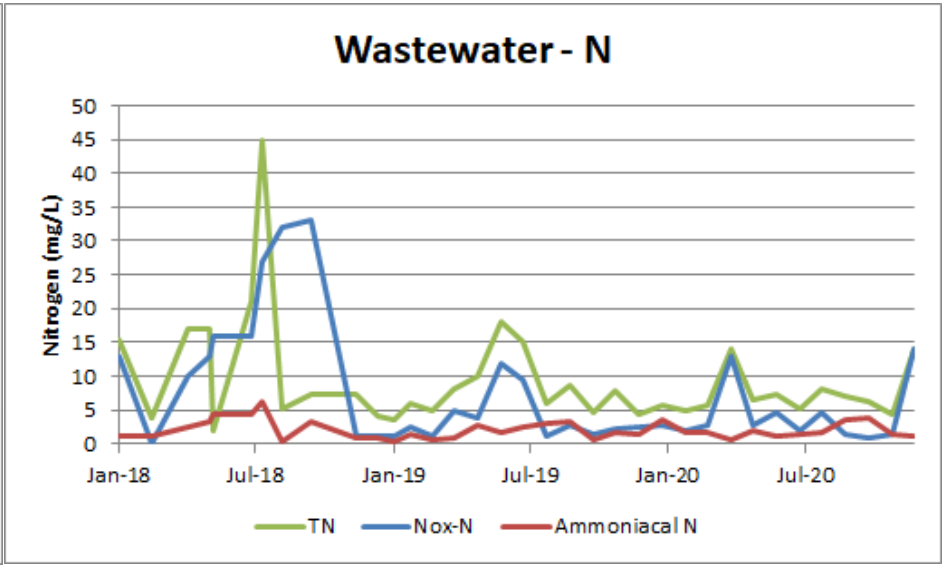


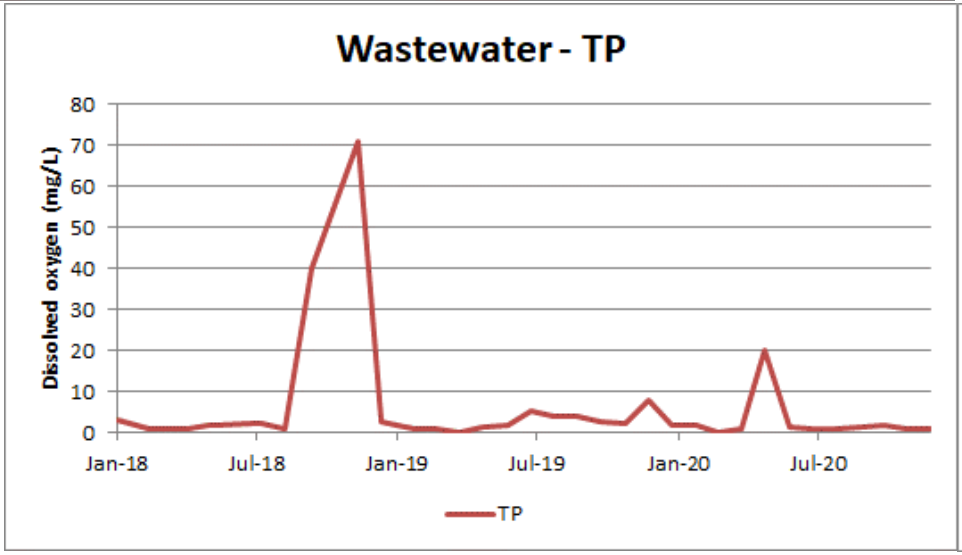


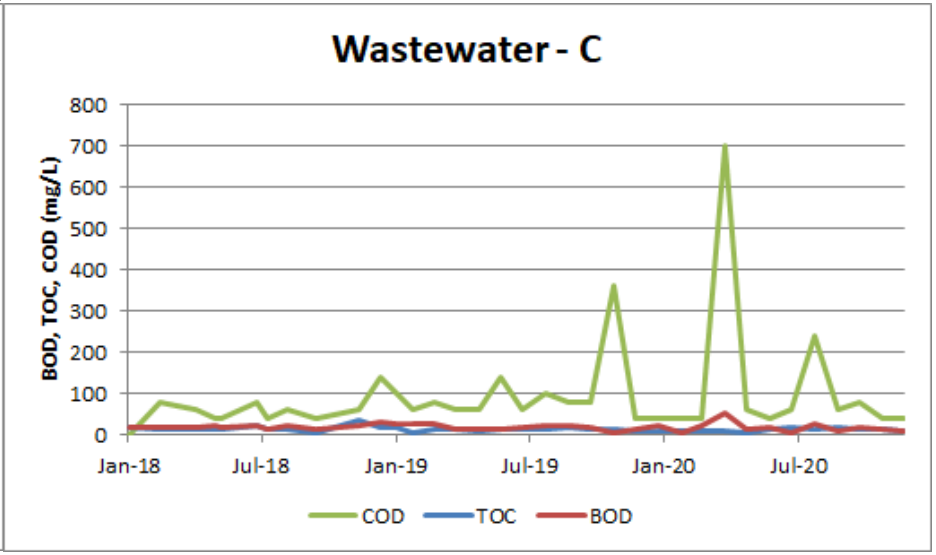


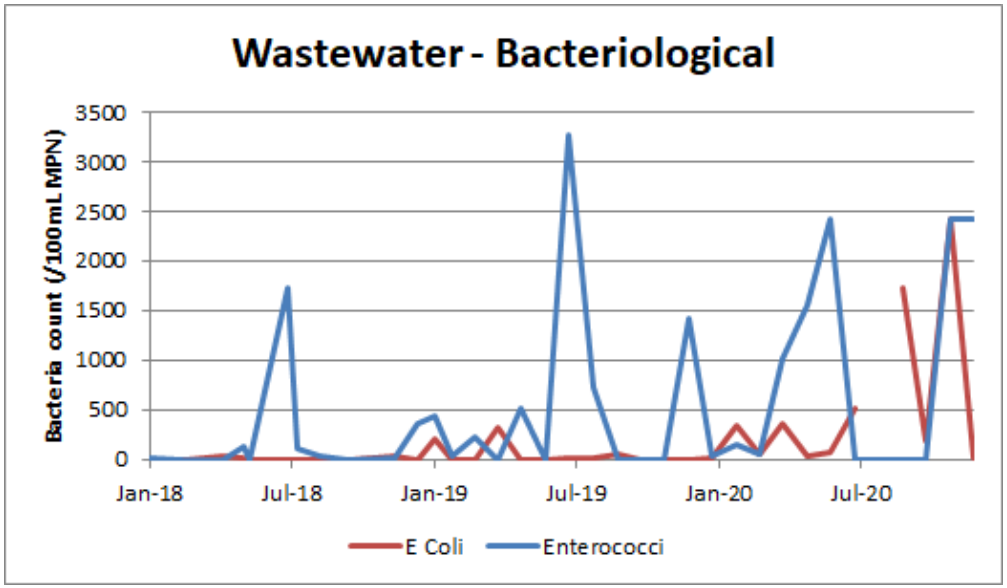












APPENDIX D:

STORMWATER MONITORING

Utilities stormwater discharge monitoring (SW-01)

	Utilities Stormwater (SW-01)		
	pH	**EC**	**OIW**
Units	pH	µs/cm	mg/L
Trigger value	**-**	**-**	**1**
Limit	**-**	**-**	**6**
ANZECC[3]	**-**	**-**	**-**
14 January 2020	7.08	204.2	4.2
16 February 2020	5.8	95.4	5.7
23 February 2020	5.73	113.4	0
29 February 2020	5.78	98	3.2
15 March 2020	5.71	89.2	1.35
21 March 2020	5.73	89.5	1.89
5 April 2020	5.86	214.4	2.25
20 April 2020	5.83	121.9	3.3
3 May 2020	5.65	177	1.08
18 May 2020	5.12	300.7	1.53
7 June 2020	5.56	154.5	4.8
21 June 2020	5.6	*NT*	2.23
22 July 2020	5.83	121.9	3.2
30 July 2020	5.78	90.6	2.8
16 August 2020	5.17	88.8	2.7
13 September 2020	5.61	98.4	3.1
11 October 2020	5.85	90.1	0.1
8 November 2020	5.44	142	0.5
15 November 2020	5.44	142	0.5
29 November 2020	5.48	115	1.4

Notes:
[1] This table summarises the discharge monitoring between 1 January 2020 – 31 December 2020.
[2] NT = not tested.
[3] Trigger value for 80% species protection from the Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 1. Updated values (2018) have been used where available.
[4] Values above the EPL limit are shown in red text. Values above the trigger value or outside the ANZECC 80% species protection guideline value are shown in orange text.
[5] All routine analyses conducted in the site laboratory, using the PC700 bench meter for pH and EC, and the Horiba OCMA500 with Florisil solvent for oil in water, unless otherwise stated

Open drains sump stormwater discharge monitoring (SW-03)

	Open Drains Sump (SW-03)		
	pH	**EC**	**OIW**
Units	pH	µs/cm	mg/L
Trigger value	**-**	**-**	**1**
Limit	**-**	**-**	**6**
ANZECC[3]	**-**	**-**	**-**
2 January 2020	6.1	NT	2
9 January 2020	6.08	232.5	3.8
21 January 2020	5.17	146.7	3.8
30 January 2020	6.1	130	0
27 February 2020	5.2	75.2	3.6
29 February 2020	5.4	80	3.9
25 March 2020	6.38	183.7	5.8
7 November 2020	6.14	218	0
19 November 2020	6.55	198	1.6

Notes:
[1] This table summarises the discharge monitoring between 1 January 2020 – 31 December 2020. There was no discharge between April and October 2020.
[2] NT = not tested.
[3] Trigger value for 80% species protection from the Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 1. Updated values (2018) have been used where available.
[4] Values above the EPL limit are shown in red text. Values above the trigger value or outside ANZECC 80% species protection guideline value are shown in orange text.
[5] All routine analyses conducted in the site laboratory, using the PC700 bench meter for pH and EC, and the Horiba OCMA500 with Florisil solvent for oil in water, unless otherwise stated

Annual stormwater monitoring

	Unit	ANZECC 80% species protection	EPL limit	Trigger value	SW-03 10 Jan 2020	SW-03 13 Jan 2021[6]		
ENVIRONMENTAL PARAMETERS								
pH	-	-	-		5.9	-[6]		-
EC	µs/cm	-	-	-	195	-[6]		-
Turbidity	NTU	-	-	-	5	-[6]		-
DO	mg/L	-	-	-	7	-[6]		-
OIW	mg/L	-	6	1	6	-[6]		-
TSS	mg/L	-	-		10	-[6]		-
TDS	mg/L	-	-		140	-[6]		-
BOD	mg/L	-	-	-	16.3	-[6]		-
TOC	mg/L	-	-	-	29	-[6]		-
COD	mg/L	-	-	-	100	-[6]		-
vTRH(C6-10)/BTEX								
TRH C6-C9	µg/L	-	-	-	23	-[6]		-
TRH C6-C10	µg/L	-	-	-	53	-[6]		-
TRH C6-C10 less BTEX	µg/L	-	-	-	39	-[6]		-
Benzene	µg/L	1300	-	-	1400	-[6]		-
Toluene	µg/L	330	-	-	1400	-[6]		-
Ethylbenzene	µg/L	160	-	-	1	-[6]		-
m+p-xylene	µg/L	150	-	-	4	-[6]		-
o-xylene	µg/L	-	-	-	1	-[6]		-
napththalene	µg/L	120	-	-	<1	-[6]		-
svTRH (C10-C40)								
TRH C10-C14	µg/L	-	-	-	150	-[6]		-
TRH C15-C28	µg/L	-	-	-	270	-[6]		-
TRH C29-C36	µg/L	-	-	-	<100	-[6]		-
TRH >C10-C16	µg/L	-	-	-	200	-[6]		-
TRH >C10-C16 less Napth	µg/L	-	-	-	200	-[6]		-
TRH >C16-C34	µg/L	-	-	-	250	-[6]		-
TRH >C34-C40	µg/L	-	-	-	100	-[6]		-
Aromatic & Aliphatic TPH								
TPH >C16-C35 Aliphatic	µg/L	-	-	-	<100	-[6]		-
TPH >C35 Aliphatic	µg/L	-	-	-	<100	-[6]		-
TPH C16-C35 Aromatic	µg/L	-	-	-	<50	-[6]		-
Polycyclic Aromatic Hydrocarbons								
Naphthalene	µg/L	120	-	-	<1	-[6]		-
Acenaphthylene	µg/L	-	-	-	<1	-[6]		-
Acenaphthene	µg/L	-	-	-	<1	-[6]		-
Fluorene	µg/L	-	-	-	5	-[6]		-

	Unit	ANZECC 80% species protection	EPL limit	Trigger value	SW-03 10 Jan 2020	SW-03 13 Jan 2021[6]		
Phenanthrene	µg/L	-	-	-	1	-[6]		-
Anthracene	µg/L	7	-	-	<1	-[6]		-
Fluoranthene	µg/L	2	-	-	<1	-[6]		-
Pyrene	µg/L	-	-	-	<1	-[6]		-
Benzo(a)anthracene	µg/L	-	-	-	<1	-[6]		-
Chrysene	µg/L	-	-	-	<1	-[6]		-
Benzo(b,j+k)fluoranthene	µg/L	-	-	-	<2	-[6]		-
Benzo(a)pyrene)	µg/L	0.7	-	-	<1	-[6]		-
Indeno(1,2,3-c,d)pyrene	µg/L	-	-	-	<1	-[6]		-
Dibenzo(a,h)anthracene	µg/L	-	-	-	<1	-[6]		-
Benzo(g,h,i)perylene	µg/L	-	-	-	<1	-[6]		-
Benzo(a)pyrene TEQ	µg/L	-	-	-	<5	-[6]		-
Total +ve PAHs	µg/L	-	-	-	NIL	-[6]		-
METALS								
Al	µg/L	-	-	-	360	-[6]		-
Ar	µg/L	-	-	-	<1	-[6]		-
Ba	µg/L	-	-	-	120	-[6]		-
Be	µg/L	-	-	-	<0.5	-[6]		-
B	µg/L	-	-	-	30	-[6]		-
Cd	µg/L	36	-	-	3.5	-[6]		-
Co	µg/L	150	-	-	<1	-[6]		-
Cu	µg/L	8	-	-	<1	-[6]		-
Cr	µg/L	176	-	-	3	-[6]		-
Fe	µg/L	-	-	-	2200	-[6]		-
Hg	µg/L	1.4	-	-	<0.05	-[6]		-
Mg	µg/L	-	-	-	<0.5[4]	-[6]		-
Mn	µg/L	80	-	-	61	-[6]		-
Mo	µg/L	-	-	-	<1	-[6]		-
Pb	µg/L	12	-	-	<1	-[6]		-
Ni	µg/L	560	-	-	7	-[6]		-
Se	µg/L	-	-	-	<1	-[6]		-
Sn	µg/L	-	-	-	<1	-[6]		-
Sr	µg/L	-	-	-		-[6]		-
Zn	µg/L	43	-	-	570	-[6]		-

Notes:
[1] This table summarises the discharge monitoring between 1 January 2020 – 31 December 2020.
[2] NT = not tested.
[3] Trigger value for 80% species protection from the Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 1. Updated values (2018) have been used where available.
[4] Values above the EPL limit are shown in red text. Values above the trigger value or outside ANZECC 80% species protection guideline value are shown in orange text.
[5] All routine analyses conducted in the site laboratory
[6] January 2021 results are yet to be received

APPENDIX E:

GROUNDWATER MONITORING

Quarterly groundwater monitoring data

					Date sampled	12 February 2020		18 May 2020		16 August 2020		24 Nov 2020	
Parameter	**Test method**	**Units**	**ADWG6 [1]**	**ANZECC[2]**		**BH5**	**BH7**	**BH5**	**BH7**	**BH5**	**BH7**	**BH5**	**BH7**
pH	ASTM D1287	-	6.5-8.5	-		4.9	5.6	4.9	5.6	4.8	5.9	5.1	5.4
EC	APHA 2510	mS/cm	-	-		104	49	93	41	95	49	105	50
Turbidity	Turb1	NTU	5	-		32	73	9	210	380	43	120	430
DO	HACH	mg/L	-	-		6	7	10	10	9	9	7	8
DO[3]	HACH	% sat	85%	-		77%	89%	128%	128%	115%	115%	89%	102%
OIW	Turner TD3100	mg/L	-	-		9.8	7.2	7.3	8.2	5.6	6.1	5.9	6.8
TSS	APHA 2540 D	mg/L	-	-		30	150	50	140	<10	20	50	240
TDS	APHA 2540 C	mg/L	600	-		80	50	390	40	40	<10	50	70
BOD	APHA 5210	mg/L	-	-		3.2	2.2	6.0	6.5	13.5	5.1	8.1	9.4
TOC	APHA 5310 B	mg/L	-	-		1	<1	2	1	<1	1	1	<1
COD	WCL_13	mg/L	-	-		<20	<20	<20	<20	100	<20	<20	20
NOx	APHA No2B	mg/L	-	-		2.08	1.95	2.90	1.41	2.80	1.87	2.56	2.19
Nitrate	APHA No2B	mg/L	50[(4)]	-		2.07	1.95	2.89	1.41	2.80	1.86	2.55	2.19
Nitrite	APHA No2B	mg/L	3[(4)]	-		<0.005	<0.005	<0.005	<0.005	<0.005	0.005	0.010	<0.005
Ammonia	APHA 4500	mg/L	0.5	1.7		0.020	0.025	0.055	0.030	0.035	0.030	0.015	0.035
Total P	ICP-AES	mg/L	-	-		0.015	0.085	0.005	0.005	0.005	<0.005	0.030	0.075

					Date sampled	12 February 2020		18 May 2020		16 August 2020		24 Nov 2020	
Parameter	**Test method**	**Units**	**ADWG6 [1]**	**ANZECC[2]**		**BH5**	**BH7**	**BH5**	**BH7**	**BH5**	**BH7**	**BH5**	**BH7**
Total N	APHA no2B	mg/L	-	-		2.11	2.03	2.63	1.28	2.80	1.80	2.66	2.55
Tot. Coliform	AS4276.21-2005	/100ml MPN	-	-		124	1240	<1†	276†	<1	<1	33	<1
E. coli	AS4276.21-2005	/100ml MPN	0[(4)]	-		136	136	<1†	<1†	<1	<1	<1	<1
HCC	AS4276.3.1-2007	CFU/mL	-	-		NT	NT	NT	NT	NT	NT	NT	NT
Enterococci						<1	<1	6†	79†	NT	NT	10	57

† Out of holding time.

[1] Aesthetic water quality criteria from the Australian Drinking Water Guidelines 6 (2011) version 3.2 (ADWG6).

[2] Trigger value for 80% species protection from the Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 1. Updated values (2018) have been used where available.

[3] Estimated based on water temperature of 28°C and atmospheric pressure.

[4] Health water quality criteria (adult) from ADWG6, as there is no aesthetic criteria.

Trends of key quarterly groundwater monitoring parameters

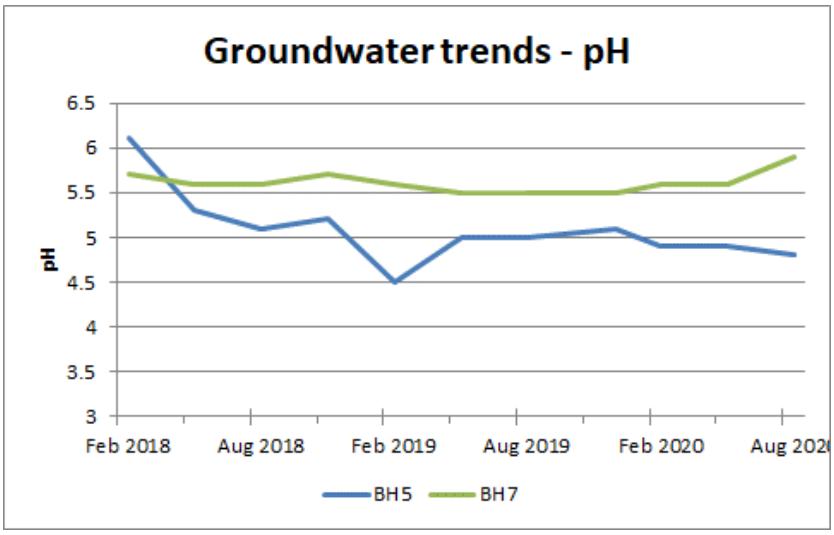


Figure F.1: Groundwater trends – pH

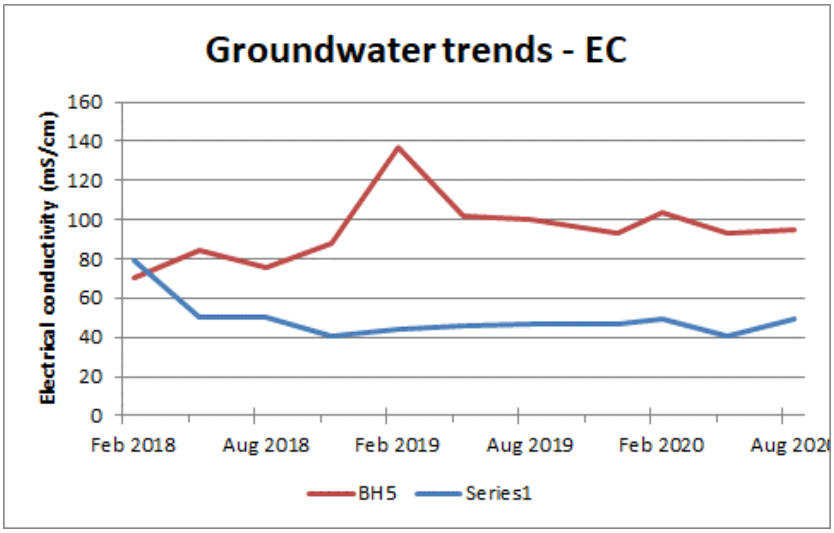


Figure F.2: Groundwater trends – EC

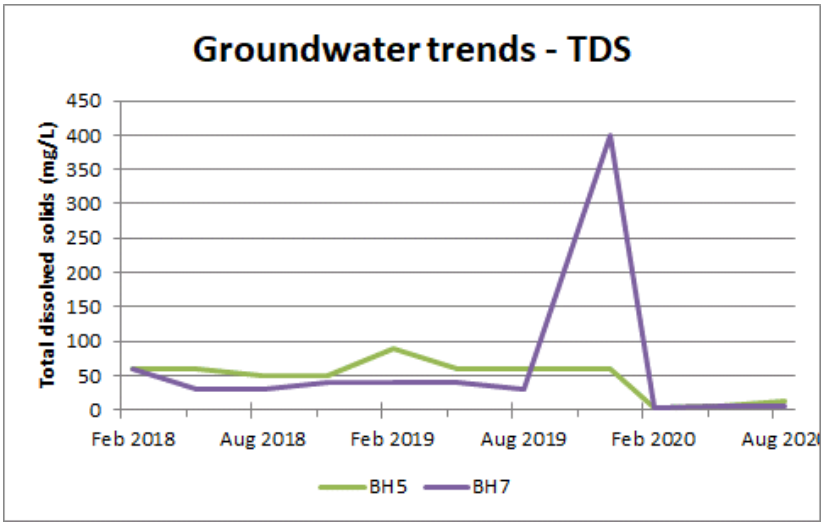


Figure F.3: Groundwater trends – TDS

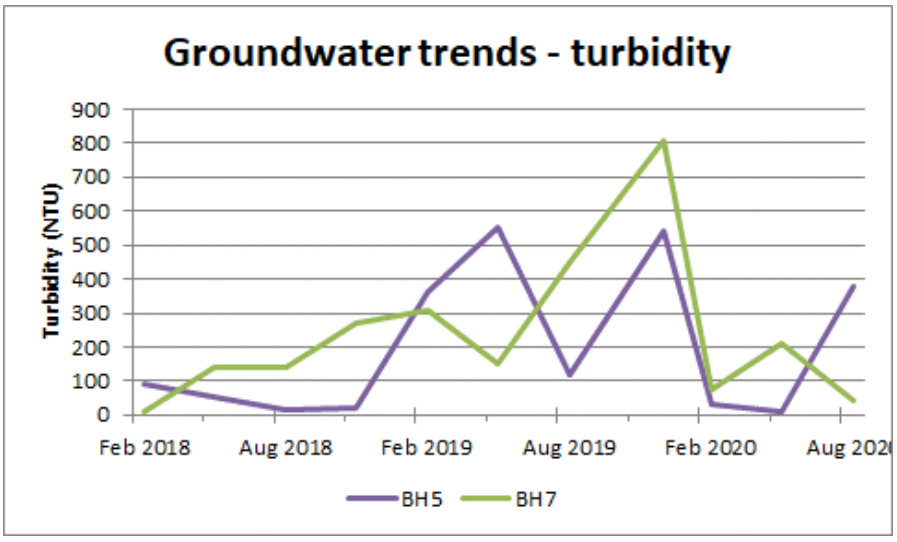


Figure F.4: Groundwater trends – turbidity

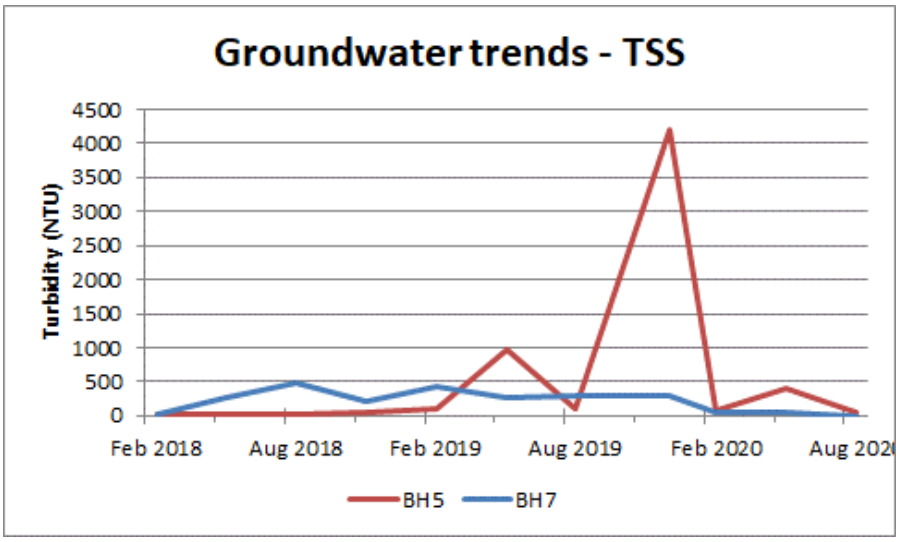


Figure F.5: Groundwater trends – total suspended solids

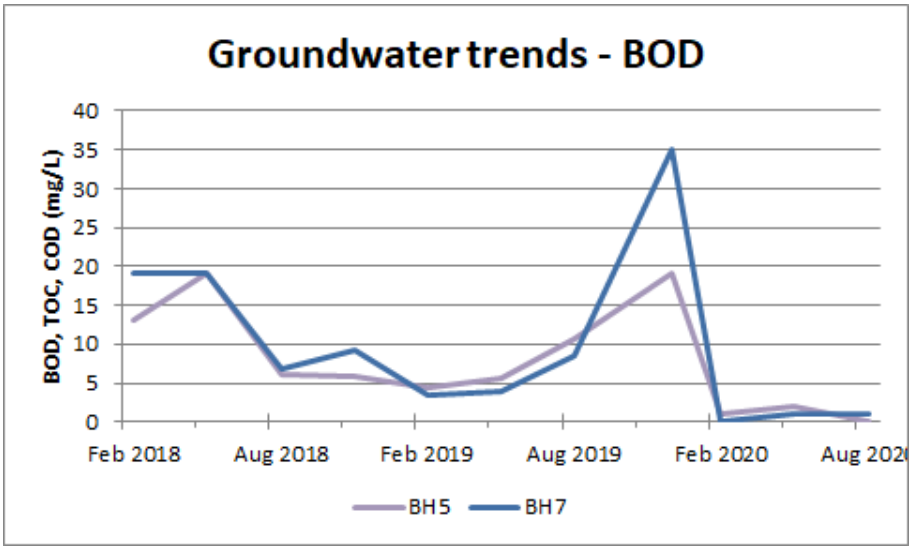


Figure F.6: Groundwater trends – biochemical oxygen demand

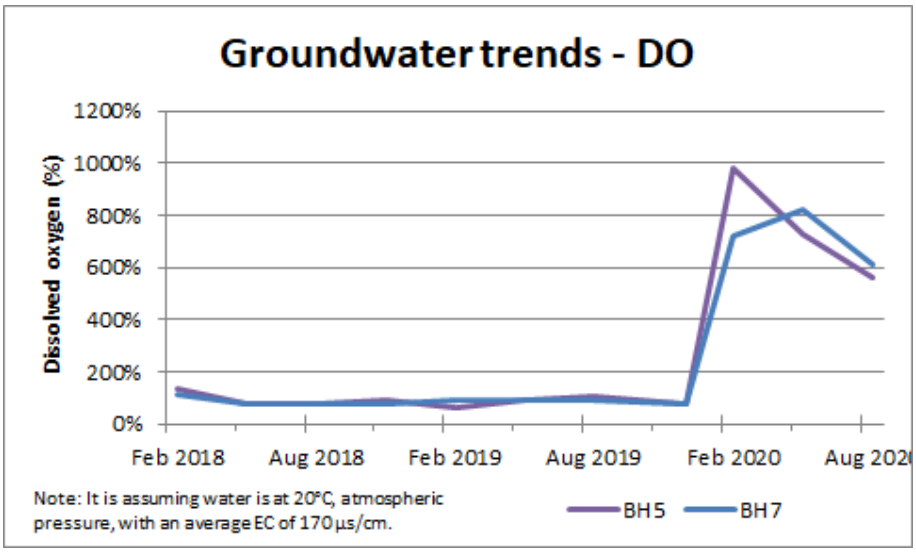


Figure F.7: Groundwater trends – dissolved oxygen

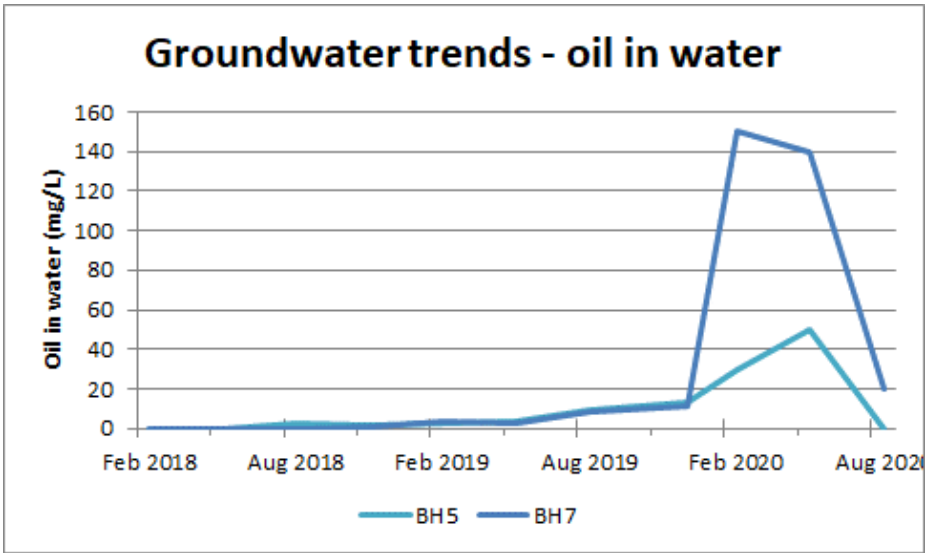


Figure F.8: Groundwater trends – oil in water

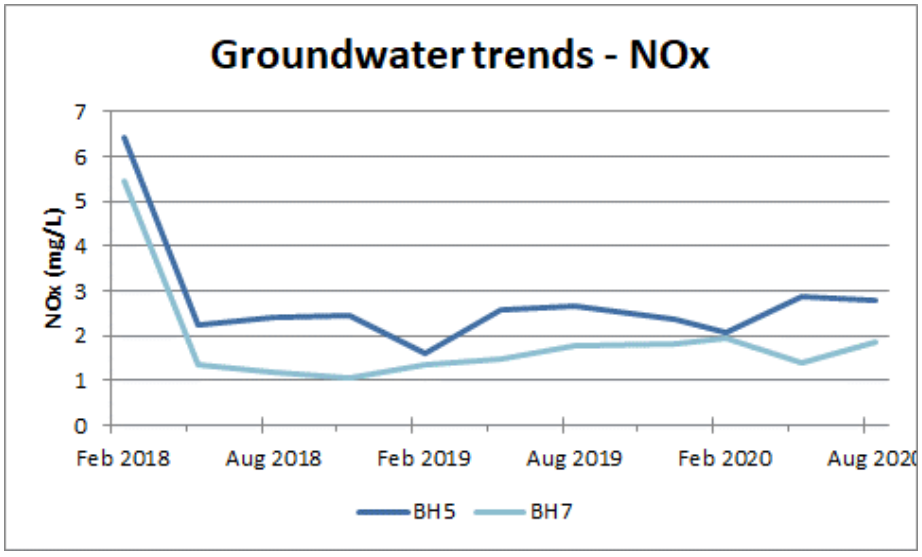


Figure F.9: Groundwater trends – NOx

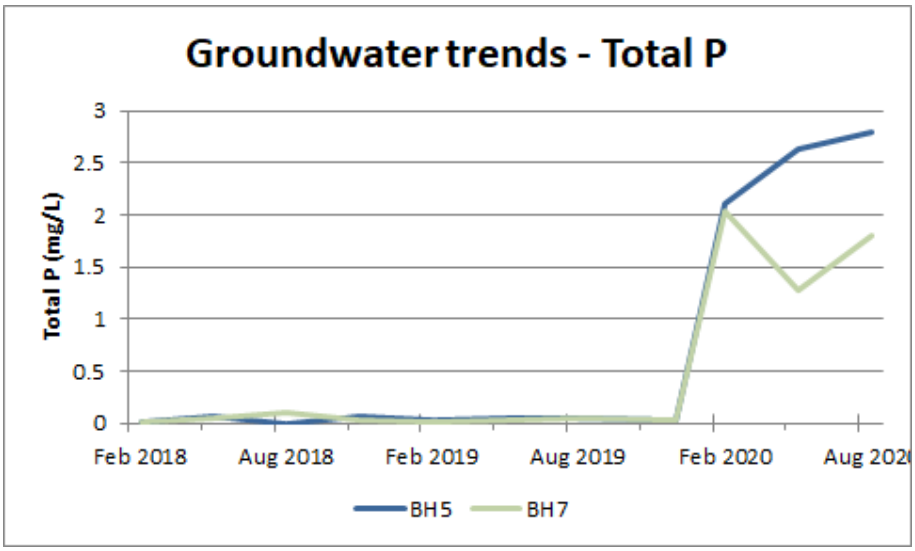


Figure F.10: Groundwater trends – Total P

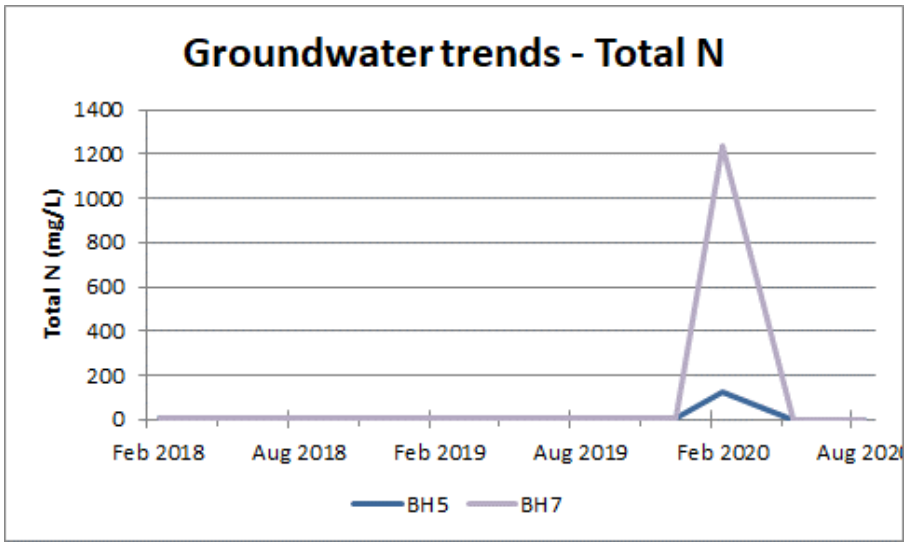


Figure F.11: Groundwater trends – Total N

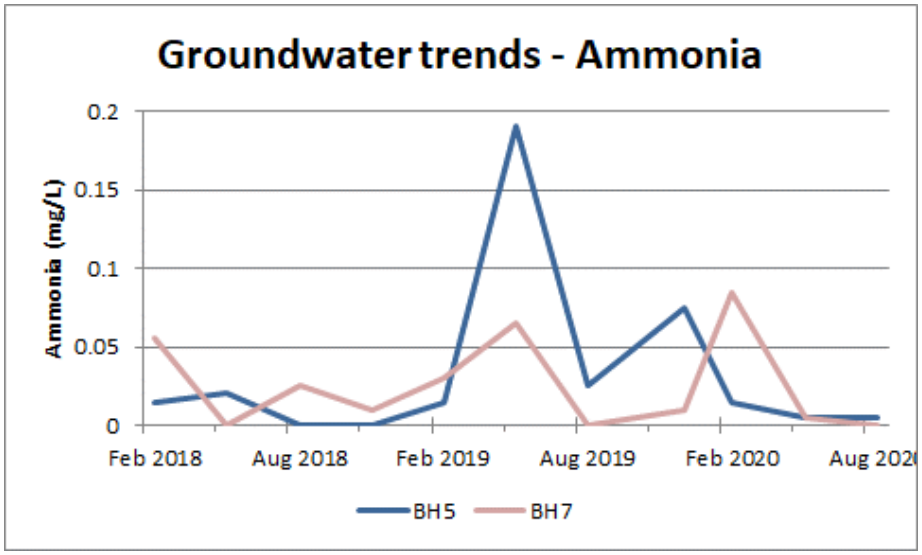


Figure F.12: Groundwater trends – Ammonia

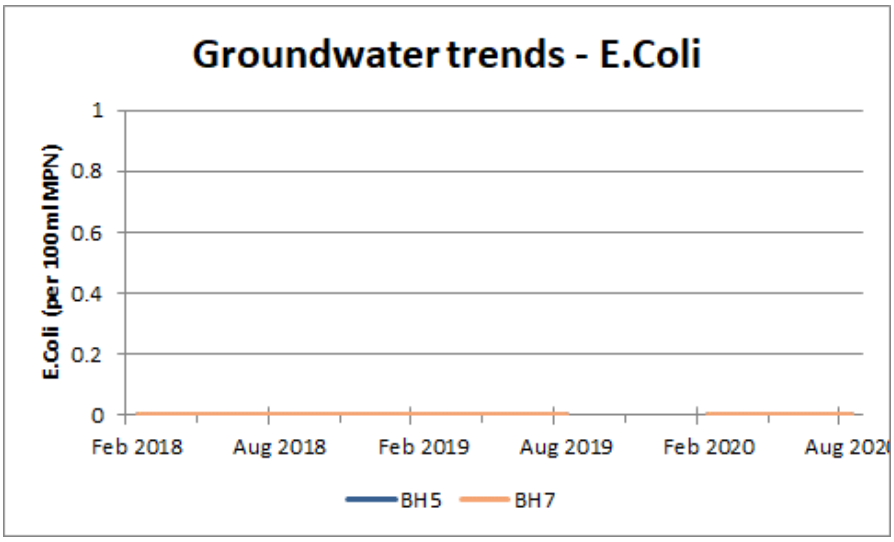


Figure F.13: Groundwater trends – E.Coli