ntepa Northern Territory Environment Protection Authority

ENVIRONMENT PROTECTION LICENCE

(Pursuant to section 34 of the *Waste Management and Pollution Control Act)*

PERMIT ATTACHMENTS (EPL228-04)

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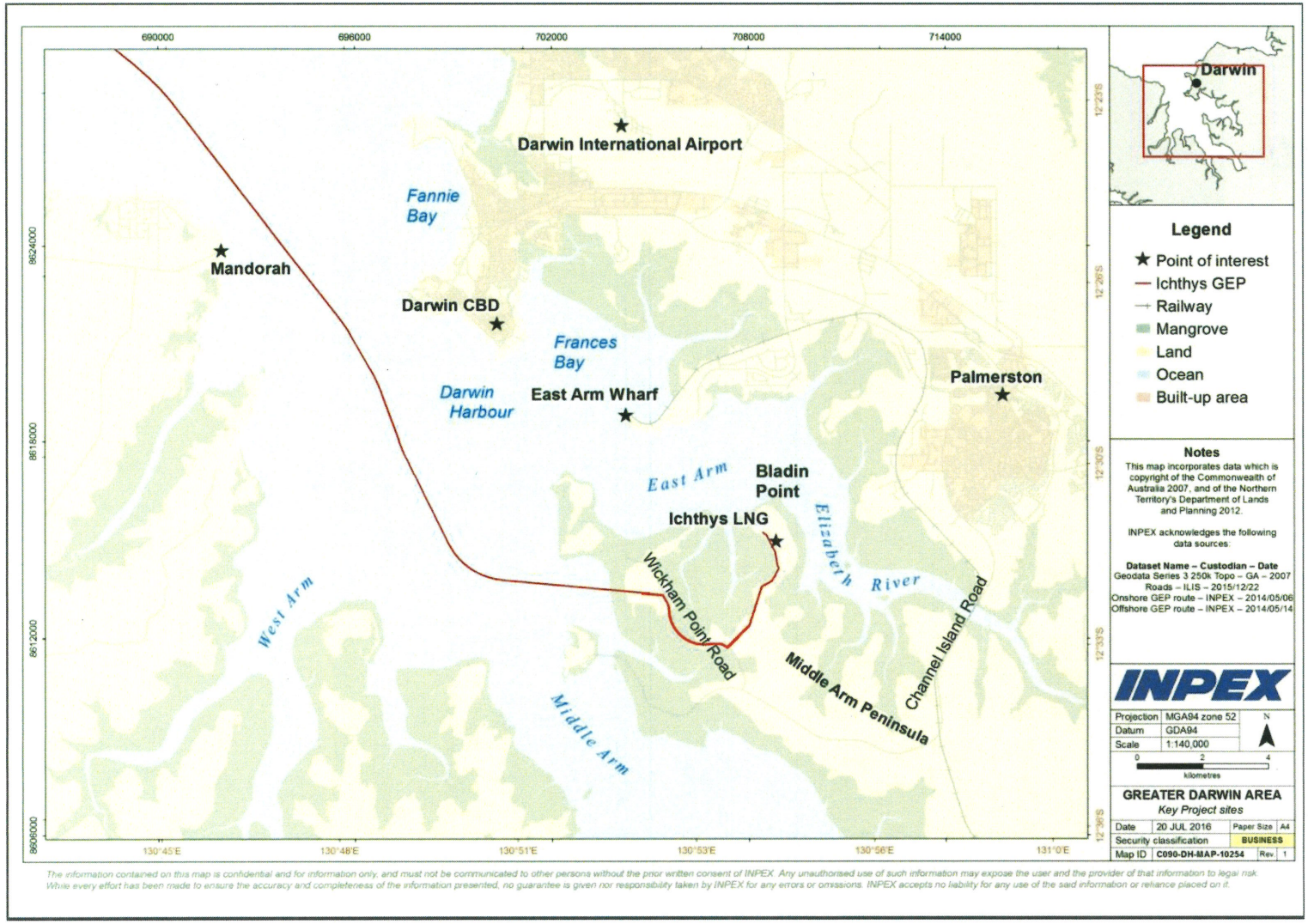


Figure 2 – Location of the Premises (NT Portion 7002)

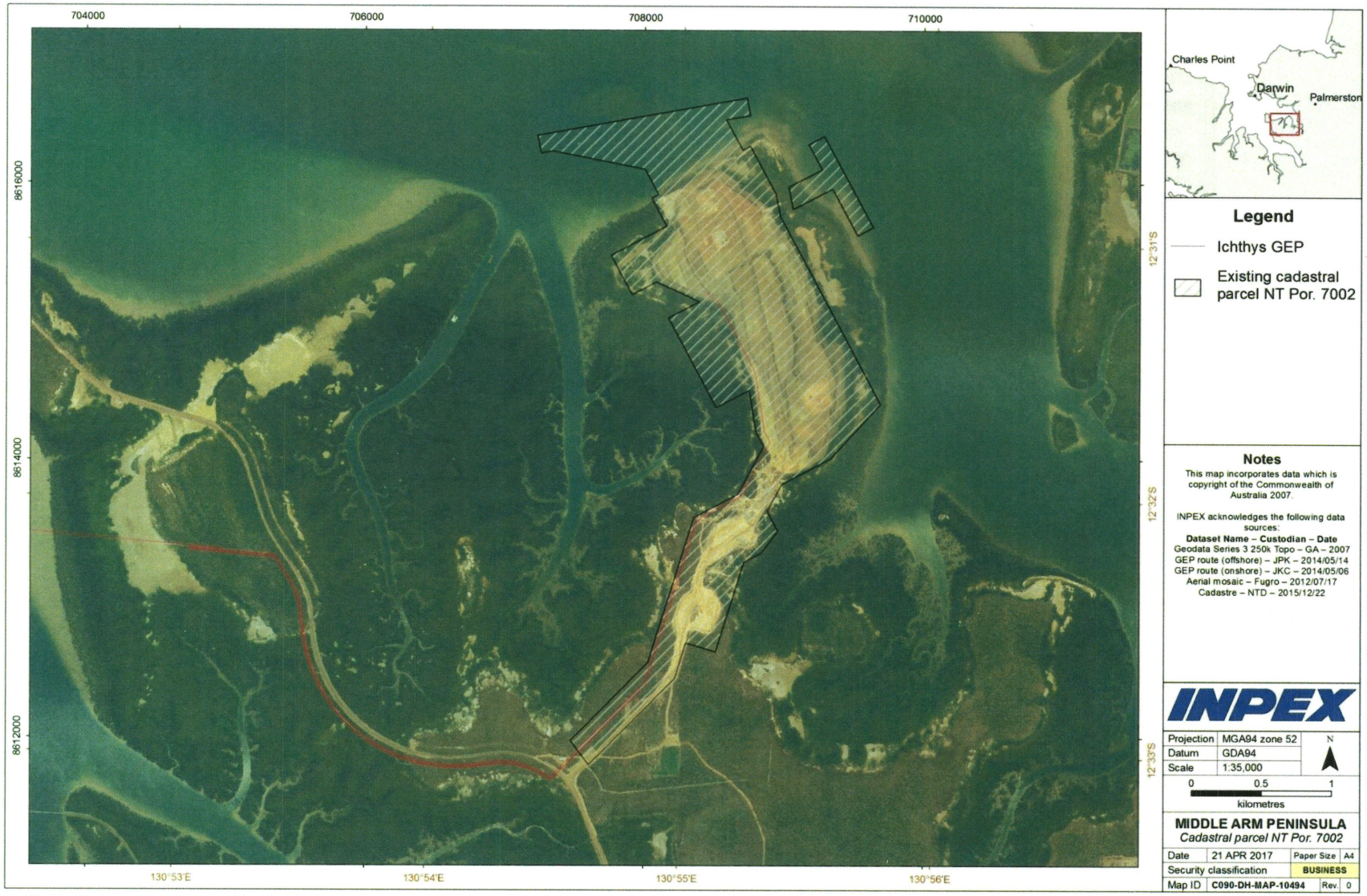


Figure 3 – Site layout

APPENDIX 2 – Authorised Wastewater Discharge

Table 1 – Authorised Wastewater Discharge Points

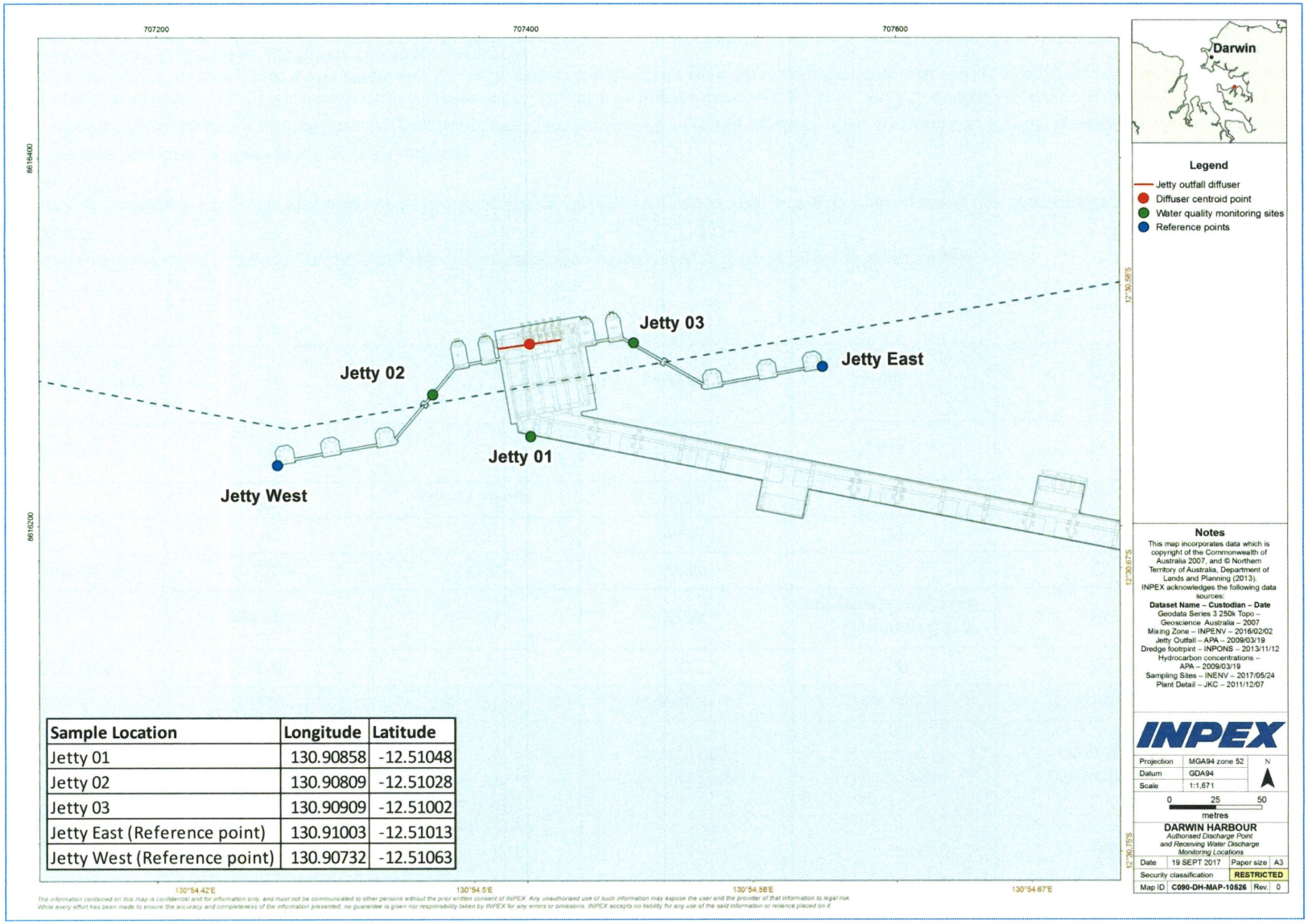
Authorised Discharge Point	Description	Latitude	Longitude
ADP 1	Jetty Outfall. Central Location Coordinates for the Diffuser • outfall pipe about 20 m long, with four diffuser ports (100 mm diameter), approximately 5 m apart angled upwards by 30° from horizontal, at a minimum depth of -11m relative to Lowest Astronomical Tide	-12.510025	130.908554
ADP 2	Fire water pumps • wastewater discharged to minimise marine fouling of the seawater firewater pumps	-12.510793	130.911174
ADP 3		-12.510810	130.91123
ADP 4		-12.510854	130.911294

Table 2 – Monitoring Location for Authorised Discharge Point

Monitoring Location	Description	Latitude	Longitude
750-SC-003	Compliance Monitoring Location for discharge to Jetty Outfall Diffuser (ADP1) and to Firewater Pumps (ADP 2, ADP 3, ADP 4))	-12.514931	130.916643
Jetty Outfall 1 [1]	Receiving environment, approximately 50 m south of diffuser centroid	-12.51048	130.90858
Jetty Outfall 2 [4]	Receiving environment, approximately 60 m south west of diffuser centroid	-12.51028	130.90809
Jetty Outfall 3 [4]	Receiving environment, approximately 60 m east of diffuser centroid	-12.51002	130.90909
Reference site [2,4]	Jetty East	-12.51013	130.91003
Reference site [2,4]	Jetty West	-12.51063	130.90732

[1] At a depth suitable for the parameter being measured and relative to exposure pathways, depending on REMP requirements as per conditions 74 - 78 of this licence.
[2] Minimum requirement. Additional reference sites may be required, depending on REMP requirements as per conditions 74 – 78 of this licence.

Figure 4 – Location of Jetty Outfall Diffuser and Jetty Outfall Monitoring Locations for authorised discharge



Sample Location	Longitude	Latitude
Jetty 01	130.90858	-12.51048
Jetty 02	130.90809	-12.51028
Jetty 03	130.90909	-12.51002
Jetty East (Reference point)	130.91003	-12.51013
Jetty West (Reference point)	130.90732	-12.51063

Table 3 – Wastewater discharge monitoring, discharge limits and receiving environment trigger values

Water Quality Parameters to be Measured	Unit	Sampling Method[3]	750-SC-003		Jetty Outfall Monitoring Locations[4]	
			Monitoring Frequency[5]	Discharge Limit[6]	Monitoring Frequency[7]	Trigger Value[8]
Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7
Volumetric flow rate	m^3/h	CFI	C	180	n/a	n/a
pH	pH units	SFLA	W/M	not less than 6.0 & not greater than 9.0	Q	outside the range of 6.0 to 8.5
Electrical conductivity	µS/cm	SFLA	W/M	n/a	Q	n/a
Temperature	°C	CFI	W/M	35	Q	± 3 from ambient
Turbidity[9]	NTU	CFI or SFLA	W/M	n/a	Q	> 10 from ambient
Dissolved Oxygen	%	CFI	W/M	n/a	Q	outside the range of 80 to 100
Visual clarity and colour	-	O	n/a	n/a	Q	no decrease in visual clarity or increase in colour

[3] CFI = calibrated field instrument; SFLA = sample for laboratory analysis; O = field observation; all metal analysis to be carried out on filtered samples

[4] As defined in Figure 4

[5] C = continuous online measurement; W/M = grab sample, weekly during start-up when discharging, then monthly when Ichthys LNG reaches steady state operations for the first time; M = grab sample, monthly

[6] Not to exceed value prescribed (or as otherwise stated); n/a = not applicable

[7] Sampling to be carried out as close to slack water high tide during neap tidal phase, for the first 24 months following completion of first start-up of LNG Train T2; Q = quarterly; n/a = not applicable

[8] Not compliance limits. Exceedance of Trigger Value requires review and assessment of cause at the time results are received as per ANZECC & ARMCANZ recommendations. A trigger for investigation occurs when the median value of the three receiving environment sites from water samples collected on the same day exceeds the trigger value and the exceedance is also not present at the upstream reference site determined from the tide phase of sampling on the same sampling day.

[9] No limit applied at sampling point 750-SC-003 for the term of this licence, instead monitoring data will determine if discharge quality limits if required during this licence period (s38(2) of the Act), or when the licence is renewed.

Water Quality Parameters to be Measured	Unit	Sampling Method[3]	750-SC-003		Jetty Outfall Monitoring Locations[4]	
			Monitoring Frequency[5]	Discharge Limit[6]	Monitoring Frequency[7]	Trigger Value[8]
Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7
						observed from background
Surface films[10]	-	O	n/a	n/a	Q	none observed
TPH as oil and grease	mg/L	SFLA	W/M	6	Q	no visible sheen or emulsion, no odour
TPH/TRH[11]	µg/L	SFLA	W/M	n/a	Q	greater than Reporting Limit
Total Suspended Solids	mg/L	SFLA	W/M	10	Q	10
Biological oxygen demand (BOD_5)	mg/L	SFLA	W/M	20	n/a	n/a
Chemical oxygen demand (COD)	mg/L	SFLA	W/M	125	n/a	n/a
Free Chlorine	mg/L	SFLA	W/M	2	Q	0.2
Ammonia	µg N/L	SFLA	W/M	n/a	Q	20
Total Nitrogen	µg N/L	SFLA	W/M	10,000	Q	300
Total Phosphorus	µg P/L	SFLA	W/M	2,000	Q	30
Filterable Reactive Phosphorus	µg P/L	SFLA	W/M	n/a	Q	10
Cadmium	µg/L	SFLA	W/M	n/a	Q	0.7

[10] Oil and petrochemicals should not be noticeable as a visible film on the water nor should they be detectable by odour (ANZECC & ARMCANZ 2000).

[11] The analytical method used is by Gas Chromatography-FID method. If TRH is detected over the prescribed limits, a silica gel clean-up to be undertaken and samples re-analysed to remove false positive from natural, normally occurring hydrocarbons.

Water Quality Parameters to be Measured	Unit	Sampling Method[3]	750-SC-003		Jetty Outfall Monitoring Locations[4]	
			Monitoring Frequency[5]	Discharge Limit[6]	Monitoring Frequency[7]	Trigger Value[8]
Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7
Chromium	µg/L	SFLA	W/M	n/a	Q	4.4
Copper	µg/L	SFLA	W/M	n/a	Q	1.3
Lead	µg/L	SFLA	W/M	n/a	Q	4.4
Mercury	µg/L	SFLA	W/M	n/a	Q	<0.1
Nickel	µg/L	SFLA	W/M	n/a	Q	7
Silver	µg/L	SFLA	W/M	n/a	Q	1.4
Zinc	µg/L	SFLA	W/M	n/a	Q	15
Enterococci	cfu/100mL	SFLA	W/M	n/a	Q	50
E coli	cfu/100mL	SFLA	W/M	100	n/a	n/a
Faecal coliforms	cfu/100mL	SFLA	W/M	400	n/a	n/a
Anionic surfactants	mg/L	SFLA	W/M	n/a	n/a	n/a
aMDEA	mg/L	SFLA	M	n/a	n/a	n/a
Glycol	mg/L	SFLA	M	n/a	n/a	n/a

APPENDIX 3 – Authorised Emissions to Air

Figure 5 – Location of authorised stationary emission release points

Table 4 – Description of authorised stationary source emission release points

Column 1	Column 2			Column 3		Column 4	Column 5	Column 6
Release Point Number	Source Description (with nominal power output)	Fuel Type	Operation	Latitude	Longitude	Release Internal Diameter (m)	Release Height (m RL)	Typical Emission Velocity (m/s)
A1	LNG Train Refrigerant Compressor Driver Gas Turbines; Frame 7 (compressor turbine WHRU West 1, 87 MW, Liquefaction Units)	high pressure fuel gas	continuous	-12.517647	130.918788	4.4	43	23
A2	LNG Train Refrigerant Compressor Driver Gas Turbines; Frame 7 (compressor turbine WHRU West 2,87 MW, Liquefaction Units)	high pressure fuel gas	continuous	-12.516355	130.921216	4.4	43	23
A3	LNG Train Refrigerant Compressor Driver Gas Turbines; Frame 7 (compressor turbine WHRU East 1, 87 MW, Liquefaction Units) & location of AGRU bypass vent release for LNG Train 1	high pressure fuel gas	continuous	-12.519682	130.919907	4.4	43[12]	23
A4	LNG Train Refrigerant Compressor Driver Gas Turbines; Frame 7 (compressor turbine WHRU East 2, 87 MW, Liquefaction Units) & location of AGRU bypass vent release for LNG Train 2	high pressure fuel gas	continuous	-12.51839	130.922335	4.4	43 [13]	23
A5-1	CCPP power generation Frame 6 turbine 1 (CCPP GTG 1, 38 MW)	high pressure fuel gas	intermittent	-12.520249	130.92388	3.2	40	19
A5-2 [13]	CCPP power generation Frame 6 turbine 1 (38 MW) with duct burners for the heat recovery steam generator (CCPP GTG 1 with STG, 100 MW)	high pressure fuel gas & vaporised	continuous	-12.519976	130.923725	3.2	40	19

[12] The AGRU incinerator by-pass vents (A13-2 & A14-2) are 1m higher than corresponding authorised release points (A3 and A4) to ensure the AGRU acid off gas does not corrode the gas turbine stack and gets the maximum dilution in the hot turbine exhaust plume. By-pass of the incinerator will only occur when the incinerator is undergoing major maintenance, which is likely to be every three to five years of operation, and could occur for one month, depending on circumstances. For minor issues, the AGRU acid off gas could be hot vented three to four days per year.

[13] 4 out 5 operating normally, one on stand-by; duct burners not used in stand-by mode

Column 1	Column 2			Column 3		Column 4	Column 5	Column 6
Release Point Number	Source Description (with nominal power output)	Fuel Type	Operation	Latitude	Longitude	Release Internal Diameter (m)	Release Height (m RL)	Typical Emission Velocity (m/s)
		isopentane to duct burners						
A6-1[13]	CCPP power generation Frame 6 turbine 2 (CCPP GTG 2, 38 MW)	high pressure fuel gas	intermittent	-12.520457	130.923463	3.2	40	19
A6-2[13]	CCPP power generation Frame 6 turbine 2 (38 MW) with duct burners for the heat recovery steam generator (CCPP GTG 2 with STG, 100 MW)	high pressure fuel gas & vaporised isopentane to duct burners	continuous	-12.520271	130.923453	3.2	40	19
A7-1[13]	CCPP power generation Frame 6 turbine 3 (CCPP GTG 3, 38 MW)	high pressure fuel gas	intermittent	-12.520684	130.923037	3.2	40	19
A7-2[13]	CCPP power generation Frame 6 turbine 3 (38 MW) with duct burners for the heat recovery steam generator (CCPP GTG 3 with STG, 100 MW)	high pressure fuel gas & vaporised isopentane to duct burners	continuous	-12.520425	130.922882	3.2	40	19
A8-1[13]	CCPP power generation Frame 6 turbine 4 (CCPP GTG 4, 38 MW)	high pressure fuel gas	intermittent	-12.52104	130.922436	3.2	40	19
A8-2[13,14]	CCPP power generation Frame 6 turbine 4 with duct burners for the heat recovery steam generator (CCPP GTG 4 with STG, 100 MW)	high pressure fuel gas & vaporised isopentane to duct burners	continuous	-12.520744	130.922264	3.2	40	19
A9-1[13,14]	CCPP power generation Frame 6 turbine 5 (CCPP GTG 5, 38 MW)	high pressure fuel gas	intermittent	-12.521253	130.922033	3.2	40	19

[14] Until start-up of the second LNG train the duct burners, Heat Recovery Steam Generators (HRSGs) and steam turbines will most likely not be in operation

Column 1	Column 2			Column 3		Column 4	Column 5	Column 6
Release Point Number	**Source Description (with nominal power output)**	**Fuel Type**	**Operation**	**Latitude**	**Longitude**	**Release Internal Diameter (m)**	**Release Height (m RL)**	**Typical Emission Velocity (m/s)**
A9-2[13,14]	CCPP power generation Frame 6 turbine 5 (38 MW) with duct burners for the heat recovery steam generator (CCPP GTG 5 with STG, 100 MW)	high pressure fuel gas & vaporised isopentane to duct burners	continuous	-12.520966	130.921882	3.2	40	19
A13-1	Acid Gas Incinerator #1	AGRU offgas & LP fuel gas	continuous	-12.515276	130.920481	3	40	19
A13-2[12]	Acid Gas from the AGRU for LNG Train 1, by-passing the incinerator to be vented at the top of A3	AGRU offgas	Only during maintenance	-12.519682	130.919907	n/a	44	n/a
A13-3	Feed gas to AGRU – LNG Train 1 – sampling location only (541-SC-001)	AGRU feed gas	continuous	-12.519682	130.919907	N/A	N/A	N/A
A14-1	Acid Gas Incinerator #2	AGRU offgas & LP fuel gas	continuous	-12.51731	130.921609	3	40	19
A14-2[12]	Acid Gas from the AGRU for LNG Train 1, by-passing the incinerator to be vented at the top of A4	AGRU offgas	Only during maintenance	-12.51839	130.922335	n/a	44	n/a
A14-3	Feed gas to AGRU – LNG Train 2 – sampling location only (542-SC-001)	AGRU feed gas	continuous	-12.51839	130.922335	N/A	N/A	N/A
A15	Heating Medium Furnace 1	low pressure fuel gas	continuous[15]	-12.517621	130.917316	1.8	58	n/a
A16	Heating Medium Furnace 2	low pressure fuel gas	continuous[15]	-12.517539	130.917462	1.8	58	n/a

[15] Operate at ~ 30% normally, used at higher rates during start-up or high arrival pressure.

Column 1	Column 2			Column 3		Column 4	Column 5	Column 6
Release Point Number	Source Description (with nominal power output)	Fuel Type	Operation	Latitude	Longitude	Release Internal Diameter (m)	Release Height (m RL)	Typical Emission Velocity (m/s)
A17	Warm Ground Flare – fuel gas/natural gas	LP fuel gas (pilot only)	Stand-by (pilot only)	-12.521835	130.917006	n/a	3	n/a
A18	Cold Ground Flare - gas/natural gas, gaseous propane or mixed refrigerant	LP fuel gas (pilot only)	Stand-by (pilot only)	-12.524392	130.918442	n/a	3	n/a
A19	Spare Ground Flare - fuel gas/natural gas, gaseous propane or mixed refrigerant	LP fuel gas (pilot only)	Spare (not normally operated)	-12.522798	130.917565	n/a	3	n/a
A20	LNG Tankage Flare 1 - natural gas	LP fuel gas (pilot only)	Stand-by (pilot only)	-12.517823	130.91314	n/a	25	n/a
A21	LPG Tankage Flare - butane, propane	LP fuel gas (pilot only)	Stand-by (pilot only)	-12.518759	130.913653	n/a	25	n/a
A22	Spare Tankage Flare 3 - butane, propane or natural gas	LP fuel gas (pilot only)	Spare (not normally operated)	-12.518291	130.913392	n/a	25	n/a
A23	Liquid Flare - liquid iso-pentane or off-spec condensate	LP fuel gas (pilot only)	Not normally operated	-12.525598	130.919168	n/a	3	n/a
A24	EDG1 Emergency diesel generator (2.2 MW)	diesel	Not normally operated	-12.521118	130.920829	n/a	8	n/a
A25	EDG2 Emergency diesel generator (2.2 MW)	diesel	Not normally operated	-12.521056	130.920854	n/a	8	n/a
A26	EDG3 Emergency diesel generator (2.2 MW)	diesel	Not normally operated	-12.521022	130.920953	n/a	8	n/a

Column 1	Column 2			Column 3		Column 4	Column 5	Column 6
Release Point Number	Source Description (with nominal power output)	Fuel Type	Operation	Latitude	Longitude	Release Internal Diameter (m)	Release Height (m RL)	Typical Emission Velocity (m/s)
A27	EDG4 Emergency diesel generator (2.2 MW)	diesel	Not normally operated	-12.520985	130.921028	n/a	8	n/a
A28	EDG5 Emergency diesel generator (2.2 MW)	diesel	Not normally operated	-12.5209804	130.9211346	n/a	8	n/a
A29	EDG6 Emergency diesel generator (2.2 MW)	diesel	Not normally operated	-12.520946	130.921211	n/a	8	n/a
A30	Firewater Pump Utility 1 (552 bkW)	diesel	Not normally operated	-12.535953	130.920762	n/a	4	n/a
A31	Firewater Pump Utility 2 (552 bkW)	diesel	Not normally operated	-12.535952	130.920791	n/a	4	n/a
A32	Firewater Pump Utility 3 (552 bkW)	diesel	Not normally operated	-12.535909	130.92084	n/a	4	n/a

Table 5 – Contaminant release limits to air at authorised stationary emission release points

Column 1	Column 2	Column 3	Column 4		Column 5	
Release Point Number	Source	Pollutant	Concentration Target[16]		Concentration Limit[17]	
			mg/Nm³	ppmv	mg/Nm³	ppmv
A1, A2, A3, A4	LNG Refrigerant Compressor Driver Gas Turbines (GE Frame 7s)	NO_x as NO_2	50 @ 15% O_2 dry	25 @ 15% O_2 dry	70	35 @ 15% O_2 dry
A5-1, A6-1, A7-1, A8-1, A9-1	CCPP Gas Turbine Generators (GE Frame 6s, 38 MW)	NO_x as NO_2	50 @ 15% O_2 dry	25 @ 15% O_2 dry	70	35 @ 15% O_2 dry
A5-2, A6-2, A7-2, A8-2, A9-2	CCPP Gas Turbine Generators (GE Frame 6s, 38 MW) also burning vaporised iso-pentane in duct burners	NO_x as NO_2	150 @ 15% O_2 dry	75 @ 15% O_2 dry	350	175 @ 15% O_2 dry
A13-1, A14-1	AGRU Incinerators[18]	NO_x	320 @ 3% O_2 dry	160 @ 3% O_2 dry	350	175 @ 15% O_2 dry
A15, A16	Heating Medium Furnaces	NO_x	160 @ 3% O_2 dry	80 @ 3% O_2 dry	350	175 @ 3% O_2 dry

[16] Ichthys LNG design criteria for normal operations
[17] NSW PEO Act – Group 6
[18] Incineration temperature to be in the range 750 to 900 °C

Table 6 – Air emissions monitoring program

Column 1	Column 2	Column 3	Column 4	Column 5
Release Point Number	**Sampling Location Number**	**Source**	**Monitoring Frequency**	**Parameter [19]**
A1	L-641-A-001	LNG Train 1 Refrigerant Compressor Driver Gas Turbine (GE Frame 7)	quarterly	NO_x as NO_2, N_2O, Hg, $PM_{2.5}$, PM_{10}, CO, temperature, efflux velocity, volumetric flow rate
A2	L-642-A-001	LNG Train 2 Refrigerant Compressor Driver Gas Turbine (GE Frame 7)		
A3	L-641-A-002	LNG Train 1 Refrigerant Compressor Driver Gas Turbine (GE Frame 7)		
A4	L-642-A-002	LNG Train 2 Refrigerant Compressor Driver Gas Turbine (GE Frame 7)		
A5-1	L-780-GT-001	CCPP Gas Turbine Generator #1 (GE Frame 6) – conventional stack	quarterly	NO_x as NO_2, N_2O, Hg, $PM_{2.5}$, PM_{10}, CO, temperature, efflux velocity, volumetric flow rate
A6-1	L-780-GT-002	CCPP Gas Turbine Generator #2 (GE Frame 6) – conventional stack		
A7-1	L-780-GT-003	CCPP Gas Turbine Generator #3 (GE Frame 6) – conventional stack		
A8-1	L-780-GT-004	CCPP Gas Turbine Generator #4 (GE Frame 6) – conventional stack		
A9-1	L-780-GT-005	CCPP Gas Turbine Generator #5 (GE Frame 6) – conventional stack		
A5-2	L-630-F-001	CCPP Gas Turbine Generator #1 (GE Frame 6) – HRSG stack		
A6-2	L-630-F-002	CCPP Gas Turbine Generator #2 (GE Frame 6) – HRSG stack		
A7-2	L-630-F-003	CCPP Gas Turbine Generator #3 (GE Frame 6) – HRSG stack		
A8-2	L-630-F-004	CCPP Gas Turbine Generator #4 (GE Frame 6) – HRSG stack		

[19] NO_x as NO_2 = Oxides of nitrogen as nitrogen dioxide; $PM_{2.5}$ = particulate matter with a diameter of 2.5 micrometres (µm) or less; PM_{10} = particulate matter with a diameter between 2.5 and 10 µm; TSP = total solid particles; CO = carbon monoxide; CO_2 = carbon dioxide; NMVOC = non-methane volatile organic carbon; CH_4 = methane; SO_2 = sulfur dioxide; BTEX = benzene, toluene, ethylbenzene, xylenes; H_2S = hydrogen sulfide.

Column 1	Column 2	Column 3	Column 4	Column 5
Release Point Number	**Sampling Location Number**	**Source**	**Monitoring Frequency**	**Parameter [19]**
A9-2	L-630-F-005	CCPP Gas Turbine Generator #5 (GE Frame 6) – HRSG stack	quarterly	NO_x as NO_2, N_2O, Hg, $PM_{2.5}$, PM_{10}, CO, temperature, efflux velocity, volumetric flow rate
A13-1	L-551-FT-031	AGRU Incinerator – LNG Train 1	quarterly	NO_x as NO_2, N_2O, Hg, $PM_{2.5}$, PM_{10}, CO, temperature, efflux velocity, volumetric flow rate
A13-2	551-SC-003	AGRU Hot Vent – LNG Train 1, prior to release at A3	Quarterly and during incinerator by-pass [20]	BTEX, H_2S, volumetric flow rate
A13-3	541-SC-001	Feed gas to AGRU – LNG Train 1 – prior to release at A3	Quarterly and during incinerator by-pass	Hg
A14-1	L-552-FT-031	AGRU Incinerator – LNG Train 2	Quarterly and during incinerator by-pass	NO_x as NO_2, N_2O, Hg, $PM_{2.5}$, PM_{10}, CO, temperature, efflux velocity, volumetric flow rate
A14-2	552-SC-003	AGRU Hot Vent – LNG Train 2, prior to release at A4	Quarterly and during incinerator by-pass [20]	BTEX, H_2S, volumetric flow rate
A14-3	542-SC-001	Feed gas to AGRU – LNG Train 2 – prior to release at A4	Quarterly and during incinerator by-pass	Hg

[20] If AGRU off gas quality can be demonstrated to be predictable and does not vary greatly when the by-pass of the incinerator occurs, the NT EPA may approve quarterly sampling for first 18 months after commencement of Steady-State, then annual.

Column 1	Column 2	Column 3	Column 4	Column 5
Release Point Number	**Sampling Location Number**	**Source**	**Monitoring Frequency**	**Parameter [19]**
A15	L-640-A-001-A	Heating Medium Furnaces	quarterly	NO_x as NO_2, N_2O, Hg, $PM_{2.5}$, PM_{10}, CO, temperature, efflux velocity, volumetric flow rate
A16	L-640-A-001-B	Heating Medium Furnaces	quarterly	NO_x as NO_2, N_2O, Hg, $PM_{2.5}$, PM_{10}, CO, temperature, efflux velocity, volumetric flow rate
A17	L-700-F-002	Ground flare #5 warm	all flare events	mass of hydrocarbons flared
A18	L-700-F-001-A/B	Ground flare #2 cold		
A19	L-700-F-003	Ground flare #1 spare		
A20	L-700-F-005-A/B	Tank flare #1 LNG		
A21	L-700-F-006-A/B	Tank flare #2 LPG		
A22	L-700-F-007	Tank flare #3 LNG/LPG		
A23	L-700-F-004	Liquid flare		