Gorgon Gas Development and Jansz Feed Gas Pipeline

Five-year Environmental Performance Report 2020–2025

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1 Introduction

1.1 Proponent

Chevron Australia Pty Ltd (CAPL) is the Proponent and the person taking the action for the Gorgon Gas Development and Jansz Feed Gas Pipeline (collectively referred to hereafter as the Gorgon Gas Development [the 'Project']) on behalf of these companies (collectively known as the Gorgon Joint Venture Participants):

- Chevron Australia Pty Ltd
- Shell Australia Pty Ltd
- Mobil Australia Resources Company Pty Ltd
- Osaka Gas Gorgon Pty Ltd
- MidOcean Gorgon Pty Ltd
- JERA Gorgon Pty Ltd.

1.2 Purpose of this Environmental Performance Report

CAPL, as the Proponent, is required to prepare a Five-year Environmental Performance Report (EPR) in accordance with:

- Condition 5 and Schedule 3 of Ministerial Statement (MS) 800 (and Condition 2 of MS 965), as amended by MS 1198
- Condition 5 and Schedule 3 of MS 769
- Condition 4 and Schedule 3 of EPBC 2003/1294
- Condition 4 and Schedule 3 of EPBC 2008/4178
- relevant systems, programs, and plans as amended or replaced from time to time approved under MS 800, MS 769, MS 965, and EPBC 2003/1294 and 2008/4178.

1.3 Contents of this EPR

This EPR covers the period from 10 August 2020 to 9 August 2025 (the 'Reporting Period') unless otherwise stated. Table 1-1 lists the State and Commonwealth Condition requirements of this EPR and the sections in this EPR that fulfil them. This includes the EPR requirements under Schedule 3 of MS 800, MS 769, EPBC 2003/1294, and EPBC 2008/4178 and any additional EPR commitments contained in relevant systems, programs, and plans.

CAPL is developing the gas reserves of the Greater Gorgon Area. The gas is processed in a Gas Treatment Plant (GTP) on Barrow Island (BWI), which is located off the Pilbara coast 85 km north-north-east (NNE) of Onslow in Western Australia (WA) (Figure 1-1).

Table 1-1: Environmental Performance Reporting Requirements Addressed in this EPR

Environmental Aspect	MS 800	MS 769	EPBC 2003/1294	EPBC 2008/4178	EMP Commitment	Section in this EPR
Terrestrial and Subterranean Environment State	✓	✓	✓	✓	✓	2
Terrestrial and Marine Quarantine (including weed management)	✓		✓	✓		3
Marine Turtles (including light and noise management)	✓		✓	✓		4
Short-range Endemics and Subterranean Fauna	✓		✓	✓		5
Fire Management	✓	✓	✓	✓		6
Carbon Dioxide Injection System [1]			✓	✓		7
Air Quality	✓					8
Coastal Stability	✓		✓	✓		9
Terrestrial Rehabilitation	✓				✓	10
Greenhouse Gas Abatement [1]	NA	NA	NA	NA	NA	NA
Spill Management		✓				11

1 Ministerial Statement 1198, published 20 October 2022, amended Condition 5.2 of Ministerial Statement 800 removing the requirement for environmental performance reporting of Carbon Dioxide Injection System and Greenhouse Gas Abatement, and establishing specific greenhouse gas reporting requirements under amended Conditions 26 and 27.

Subsea gathering systems and pipelines deliver feed gas from the Gorgon and Jansz–Io gas fields to the west coast of Barrow Island. The underground feed gas pipeline system then traverses Barrow Island to the east coast where the GTP is located. The GTP includes natural gas trains that produce liquefied natural gas (LNG) as well as condensate and domestic gas (DomGas). Carbon dioxide (CO_2), which occurs naturally in the feed gas, is separated during the production process, and injected into deep rock formations below Barrow Island. The LNG and condensate are loaded onto tankers from a jetty and then transported to international markets. Gas for domestic use is exported by pipeline from Barrow Island to the DomGas collection and distribution network on the WA mainland.

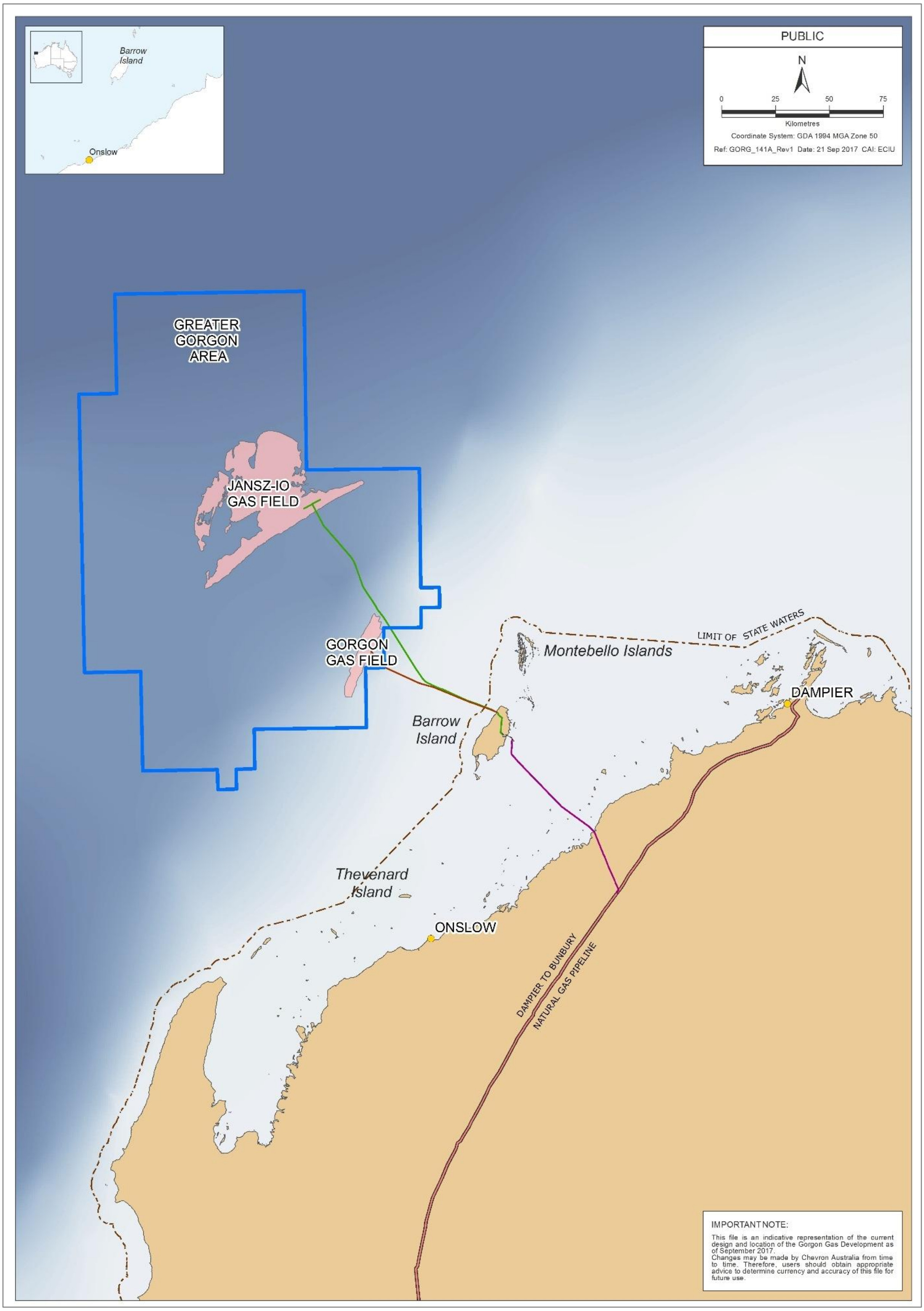


Figure 1-1: Location of Gorgon Gas Development and Greater Gorgon Area

1.3.1 Status of Implementation

Construction of the Gorgon Gas Development started in December 2009 and 3-train LNG operations began in July 2018.

During the Reporting Period of 10 August 2020 to 9 August 2025, the Gorgon Joint Venture Participants:

- supplied almost 25 percent of Western Australia's domestic gas supply.
- delivered more than 1120 liquified natural gas (LNG) cargoes, confirming Gorgon's leading role as a reliable supplier of energy to the Asia Pacific region.
- injected more than 10.4 million tonnes of CO_2e from the Carbon Dioxide Injection System. More than 100 million tonnes of CO_2e is expected to be mitigated over the life of the Gorgon Gas Development.
- commenced a project that aims to expand the Carbon Dioxide Injection System's capacity to manage water found within the reservoir where carbon dioxide is stored, thereby reducing reservoir pressure and enabling increased carbon dioxide injection rates.
- committed A$40 million to the Western Australian Government's Lower Carbon Grants Program – Gorgon Fund and GreenTech Hub.
- commenced production from the Gorgon Stage Two development. In line with the original development plan for the Gorgon Project, Gorgon Stage Two involved the installation of 11 additional wells in the Gorgon and Jansz-Io fields and accompanying offshore production pipelines and subsea structures to maintain feed gas supply for the gas processing facilities on Barrow Island.
- progressed the Jansz-Io Compression (J-IC) project involving the installation of subsea compression infrastructure in the Jansz-Io field to maintain gas supply to the three existing LNG trains and domestic gas plant on Barrow Island.
- submitted regulatory approvals for the Gorgon Gas Development Backfill Fields (the Development). The Development represents the next phase of Gorgon, and the intent is to maintain current rates of LNG and domestic gas production at the Gorgon Gas Facility on Barrow Island.
- undertook routine major maintenance 'turnarounds' on Train 3 (2021), Train 1 (2023), Train 2 (2024) and Train 3 (2025). Turnarounds are routine major maintenance shutdowns involving numerous inspections, repairs, and equipment change outs.

2 Terrestrial and Subterranean Environment State

Table 2-1: EPR Reporting Requirements for Terrestrial and Subterranean Environment

Item	Source	Section in this EPR
Results of monitoring and any measurable impacts from the Project, including any changes from the baseline	MS 800, Schedule 3(1i) MS 769, Schedule 3(1i) EPBC 2003/1294 and 2008/4178, Schedule 3(1i)	2.2
Conclusions as to the Project stressors (if any) causing the impacts identified	MS 800, Schedule 3(1ii) MS 769, Schedule 3(1ii) EPBC 2003/1294 and 2008/4178, Schedule 3(1ii)	Not applicable (N/A)[1]
Any mitigation measures applied during the Reporting Period, and results of that mitigation	MS 800, Schedule 3(1iii) MS 769, Schedule 3(1iii) EPBC 2003/1294 and 2008/4178, Schedule 3(1iii)	N/A[2]
Any changes to monitoring sites	MS 800, Schedule 3(1iv) MS 769, Schedule 3(1iv) EPBC 2003/1294 and 2008/4178, Schedule 3(1iv)	2.2
Any changes to monitoring sites below the minimum number required	Terrestrial and Subterranean Environment Monitoring Program (TSEMP) (Ref. 1), Section 3.4	N/A[3]
Any changes to ecological elements	TSEMP (Ref. 1), Section 5	2.2
Threatened or listed fauna cared for, injured, or killed within the Terrestrial Disturbance Footprint (TDF)	Terrestrial and Subterranean Environment Protection Plan (TSEPP) (Ref. 2), Section 7.2	2.3
A five-year overview of environmental performance	MS 800, Condition 5.3(iii) MS 769, Condition 5.3(ii) EPBC 2003/1294 and 2008/4178, Condition 4.2(iii)	2.4
Proposed environmental management improvements	MS 800, Condition 5.3(iv) MS 769, Condition 5.3(iii) EPBC 2003/1294 and 2008/4178, Condition 4.2(iv)	2.5

1 *No Project-related adverse impacts to ecological elements (as listed in Condition 6.1 of MS 800 and MS 769, and Condition 5.1 EPBC 2003/1294 and 2008/4178) were identified outside the TDF during the Reporting Period; therefore, reporting is not applicable at this time.*

2 *No mitigation measures were implemented in response to Project-related adverse impacts outside the TDF during the Reporting Period; therefore, reporting is not applicable at this time.*

3 *No changes were made to the TSEMP monitoring sites during the Reporting Period.*

2.1 Terrestrial Disturbance Footprint

In accordance with Condition 6.4 of MS 800 and MS 769 and Condition 5.4 of EPBC Reference: 2003/1294 and 2008/4178, the TDF is defined in the section 6 of the Terrestrial and Subterranean Baseline State and Environment Impact Report (Ref. 3) (TSBSEIR), as amended from time to time.

The TDF includes the Gorgon Gas Development and Jansz Feed Gas Pipeline Footprints and a zone beyond them that contains the area that may be disturbed by construction or operations activities associated with the Terrestrial Facilities.

The TSBSEIR is the source document for the TDF and provides the methodology for delineating the TDF and the resulting dimensions. Given the TSBSEIR needs to remain the primary information source for the TDF, details are not duplicated in this Report.

The TDF used for analysing monitoring program results was amended in December 2023 to account for new areas of activity associated with the CO_2 Injection System (Figure 2-1)

The stated objectives of this TSEPP (Ref. 2) are as per Condition 7.4 of MS 800, CAPL will aim to reduce adverse impacts from the construction and operation of the Terrestrial Facilities as far as practicable. As required under Condition 7.4 of MS 769, CAPL will also aim to reduce Material and Serious Environmental Harm from the construction and operation of the Terrestrial Facilities as far as practicable inside the TDF (excluding the Gorgon Gas Development Footprint), noting that CAPL shall not cause or allow Material or Serious Environmental Harm outside the TDF (in accordance with Condition 6.6 of MS 800).

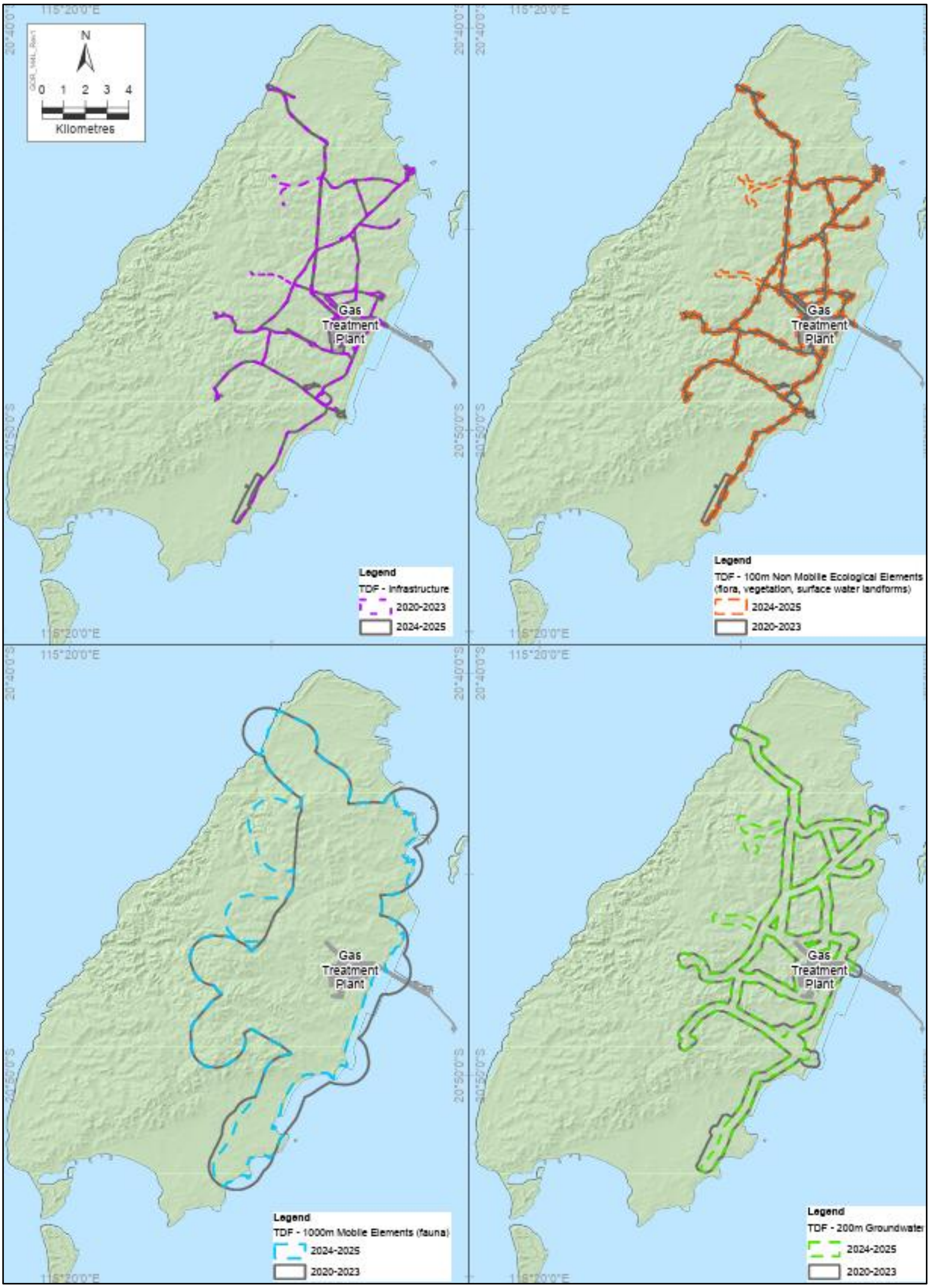


Figure 2-1: Gorgon Indicative TDF and Amendment During the Reporting Period

2.2 Monitoring Results

The objective of the TSEMP (Ref. 1), as defined by Ministerial conditions, is to establish a statistically valid ecological monitoring program to detect any Material or Serious Environmental Harm to the ecological elements outside the TDF.

The ecological elements considered at risk from the Gorgon Gas Development that require monitoring on Barrow Island are listed in the TSEMP (Ref. 1).

At Risk zones (located within the relevant TDF—a zone where potential impacts are predicted to occur) and Reference zones (located in comparable areas beyond the TDF) were established for each monitoring program to detect changes attributable to Gorgon Gas Development activities.

Where applicable, monitoring data are presented in time-series control charts used to diagnose trends in population abundance and identify deviations from baseline estimates. Trends identified in control charts act as early-warning signals to guide a tiered management approach. A management response is triggered if a parameter demonstrates a trend towards or changes beyond statistical deviations (±1, ±2, or ±3 statistical deviations (SD) from baseline conditions or other reference point (e.g. the zero centreline of a ratio).

CAPL uses management triggers based on a tiered structure of alert, review, and action to guide the response strategy to mitigate Material or Serious Environmental Harm from manifesting outside the TDF. Decision rules differ for management triggers associated with vegetation and fauna, groundwater, and surface water landforms and the associated response actions are described in the TSEMP.

For most ecological elements, a positive (+1,+2,+3 SD) represents a favourable change in the parameter measured. For example, for biennial vegetation monitoring, +SD results indicate an increase in plant health or diversity. However, a positive change in the At-Risk zone may also indicate a decline in the Reference zone and therefore the parameter is still displayed as a management trigger. This approach allows for routine review of risk and management measures in the context of the island wide environmental and population dynamics.

Management triggers are established to identify and report if a deviation in a measured parameter or indicator may be outside the bounds of what might be expected, given the natural temporal variability measured across At Risk Sites and Reference Sites. If an environmental management trigger is exceeded, appropriate responses will be considered, including measures to investigate and establish the significance of any Project-attributable adverse impacts.

Monitoring results are discussed in the context of climate and weather, as key drivers for environmental change. During the Reporting Period, rainfall on Barrow Island has fluctuated in line with the El Nino Southern Oscillation Cycle (ENSO). Lower than average rainfalls were experienced in 2020 before conditions shifted to the La Niña phase until the start of 2023 bringing higher than average rainfalls for 2021 and 2022. The cycle moved to El Niño phase until the end of April 2024 reducing rainfall to below the average for 2023. Since June 2024 Barrow Island has experienced ENSO in a neutral state.

Year to year, and month to month, rainfall records for the Reporting Period provide further insight into local environmental conditions and drivers for population change. For example, March to May 2021 received considerably higher than average rainfall (>320 mm combined), as did May 2022 (>250 mm received), December 2024 and January 2025 (>380 mm combined) (Ref. 23).

The presentation of monitoring results for the TSEMP also varies depending on timing of surveys year to year. For example, results of biennial vegetation monitoring are presented for the surveys undertaken in 2021, 2023 and 2025 as surveys were completed around May each year and results could be analysed by the end of the Reporting Period.

Conversely, results for fauna monitoring are presented for years 2020, 2021, 2022, 2023 and 2024 as the timing of field surveys approached the end of the Reporting Period. This approach is consistent across annual and previous Five-year EPR Reporting Periods.

Table 2-2 shows the frequency and survey data collection year for each ecological element listed in the TSEMP.

Individual monitoring program objectives, methods, results and discussion are provided in subsequent tables.

Table 2-2: Survey timing and reporting

Ecological Element	Monitoring Frequency	Survey Years Reported
Vegetation	Biennial	2021, 2023, 2025
White-winged Fairy-wrens	Annual	2020, 2021, 2022, 2023, 2024
Barrow Island Euros	Annual	2020, 2021, 2022, 2023, 2024
Spectacled Hare Wallabies	Annual	2020, 2021, 2022, 2023, 2024
Burrowing Bettongs	Annual	2020, 2021, 2022, 2023, 2024
Golden Bandicoots	Five-yearly / rainfall trigger	2021 (2016 and 2017 provided for context)
Wedge-tailed shearwaters	Annual	2020/21, 2021/22, 2022/23, 2023/24, 2024/25
Bridled Terns	Annual	2020/21, 2021/22, 2022/23, 2023/24, 2024/25
Surface Water Landforms	Annual	2020, 2021, 2022, 2023, 2024
Groundwater	Biannual	2020 (Q3), 2021, 2022, 2023, 2024, 2025 (Q1)

Ecological Element: Vegetation

Objective

To detect loss of diversity—attributable to the Gorgon Gas Development—over time.

Changes to monitoring sites

There were no substantial changes to the monitoring sites during the Reporting Period.

Methodology

Survey method

- Biennial survey of vegetation monitoring transects across the three dominant habitat types ‘coastal complex and dune system’, ‘creeks and seasonal drainage lines’ and ‘limestone slopes and ridges’. Monitoring transects were established within each representative vegetation association encompassing both At Risk and Reference sites (Figure 2-2)
- Parameters comprised: percentage foliage cover (PFC); total species richness; known, suspected, or potential non-indigenous species (NIS); and plant health.

Analysis method

- An exponentially weighted moving average (EWMA) control chart approach was applied to total species richness, PFC, and plant health. A permutation-based multivariate analysis of variance was used to examine if there were differences in floristic composition and health of plants between the At Risk and Reference sites, or between years. The site type by year interaction was also tested for significance.

Results

The results of vegetation monitoring during the Reporting Period are presented in Table 2-3 and Figure 2-3 (Ref. 24).

Discussion and conclusions

Monitoring has not detected an adverse impact on total species richness, PFC, or plant health within or outside the TDF, since vegetation monitoring began in 2009 (Ref. 25). Although the management trigger levels have been reached for both PFC and total species richness in the Reporting Period, this is considered a favourable increase in +2 SD for vegetation associations C4a1, C3b1, C1c1, D5b2, L7d2 and a favourable increase in +3 SD for vegetation associations L8a4, C1c1 therefore no action was required.

During the Reporting Period, the vegetation association D5a1 exceeded the -1SD control limit for total species richness in 2021 and 2023 and the -2 SD control limit in 2025 resulting in further investigation and review. A time series chart and linear model were used to further investigate differences in total species richness between TDF, and reference transects. Results showed there were no significant differences between years or treatments (TDF and Reference) as well as no significant interaction between year and treatment for total species richness.

Vegetation health remains strongly linked to rainfall, with no distinct differences observed when comparing TDF transect data to Reference data in years of either high or low rainfall. Vegetation affected by the bushfire (caused by lightning) in October 2013 (Ref. 24) continues to progress towards a similar structure to that surveyed before being burnt (Ref. 25).

Overall results from control charts, and targeted assessment of vegetation association D5a1 suggest that TDF transects had not changed more significantly over time in comparison to the Reference transects between 2009 and 2025 with no evidence of project impacts attributable to the Gorgon Gas Development.

Figure 2-2: Vegetation Monitoring Location During the Reporting Period

Table 2-3: Vegetation Monitoring Results During the Reporting Period

Results						
Parameters	**Habitat Types**	**2021**		**2023**		**2025**
Percent Foliage Cover	**Coastal complex and dune system**	C4a1		C4a1		None
	Creeks and seasonal drainage lines	None		None		D5b2
	Limestone slopes and ridges	None		None		None
Total Species Richness	**Coastal complex and dune system**	C1c1	C3b1	C1c1	C1c1	C3b1
	Creeks and seasonal drainage lines	D5a1		D5a1	D5a1	D5b2
	Limestone slopes and ridges	L7d2	L8a4	L8a4		L8a4
Plant Health	**Coastal complex and dune system**	None		None		None
	Creeks and seasonal drainage lines	None		None		None
	Limestone slopes and ridges	None		None		None
Known, Potential or Suspected NIS	**Coastal complex and dune system**	None		None		None
	Creeks and seasonal drainage lines	None		None		None
	Limestone slopes and ridges	None		None		None
Management Triggers	**None**	Measured parameter remains in control limits.				
	Alert	Measured parameter deviates towards (but remains within) one standard deviation (1 SD) for two consecutive years or deviates outside a ±1 SD limit.				
	Review	Measured parameter deviates outside a ±2 SD limit.				
	Action	Measured parameter deviates outside a ±3 SD limit.				

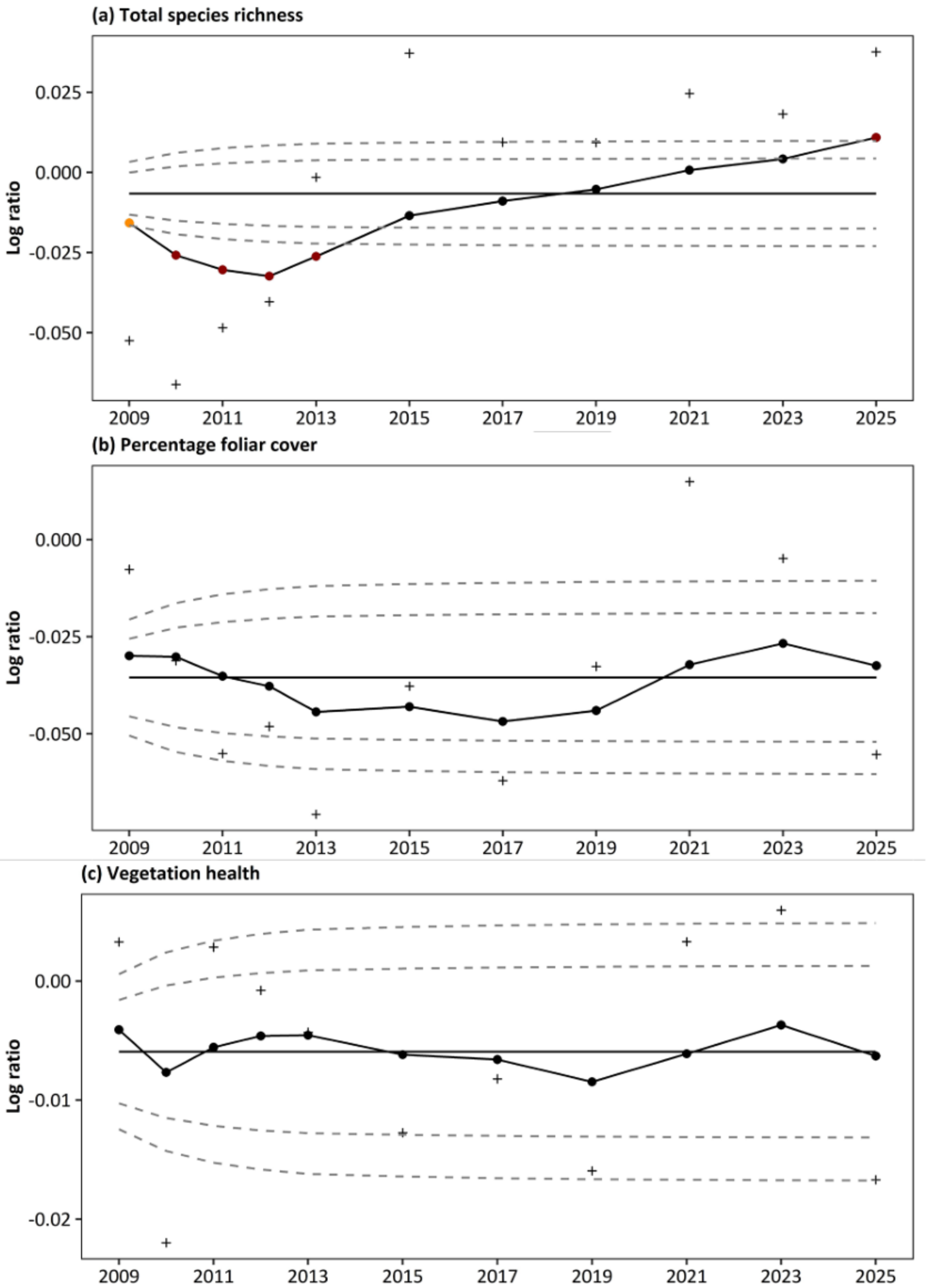


Figure 2-3: Control Charts for: (a) Total Species Richness, (b) Percent foliage Cover and (c) Vegetation Health

EWMA charts, for (a) Total species richness, (b) Percent foliage cover and (c) Vegetation health. Crosses = the calculated log response ratio metric for the ratio of the at-risk Terrestrial Disturbance Footprint population (from pooled potential impact sites) to the reference population (from pooled reference sites). Solid horizontal line = random effects estimate of all sampled seasons. First set of dotted lines from the solid line = ±1 Standard Deviation (SD) control limit. Second set of dotted lines from the solid line = ±2 SD control limit. Third set of dotted lines from the solid line = ±3 SD control limit. Control limit exceedances are highlighted in colour; Yellow dot = ±1 SD exceedance, Orange dot = ±2 SD exceedance, Red dot = ±3 SD exceedance.

Ecological Element: Fauna / habitat: White-winged Fairy-wren (Barrow Island)

Taxon, feature or species

White-winged Fairy-wren (Barrow Island) (*Malurus leucopterus edouardi*)

Objective

To detect variation in abundance—attributable to the Gorgon Gas Development and Jansz Feed Gas Pipeline—over time

Changes to monitoring sites

There were no substantial changes to the monitoring sites during the Reporting Period. Total distances surveyed varied between 219 km to 132 km and accounted for the amended TDF introduced in 2024.

Methodology

Survey method

- Diurnal distance sampling (orientated east–west across Barrow Island) to compare the densities of White-winged Fairy-wrens within the At Risk and Reference zones (Figure 2-4). Surveys were undertaken in September or October each year. The locations of observed White-winged Fairy-wrens along the transects were recorded by taking a GPS fix at each animal's approximate location.

Analysis method

- White-winged Fairy-wren observations were converted to density estimates using distance sampling software, with a truncation distance of up to 70 m applied. Changes in relative density were determined by the degree of variation observed between At Risk and Reference zones and were plotted using time-series control charts to understand trends in abundance between zones over time.

Results

The results of White-winged Fairy-wrens monitoring during the Reporting Period are presented in Table 2-4, Figure 2-5 and Figure 2-6 (Ref. 37).

Discussion and conclusions

The estimated White-winged Fairy-wren densities from 2020 to 2023 were relatively stable in the At Risk zone, whereas greater variability was shown in the Reference zone over the same time period. Stability within the At Risk zone is not unexpected given that the zone supports most of the preferred *Melaleuca cardiophylla* shrublands habitat and therefore less potential for population changes.

In 2024, whilst the density ratio remained within control, the island wide population of White-winged Fairy-Wrens was estimated to be the lowest since the monitoring program began. Several environmental factors likely contributed to the low density estimates in the monitoring period. The White-winged Fairy-wren density and abundance estimates across Barrow Island may have been in part due to the decrease in rainfall in 2023 and 2024, with rainfall being 69% below the long-term average over the 12 months preceding the survey. Additionally, localised weather conditions can also influence the detectability of White-winged Fairy-wrens. The 2024 survey recorded higher-than-usual temperatures and stronger winds compared to previous surveys, which typically leads to reduced bird activity and therefore reduced detectability and associated estimates (Ref. 37).

Overall, results indicate current White-winged Fairy-wren population estimates are within the range of historical values, and the variation in abundance is likely driven by variability in rainfall and other environmental conditions, with no evidence of impacts attributable to the Gorgon Gas Development.

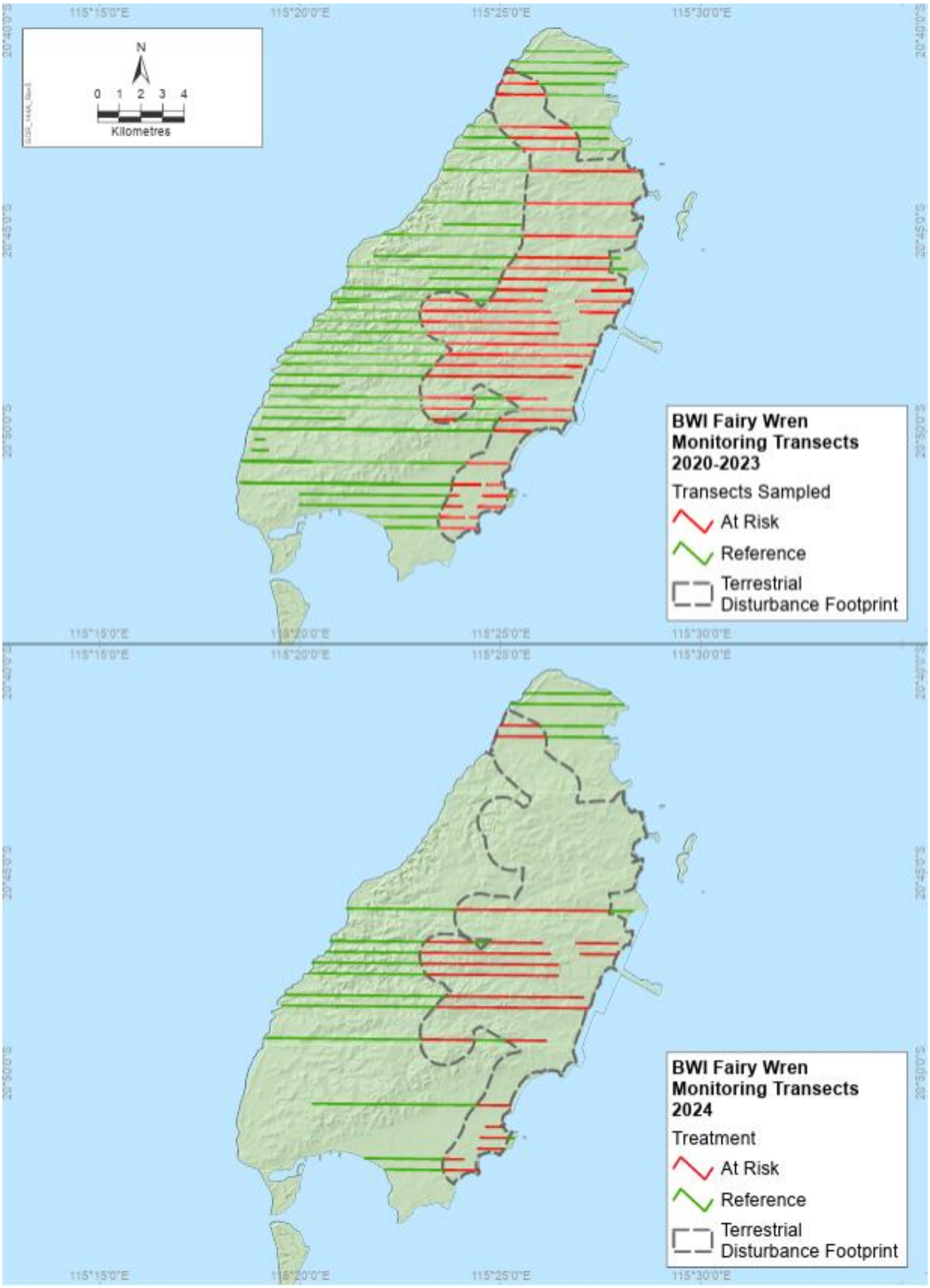


Figure 2-4: White-winged Fairy-Wren Monitoring Locations During the Reporting Period

Table 2-4: White-winged Fairy-wren Results During the Reporting Period

Results						
Parameters		**2020**	**2021**	**2022**	**2023**	**2024**
Density Estimate (ind/ha)	**At Risk**	0.31 ± 0.07	0.30 ± 0.07	0.35 ± 0.07	0.38 ± 0.07	0.17 ± 0.04
	Reference	0.12 ± 0.04	0.07 ± 0.03	0.13 ± 0.03	0.25 ± 0.07	0.12 ± 0.03
	Ratio	2.58:1	4.30:1	2.69:1	1.49:1	1.41:1
	BWI	0.20 ± 0.04	0.17 ± 0.04	0.22 ± 0.03	0.31 ± 0.06	0.14 ± 0.02
Population Estimate (individuals)	**At Risk**	3,286 ± 758	3,156 ± 720	3,655 ± 720	4,016 ± 786	1,630 ± 353
	Reference	1,688 ± 529	1,109 ± 475	1,941 ± 407	3,704 ± 1,065	1,621 ± 381
	BWI	4,487 ± 835	3,682 ± 755	4,586 ± 670	6,791 ± 1,348	3,251 ± 558
Management Triggers	**None**	Measured parameter remains in control limits.				
	Alert	Measured parameter deviates towards (but remains within) one standard deviation (1 SD) for two consecutive years or deviates outside a ±1 SD limit.				
	Review	Measured parameter deviates outside a ±2 SD limit.				
	Action	Measured parameter deviates outside a ±3 SD limit.				

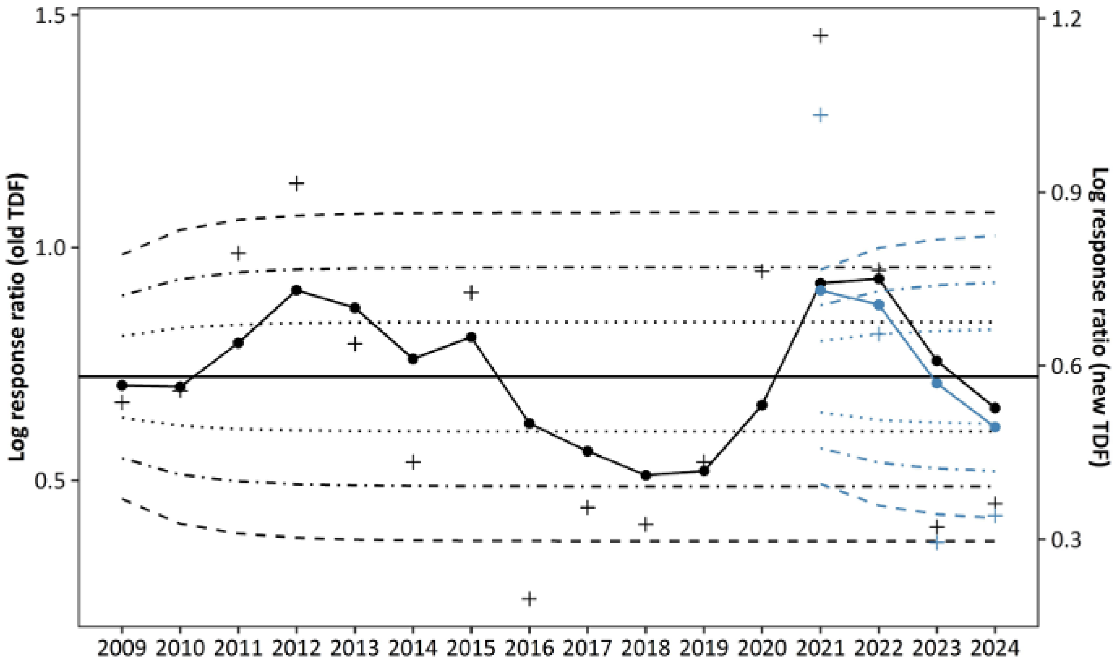


Figure 2-5: EMWA Control Chart for White-winged Fairy-wren Density at Barrow Island

EWMA control chart for White-winged Fairy-wren density using the new TDF (blue lines/points) and old TDF (black lines/points). The response variable is the log of the At Risk density/Reference density ratio.+ = log ratio of observed data. ● = smoothed standardised difference metric based on exponentially weighted three year moving average. Dotted curves represent ±1 SD, ±2 SD and ±3 SD.

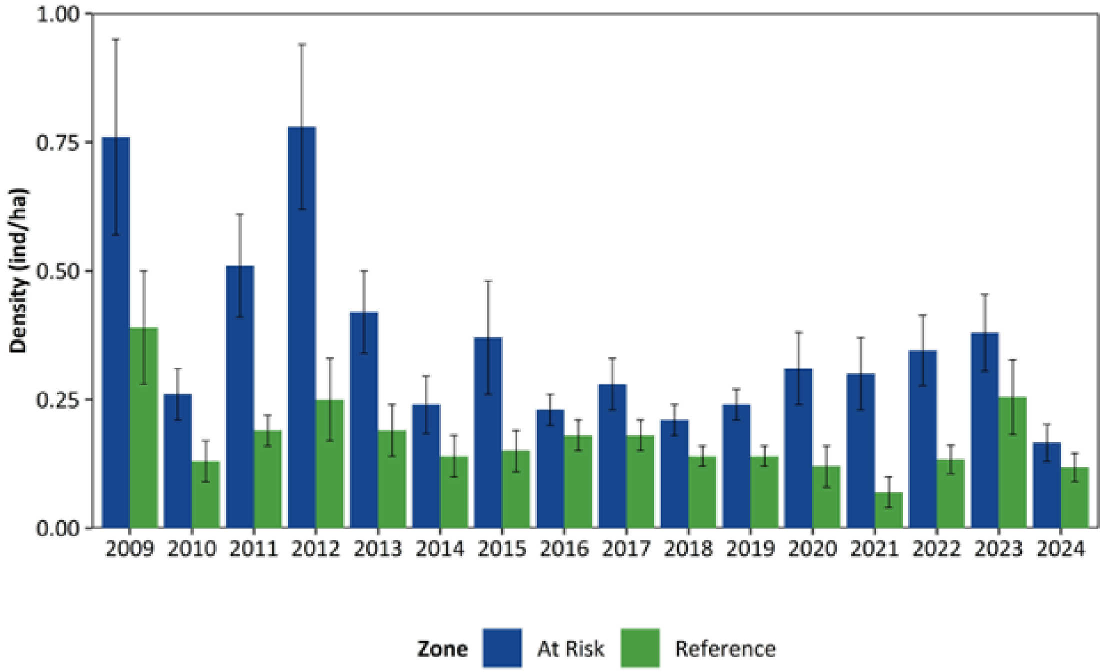


Figure 2-6: EMWA Control Chart for White-winged Fairy-wren Density at Barrow Island

Bar plot displaying the estimated density of BWI White-winged Fairy-wrens within the At Risk and Reference zone. Error bars are standard error (SE). Values for 2010 to 2023 were calculated using the old TDF; values for 2024 were calculated using the new TDF.

Ecological element: Fauna / habitat: Barrow Island Euro	
Taxon, feature, or species	
Barrow Island Euro (*Osphranter robustus isabellinus*)	
Objective	
To detect variation in abundance—attributable to the Gorgon Gas Development and Jansz Feed Gas Pipeline—over time.	

Changes to monitoring sites

There were no substantial changes to the monitoring sites during the Reporting Period. Total distances surveyed within the Reporting Period varied between 221 km to 182 km and accounted for the amended TDF introduced in 2024.

Methodology

Survey method

- Diurnal and nocturnal distance sampling walking transects were used in 2020 and 2021 with a comparative trial of a remotely piloted aircraft (RPA) thermal detection aerial survey method also used in 2021. From 2022 to 2024, RPA thermal detection aerial surveys were the sole method used for the Barrow Island Euro monitoring.
- To maintain confidence during RPA surveys, an in-field zoologist reviewed the video footage in real time to identify different target species, and where warranted, the camera zoom and height above ground level was adjusted until all animals were reliably identified. These identifications then underwent QA/QC by a zoologist reviewing recorded footage.

Analysis method

- Barrow Island Euro observations were converted to density estimates using distance sampling software, with a truncation distance of 100 m applied. Changes in relative density were determined by the degree of variation observed between At Risk and Reference zones and were plotted using time-series control charts to understand trends in abundance between zones over time.

Results

The results of Barrow Island Euro monitoring during the Reporting Period are presented in Table 2-5 and Figure 2-8 and Figure 2-9 (Ref. 38).

Discussion and conclusions

The whole island population estimate for Barrow Island Euros has been relatively stable over time, with the highest population estimates recorded over the last five years. Population models for recent years are considered reliable based on available metrics and there is growing evidence that the traditional on-ground spotlighting methods and models used before 2021 may have underestimated the population size.

In 2023, a Management Review was triggered due to an increase in both density and abundance estimates within both the At Risk and Reference zones which were relatively greater in the Reference zone. It was not clear if this was project related impact following a review of the potential stressors, consideration of changes in methods and potential natural fluctuations. The recommended outcome from the management trigger diagnosis was to continue the current monitoring program including the same transects and methodology each year for consistency to build confidence in density and abundance estimates.

The fourth highest population estimate was observed in 2024, with the dataset having a much narrower standard error confidence interval than the past three years indicating a higher confidence of these density abundance estimates (Ref. 38).

Considering island wide environmental conditions, primarily rainfall, the results from the Reporting Period suggest that monitoring has not detected an adverse impact to the Barrow Island Euro population attributable to the Gorgon Gas Development.

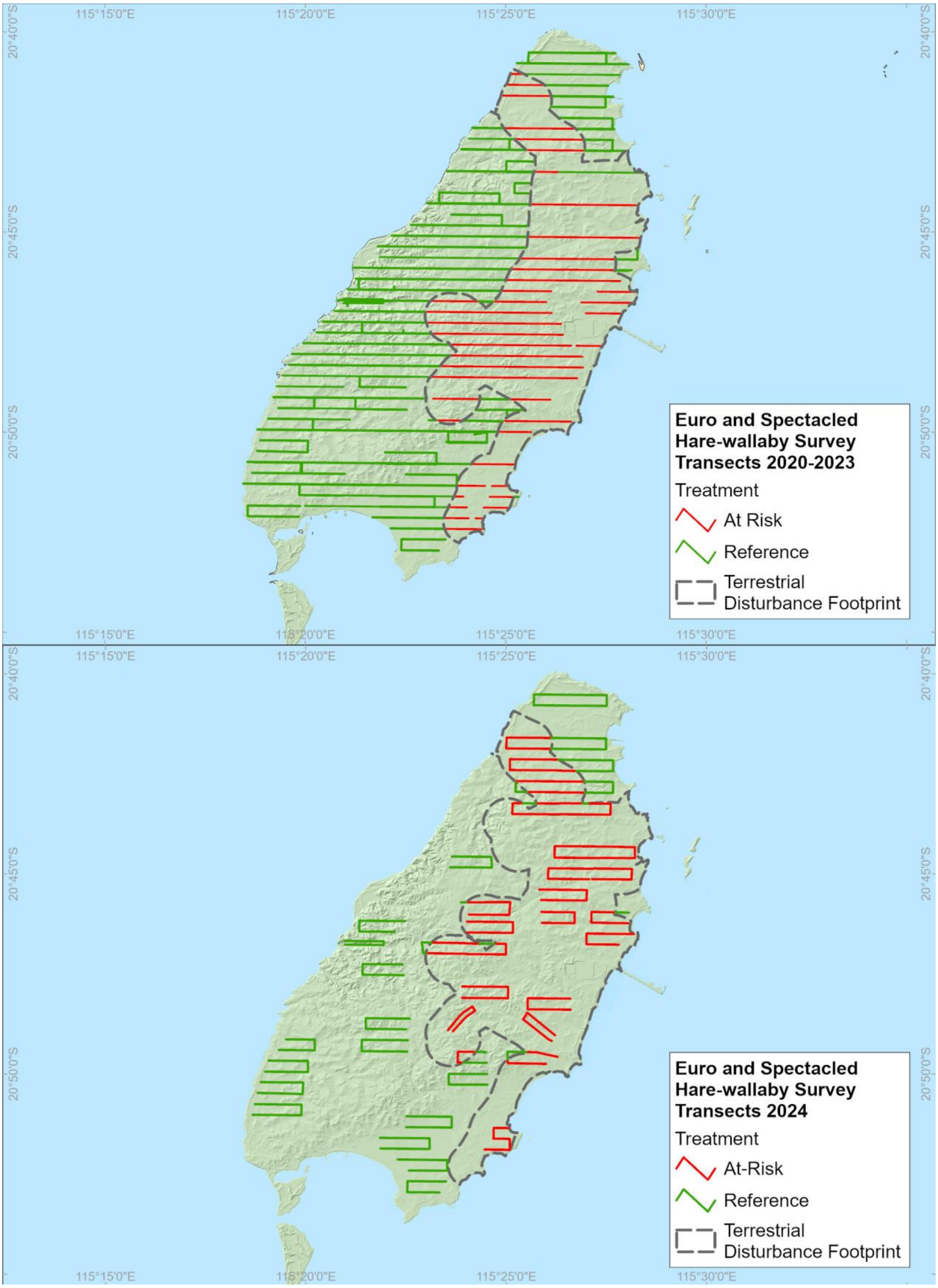


Figure 2-7: Barrow Island Euro and Spectacled Hare-wallaby Monitoring Locations During the Reporting Period

Table 2-5: Barrow Island Euro Results During the Reporting Period

Results						
Parameters		**2020**	**2021**	**2022**	**2023**	**2024**
Density Estimate (ind/ha)	**At Risk**	0.090 ± 0.033	0.06 ± 0.03	0.10 ± 0.05	0.08 ± 0.03	0.07 ± 0.02
	Reference	0.043 ± 0.055	0.09 ± 0.01	0.18 ± 0.09	0.20 ± 0.09	0.13 ± 0.03
	Ratio	0.52:1	0.67:1	0.55:1	0.40:1	0.53:1
	BWI	0.14 ± 0.03	0.08 ± 0.02	0.15 ± 0.07	0.15 ± 0.06	0.10 ± 0.02
Population Estimate (individuals)	**At Risk**	392 ± 103	659 ± 271.6	1,044 ± 547	856 ± 366	671 ± 192
	Reference	872 ± 207	1,326 ± 298.5	2,614 ± 1,310	2,968 ± 1,282	1,759 ± 379
	BWI	3,314 ± 884	1,884 ± 377	3,495 ± 1,642	3,686 ± 1,455	2,429 ± 442
Management Triggers	**None**	Measured parameter remains in control limits.				
	Alert	Measured parameter deviates towards (but remains within) one standard deviation (1 SD) for two consecutive years or deviates outside a ±1 SD limit.				
	Review	Measured parameter deviates outside a ±2 SD limit.				
	Action	Measured parameter deviates outside a ±3 SD limit.				

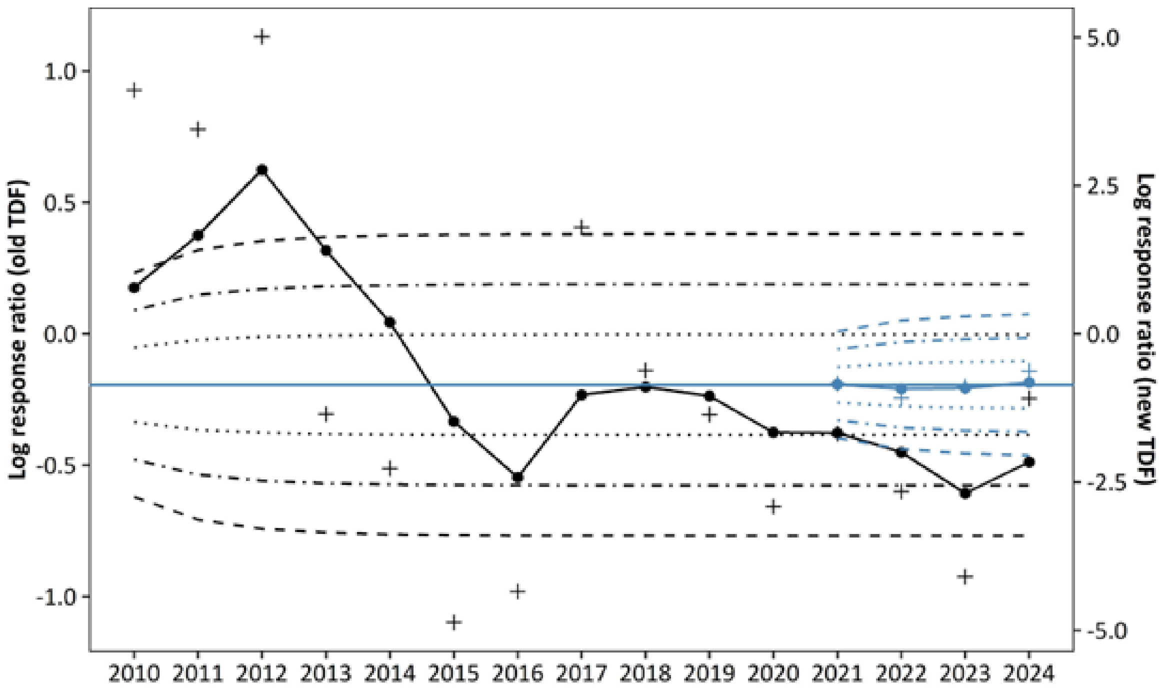


Figure 2-8: EMWA control chart for Barrow Island Euro density

New TDF = blue lines/points; Old TDF = black lines/points.
The response variable is the log of the At Risk: Reference zone density estimate ratio.
EMWA Chart: + = log ratio of observed data; • = smoothed standardised difference metric based on exponentially weighted 3-year moving average; dotted curves represent ±1 SD, ±2 SD, and ±3 SD

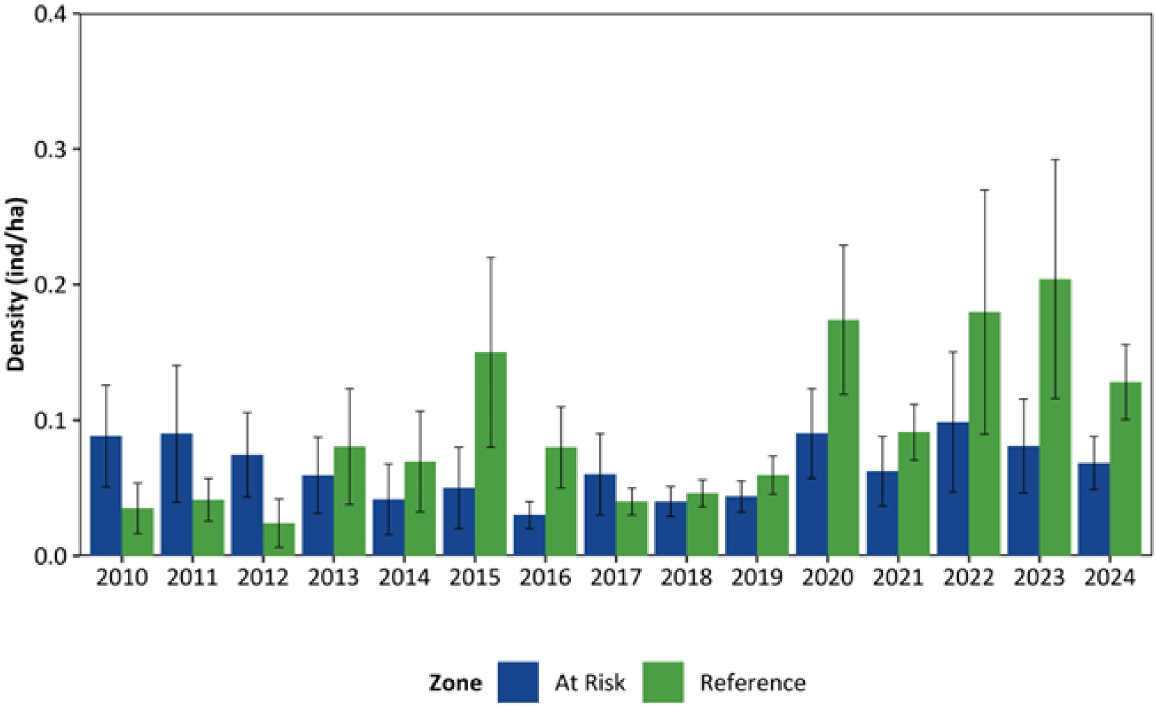


Figure 2-9: Annual estimates of Barrow Island Euro Densities within the At Risk and Reference Zones

Bar plot displaying the estimated density of BWI Euros within the At Risk and Reference zone. Error bars are standard error (SE). Values for 2010 to 2023 were calculated using the old TDF; values for 2024 were calculated using the new TDF.

Ecological element: Fauna / habitat: Spectacled Hare-wallaby (Barrow Island)	
Taxon, feature, or species	
Spectacled Hare-wallaby (Barrow Island) (*Lagorchestes conspicillatus conspicillatus*)	
Objective	
To detect variation in abundance—attributable to the Gorgon Gas Development and Jansz Feed Gas Pipeline—over time.	
Changes to monitoring sites	
Changes to monitoring sites were the same as those used for the Barrow Island Euro.	
Methodology	
The survey method and data analysis used for the Spectacled Hare-wallaby were the same as those used for the Barrow Island Euro throughout the Reporting Period (see Figure 2-7).	
Results	
The results of Barrow Island Spectacled Hare-wallaby monitoring during the Reporting Period are presented in Table 2-6, Figure 2-10 and Figure 2-11 (Ref. 39).	
Discussion and conclusions	
Accounting for the new TDF in 2024, control charts for Spectacled Hare-wallaby density have remained within control limits throughout the Reporting Period. The whole of island population estimate for Spectacled Hare-wallabies has varied considerably over the years, as has the density and abundance estimates within each zone, and although no significant trends have been found, these values have decreased since 2020. The recent decreases over the past two years might be expected due to below average rainfall, however no significant correlation between the amount of rainfall and the population estimate were found. It is suggested that the relationship is more complex in terms of population dynamics and timing of certain stages in development or recruitment which cannot be assessed with the available data (Ref. 39). There was a decrease in density and abundance estimates of Spectacle Hare-wallabies in 2024 across the whole of island and within each of the zones to the lowest recorded since monitoring began. This decrease may be similar to population dynamics that were observed around 2015 to 2016 or may also be due to the more clustered and patchy distribution of Spectacled Hare-wallabies observed in 2024 where transects surveyed did not capture as many of these ‘clusters’ as previous years (Ref. 39). Considering island wide environmental conditions, primarily rainfall, the results from the Reporting Period suggest that monitoring has not detected an adverse impact to the Spectacled Hare-wallaby population attributable to the Gorgon Gas Development.	

Table 2-6: Spectacled Hare-wallaby Results During the Reporting Period

Results						
Parameters		**2020**	**2021**	**2022**	**2023**	**2024**
Density Estimate (ind/ha)	**At Risk**	0.49 ± 0.13	0.37 ± 0.13	0.26 ± 0.08	0.12 ± 0.13	0.07 ± 0.02
	Reference	0.67 ± 0.13	0.48 ± 0.08	0.49 ± 0.13	0.20 ± 0.05	0.16 ± 0.05
	Ratio	0.73:1	0.77:1	0.53:1	0.61:1	0.43:1
	BWI	0.60 ± 0.09	0.44 ± 0.07	0.39 ± 0.09	0.17 ± 0.04	0.12 ± 0.03
Population Estimate (individuals)	**At Risk**	5,197 ± 1,362	3,922 ± 1,374	2,747 ± 873	1,300 ± 344	657 ± 170
	Reference	9,815 ± 1,829	7,046 ± 1,208	7,071 ± 1,868	2,951 ± 793	2,147 ± 620
	BWI	15,012 ± 2,280	10,967 ± 1, 562	9,818 ± 2,334	4,251 ± 908	2,804 ± 659
Management Triggers	**None**	Measured parameter remains in control limits.				
	Alert	Measured parameter deviates towards (but remains within) one standard deviation (1 SD) for two consecutive years or deviates outside a ±1 SD limit.				
	Review	Measured parameter deviates outside a ±2 SD limit.				
	Action	Measured parameter deviates outside a ±3 SD limit.				

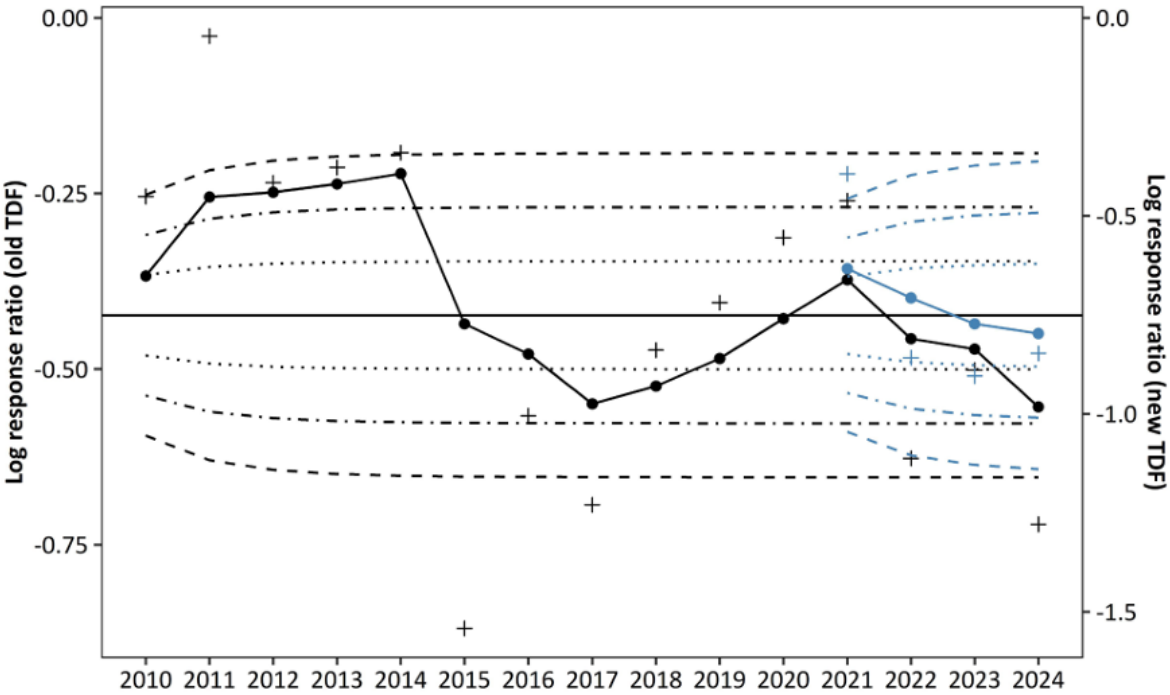


Figure 2-10: EMWA control chart for Spectacle Hare-wallaby density

New TDF = blue lines/points; Old TDF = black lines/points.
The response variable is the log of the At Risk: Reference zone density estimate ratio.
EMWA Chart: + = log ratio of observed data; • = smoothed standardised difference metric based on exponentially weighted 3-year moving average; dotted curves represent ±1 SD, ±2 SD, and ±3 SD

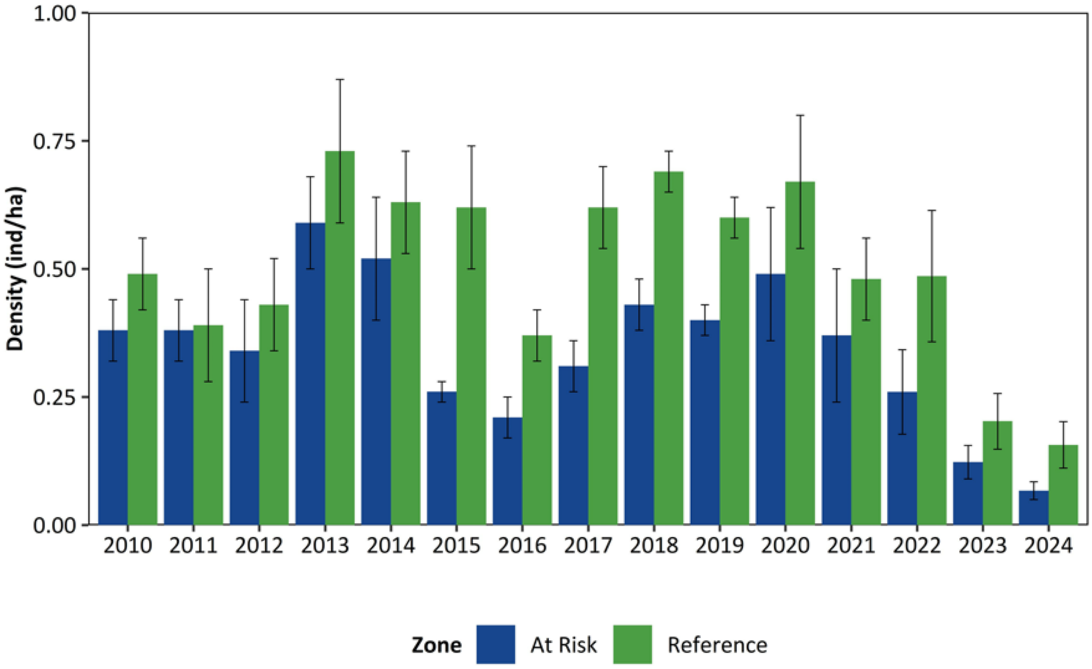


Figure 2-11: Annual Estimates of Spectacled Hare-wallaby Densities within the At Risk and Reference Zones

Ecological element: Fauna / habitat: Boodie

Taxon, feature, or species

Burrowing Bettong, Boodie (Barrow and Boodie Islands) (*Bettongia lesueur Barrow* and Boodie Islands subspecies)

Objective

To detect variation in abundance—attributable to the Gorgon Gas Development and Jansz Feed Gas Pipeline—over time.

Changes to monitoring sites

Following a review of the long-term dataset to determine optimal sampling efficacy, a reduction in trapping nights from four consecutive nights in 2019 to three consecutive nights from 2020-2024 was undertaken. All warrens sampled from 2020 had long-term sampling history, with the subset selected based on level of activity (occupancy) and where known, social connectivity. This reduction in sampling was found to maintain reliable abundance estimates with an acceptable level of precision. In 2021 an additional three warrens were added to the At Risk zone due to connectivity with existing monitored warrens so not to violate the assumption of a closed population (Ref. 42). There were no further substantial changes to monitoring sites during the remainder of the monitoring period.

Methodology

Survey method

- Annual capture-mark-recapture (CMR) sampling using baited cage traps for three consecutive nights at 25 routinely monitored warrens (15 At Risk, 10 Reference, Figure 2-12). Monitoring was undertaken in July or August each year.

Analysis method

- The CMR analyses included all capture histories from available data for the sampled warrens using a robust Huggins model design, which included a closed population component (across nights) and open population component (across years) to derive ‘at warren’ abundance estimates. Changes in relative abundance were determined by the degree of variation observed between At Risk and Reference zones and were plotted using time-series control charts to understand trends in abundance between zones over time. The 2024 CMR analyses included capture histories from 2012 to 2024.

Results

The results of Boodie monitoring during the Reporting Period are presented in Table 2-7, Figure 2-13, Figure 2-14 and Figure 2-15 (Ref. 43).

Discussion and conclusions

Following a +2SD control limit exceedance in 2023, Boodie abundance at monitored warrens deviated outside the +3 SD control limit in 2024 for the first time since monitoring began, with an increasing trend in the At Risk to Reference ratio observed since 2017. This deviation triggered a Management Review which prompted further investigation into the potential stressors and natural fluctuations. Data re-analysis showed the average change in abundance of two particular warrens may have skewed the overall ratio. The average change in abundance at At Risk warren B035 has increased significantly more than other At Risk warrens, and Reference warren B070 has decreased significantly more than other Reference sites, the majority of which have increased during the same time period. The difference between the two zones is predominantly due to the influence of the average change of abundance at these two warrens (B035 and B070). When excluding these two sites from the overall data, the average change of both zones is very similar (both positive) and the abundance ratio, over time, more stable (Ref. 43). Overall, At Risk warrens have increased in abundance in recent years with improved environmental conditions (i.e. rainfall), however Reference warrens have not exhibited the same recovery which has led to the control limit exceedance.

The survival estimates remained above the +1 SD control limit in 2024 for the second consecutive year. The EWMA metric has been increasing since 2016 due to greater increases or lesser declines in survival rate within the At Risk zone compared to the Reference zone (Figure 2-15).

Ecological element: Fauna / habitat: Boodie
Considering island wide environmental conditions, primarily rainfall, the results from the Reporting Period suggest that monitoring has not detected an adverse impact to the Boodie population attributable to the Gorgon Gas Development.

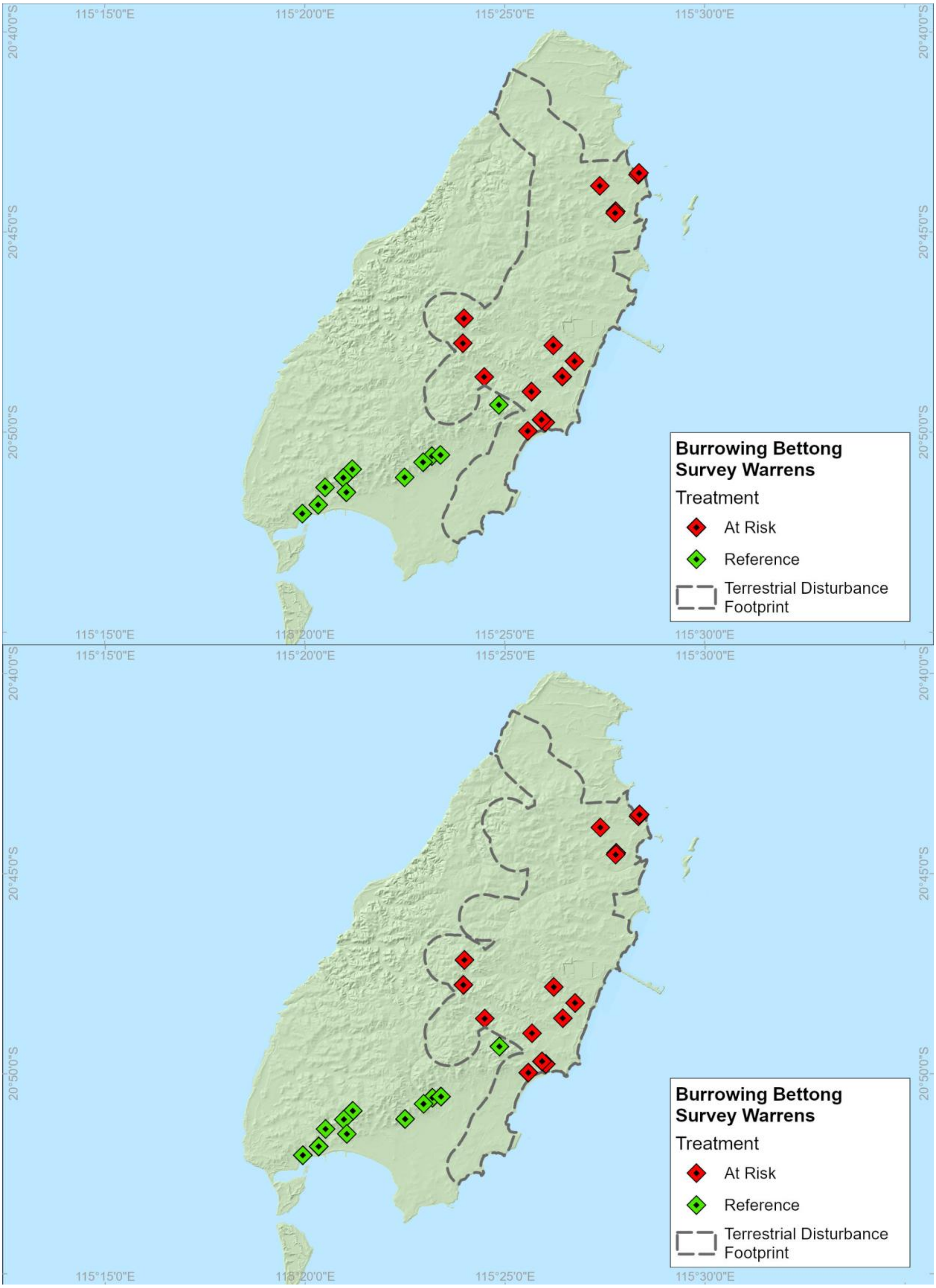


Figure 2-12: Boodie Warrens Monitored During the Reporting Period

Table 2-7: Boodie Results During the Reporting Period

Results						
Parameters		**2020**	**2021**	**2022**	**2023**	**2024**
Abundance at monitored warrens	**At Risk**	117 (110-129)	124 (118-133)	105 (98-116)	119 (113-129)	133 (128-142)
	Reference	86 (79-98)	103 (97-112)	83 (76-94)	75 (69-85)	78 (73-87)
	Ratio	1.36:1	1.22:1	1.27:1	1.59:1	1.71:1
Survivorship	**At Risk**	0.63 (0.54-0.72)	0.85 (0.73-0.92)	0.64 (0.54-0.73)	0.75 (0.63-0.84)	0.79 (0.49-0.94)
	Reference	0.58 (0.48-0.67)	0.85 (0.74-0.92)	0.65 (0.54-0.74)	0.75 (0.64-0.84)	0.70 (0.44-0.87)
	Ratio	1.09:1	1.00:1	0.97:1	0.99:1	1.13:1
Management Triggers	**None**	Measured parameter remains in control limits.				
	Alert	Measured parameter deviates towards (but remains within) one standard deviation (1 SD) for two consecutive years or deviates outside a ±1 SD limit.				
	Review	Measured parameter deviates outside a ±2 SD limit.				
	Action	Measured parameter deviates outside a ±3 SD limit.				

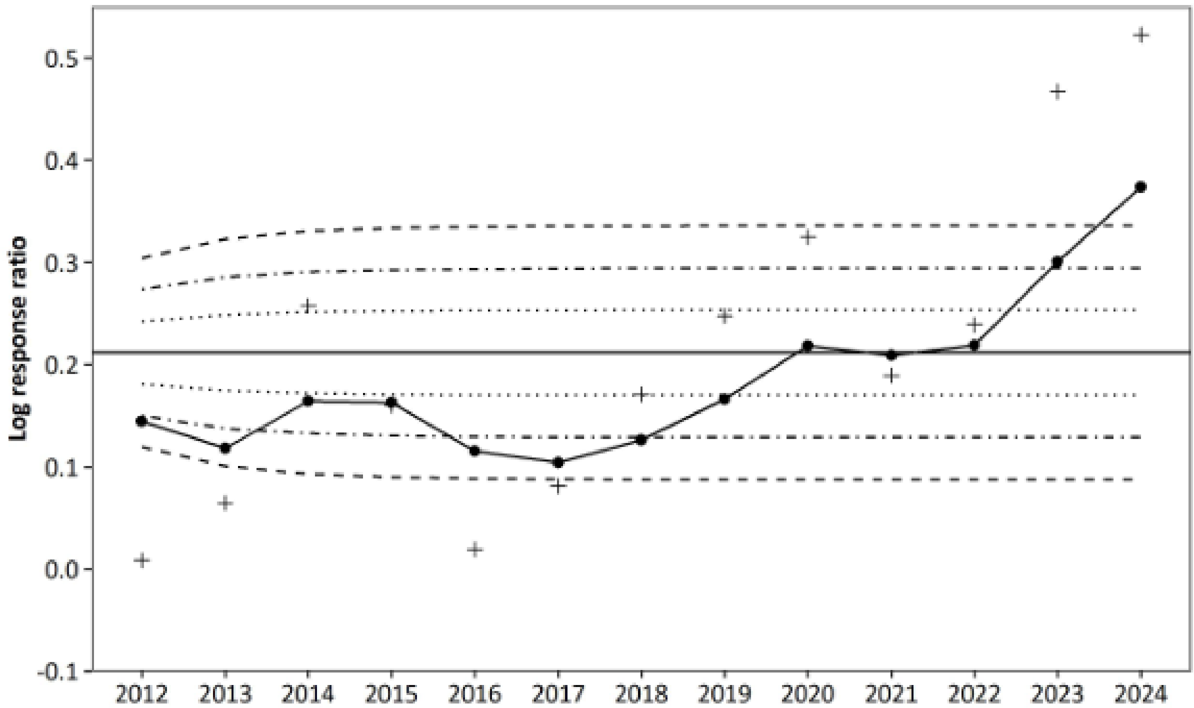


Figure 2-13: EWMA Control Chart for Boodie Population Density: Difference between At Risk and Reference Zone

EWMA control chart for Burrowing Bettong abundance at monitored warrens. The response variable is the log of the At Risk/Reference abundance ratio. + = log ratio of observed data. ● = smoothed standardised difference metric based on exponentially weighted three year moving average. Dotted curves represent ±1 SD, ±2 SD and ±3 SD.

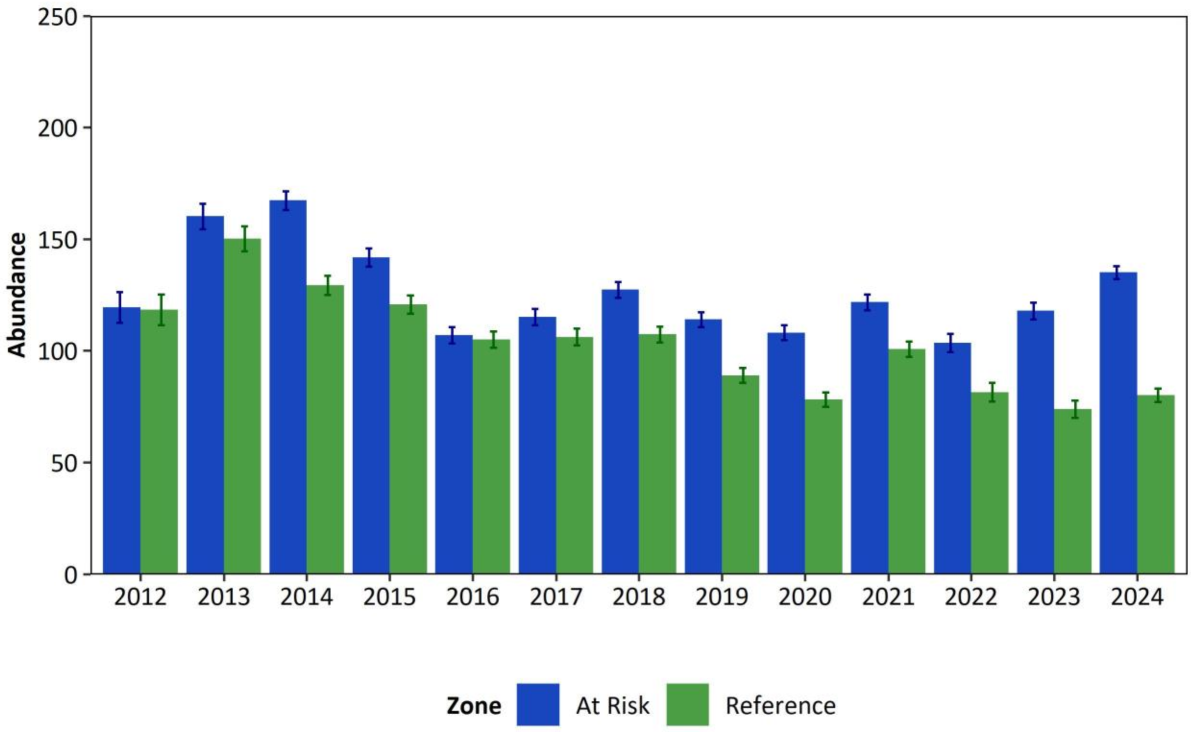


Figure 2-14: Annual estimates of Boodie Abundance at Monitored Warrens within the At Risk and Reference Zones *Bar plot displaying the estimated density of Boodies within the At Risk and Reference zone. Error bars are standard error (SE).*

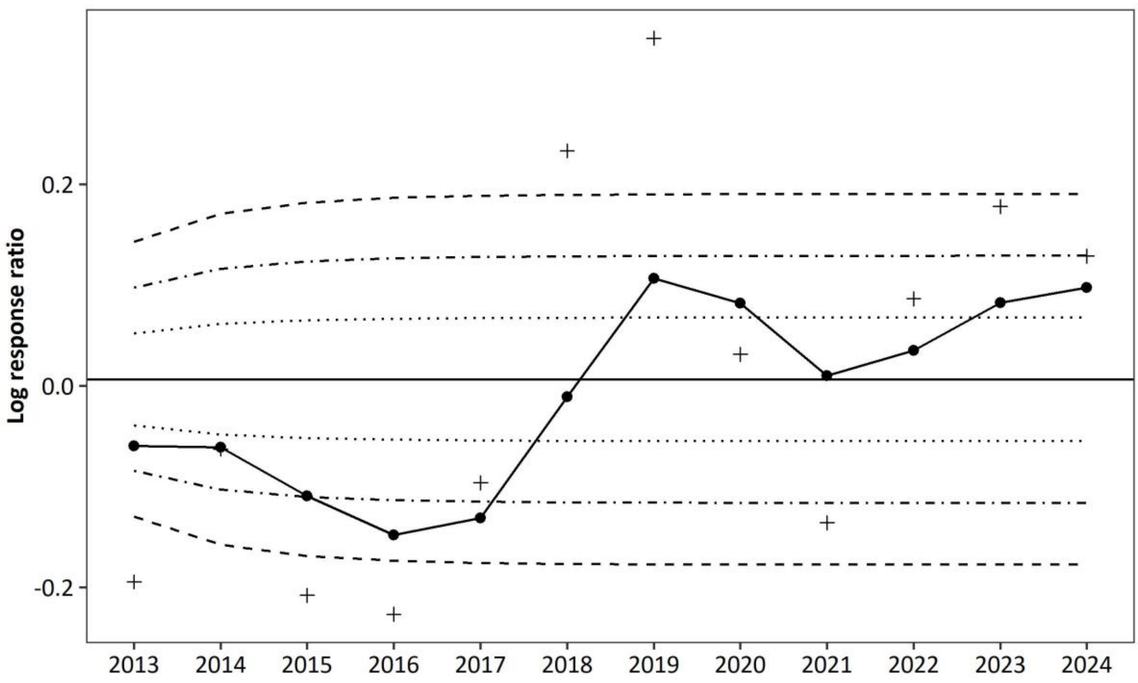


Figure 2-15: EWMA Control Chart for Boodie Survivorship: Difference between At Risk and Reference Zone

EWMA control chart for Burrowing Bettong survival rate. The response variable is the log of the At Risk / Reference ratio. + = log ratio of observed data. ● = smoothed standardised difference metric based on exponentially weighted three year moving average. Dotted curves represent ±1 SD, ±1 2SD and ±1 3SD.

Ecological element: Fauna / habitat: Barrow Island Golden Bandicoot

Taxon, feature, or species

Barrow Island Golden Bandicoot *Isoodon auratus barrowensis*

Objective

To detect variation in abundance—attributable to the Gorgon Gas Development and Jansz Feed Gas Pipeline—over time.

Changes to monitoring sites

There were no substantial changes to the monitoring sites during the Reporting Period.

Methodology

Survey method

- Monitoring of the Barrow Island Golden Bandicoot is required 'At least every five years or in response to three consecutive years above or below average rainfall'. In 2021 Barrow Island experienced three consecutive years of below average rainfall (2018, 2019 and 2020) triggering the monitoring program in 2021.
- Spatially explicit CMR sampling using baited Elliott traps at 24 trapping grid locations (12 At Risk, 12 Reference) over five consecutive nights across Barrow Island (Figure 2-16).

Analysis method

- Spatially explicit capture-recapture analyses included all available capture history data (2016, 2017 and 2021).
- Changes in relative density were determined by the degree of variation observed between At Risk and Reference zones and were plotted using time-series control charts to understand trends in abundance between zones over time.

Results

The results of Barrow island Golden Bandicoot monitoring during the Reporting Period are presented in Table 2-8, Figure 2-17 and Figure 2-18 (Ref. 40).

Discussion and conclusions

The 2021 monitoring indicated that the ratio of population densities in the At Risk to Reference zone for Golden Bandicoots is within control limits. A marked increase occurred in 2021 in the estimated density and population size of Golden Bandicoots across Barrow Island in and within both zones when compared to all previous monitoring data (Ref. 40). This is most likely a consequence of the monitoring survey intersecting a 'boom' period related to above average in the six to seven months preceding the survey, triggering breeding and reflecting the rapid response of the Golden Bandicoot to significant rainfall events.

Considering island wide environmental conditions, primarily rainfall, the results from the Reporting Period suggest that monitoring has not detected an adverse impact to the Golden Bandicoot population attributable to the Gorgon Gas Development.

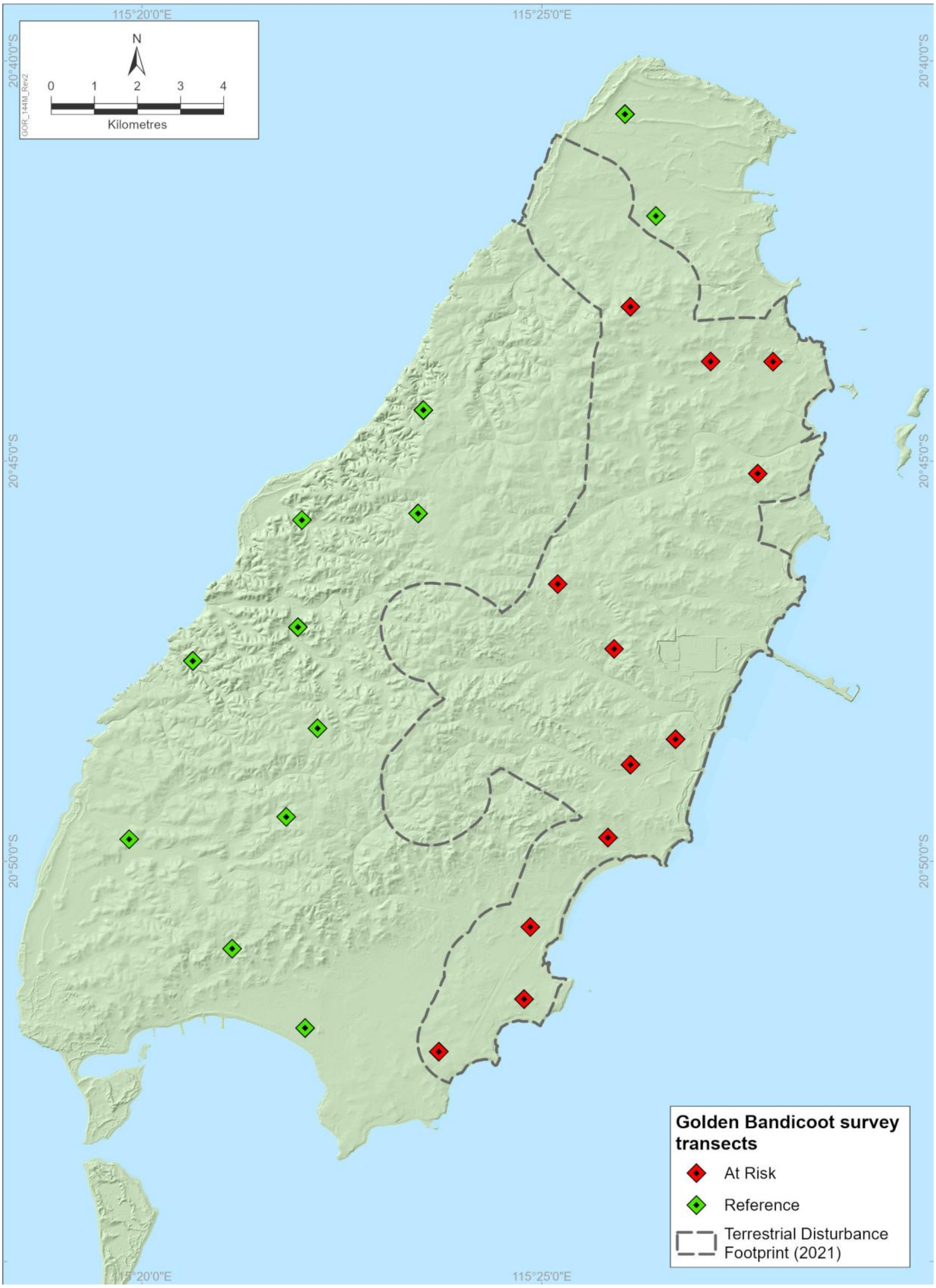


Figure 2-16: Golden Bandicoot Locations Surveyed During the Reporting Period

Table 2-8: Barrow Island Golden Bandicoot Results during the Reporting Period

Results				
Parameters		**2016***	**2017***	**2021**
Density Estimate (ind/ha)	**At Risk**	1.32 ± 0.35	2.36 ± 0.49	4.63 ± 0.27
	Reference	1.59 ± 0.45	2.79 ± 0.60	4.24 ± 0.31
	Ratio	0.83:1	0.85:1	1.09:1
	BWI	1.45 ± 0.40	2.58 ± 0.54	4.17 ± 0.21
Population Estimate (individuals)	**At Risk**	1.32 ± 0.35	2.36 ± 0.49	48,99 ± 2,857
	Reference	1.59 ± 0.45	2.79 ± 0.60	54,259 ± 3,958
	BWI	33,858	60,243	97,369 ± 4,974
Management Triggers	**None**	Measured parameter remains in control limits.		
	Alert	Measured parameter deviates towards (but remains within) one standard deviation (1 SD) for two consecutive years or deviates outside a ±1 SD limit.		
	Review	Measured parameter deviates outside a ±2 SD limit.		
	Action	Measured parameter deviates outside a ±3 SD limit.		

**2016 and 2017 Data provided for reference as only one survey was required during the Reporting Period*

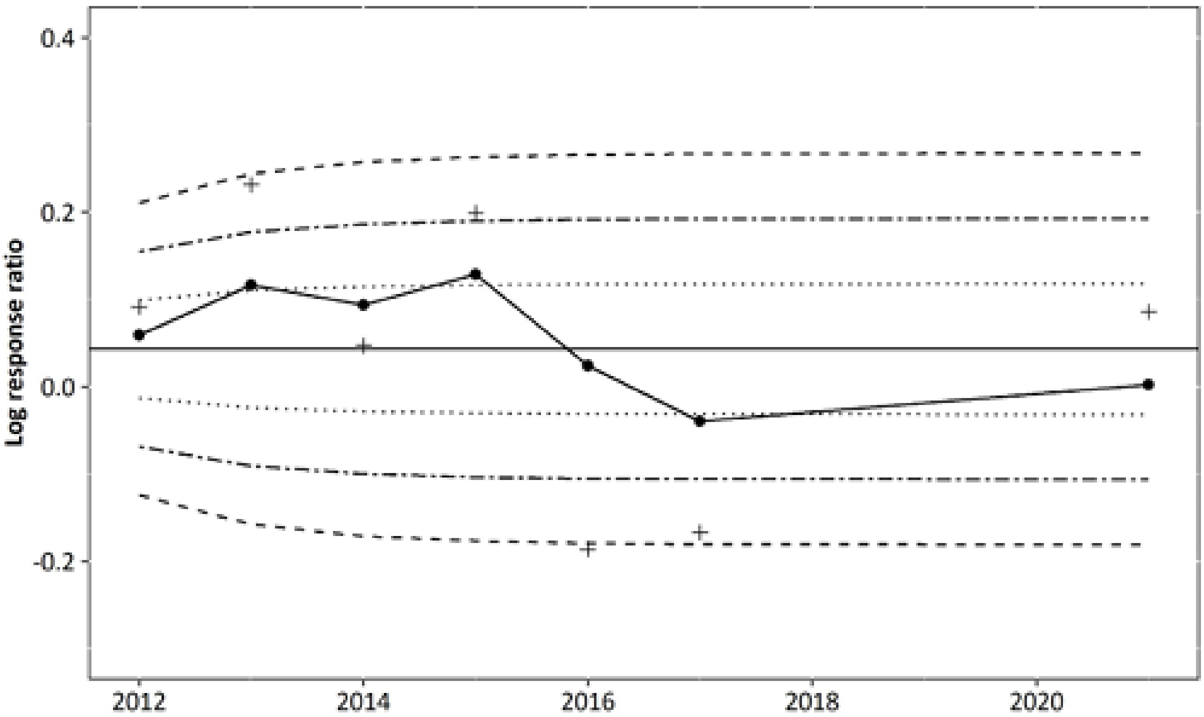


Figure 2-17: EWMA Control Chart for Golden Bandicoot Density.

The response variable is the log of the At Risk density/Reference density ratio. + = log ratio of observed data. ● = smoothed standardised difference metric based on exponentially weighted three year moving average. Dotted curves represent ±1 SD, ±2 SD and ±3 SD. Golden Bandicoots were not surveyed in 2018, 2019 and 2020.

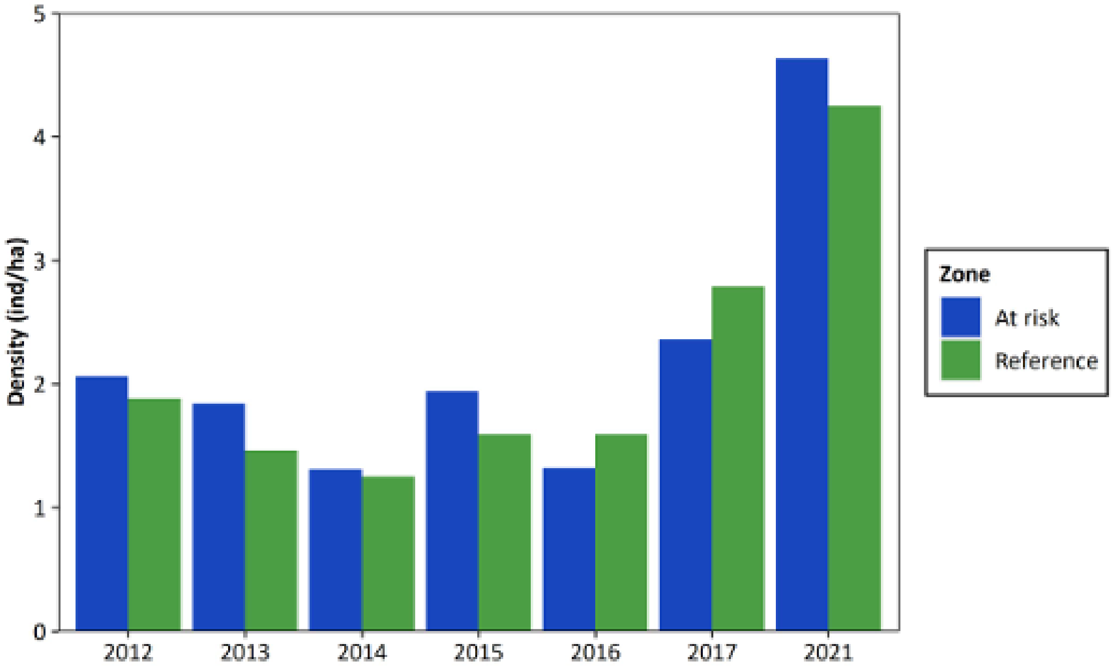


Figure 2-18: Bar plot displaying estimated density of Golden Bandicoot within the At Risk and Reference zone across all monitoring years.

Ecological element: Fauna / habitat: Wedge-tailed Shearwater

Taxon, feature, or species

Wedge-tailed Shearwater (*Ardenna pacifica*)

Objective

To detect variation in abundance and demographics—attributable to the Gorgon Gas Development and Jansz Feed Gas Pipeline—over time.

Changes to monitoring sites

There were no changes to monitoring sites during the Reporting Period.

Methodology

Survey method:

- Three fixed long-term transects (100 m × 10 m) on the At Risk island, split into Double Island North (DIN) and Double Island South (DIS), and the Reference island - Ah Chong Island (AHC) - were surveyed twice during the summer breeding season (Figure 2-19).
- For each survey, all burrows within transects were counted and their contents identified using a purpose-built burrow scope to determine breeding status. The first survey was undertaken during the early egg incubation period (November each year) to derive breeding participation estimates. The second survey was undertaken during late chick provision and just before fledging (March each year) to determine fledging success estimates (burrows that contained live, well-developed fledglings were also considered fledged).

Analysis method:

- The breeding performance metrics used for control charting were:
  - Burrow density (per 100 m^2) = total number of burrows (active and inactive) within the transects
  - Breeding participation (%) = number of breeding attempts / total number of burrows (active and inactive)
  - Fledging success (%) = number of developed chicks / number of breeding attempts derived from the first field visit.
- Changes were determined by the degree of variation observed between At Risk and Reference islands and plotted using time-series control charts to understand trends over time.
- Note: In 2023/24, Wedge-tailed Shearwater data were revised to exclude old collapsed burrow counts from breeding density and breeding participation calculations. Removing old collapsed burrow counts enabled equivalent comparisons. Old collapsed burrows represent historical information from previous seasons and are no longer a viable burrow structure that can be used by breeding birds, so were excluded from current density and participation metrics.

Results

The results of Wedge-tailed Shearwater monitoring during the Reporting Period are presented in Table 2-9, and Figure 2-20 (Ref. 24).

Discussion and conclusions

Monitoring of Wedge-tailed Shearwaters over the Reporting Period shows that most monitored breeding parameters fell within control limits with only Alert Triggers reported in 2022/23 and 2023/24. Variation in reported metrics during each annual survey is largely due to climatic conditions or habitat variability.

An El Niño event was declared in September 2023, following three consecutive years of La Niña oceanographic conditions (Ref. 28). While such climate events can cause variability in oceanographic conditions (e.g. sea surface temperature), which may influence prey distribution—and in turn affect seabird foraging efficiency and reproductive success—the El Niño conditions during the last two surveys (2023/24 and the 2024/25 season) were relatively weak compared to previous major events. As such, they did not appear to create unfavourable conditions for either breeding season (Ref. 29).

With respect to habitat variability, burrow density at DIN occurs in a predominantly rocky habitat. Rocky habitats are known to constrain burrow density, as the availability of suitable subterranean rock hollows is

Ecological element: Fauna / habitat: Wedge-tailed Shearwater
limited, and the excavation of new burrows is prevented or limited due to predominantly solid substrate. Nevertheless, burrows in rocky habitats are structurally stable and less susceptible to collapse. In contrast, monitoring transects at DIS and AHC are predominantly located in sandy habitats, where burrow density exhibits greater variability. In these more sandy and dynamic environments, burrow density fluctuates seasonally. This is because burrows need to be repaired or excavated each year, and they are more susceptible to collapse (Ref. 28). Both DIS and AHC experienced a decrease in burrow density during the 2024/25 monitoring period compared to the previous years in the Reporting Period. Notably, both islands had among the highest recorded burrow densities recorded over the previous 15 years. Burrow-nesting seabirds, such as petrels and shearwaters, are susceptible to nest loss due to rain flooding the nests and subsequent erosion or collapse. Over many years of high use, a dense colony of burrow-nesting seabirds can also compromise the structural integrity of the burrowing habitat, leading to nest collapse and the mortality of adults and juveniles. Moreover, prolonged periods of drought and low soil moisture may exacerbate burrow collapse. Vegetation and associated root systems play a crucial role in the structural integrity and stability of seabird burrows in sandy soils. Observations at both DIS and AHC indicated the presence of senescent vegetation and the collapse of older burrows within the transects. Furthermore, the 12-month rainfall deficit preceding the November 2024 survey was 66% below the long-term average and may have contributed to the observed reduction in burrow density recorded during the 2024/25 survey in sandy transects (Ref. 24). Despite the observed differences in burrow density between DIS and DIN, these did not correspond to significant variations in breeding participation beyond the long-term mean, with relatively similar participation in the 2024/25 period when compared the previous years in the Reporting Period (Ref. 24). Fledging success varied year to year both At Risk and Reference islands during the Reporting Period, particularly at DIN, though remained within control limits in all years. This metric was again low in during the 2024/25 period. Severe Tropical Cyclone Sean developed off the Pilbara Coast in January 2025, producing destructive winds, 37% above-average rainfall, with a significant cyclonic rainfall event on 20 January 2025, recording >140 mm in a single day. The combination of intense rainfall following a prolonged drought likely contributed to the reduced fledging success observed at sites with sandy substrate and burrow inundation in rocky habitats, with some burrows on DIN experiencing mud inundation (Ref. 24). The Gorgon Seabird Monitoring Program has now obtained 16 years of data on breeding metrics for the population at Double Island, in comparison with Reference sites. In the absence of baseline monitoring prior to the Gorgon Gas Development, control chart breeding performance metrics obtained from comparing At Risk with Reference sites each season have provided the most appropriate measure to detect potential impacts. There was no indication of Project-attributable impacts to Wedge-tailed Shearwater breeding parameters during the Reporting Period.

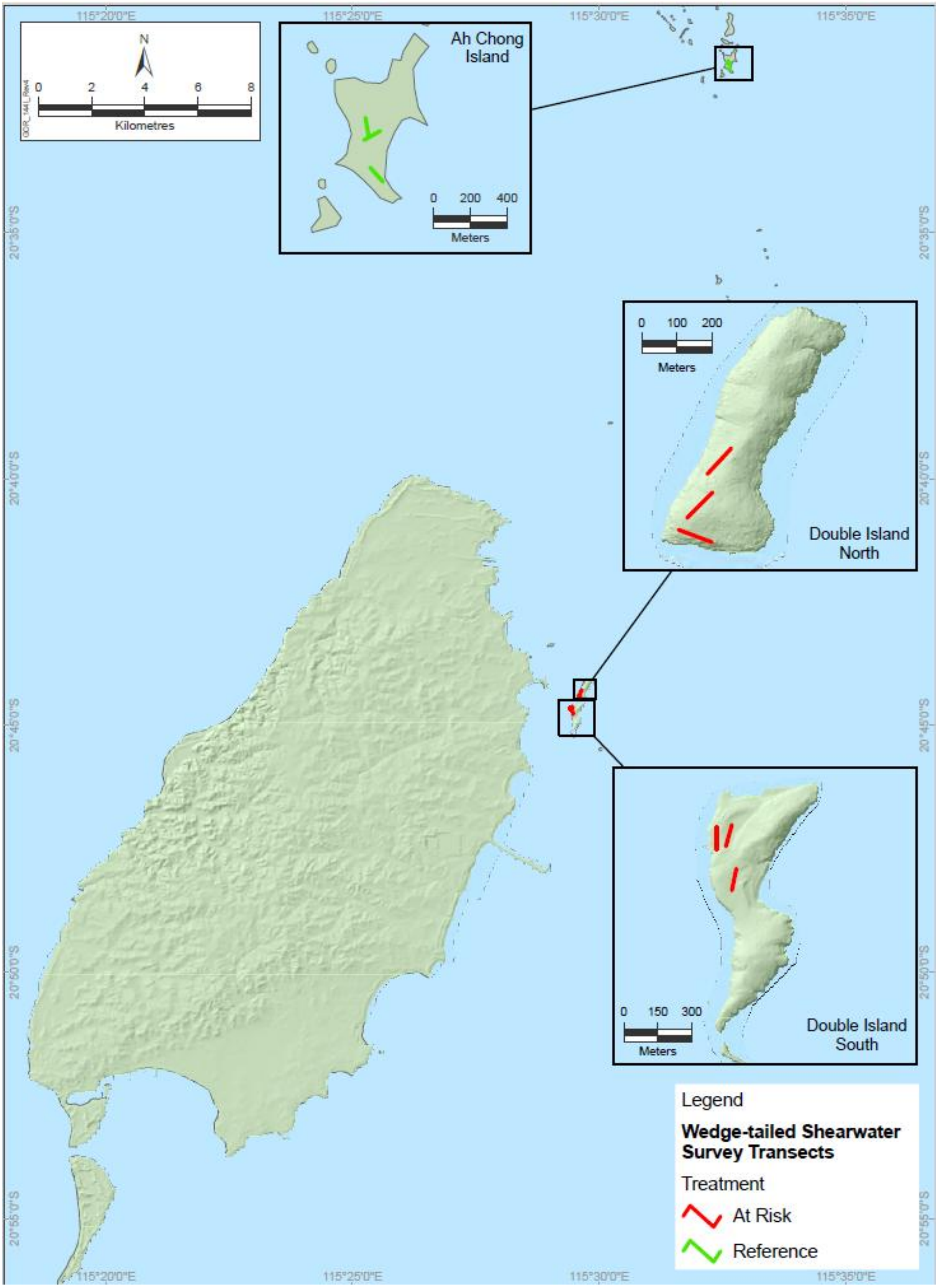


Figure 2-19: Wedge-tailed Shearwater Survey Transects for the Reporting Period

Table 2-9: Wedge-tailed Shearwater Results during the Reporting Period

Results						
Parameters		**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**
Burrow Density (nests per 100m²)	**DIS**	9.5 ± 2.9	10.1 ± 2.8	10.7 ± 2.9	9.4 ± 2.1	6.0 ± 2.2
	DIN	4.7 ± 1.7	4.8 ± 1.6	4.8 ± 1.6	4.8 ± 1.5	6.3 ± 2.5
	AHC	9.5 ± 4.2	10.4 ± 2.4	10.8 ± 2.4	9.7 ± 2.4	6.9 ± 2.2
	Ratio DIS:AHC	1.00:1	0.97:1	1.04:1	0.97:1	0.87:1
	Ratio DIN:AHC	0.49:1	0.46:1	0.49:1	0.50:1	0.91:1
Breeding Participation (%)	**DIS**	45.4 ± 11.8	41.9 ± 11.7	42.6 ± 12.0	54.4 ± 16.0	55.7 ± 14.8
	DIN	62.2 ± 5.1	55.0 ± 8.4	60.7 ± 7.3	58.7 ± 2.7	55.6 ± 14.8
	AHC	51.2 ± 4.0	43.1 ± 1.0	45.9 ± 5.0	54.7 ± 5.6	70.5 ± 4.2
	Ratio DIS:AHC	0.84:1	0.92:1	0.85:1	0.97:1	1.01:1
	Ratio DIN:AHC	1.19:1	1.31:1	1.24:1	1.08:1	0.80:1
Fledging Success (%)	**DIS**	62.0 ± 5.4	55.0 ± 7.4	56.5 ± 14.7	69.1 ± 3.5	43.2 ± 17.4
	DIN	39.6 ± 13.7	61.8 ± 15.5	26.9 ± 13.8	69.8 ± 19.2	39.3 ± 5.2
	AHC	53.9 ± 1.7	61.8 ± 6.1	61.8 ± 1.7	74.8 ± 4.0	62.7 ± 4.3
	Ratio DIS:AHC	1.15:1	0.78:1	0.92:1	0.92:1	0.74:1
	Ratio DIN:AHC	0.77:1	1.04:1	0.49:1	0.97:1	0.66:1
Management Triggers	**None**	Measured parameter remains in control limits.				
	Alert	Measured parameter deviates towards (but remains within) one standard deviation (1 SD) for two consecutive years or deviates outside ±1 SD limit.				
	Review	Measured parameter deviates outside a ±2 SD limit.				
	Action	Measured parameter deviates outside a ±3 SD limit.				

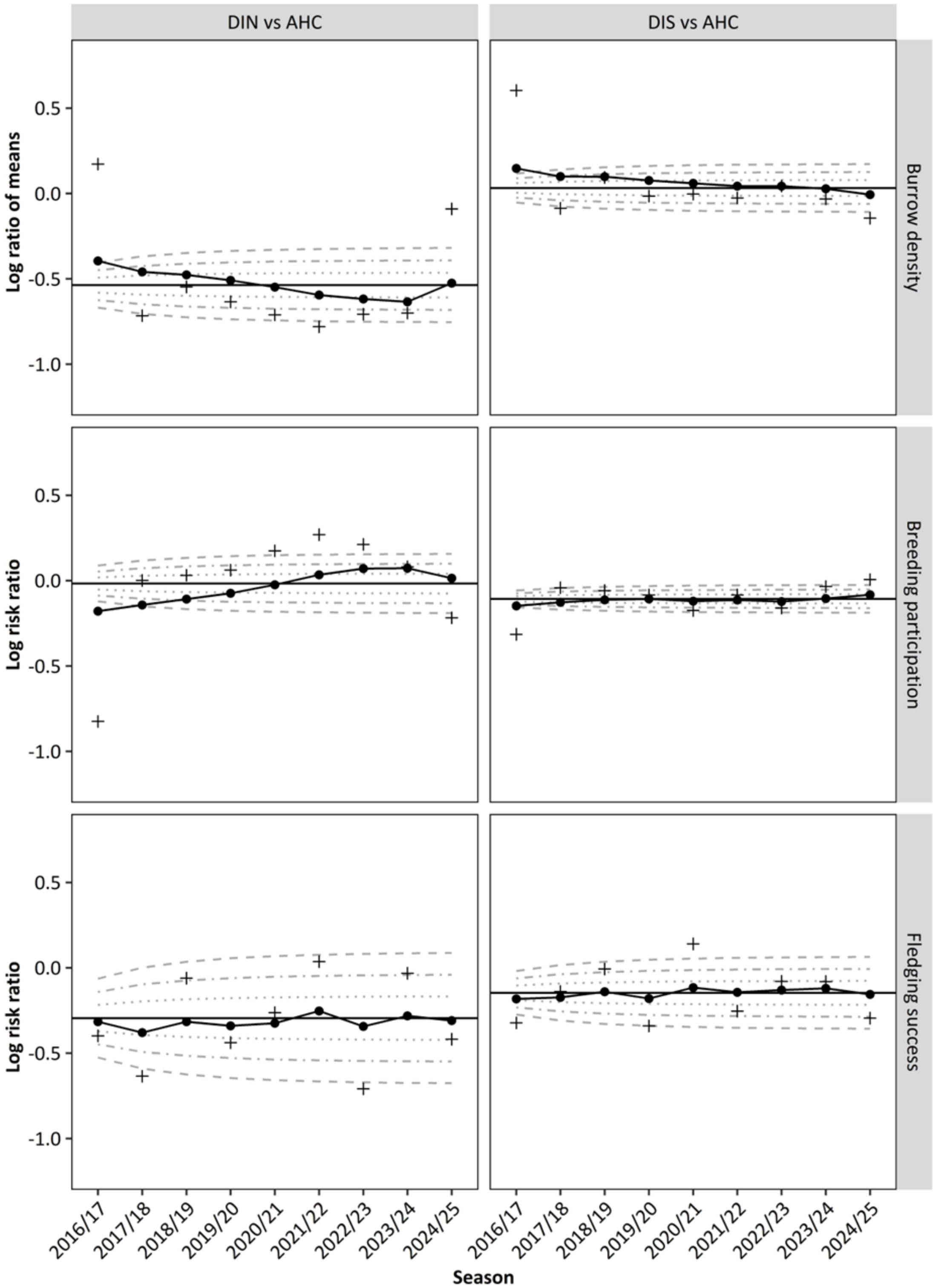


Figure 2-20: EWMA control charts for Wedge-tailed Shearwater nest density (top), breeding participation (middle), and fledgling success (bottom) between At Risk islands (Double Island - North [DIN] and South [DIS]) and Reference island (Ah Chong [AHC])

EWMA Chart: + = log response ratio metric for the At Risk population compared with the Reference population, which is then centred around the random effects estimate of all sampled seasons (= thin horizontal line); • = smoothed log response ratio metric based on an exponentially weighted 3-year moving average; dotted curves represent ±1 SD, ±2 SD, and ±3 SD. Positive values show an effect that is higher at the At Risk site compared to the Reference site, and vice versa.

Ecological element: Fauna / habitat: Bridled Tern

Taxon, species, or feature

Bridled Tern (*Onychoprion anaethetus*)

Objective

To detect variation in abundance and demographics—attributable to the Gorgon Gas Development and Jansz Feed Gas Pipeline—over time.

Changes to monitoring sites

There were no significant changes to monitoring sites during the Reporting Period. Due to field conditions (weather: temperature and rainfall) in the 2024/25 survey, there was a slight reduction in transects survey during the Breeding participation survey.

Methodology

Survey method

- Three fixed long-term transects (100 m × 10 m) on each of Double Island North, Double Island South (At Risk islands), and Parakeelya Island (Reference island) were surveyed twice during the summer breeding season (Figure 2-21).
- For each survey, all nest sites within transects were counted and their contents identified to determine breeding status. The first survey was undertaken during the early egg incubation period (January 2024) to derive breeding participation and nest density estimates. The second survey was undertaken during late chick provision and just before fledging (March 2023) to determine fledgling success estimates (either through direct sighting of a chick, or other indicators such as guano [sign of chick presence but no actual chick observed] in the nest scrape).

Analysis method

As per Wedge-tailed Shearwater monitoring.

Results

The results of Bridled Tern monitoring during the Reporting Period are presented in Table 2-10, and Figure 2-22 (Ref. 29).

Discussion and conclusions

Monitoring of Bridled Terns over the Reporting Period shows that most monitored breeding parameters fell within control limits with only Alert Triggers reported in the past three seasons. Similar to Wedge-tailed shearwaters, variation in reported metrics during each annual survey is largely due climatic conditions or habitat variability. Climatic patterns and the onset of El Niño in 2023 is described previously.

With respect to habitat variability, survey locations for Bridled Terns differ between primarily rocky habitat at Double island and sand and sparse to dense shrubs at Parakeelya island. Nest density and breeding participation variation at Parakeelya may be due to interspecific competition with Silver Gulls for nest sites beneath *Rhagodia* sp. and *Cynanchum viminale* subsp. *australe* shrubs. Gull predation of Bridled Tern eggs and chicks is typically less common than of other terns because Bridled Terns typically construct nests under protective vegetation or rocky crevices. However, as the ongoing nesting presence on Silver Gulls at Parakeelya island, coupled with the relatively open areas with sparse shrub cover in some transects, potentially makes bridled Terns more prone to Silver Gull predation. This competition is evident year to year.

Nest density was higher at all sites in 2024/25 compared to the previous surveys in the Reporting Period and has remained in control throughout the Reporting Period.

Breeding participation was higher at all three sites during the 2024/25 monitoring period compared to the previous surveys in the Reporting Period. Control charts show an increasing trend at Double island relative to Parakeelya island, and therefore +SD Alert Triggers, suggesting that the relative breeding participation increases observed at the At Risk island have been greater than those observed at the Reference island.

On 20 January 2025, Barrow Island received >140 mm of rainfall. This extreme rainfall event occurred during the peak nesting period for Bridled Terns and likely had severe impacts on egg and chick survival. The sudden

Ecological element: Fauna / habitat: Bridled Tern
influx of water may have led to nest flooding or increased exposure, both of which are known to reduce breeding success in this species. This is among the highest single-day rainfall totals recorded during the breeding season in recent years, raising concern about widespread nesting failure. Fledging success was therefore predictably lower at all three islands during the 2024/25 survey compared to the previous surveys during the Reporting Period with a notably significant reduction in fledging success at Double island South and Parakeelya island. Both sites recorded large numbers of large fledglings (referred to as runner chicks) and empty nests, indicating that breeding may have occurred earlier than expected with fledglings already leaving the nest prior to the survey. Two of the three Double Island South transects occur on steep south/ south-west facing terrain, and with the severe weather conditions experienced this may have caused wash out of nests, reducing the number of fledgling detections. With similar environmental conditions affecting all sites, control charts for fledging success at Double island South remained within the control limits for the 2024/25 monitoring period, as a result of the similar reduction in success on Parakeelya. The metric for Double Island North exceeded the +1SD limit for the 2024/25 period, although was similar to the 2023/24 monitoring period of 68.3% compared to 65.6%, this is a result of a significant relative decrease in the Reference site. The Gorgon Seabird Monitoring Program has now obtained 16 years of data on breeding metrics for the population at Double Island, in comparison with Reference sites. In the absence of baseline monitoring prior to the Gorgon Gas Development, control chart breeding performance metrics obtained from comparing At Risk with Reference sites each season have provided the most appropriate measure to detect potential impacts. There was no indication of Project-attributable impacts to Bridled Tern breeding parameters during the Reporting Period.

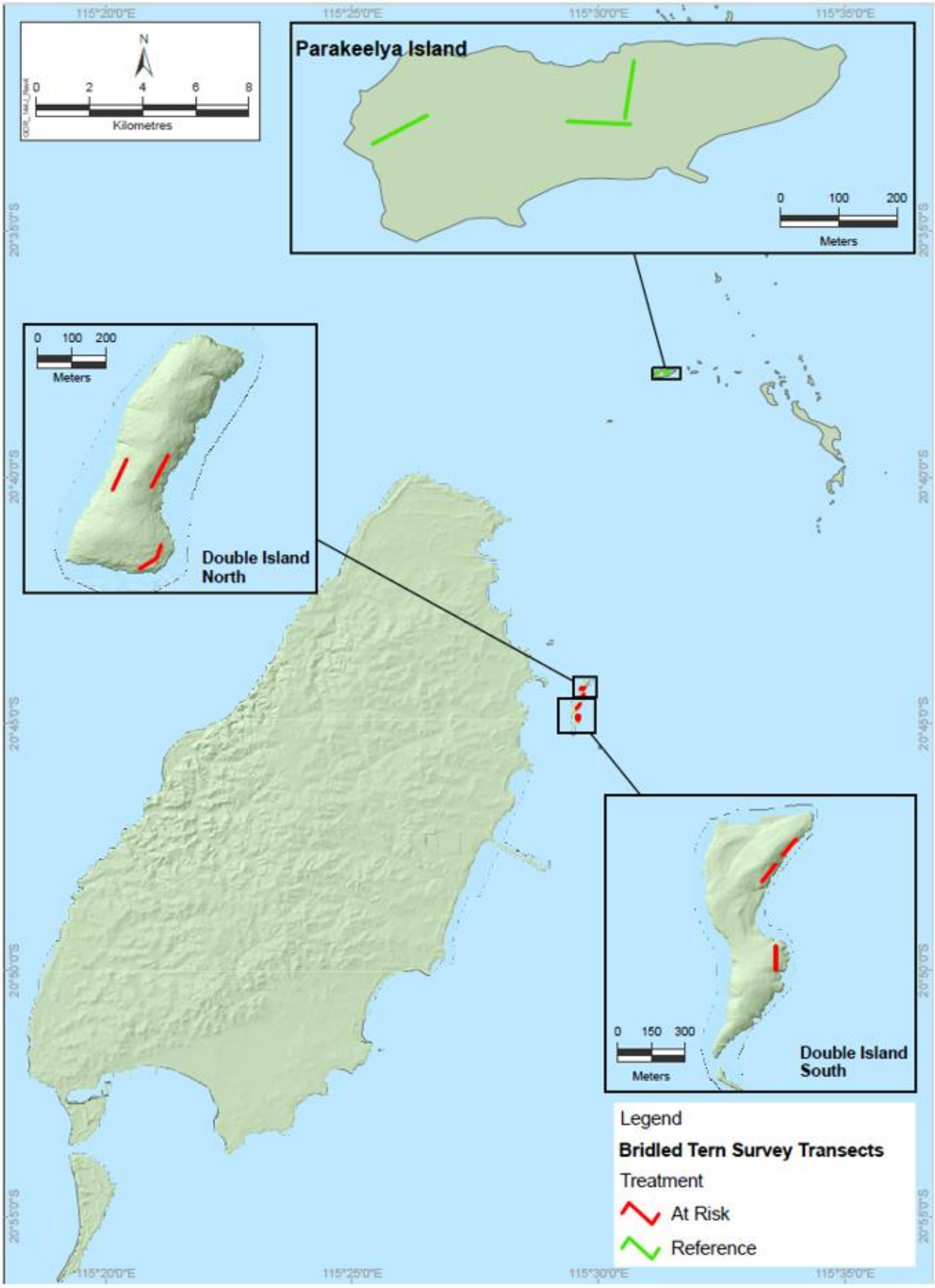


Figure 2-21: Bridled Tern survey transects for the Reporting Period

Table 2-10: Bridled Tern Results during the Reporting Period

Results						
Parameters		**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**
Nest Density (nests per 100m^2)	**DIS**	9.9 ± 2.5	9.7 ± 2.7	9.9 ± 2.7	9.9 ± 2.6	11.8 ± 1.8
	DIN	9.7 ± 1.2	9.0 ± 3.0	9.6 ± 2.1	9.0 ± 3.2	11.4 ± 1.7
	PAR	8.2 ± 0.8	8.5 ± 0.6	8.4 ± 0.8	8.2 ± 0.7	10.4 ± 1.5
	Ratio DIS:PAR	1.22:1	1.15:1	1.17:1	1.21:1	1.14:1
	Ratio DIN:PAR	1.19:1	1.06:1	1.14:1	1.10:1	1.09:1
Breeding Participation (%)	**DIS**	40.9 ± 7.5	49.6 ± 5.4	51.0 ± 11.0	48.8 ± 5.7	55.2 ± 6.5
	DIN	39.8 ± 14.2	41.0 ± 6.9	42.7 ± 13.4	41.2 ± 13.0	48.8 ± 10.7
	PAR	27.8 ± 5.4	39.9 ± 6.5	41.8 ± 6.0	39.9 ± 5.1	43.5 ± 8.8
	Ratio DIS:PAR	1.46:1	1.26:1	1.21:1	1.24:1	1.23:1
	Ratio DIN:PAR	1.44:1	1.03:1	1.08:1	1.10:1	1.15:1
Fledging Success (%)	**DIS**	79.6 ± 1.6	77.9 ± 4.1	68.1 ± 12.2	87.1 ± 3.4	43.2 ± 17.4
	DIN	70.0 ± 8.4	68.2 ± 7.6	64.5 ± 21.5	68.3 ± 10.6	65.6 ± 15.0
	PAR	88.9 ± 9.6	57.5 ± 11.0	77.2 ± 0.9	68.8 ± 7.1	5.9 ± 4.6
	Ratio DIS:PAR	0.91:1	1.35:1	0.90:1	1.25:1	3.84:1
	Ratio DIN:PAR	0.79:1	1.15:1	0.92:1	1.04:1	10.60:1
Management Triggers	**None**	Measured parameter remains in control limits.				
	Alert	Measured parameter deviates towards (but remains within) one standard deviation (1 SD) for two consecutive years or deviates outside a ±1 SD limit.				
	Review	Measured parameter deviates outside a ±2 SD limit.				
	Action	Measured parameter deviates outside a ±3 SD limit.				

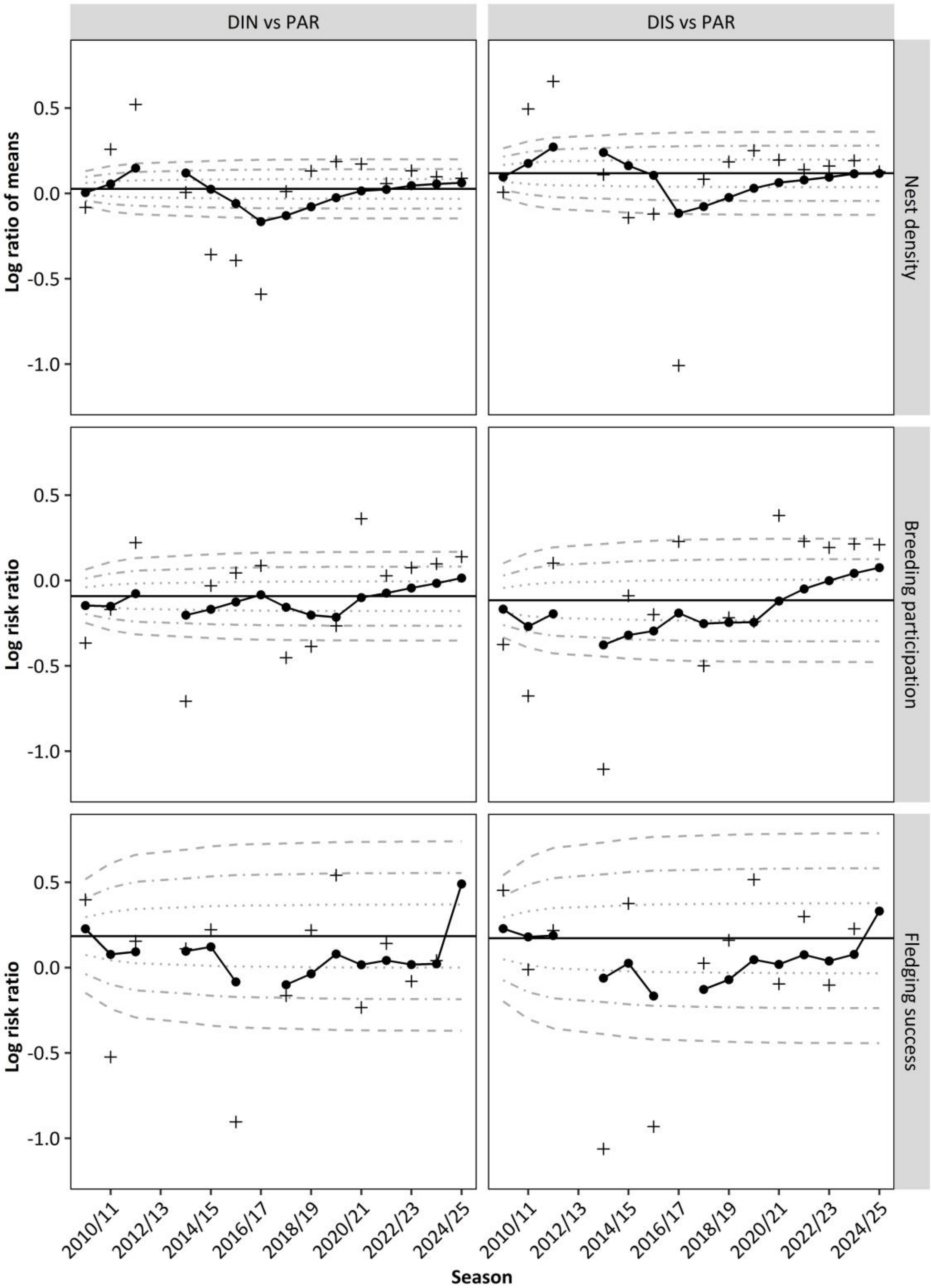


Figure 2-22: Bridled Tern EWMA control charts for nest density (top), breeding participation (middle), and fledging success (bottom), between At-Risk islands (DIN and DIS) and the Reference island (PAR)

EWMA Chart: + = log response ratio metric for the At Risk population compared with the Reference population, which is then centred around the random effects estimate of all sampled seasons (= thin horizontal line); • = smoothed log response ratio metric based on an exponentially weighted 3-year moving average; dotted curves represent ±1 SD, ±2 SD, and ±3 SD. Positive values show an effect that is higher at the At Risk site compared to the Reference site, and vice versa.

Ecological element: Groundwater / ecological communities
Taxon, feature, or species
Superficial aquifer
Objective
Collect information on groundwater levels and the physicochemical parameters of the groundwater to diagnose observed changes—attributable to the Gorgon Gas Development and Jansz Feed Gas Pipeline—over time.
Changes to monitoring sites
There was no deviation from the Gorgon GTP Groundwater Monitoring Operational Sampling Analysis and Quality Plan (SAQP) (Ref. 4) for the monitoring events between September 2020 (Q3) and August 2024 (Q3), except the adoption of an individual well pre-operations baseline value for the assessment, implemented in 2021. The latest revision of the Operational SAQP was completed in 2025 (Ref. 31), developed in accordance with the latest revision to the TSEMP in June 2024 (Ref. 32; pending approval) and the TSEPP (Ref. 33) in December 2023. Changes between the previous (2017) SAQP (Ref. 4) and the current (2025) Operational SAQP (Ref. 31) include: - Additional locations (monitoring wells) added to the program to monitor groundwater impacts associated with recently identified contaminants of potential concern at the GTP and key operational zones within the TDF (i.e., Drill Centres). Monitoring wells/locations added to the program include: one 'At Risk' well at the southern boundary of the GTP (GTP-26), one 'At Risk' well to the northeast of the GTP (TPMW06), and three wells at CO_2 injection sites (Drill Centres (DC)) DC-A (GW-CO2-03), DC-B (GW-CO2-02) and DC-C (GW-C2-01). - A narrowed analytical suite adopted for the assessment of groundwater chemistry including removal of dissolved organic carbon (DOC), major cations, major anions and total dissolved solids (TDS) from the analytical suite. During March (Q1) 2025 GME, field measured physico-chemical parameters (pH, electrical conductivity (EC) and oxidation-reduction potential (ORP) are used to assess shifts in groundwater conditions. Where a significant deviation from historical ranges is identified for the physico-chemical parameters, laboratory analysis of TDS and other parameters is completed. - The addition of PFAS (standard 28 suite) to the analytical suite for all monitoring locations (wells) at the GTP, Temporary Disposal Wells and Permanent Disposal Wells. - The addition of nutrients, including nitrate, ammonia and total phosphorus, to the analytical suite for selected monitoring wells (GTP-02A, GTP-03A and GTP-04A) located down gradient of wastewater storage and treatment areas at the GTP. From March 2025 (Q1), monitoring was completed in accordance with the current (2025) SAQP (Ref. 31).
Methodology
Monitoring frequency • During the Reporting Period, ten biannual operational monitoring events were undertaken. • Between September 2020 and August 2024, nine biannual sampling events were undertaken at the site, in accordance with the former operational SAQP (Ref. 4). • During March 2025, one sampling event was undertaken, in accordance with the current (2025) Operational SAQP (Ref. 31). **Sampling method** • Between September 2020 and August 2024, groundwater samples were collected from 18 monitoring locations, including 14 monitoring wells within the GTP, two monitoring wells near the Permanent Wastewater Disposal (PWD) wells on Road 5, and two monitoring wells near the Temporary Wastewater Injection Plant (TWIP) or Temporary Wastewater Disposal (TWD) wells. In March 2025, in addition to the above locations, samples were collected from one monitoring well at the southern boundary of the GTP (GTP-26), one monitoring well northeast of the GTP (TPMW06) and from one monitoring well at each of three CO_2 injection sites (Drill Centres) DC-A, DC-B and DC-C, for a total of 23 monitoring locations. • Samples were collected using low-flow and passive sampling techniques. • Physical parameters (including water level, pH, electrical conductivity, redox potential [ORP], dissolved oxygen [DO], and temperature) were recorded in the field. • Samples were also sent to a National Association of Testing Authorities (NATA) accredited laboratory for further analysis.

Ecological element: Groundwater / ecological communities
Sample analysis • GTP monitoring wells - shallow - Between September 2020 and August 2024 laboratory analysis was conducted for physical parameters, major cations, major anions, mercury, monoethylene glycol (MEG), methyldiethanolamine (MDEA), benzene, toluene, ethylbenzene, and xylenes (BTEX), total recoverable hydrocarbons (TRH), and dissolved organic carbon (DOC). - During March 2025 GME, laboratory analysis was conducted for physical parameters, mercury, MEG, MDEA, BTEX, TRH and PFAS. Nutrients, including nitrate, ammonia and total phosphorus, were analysed for samples from selected wells at the GTP (GTP-02A, GTP-03A and GTP-04A) only. • GTP monitoring wells – deep - Between September 2020 and August 2024 laboratory analysis was conducted for physical parameters, major cations, major anions, mercury, MEG, MDEA, and DOC. - During March 2025 GME, laboratory analysis was conducted for physical parameters, mercury, and PFAS. • Monitoring wells near PWD wells - Between September 2020 and August 2024 laboratory analysis was conducted for physical parameters, major cations, major anions, mercury, MEG, MDEA, BTEX, TRH, DOC, and nutrients. - During March 2025 GME, laboratory analysis was conducted for physical parameters, mercury, MEG, MDEA, BTEXN, TRH, nutrients and PFAS. • Monitoring wells near TWD wells - Between September 2020 and August 2024 laboratory analysis was conducted for physical parameters, major cations, major anions, BTEX, TRH, DOC, and nutrients. - During March 2025 GME, laboratory analysis was conducted for physical parameters, mercury, MEG, MDEA, BTEXN, TRH, nutrients and PFAS. • Monitoring wells at CO2 Injection sites (Drill Centres) (added to program in 2025) - During March 2025 GME, laboratory analysis was conducted for physical parameters, TRH and BTEXN. Due to a miscommunication with the laboratory, mercury analysis was not completed during this event. Mercury analysis will be completed during future monitoring events. Based on the primary analytical results, some wells were analysed for additional analyses such as TRH silica gel clean-up (SGC), polycyclic aromatic hydrocarbons (PAH), monocyclic aromatic hydrocarbons (MAH), or an additional dissolved metals suite. During March 2025 GME, where MEG and/or MDEA were detected in shallow (GTP) wells, analysis of these compounds was completed in the co-located deeper well. Also, where MDEA is detected, piperazine will also be analysed. Field and laboratory results were compared against pre-operational baseline values for each well and published water quality criteria guidelines or limits of reporting (LORs), where applicable. Changes in selected groundwater parameters are used as an indirect habitat indicator for stygofauna.
Results
GTP Monitoring Wells Analysis of results for the GTP wells indicated that parameters were generally within the range of baseline results, were not detected above the LOR, or were below assessment criteria, as outlined in the previous (2017) SAQP [Ref. 4] and the current operational (2025) SAQP [Ref. 31]), with these exceptions: – Physical parameters: Some pH, DO, salinity and ORP values were recorded outside the baseline values for each individual well during the 2020–2025 Reporting Period. DO content in GTP-01A and GTP-03A increased from ‘low’ levels during pre-operations to ‘high’ levels, with increasing levels also recorded at GTP-15A and GW05-E during 2024. A trend towards more oxidising conditions was observed at most wells during the reporting period, with changes from baseline conditions noted during one or more GME at GW05-B, GW05-E, GTP-01B, GTP-02A, GTP-02B, GTP-03A, GTP-04A, GTP-04B, GTP-15A and GTP-24A. pH levels were generally recorded within baseline ranges for each well, with some levels marginally above or below individual well baseline ranges. – Some metals were recorded outside the baseline values, but below the assessment criteria during the reporting period. Barium, copper, strontium, vanadium and zinc have been recorded at one or more wells above the baseline value but below the assessment criteria, including at GTP-01A, GTP-03A, GTP-04A/B, GTP-14A, GTP-15A, GTP-24B and GW05-B. During March 2024, hexavalent

Ecological element: Groundwater / ecological communities
chromium at GTP-04A and cobalt at GTP-15A were both recorded above assessment criteria. Metals with exceedances did not generally record significant increasing trends over this period. Mercury, TRH, BTEXN, MEG and MDEA were not detected above the respective LORs in any well during the reporting period, with these exceptions: - MDEA was recorded in 5 wells (GTP-03A, GTP-03B, GTP-04A, GTP-04B and GTP-14A) in April 2023. Review of QA/QC procedures and documents identified this was likely due to cross-contamination of one batch of samples. Subsequent sampling in August 2023, October 2023 and March 2024 did not detect MDEA in any well at the GTP. The April 2023 results were therefore considered to be anomalous and not representative of groundwater conditions at the GTP. During March 2025 GME, in addition to results discussed above, PFAS (total) were detected above the LOR in all wells at the GTP, except for GTP-03A. PFOS was detected above the NEMP 3.0 99% species protection criteria (Ref. 34) in six locations; four 'At Risk' wells (GTP-02B, GTP-04A, GTP-04B and GW05-E) and two 'Reference' wells (GTP-01B and GTP-24B). All PFOS concentrations were below the Barrow Island site-specific freshwater ecological guideline value (EGV) (99% species protection for stygofauna) of 0.031 µg/L (Ref. 35). There are no baseline values for PFAS at the GTP wells and trend analysis was not completed for PFAS concentrations at this time due to insufficient data available (only 1 dataset). ***Permanent Disposal Wells*** Analysis of results for the permanent disposal wells indicated that parameters were not detected above the LOR or were below assessment criteria (as outlined in the former operational SAQP [Ref. 4] and the current operational (2025) SAQP [Ref. 31]), with these exceptions: – Physical parameters: Since August 2017, groundwater conditions at the permanent disposal wells GW-RD5-02 and GW-RD5-03 have reported trends of reduced salinity (from saline to fresh/brackish), increased DO, and a change in anionic composition relative to historical monitoring. During this reporting period more oxidising conditions have been recorded at GW-RD5-02 and GW-RD5-03, compared to reducing or mildly reducing baseline conditions. Trends of increased DO and reduced salinity were recorded at both wells. These changes may indicate changes to aquifer conditions since operations commenced. – Elevated levels of nitrate (as N) above maximum baseline concentrations and assessment criteria have been recorded at GW-RD5-02 since April 2017. During this reporting period elevated nitrate (as N) was recorded during all monitoring events, except April 2022 when levels remained above baseline levels but were recorded below the assessment criteria. – Metal concentrations were generally below the baseline criteria for the permanent disposal wells between 2020 and 2025, except for copper, which was recorded above maximum baseline levels and assessment criteria at GW-RD5-02 in March 2021 and March 2022. Zinc and vanadium were recorded marginally above baseline but below assessment criteria during March 2021 and April 2024, respectively, at GW-RD5-02, along with hexavalent chromium which was recorded at the LOR (same value as baseline level and assessment criteria) in March 2021. Mercury, TRH, BTEXN, MEG and MDEA were not detected above the respective LORs in any well during the reporting period. During March 2025 GME, in addition to results discussed above, PFOS was detected above the LOR in one well near the PWD wells, GW-RD5-03. The concentration of PFOS was marginally above the NEMP 3.0 99% species protection criteria (Ref. 34), but below the BWI site-specific freshwater EGV (99% species protection for stygofauna) (0.031 µg/L) (Ref. 35), by three orders of magnitude. There are no baseline values for PFAS at the PWD wells. Trend analysis was not completed for PFAS concentrations at this time due to insufficient data available (only 1 dataset). ***Temporary Disposal Wells*** Analysis of results for the temporary disposal wells indicated that parameters were generally within the range of baseline results, were not detected above the LOR, or were below assessment criteria, as outlined in the SAQP [Ref. 4] and the current operational SAQP [Ref. 31]), with these exceptions: – Physical parameters: Dissolved oxygen (DO) was recorded as 'low' at DWDB1-MW2 during September 2020, a decrease from the baseline level ('high'). More oxidising conditions were recorded, compared to baseline, at DWDB2-MW3 in March 2021 and March 2025, at DWDB1-MW2 in August 2023, and in both wells in August 2021 and September 2024. – Nitrate (as N) was recorded above baseline levels and assessment criteria at DWDB1-MW2 during all monitoring events, except March 2022, March 2024 and March 2025. Elevated levels of nitrate (as N) at DWDB2-MW3 were recorded above the criteria but within baseline levels during all GMEs,

Ecological element: Groundwater / ecological communities
except July 2022, where baseline levels were also exceeded. Ammonia was recorded above baseline levels but below assessment criteria in both wells in March 2024 and March 2025. – TRH >C16-34 (F3 fraction) was detected above the LOR (as assessment criteria) but below baseline levels at DWDB1-MW2 during all monitoring events except March 2021, July 2022 and March 2025. Further investigation of detected concentrations using TRH-silica gel clean up analysis indicated that the hydrocarbons were not of petrogenic origin, therefore no further actions were taken. – Metals detected in the temporary disposal wells at concentrations exceeding baseline levels and assessment criteria during the reporting period include barium at DWDB1-MW2 during April 2023, August 2023 and March 2024, and at DWDB2-MW3 during August 2023. Strontium was recorded above baseline levels but below assessment criteria at DWDB1-MW2 during April 2023 and at both wells in August 2023 and exceeded both baseline levels and assessment criteria at DWDB1-MW2 in March 2024. The results for barium and strontium were all within the same order of magnitude when compared to baseline concentrations, therefore, no further management action was taken. Hexavalent chromium was detected above the assessment criteria but within baseline levels at DWDB1-MW2 during March 2024. - BTEXN was not detected above the LOR during any monitoring event. During March 2025 GME, in addition to results discussed above, PFAS were detected above the LOR in one well near the TWD wells; DWDB2-MW3. The concentration of PFOS marginally exceeded the NEMP 3.0 99% species protection criteria (Ref. 34) but was below the BWI site-specific freshwater EGV (99% species protection for stygofauna) (0.031 µg/L) (Ref. 35) by three orders of magnitude. There are no baseline values for PFAS at the TWD wells. Trend analysis was not completed for PFAS concentrations at this time due to insufficient data available (only 1 dataset). ***CO2 Injection Site Wells (Drill Centres)*** Groundwater monitoring at three drill centre wells (at DC-A, DC-B and DC-C) were recorded for the first time as part of the TSEMP monitoring program in March 2025, in accordance with the latest revision of the operational SAQP (Ref. 31). Pre-operational baseline levels for relevant parameters recorded at these locations are not available. An operational baseline level data set will be developed for these monitoring locations over the first 4 monitoring events. The analytical suite at each of the drill centre locations includes physical parameters, mercury, TRH and BTEXN. Due to a miscommunication with the laboratory, mercury analysis was not completed during the March 2025 GME. Mercury analysis will be completed for these three well locations for future monitoring events. Analysis of results for the drill centre locations during March 2025 GME included the following: - Dissolved oxygen was very low at each location, indicating anoxic conditions at each well. pH was neutral at each location and salinity was low to moderate, indicating brackish conditions. Ammonia concentrations ranged from 0.05 mg/L (GW-CO2-03) to 0.78 mg/L (GW-CO2-02). Nitrate (as N) was below the LOR (0.01 mg/L) at GW-CO2-01 and ranged up to 3.3 mg/L at GW-CO2-03. Total phosphorus exceeded the generic assessment level at GW-CO2-02 and GW-CO2-03. – TRH and BTEXN were not detected above the LOR at any monitoring location.
Discussion and conclusions
• Groundwater monitoring (9 events) during the Reporting Period of September 2020 (Q3) to August 2024 (Q3), is considered to have been completed in accordance with the TSEMP (Ref. 1). The latest revision of the Operational SAQP (Ref. Y) was completed in 2025 and was developed in accordance with the recent revisions to the TSEMP (Ref. 32; pending approval) and TSEPP (Ref. 33). One monitoring event (March 2025) was completed in accordance with the current operational SAQP (Ref. 31). • Monitoring near the GTP, permanent, and temporary disposal wells has generally indicated that no significant observable changes to groundwater attributable to the Gorgon Gas Development have occurred during the Reporting Period, except at GW-RD5-02 and GW-RD5-03 (permanent disposal wells), which reported increased DO and decreased salinity compared with pre-operations monitoring. It is uncertain whether the observed changes in groundwater conditions are attributable to the operation of the LNG Plant or other factors. • Elevated nitrate concentrations, above baseline levels and assessment criteria, recorded at GW-RD5-02 since operations commenced in 2017 remained elevated during this reporting period. In accordance with the management triggers outlined in Figure 4-2 of the TSEMP (Ref. 1), review of the risk to ecological elements (e.g., groundwater and stygofauna) was undertaken. Despite recorded levels being above baseline for this monitoring location, recently published technical guidance from the Australia and New Zealand Guidelines for Fresh and Marine Water Quality (Ref. 36), suggests that the toxicity of nitrate and impacts to the ecological elements may be largely buffered by the increased hardness of the groundwater at this location. Further review of the data also indicated that nitrate concentrations recorded at GW-RD5-

Ecological element: Groundwater / ecological communities
03, downgradient monitoring well located further east towards the marine environment, have been below the assessment criteria during the operational period suggesting the elevated nitrate is likely localised. • In accordance with the latest revision of the Operational SAQP (Ref. 31), PFAS was analysed at monitoring locations at the GTP, permanent and temporary disposal wells in March (Q1) 2025. PFAS were detected above the LOR at one or more monitoring wells at each site. PFOS concentrations did not exceed the site-specific assessment criteria developed for the protection of stygofauna (Ref. 35) and therefore no further management action has been taken.

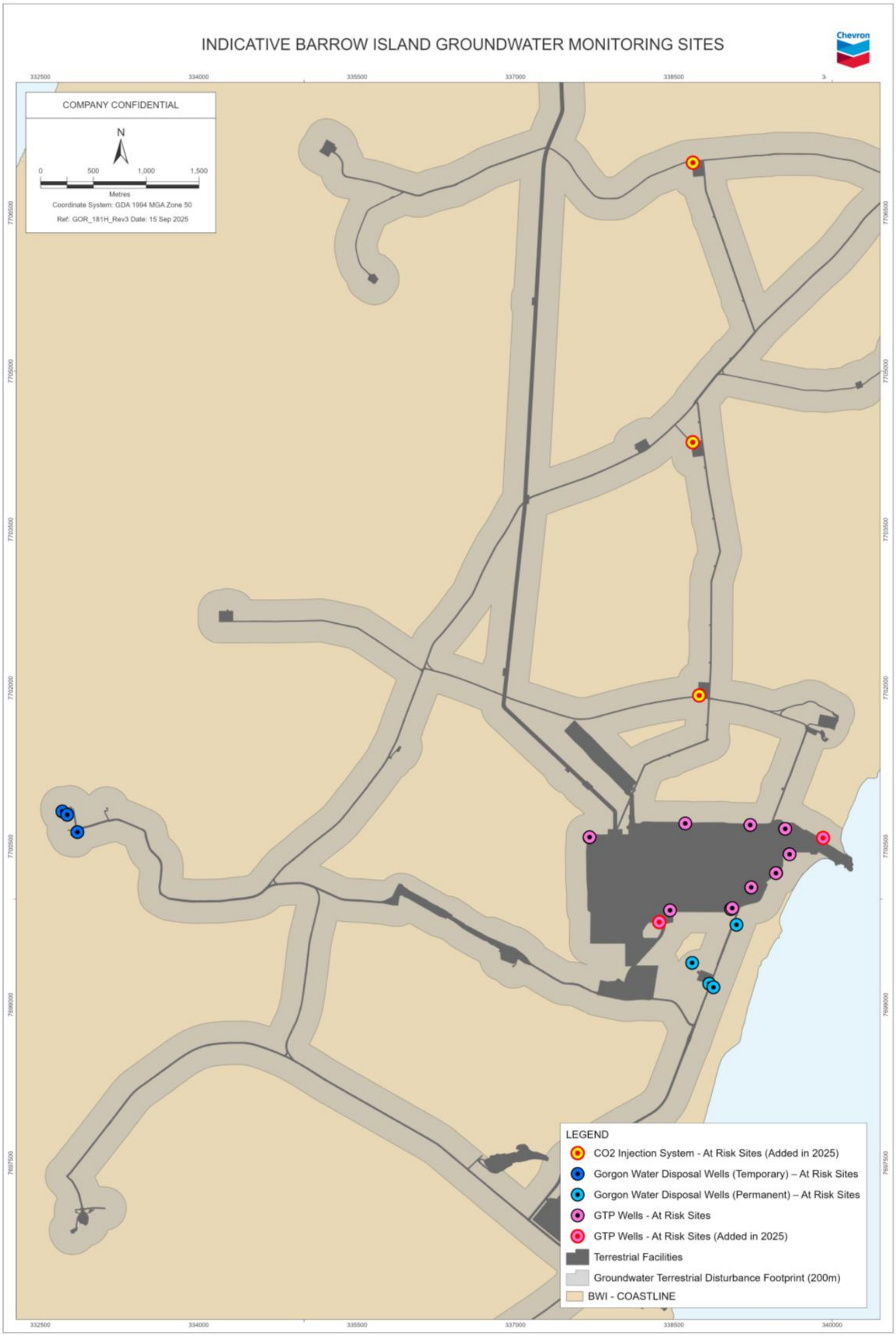


Figure 2-23: Groundwater monitoring sites

Ecological element: Surface water landforms

Taxon, feature, or species

Geomorphological profile of drainage lines and claypans

Objective

To detect impacts to surface water landforms—attributable to the Gorgon Gas Development and Jansz Feed Gas Pipeline—over time.

Changes to monitoring sites

There were no changes to monitoring sites during the Reporting Period. All 14 sites were transitioned to direct field inspection in 2020 after two or more years had elapsed since clearing or earthworks, and remote sensing had not identified any Project-related impacts (Figure 2-16).

Methodology

- Detecting changes to surface water landforms at risk of erosion or sedimentation is undertaken annually using remote sensing (aerial imagery) and/or direct field inspection of Reference sites (upstream of the disturbance, e.g. road, pipeline right-of-way) and At Risk sites (downstream of the disturbance) or by direct field inspection after heavy or cyclonic rainfall.
- A review of aerial imagery was undertaken, comparing imagery captured in October 2023 and October 2024 (Ref. 50). Year to year comparisons were previously undertaken for 2020-2023 and reported in annual EPRs.

Results

Year to year rainfall records for the Reporting Period varied with March to May 2021 receiving considerably higher than average rainfall (>320 mm combined), as did May 2022 (>250 mm), and December 2024 and January 2025 (>380 mm combined) (Ref. 45).

Following these rainfall events, no significant erosion or sedimentation was observed at any of the 14 monitoring sites via aerial imagery. There were no areas of significant impact to surface water landforms identified through desktop analysis or field inspection.

Discussion and conclusions

Monitoring to date has not detected an adverse impact, attributable to the Gorgon Gas Development, to any surface water landform monitoring locations.

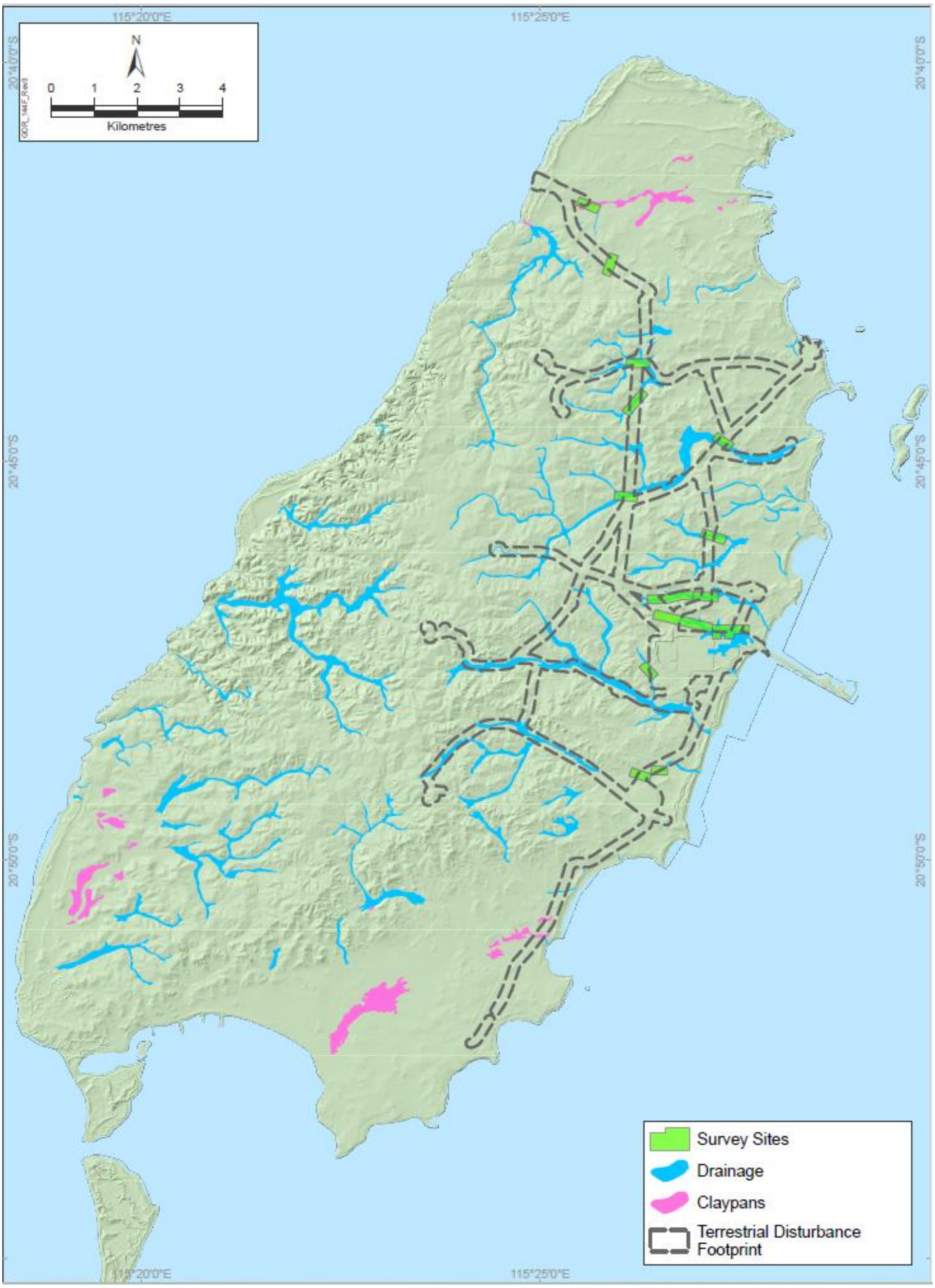


Figure 2-24: Surface water landforms sites surveyed for the Reporting Period

2.3 Event Data

The Threatened or Listed fauna reporting undertaken during the Reporting Period is summarised in the following table.

Event data: Threatened or Listed fauna reporting
Reporting requirement
Threatened or Listed fauna cared for, injured, or killed within the TDF
Results
Table 2-11 lists the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and WA *Biodiversity Conservation Act 2016* (BC Act) Threatened or Listed fauna injured or killed during the Reporting Period both within and outside the TDF. This includes where the cause was either attributed to the Gorgon Gas Development or listed as unknown. No threatened or listed fauna were cared for[1] during the Reporting Period.
Fauna interaction: Management initiatives, activities, and improvements
• A comprehensive awareness campaign was undertaken during the Reporting Period to highlight operational risks to fauna and reinforce reporting commitments, in the form of site notices, toolbox talks, and attendance of ecologists and environmental specialists at prestart meetings. • Maximum vehicle speed limitations, of 40km/h between sunrise/sunset, continue to be in effect. This is the period of higher risk of fauna / vehicle interactions. • Vehicle speed limit reductions (to 40km/hr) continue to be applied during and following rainfall events, to reduce risk of impacts to fauna when they are more prevalent/active along roads. • Fauna road signs continued to be installed in areas considered at higher risk of fauna / vehicle interactions. • An online Fauna Event tool was completed during the reporting period. The tool supports direct upload of fauna event information into the reporting database and is expected to improve reporting accuracy. • Completion of roadside clearing activities along higher risk roads to reduce risk of vehicle strikes. • Ongoing investigation of additional safeguards to further reduce the incidence of vehicle strikes.

1 *Does not include cared-for fauna that is held temporarily, and that is not believed to be sick, diseased or abandoned (i.e. captured and temporarily held for relocation). The following are not included as cared for fauna:*

a. *Fatigued fauna, such as storm-blown seabirds.*
b. *Fauna captured for relocation and held temporarily until dusk or dawn for release.*
c. *Injured fauna which is immediately euthanised.*
d. *Fledgling birds (uninjured and not sick) that are subsequently released on island.*

Table 2-11 EPBC Act and BC Act Threatened or Listed fauna recorded as injured or deceased during the Reporting Period within and outside the TDF

Common name	Species name	No. deceased[1]
Bridled Tern	*Onychoprion anaethetus*	1
Burrowing Bettong, Boodie (Barrow Island)	*Bettongia lesueur*	64
Crested Tern	*Sterna bergii*	1
Eastern Reef Egret	*Ardea (Egretta) sacra*	2
Euro (Barrow Island)	*Macropus robustus isabellinus*	59
Golden Bandicoot (Barrow Island)	*Isoodon auratus barrowensis*	536
Nankeen Kestrel	*Falco cenchroides*	3
Northern Brush-tailed Possum	*Trichosurus vulpecula arnhemensis*	1
Red-capped Plover	*Charadrius ruficapillus*	1
Red-necked Stint	*Calidris ruficollis*	1
Silver Gull	*Chroicocephalus novaehollandiae*	17
Spectacled Hare-wallaby (Barrow Island)	*Lagorchestes conspicillatus*	164
Water Rat, Ratkali	*Hydromys chrysogaster*	1
Wedge-tailed Shearwater	*Ardenna pacifica*	11
Welcome swallow	*Hirundo neoxena*	7
White-winged Fairy-wren (Barrow Island)	*Malurus leucopterus edouardi*	7

1 *Includes fauna deaths where the cause of death is attributed to the Gorgon Gas Development, and sick or injured fauna that were cared for and subsequently euthanised; does not include fauna where the death was from natural causes.*

2.4 Five-year Overview of Environmental Performance

The 2020–2025 outcome for the Terrestrial and Subterranean Environment State is summarised in the table below.

Objectives[1]	Outcome
Establish a statistically valid ecological monitoring program to detect any Material or Serious Environmental Harm to the ecological elements outside the TDF.	Monitoring of fauna, vegetation, groundwater, and surface water, as per the requirements of the approved TSEMP (Ref. 1), throughout the five-year Reporting Period did not detect any Material or Serious Environmental Harm to the ecological elements outside the TDF that can be attributed to the Gorgon Gas Development.

1 *As defined in Condition 8.3 of MS 800 and Condition 7.3 of EPBC 2003/1294 and 2008/4178.*

2.5 Proposed Environmental Management Improvements

The key proposed management improvements for the TSEMP (Ref. 1) are summarised in the table below.

Proposed Management Improvement	Justification
Alter the frequency of vegetation monitoring from 2- to 5-yearly	Long-term monitoring data does not support evidence for impact attributable to the Gorgon Gas Development: To date, no adverse impact on vegetation species composition, species richness, vegetation cover, or plant health has been detected within or outside the TDF that can be attributed to Gorgon Gas Development activities. Changes in vegetation health have been linked to rainfall patterns, with the

Proposed Management Improvement	Justification
	amount of rain in the preceding period being the primary driver for such changes. Adjusting the frequency of vegetation monitoring to every five years will retain capability for impacts to be detected, but on a temporal scale that better represents the period over which changes to vegetation communities are likely to occur.
Alter the frequency of Barrow Island Euro and Spectacled Hare-wallaby from yearly to every two years.	Long term monitoring data has not detected an adverse impact attributable to the Gorgon Gas Development to the Spectacled Hare-wallaby or Euro Wallaby population Reducing the monitoring frequency to every two reduces survey time while still retaining capability for impacts to be detected.
Alter the frequency of Wedge-tailed Shearwater from yearly to every five years.	Monitoring has not detected an adverse impact (attributable to the Gorgon Gas Development) to the Burrow Density, Breeding Participation, and Fledging Success of Wedge-tailed Shearwaters. Adjusting the frequency to every five years reduces foot traffic around fragile nesting areas while still retaining capability for impacts to be detected.
Conclude Bridled Tern Monitoring	Monitoring of Bridled Terns since 2009 has indicated no impacts from identified stressors associated with the Gorgon Gas Development or Jansz Feed Gas Pipeline. Stressors and risks such as artificial light and incursion by non-indigenous species of rodents have effectively been managed via the Long-Term Marine Turtle Management Plan and QMS, respectively. Silver Gulls, that were thought to potentially compete with Bridled Tern nesting habitat, have not been recorded nesting in high numbers on Double islands. Control charts have consistently stayed within 2SD of the Mean for all measured parameters (nest density, breeding participation and fledgling success). Recent data indicates an increasing trend in nest density and breeding participation.
Alter the frequency of White-winged Fairy-wren (Barrow Island) from yearly to every two years.	Data indicates current White-winged Fairy Wren population estimates are within the range of historical values, and the variation in WWFW abundance is likely driven by variability in rainfall and other environmental conditions, with no evidence of impacts attributable to the Gorgon Gas Development. Adjusting the frequency to every two years reduces survey time while still retaining capability for impacts to be detected.
Implementation of stormwater monitoring pending sufficient run-off	Monitoring of surface water runoff has been added as an additional proxy indicator for a range of ecological elements.

3 Terrestrial and Marine Quarantine

Table 3-1: EPR Reporting Requirements for Terrestrial and Marine Quarantine

Item	Source	Section in this EPR
Results of the audit and monitoring programs	MS 800, Schedule 3(2i) EPBC 2003/1294 and 2008/4178, Schedule 3(2i)	3.1, 3.2
Detected introduction(s) of non-indigenous terrestrial flora or fauna (NIS) and marine pest species, including procedure breaches and 'near misses' including special reference to weeds	MS 800, Schedule 3(2ii) EPBC 2003/1294 and 2008/4178, Schedule 3(2ii)	3.2, 3.3
Consequences of the introduction	MS 800, Schedule 3(2iii) EPBC 2003/1294 and 2008/4178, Schedule 3(2iii)	3.2
Modification, if any, to the Quarantine Management System (QMS) because of: • audits and monitoring • detected introductions • 'best practice' improvements.	MS 800, Schedule 3(2iv) EPBC 2003/1294 and 2008/4178, Schedule 3(2iv)	3.4
Eradication actions if any taken; reasons for any action or non-action; changes to improve procedures and outcomes and progress	MS 800, Schedule 3(2v) EPBC 2003/1294 and 2008/4178, Schedule 3(2v)	3.2
Mitigation actions	MS 800, Schedule 3(2vi) EPBC 2003/1294 and 2008/4178, Schedule 3(2vi)	3.2
Results of any QMS-related studies, where conducted, to improve performance	MS 800, Schedule 3(2vii) EPBC 2003/1294 and 2008/4178, Schedule 3(2vii)	3.5
Weed management incidents: • new infestations • proliferations	MS 800, Schedule 3(2viii) EPBC 2003/1294 and 2008/4178, Schedule 3(2viii)	3.2; N/A[1]
Weed eradication performance; and • areas treated • results against measurable indicators and limits	MS 800, Schedule 3(2xi) EPBC 2003/1294 and 2008/4178, Schedule 3(2ix)	3.2; N/A[1]
Targets proposed for the next year	MS 800, Schedule 3(2x) EPBC 2003/1294 and 2008/4178, Schedule 3(2x)	4.2
A five-year overview of environmental performance	MS 800, Condition 5.3(iii) EPBC 2003/1294 and 2008/4178, Condition 4.2(iii)	3.6
Proposed environmental management improvements	MS 800, Condition 5.3(iv) EPBC 2003/1294 and 2008/4178, Condition 4.2(iv)	3.7

1 *No proliferations of existing weeds or new weed establishments, were recorded during the Reporting Period; therefore, reporting is not applicable at this time.*

2 *No QMS-related studies were implemented during the Reporting Period; therefore, reporting is not applicable at this time.*

3 *Targets are developed in response to introductions of NIS or Marine Pests, or in response to proliferations of existing weeds or new weed establishment.*

3.1 Audits

CAPL audits of the quarantine management measures described in the QMS (Ref. 5) are conducted at least every two years during the operations phase of the Gorgon Gas Development operations. Outcomes of audits completed during the Reporting Period are described in the table below.

Audit Data
Regulator Audits
No regulator audits were undertaken during the Reporting period. The Commonwealth Department of Agriculture, Water and the Environment (DAWE, now the Department of Agriculture, Fisheries and Forestry from 1 July 2022) undertook a verification site visit in November 2021 to confirm the LNG trading vessel inspection and clearance process, and associated training and accreditation program is implemented and consistent with their requirements. One opportunity for improvement was identified and implemented relating to the challenges associated with access to vessels for verifying ballast water management due to COVID-19 restrictions.
CAPL Audits[1]
CAPL conducted two audits of the QMS during the Reporting Period An internal audit was conducted in July/August 2022 and assessed compliance with 24 commitments selected from the QMS. The audit identified three findings, five recommendations, three observations and one good practice. Corrective actions to address the three findings were implemented. • Finding One focused on controls required when working within a WHZ. Necessary controls were not documented in the job hazard analysis and could not be verified as implemented. Corrective actions focused on ensuring workers were trained and scope specific work templates, including JHAs, were updated to reflect weed hygiene controls. This action is complete. • Finding Two reviewed the CAPL approved Quarantine Management Plans for contractors with quarantine specific scopes of work. Preventative maintenance (PM) on fumigation equipment was overdue. The corrective actions included updating the PM schedule and assigning responsibility for management of the schedule. This action is complete. • Finding Three focused on procedural deviations recorded prior to shipment to Barrow Island. This requirement was inconsistent with the definition of a procedural deviation which is classified when non-compliant cargo is received at Barrow Island. The corrective action included revising the wording of the QMS to align with the definitions and enable reporting. This action is complete. An internal audit in July 2024 was completed by a third-party consultant and focused on 21 selected commitments from the QMS and six conditions relating to the QMS in MS 800. The audit methodology followed the ABU OE Assurance Audit Procedure (OE-12.01.1018) and included interviews, desktop document reviews, data collection and visual observations of activities (including site and contractor facility inspections). The audit identified two findings, five recommendations, three observations, with fourteen satisfactory outcomes and four examples of good practice. • Finding One related to the quarantine response activities associated with the detection of NIS on Barrow Island and highlighted inconsistent commitments between the QMS and the Quarantine Response Guideline. The corrective action involves reviewing the QMS or supporting documentation to align transition criteria between the different response phases. This corrective action is underway. • Finding Two related to Quarantine Advice Reports. The QMS requires the contractor to complete actions outlined in Advice Reports within a specified timeframe and to the satisfaction of the CAPL Quarantine Manager. There was limited evidence observed during the audit to demonstrate how contractors were completing actions in Advice Reports per the requirements of the QMS (including within specified timeframes and to the satisfaction of CAPL's Quarantine Manager). The corrective action involved reviewing and updating the Advice Report template to enable recording of completed actions and to demonstrate approval by CAPL. This action is complete. The findings relating to implementation of the QMS were reported in the Annual Compliance Assessment Reports[2].

1 *CAPL assesses compliance with the requirements of the QMS in accordance with the Compliance Assessment Plan (Ref. 46) required by Condition 4.1 of MS 800.*

2 *Audit findings reported in the relevant Compliance Assessment Report relate to the implementation of the QMS as required under Condition 10.5 of MS 800, and Condition 8.5 of EPBC 2003/1294 and 2008/4178.*

3.2 Monitoring Results

A quarantine surveillance program determines the presence or absence of NIS (plants, invertebrates, and vertebrates) on Barrow Island and marine pests in the waters surrounding Barrow Island.

The results of surveillance programs implemented during the Reporting Period are summarised in the following tables.

Surveillance program: Plant NIS
Objective
To detect the presence and/or proliferation of plant NIS (weeds) on Barrow Island attributable to Gorgon Gas Development activities.
Methodology
• Repeated weed surveillance at identified risk localities within the Gorgon Gas Development tenure and surrounding areas. • Repeated weed inspections of areas where weeds were previously recorded as a follow-up measure to ensure any further weed detections are controlled immediately. • Validation of the weed surveillance program was completed by undertaking a Botanist Assurance field visit (weed inspection, surveillance and control within designated areas on Barrow Island).
Results
Weed surveillance and inspections were implemented successfully across all required locations on Barrow Island during the Reporting Period. Weed inspections were implemented within all Weed Hygiene Zones (WHZs) and Primary Weed Management Areas (PWMAs). Weed surveillance was implemented within secondary and tertiary weed management areas. Botanist assurance field visits were conducted. Seven weed species were detected and controlled by hand removal (unless stated otherwise). These included: • Buffel Grass (*Cenchrus ciliaris*). All specimens were detected within existing WHZs. One seeding event occurred during the Reporting Period (Aug 2024). The seed heads of this weed were removed before manually removing the rest of the plant and all plant material was double bagged in the field. • Kapok (*Aerva javanica*). All seedlings were detected within an existing WHZ, with the last seedling detected in 2022. • Common Sow thistle (*Sonchus oleraceus*). Except for one, all specimens were detected within an existing WHZ. One was detected within a zero-vegetation management area. • Blackberry Nightshade (*Solanum nigrum*) All specimens were detected in and around existing PWMAs. PWMA boundaries were expanded around detections when required. • Whorled Pigeon Grass (*Setaria verticillata*) PWMAs were established in consideration of the last detection in 2023. • Tomato (*Solanum lycopersicon*) – Specimen was detected within Zero Vegetation area where the plant was removed by hand. • Bulrush (*Typha sp.*) – All species were detected within Zero Vegetation areas where plants were remediated by hand (including removal of rhizomes) and/or treated with a knock-down herbicide. No new Weed Hygiene Zones were required to be established during the Reporting Period. • No detections of weeds were considered proliferation events.
Conclusions
No introductions, infestations (Refer to Section 12 for terminology) or proliferation of weed species that can be attributed to the Gorgon Gas Development were recorded during the Reporting Period.

Surveillance program: Invertebrate NIS
Objective
To detect the presence and/or proliferation of invertebrate NIS on Barrow Island, attributable to Gorgon Gas Development activities.
Methodology
• Surveillance effort focused on identified risk localities and used multiple surveillance system components (SSCs). • The SSCs used for the Reporting Period included: baited ant traps (including sticky traps), biologist structured and unstructured surveys (day and night), dry barrier pitfall traps, leaf litter sieving, vacuum suction sampling, UV light traps, and workforce observations/reporting.
Results
Fourteen NIS invertebrate species were detected during the Reporting Period. Details on these are provided below: • Jumping Spider (*Menemerus nigli*) • Lesser Auger Beetle (*Heterobostrychus aequalis*) • Indian House Cricket (*Gryllodes sigillatus*) • Cigarette Beatle (*Lasioderma serricorne*) • Gisborne Cockroach (*Drymaplaneta semivittata*) • Indian Meal Moth (*Plodia interpunctella*) • Maritime Earwig (*Anisolabis maritima*) • Ring-legged Earwig (*Euborellia annulipes*) • Oleander Scale (*Aspidiotus nerii*) • Soft Brown Scale (*Coccus hesperidum*) • Mexican Black Scale (*Saissetia miranda*) • Australian Iridescent Ant (*Calomyrmex purpureus smaragdinus*) [Status reviewed, refer below] • Desert Muscleman Ant (*Podomyrma adelaidae*) [Status reviewed, refer below] • Longicorn Beetle (*Coleocoptus senio*) [Status reviewed, refer below] **NIS Management Program** *Jumping Spider (Menemerus nigli)* • October 2011 - *Menemerus nigli (M. nigli)* was first detected during NIS surveillance activities. Taxonomic uncertainty existed initially, with the species identified as a Barrow Island native, *Clynotis sp. 1*. Subsequent species identification changes occurred periodically until 2021, when the species identification was confirmed as *M. nigli* and non-indigenous to Barrow Island. Following identification, a First Response was initiated, which included delineation surveillance for this species. • During the Reporting Period, CAPL consulted with the QEP (2021) and relevant SMEs regarding the presence of the Jumping Spider, *M. nigli*, on Barrow Island. It was determined that *M. nigli* is a NIS that has been introduced to Barrow Island as a result of and after the Gorgon Gas Development commenced. In accordance with MS 800 Conditions 9.2 and 10.3, the QEP wrote to the Minister for the Environment on 16 September 2021 to notify them of this establishment and received a response 8 November 2021. Given the uncertain effects of *M. nigli* on Barrow Island native species and ecosystems and the potential for adverse impacts from chemical eradication options, the QEP recommended that eradication and control was not possible for *M. nigli*. • CAPL developed an NIS Management Procedure (GOR-COP-03307), as required under the QMS. The objective of this procedure is to prevent the proliferation of *M. nigli* into new areas associated with CAPL activities and to mitigate management actions against non-target species. The procedure outlines surveillance targets for both tenure and natural areas, and chemical treatments of selected infrastructure to prevent proliferation. These targets include annual reporting requirements and surveillance of known and potential habitats. During the Reporting Period, *M. nigli* were detected on infrastructure at the Materials Offloading Facility (MOF), Butler Park, the Barrow Island Airport, the Old Airport, Terminal Tanks, POF, WAPET Landing, WAO Base and the GTP (Figure 3-1). • Structured day surveillance was conducted on tenure and in undisturbed areas away from infrastructure. *M. nigli* has been detected associated with buildings, concrete foundations and concrete blocks, and within monitoring stations around CAPL infrastructure. No detections have been made in any undisturbed/natural areas. • Within the last 12 months, there were 9 detections of *M. nigli* identified at a new location - WA Oil Base. Following the initial detection in September 2024 at WAO Base, an increased insecticide treatment

program was implemented, and additional surveillance was undertaken to determine the effectiveness of these treatments. There have been no detections at this location since February 2025. The NIS Management Procedure remains active.

Figure 3-1: All known detections of Jumping Spider (*Menemerus nigli*) on Barrow Island.

NIS Responses – Successful, Closed

The following NIS were detected and a response implemented to successfully contain, control and remove all individuals.

Lesser Auger Beetle (Heterobostrychus aequalis)

- 17 October 2020 - *H. aequalis* were reported by workforce observation from inside a container within the GTP laydown. A First Response was initiated, which included structured surveillance and a targeted UV light trapping program over a two-year period. No further *H. aequalis* detections occurred after 19 October 2020. The response is closed.

Indian House Cricket (Gryllodes sigillatus)

- January 2020 - A Quarantine Incident for the detection of the *G. sigillatus* was reported. A First Response was initiated, which included targeted visual surveillance, deployment of targeted monitoring stations, application of insecticide and the physical remediation of sites, (including the removal of soil and debris/detritus across the GTP). The last detection of *G. sigillatus* occurred in December 2021. Successful eradication was declared in October 2022, following advice from independent SMEs and the QEP, and demonstrating area freedom. The Response is closed.

Cigarette Bettle (Lasioderma serricorne)

- August 2022 - *L. serricorne* was reported by workforce observation within tea stored in a desk drawer of an office within the GTP. A First Response was initiated, which included inspection of the area, follow up surveillance around the building and targeted application of residual insecticide. No further *L. serricorne* were detected. The response is closed.
- February 2024 - *L. serricorne* was reported by workforce observation within the Butler Park kitchen dry stores. A First Response was initiated, which included remediation of affected dry stores and surveillance of the kitchen stores and other stored products. No further *L. serricorne were* detected. The response is closed.

Gisborne Cockroach (Drymaplaneta semivitta)

- 18 November 2024 - A individual *D. semivitta* was reported by workforce observation at the Barrow Island Airport. A First Response was initiated, which included surveillance and the deployment of monitoring stations and insecticide around the airport terminal. No further *D. semivitta* detections were made. The response is closed.
- 16 January 2025 – An individual *D. semivitta* was detected during final quarantine clearance of a consignment of milk, at Butler Park kitchen. A First Response was initiated, which included surveillance around the kitchen loading docks. No further *D. semivitta* were detected. The response is closed.

Indian Meal Moth (Plodia interpunctella)

- 26 May 2025 – An individual *P. interpunctella* larva was reported by workforce observation within a mandarin collected from the crib room within the GTP. A First Response was initiated, which included inspection of fruit at the crib room and Butler Park kitchen stores. No further *P. interpunctella* were detected. The response is closed.

NIS Responses – On-going

The two following Quarantine Responses remain open and in place for NIS invertebrate species:

Maritime Earwig (Anisolabis maritima)

- 5 February 2021 - *A. maritima* was detected in a monitoring station deployed on the Causeway as part of the Indian House Cricket response. Following identification, a First Response was initiated, which included structured surveillance, the deployment of 230 monitoring stations and targeted chemical insecticide treatments (residual spray, gel, pellets and misting/fogging) to infrastructure along the Causeway and MOF.

  During the response, further detections have occurred. *A. maritima* detections are recorded and mapped to aid response activities. Ongoing assessment of monitoring stations along the Causeway suggested an increase in *A. maritima* numbers (with possible seasonal fluctuations) and a slow westerly movement of population towards Barrow Island.
- September 2024 - *A. maritima* was detected at the base of the Causeway X-blocks at the junction of Terminal Beach for the first time. *A. maritima* continues to be detected in this location. Given this change, in consultation with the QEP, the decision was made to move the response from First to Inclusion Response. To support the response, CAPL engaged the QEP members and independent SMEs to attend a workshop focusing on identifying knowledge gaps, understanding *A. maritima* ecology and potential ecological impacts; as well as identifying strategies for control, containment and eradication. Subsequent activities and studies have commenced to address the above focus areas.
- August 2025 - *A. maritima* was detected at the base of the Causeway X-blocks at the junction of Bivalve Beach for the first time.

  Delineation surveillance activities have been conducted across multiple beach locations on Barrow Island, and to date, *A. maritima* has not been detected outside of the aforementioned known locations. The response remains open and will be reported on in the next EPR.

Figure 3-2: All known detections of Maritime Earwig (Anisolabis maritima) along Causeway, Barrow Island. (Date: 16 September 2025).

Figure 3-3: Image of Causeway X-block infrastructure at Terminal Beach, and the Causeway into the distance.

Ring-legged Earwig (Euborellia annulipes)

- During the Reporting Period the species status for *E. annulipes* was reviewed in consultation with the QEP (Refer to Section 3.3 Event Data) for further detail. As a result, a quarantine response was initiated to determine the presence of *E. annulipes* around Butler Park and the GTP. The response included targeted surveillance and insecticide treatments. There have been no detections of *E. annulipes* during the response. The Response remains open.

NIS – Scale Insects

- The following species are NIS to Barrow Island, however, are not considered attributable to Gorgon Project activities:
  - Soft Brown Scale (*Coccus hesperidum*)
  - Mexican Black Scale (*Saissetia miranda*)
  - Oleander Scale (*Aspidiotus nerii*)
- The pathway of these species to Barrow Island remains indeterminate and likely includes natural dispersion via wind or birds, or via anthropogenic pathways outside of CAPL's control, or introduction to the Island prior to the Gorgon Project.
- In December 2023, the QEP considered the status of the above scale insect species on Barrow Island as 'indeterminate'. A 2024 QEP recommendation was to establish a Working Group outside of the QEP.
- Although the presence of scale insects is not attributed to Gorgon Project activities, CAPL has continued to undertake structured and opportunistic surveillance, implement controls to prevent the proliferation of scale insects, and support additional studies to further understand ecology / ecosystems.
- Ongoing surveillance has found the presence of additional scale insects and investigations into their taxonomy is ongoing. Molecular identification of some scale species is complex, and as a result the taxonomic classification of scale specimens collected (including those listed above) has changed overtime.
- CAPL has and will continue to collaborate with DBCA to support the activities of the Working Group.

NIS – Reviewed

Initially the below species were identified as NIS, however, after review of their status, and in consultation with the QEP, the species have since been revised as follows:

Australian iridescent Ant (Calomyrmex purpureus smaragdinus)

- March 2021 - An individual *C. purpureus smaragdinus* was collected from a light trap near the Oliver Laydown area within the GTP. Following initial detection, a First Response was initiated, which included surveillance. A further detection on the 7 September 2021 in a light trap near the Oliver Laydown area within the GTP. No further *C. purpureus smaragdinus* were detected. The Response is closed. In consultation with SMEs and the QEP *C. purpureus smaragdinus* status has since been revised as indigenous.

Desert Muscleman Ant (Podomyrma adelaidae)

- August 2021 – An individual *P. adelaidae* was detected during structured day surveillance in vegetation near the Old Airport. Following initial detection, a First Response was initiated, which included surveillance. No further *P. adelaidae* were detected. The Response is closed. In consultation with SMEs and the QEP *P. adelaidae* status has since been revised as indigenous.

Longicorn Beetle (Coleocoptus senio)

- November 2020 – An individual *C. senio* was detected in a UV light trap at Oliver Laydown within the GTP. Following initial detection, a First Response was initiated and a further 12 beetles were detected (two at WA Oil Base, two within the GTP, one at Production Village and seven along the coastline). The response is closed, however surveillance is on-going as part of the broader NIS surveillance program.
- 2023 - The status of this species was discussed with SMEs and the QEP and it was recommended the species status was changed to indeterminate.

Identification of some invertebrate specimens from the 2024-2025 surveillance period are still pending and will be included in the next EPR.

Conclusions

- One established NIS was recorded during the Reporting Period; the Jumping Spider (*Menemerus nigli).*
- Two species are currently under a Quarantine Response - the Maritime Earwig (*Anisolabis maritima*) and Ring-legged Earwig (*Euborellia annulipes*), the outcomes of which will be reported in the next EPR.

- Eight species of NIS were successfully detected, contained and controlled under Quarantine First Response activities. This included: Lesser Auger Beetle (*Heterobostrychus aequalis*), Indian house cricket (*Gryllodes sigillatus),* Cigarette Bettle (*Lasioderma serricorne*), Gisborne Cockroach (*Drymaplaneta semivittata*), Indian Meal Moth (*Plodia interpunctella*), Australian Iridescent Ant (*Calomyrmex purpureus smaragdinus*), Desert Muscleman Ant (*Podomyrma adelaidae*) and Longicorn Beetle (*Coleocoptus senio*).
- Three species of NIS scale insects were detected. Their presence on Barrow Island is not considered to be associated with Gorgon Project activities, and CAPL is working collaboratively with DBCA to delineate and prevent proliferations.

Surveillance program: Vertebrate NIS
Objective
To detect the presence and/or proliferation of vertebrate NIS on Barrow Island attributable to Gorgon Gas Development activities.
Methodology
• Surveillance effort focused on identified risk localities and used several SSCs. • The SSCs used for the Reporting Period included: biologist unstructured surveys, biologist structured surveys (night and day), cage traps, Elliot traps, pitfall traps, hair cards, environmental acoustic recognition sensors (EARS), print acquisition for wildlife sensors (PAWS), and workforce observations/reporting.
Results
Five NIS vertebrate species were detected during this Reporting Period: • 1 x Little Red Tree Frog (*Litoria rubella*) • 2 x Asian House Gecko (*Hemidactylus frenatus*) • 1 x Pacing Pigeon (*Columba livia*) • 1 x Red Collared Dove (*Streptopelia tranquebarica*) • 1 x Spotted Pilbara Rock Gehyra (*Gehyra punctata*) **<u>NIS Responses – Successful, Closed</u>** *Little Red Tree Frog (Litoria rubella)* • April 2021 – An individual *L. rubella* was reported on the MOF by workforce observation. A First Response was initiated to collect the frog, which included structured night and day surveillance at water sources on the MOF and surrounding areas, including the use of frog attracting devices (FADs). No further *L. rubella* were detected. The response is closed. *Asian House Gecko (Hemidactylus frenatus)* Two specimens of *H. frenatus* were detected from separate events, during the Reporting Period. • April 2022 – An individual *H. frenatus* was detected and caught within the GTP whilst undertaking Indian House Cricket surveillance. A First Response was initiated, which included 350 hours of structured day and night surveillance and scat searches and deployment of 20 EARS devices. No further *H. frenatus* were detected. The response is closed. • August 2023 – A *H. frenatus* call was detected at Area 3, within the GTP via an EARS unit. A First Response was initiated, which included 370 hours of structured day and night surveillance, scat searches, fumigation of buildings and equipment, and the deployment of 16 EARS devices at Area 3 and additional areas across the island in response to possible gecko sightings by the workforce. A single *H. frenatus* was caught in Area 3 four days after the initial detection. No further *H. frenatus* were detected. The response is closed. *Racing Pigeon (Columba livia)* • April 2024 – An individual *C. livia* was reported by workforce observation at the Horizontal Directional Drilling (HDD) site. A First Response was immediately initiated, which included structured day surveillance. On the 10 April 2024, the *C. livia* was hand captured and subsequently taken to DBCA to be euthanised. No further detections of *C. livia* occurred. The response is closed. *Red Collared Dove (Streptopelia tranquebarica)* • May 2024 – An individual *S. tranquebarica*, was reported by the workforce observation at the HDD. A First Response was initiated, which included structured day surveillance, including wet area surveys. Identification was only possible through photographs taken at the time of the initial workforce reporting. Surveillance concluded after five days, with no further detection of the *S. tranquebarica* occurring.. This species is considered a vagrant and unlikely to be attributable to Gorgon Project activities. The response is closed. *Spotted Pilbara Rock Gehyra (Gehyra punctata)* • April 2024 - An individual *Gehyra punctata* was detected near the BWI airport. A First response was initiated which included structured day and night surveillance. The *G. punctata* was captured 14 May 2024. The individual was submitted to the Western Australian Museum (WAM) for formal identification and genetic analysis. Response surveillance continued for 9 weeks. No further *G. punctata* were detected. The response is closed. Genetic assessment results by WAM yielded that it was unclear whether the *G. punctata* individual was part of a remnant population last detected in 2006.

Conclusions
No introduction of non-indigenous vertebrate species, that can be attributed to the Gorgon Gas Development activities, were recorded during the Reporting Period. Five non-indigenous vertebrate species detections that can be attributed to Gorgon Gas Development activities were recorded during the Reporting Period. All detections were remediated as part of a First Response plan and did not survive past this response phase.

Surveillance program: Marine pests
Objective
Detect the presence of marine pests in the waters around Barrow Island, attributable to Gorgon Gas Development activities.
Methodology
• The Marine Pest Surveillance Program conducted at Barrow Island during the Reporting Period included: – intertidal surveillance, using visual surveillance transects – visual examination of settlement arrays – analysis of environmental deoxyribonucleic acid (eDNA) from settlement arrays (including 8 plates each) and water samples. DNA present on settlement arrays and in water samples was analysed using next-generation sequencing methodology, or real-time polymerase chain reaction testing, and the results compared against a reference database of targeted Marine Pests. • Surveillance and sampling locations focused on high-risk localities around operational areas of the Causeway. These sampling locations were reviewed and adjusted to align with assessed risk. • Twenty-nine settlement plates soaked for various durations (2 months and either 6 months or 12 months) were collected. Three replicates were taken from each array and analysed. Water samples were collected every 2 months.
Results
• Two intertidal surveys and visual examination of two settlement arrays, which had been immersed for 6 months, were completed (January and July 2021). No marine pests were detected from visual examinations. • Six sampling events from 12 settlement arrays were completed for eDNA analysis (in October, November 2020, and January, March, May, and July 2021). No confirmed marine pests were detected. • Two intertidal surveys and visual examination of two settlement arrays, which had been immersed for 6 months, were completed (September 2021 and March 2022). No marine pests were detected from visual examinations. • Six sampling events from 12 settlement arrays were completed for eDNA analysis (in September and November 2021, and January, March, May, and July 2022). No confirmed marine pests were detected. • Six sampling events from four settlement arrays were completed for eDNA analysis during the Reporting Period (in September and December 2022, and January, April, June, and July 2023). No confirmed marine pests were detected. • Five sampling events from six settlement arrays were completed for eDNA analysis during the Reporting Period (in October and November 2023, and February [included 12-month soak], May, and July 2024). No confirmed marine pests were detected. An additional sampling event occurred in March 2024 due to cyclone response activities – where arrays were required to be removed from the water (these had soaked for 7 months). • Five sampling events from four settlement arrays were completed for eDNA analysis during the Reporting Period (in November 2024, January, March, May and July 2025). The White ascidian (*Didenmum perlucidum*) was detected in settlement plates sampled from the tug pen in May 2024. This species is widespread in Western Australian waters. *D. perlucidum* has been recorded in Barrow Island waters periodically since 2012 and it is considered likely that this species was present before the Gorgon Gas Development commenced. The detection of *D. perlucidum* during the 2023–2024 Reporting Period is not considered attributable to Gorgon Gas Development activities. No other marine pests were detected during this Reporting Period. • Throughout the Reporting Period, cyclone response activities impacted the settlement plate sampling schedule, with some sampling delayed, or brought forward as needed. • One Sampling array was lost due to a broken rope line in March 2025. A replacement array was installed; however this interruption shortened the soak time by two weeks for one sampling round. Improved ropes and knots have been utilised across all sampling arrays to prevent this reoccurring.
Conclusions
No introduction of marine pests that can be attributed to Gorgon Gas Development activities were recorded during the Reporting Period.

3.3 Event Data

The quarantine detections recorded during the Reporting Period are summarised in the following table.

Event data: Quarantine detections

Reporting requirement

Detected introduction(s) of NIS and Marine Pest species, procedure breaches, and intercepts, with special reference to weeds.

Figure 3-4: Asian house gecko at GTP

Figure 3-5: Bulrush within drain at GTP

Results

During the reporting period, one NIS was declared as introduced to Barrow Island, as a consequence of the Gorgon Gas Development, the Jumping Spider *Menemerus nigli.* A NIS Management Procedure (GOR-COP-03307) was developed as required under the QMS. Refer to Section 3.2 Invertebrate results – *Menemerus nigli*, for further details.

No other Quarantine Introductions (including for marine pest species and weeds) were recorded.

During the Reporting Period, two Level 3 Quarantine incidents, two Level 2 Quarantine incidents, 28 Level 1 Quarantine incidents, 148 Quarantine intercepts (previously reported as near misses) and 64 Quarantine procedural deviations were recorded (Refer to Section 12 for terminology). The details of the incidents are as follows:

Two Level 3 Incidents

- April 2022 - Individual Asian House Gecko (*Hemidactylus frenatus*) was detected and captured with the GTP. A Quarantine First Response was implemented and no further AHG were detected.
- August 2023 – Individual Asian House Gecko (*Hemidactylus frenatus*) was detected via an EARS device and subsequently captured within the GTP. A Quarantine First Response was implemented and no further AHG were detected.

Two Level 2 Incidents

- February 2021 - the Maritime Earwig, *Anisolabis maritima*, was detected on the Causeway as part of the Indian House Cricket response. A quarantine response was initiated and remains in place for this species. The outcomes of this response will be included in the next EPR.
- May 2024 – A Spotted Pilbara Rock Gehyra (*Gehyra punctata)* was captured near the Barrow Island Airport. This species of gecko was previously recorded on Barrow Island in 2006, prior to the commencement of the Gorgon Project, however it is considered non-indigenous to Barrow Island. A Quarantine first response was enacted, and no further NIS were detected. The response is closed.

Twenty-eight Level 1 Incidents

During the reporting period, half of the Level 1 Incidents involved the detection of weeds on Barrow Island. Thirteen of these involved the detection of Bulrush (*Typha sp.*) within drains at either the GTP or Butler Park. One incident involved the detection of tomato plants in the drain at the GTP. In all cases weeds were removed or chemically treated, with follow up surveillance completed in the area to ensure no further geminations occurred.

Ten of the Level 1 incidents involved the detection of the following eight invertebrate species:

- Ring-legged Earwig (*Euborellia annulipes*)
- Lesser auger beetle (*Heterobostrychus aequalis*)
- Cigarette Beetle (*Lasioderma serricorne*)
- Gisborne Cockroach (Drymaplaneta semivitta)
- Indian Meal Moth (*Plodia interpunctella*)

Event data: Quarantine detections

- Longicorn Beetle (*Coleocoptus senio*) (Note the status change. Refer below).
- Desert Muscleman Ant (*Podomyrma adelaidae*) (Note the status change. Refer below).
- Australian Iridescent Ant (*Calomyrmex purpureus smaragdinus*) (Note the status change. Refer below).

There have been no further detections of the above NIS during quarantine response activities. The responses have been closed for all, except the Ring-legged Earwig (*E. annulipes*), which remains open, with the outcomes to be reported in the next EPR.

One Level 1 incident was associated with a NIS vertebrate, the Little Red Tree Frog (*Litoria rubella*), which was detected by the workforce during general work operations. No further frogs were detected during the quarantine response. The response is closed.

Three Level 1 incidents involved the detection of seeds within cargo that had been released after final quarantine clearance. These included:

- Rosewood (*Tipuana tipu*) - Helicopter seed type
- Ragwort (*Senecio sp.*) - Parachute seed type
- Dandelion (*Taraxacum sp.*) - Parachute seed type

Cargo was fully inspected and cleaned, with all seed material collected and contained. These areas are subject to regular weed inspections as part of the NIS surveillance program schedule.

Prior to the Reporting Period, one seeded mature weed of the Kapok bush *(Aerva javanica)* was detected on Barrow Island and a weed hygiene zone created around the area. The quarantine response for this Kapok Bush remains open. There have been three germination events as a result of the seed bank, with all seedlings detected within 1 metre of the original plant. The latest seedlings were detected in July 2022.

Incident Reviews and Classification Changes

Prior to the Reporting Period, a quarantine incident for the detection of the Indian House Cricket (*G. sigillatus*) occurred (January 2020). The quarantine response for *G. sigillatus* was successfully closed during the Reporting Period. Refer to Section 3.2 (Invertebrate results) for further details. During the Reporting Period, the incident classification level for *G. sigillatus* was reviewed in consultation with the QEP. It was changed from Level 2 to Level 1, based on review of the impact to Barrow Island's biodiversity.

During the Reporting Period, one historical quarantine event associated with a Racing Pigeon (*Columbia livia*) (on an LNG tanker) was reclassified in consultation with the QEP. It was changed from a non-event (not Project-attributable) to a Level 1 incident. This incident is not included in the above summary as it occurred prior to the Reporting Period.

During the Reporting Period, five historical quarantine events associated with *Typha sp*. recorded on Barrow Island between 2015 and 2019, were reclassified from non-events (not Project-attributable) to Level 1 quarantine incidents, following a review by the QEP. These incidents are therefore not included in the above summary as they occurred prior to the Reporting Period

During the Reporting Period, CAPL engaged with the QEP to review the species status of the Ring-legged Earwig (*E. annulipes*), and it was determined that it was likely a NIS. Therefore, 12 historical records of detection on Barrow Island (between 2013 and 2022) were reclassified from 'uncertain' to Level 1 quarantine incidents. Those detections that occurred during the Reporting Period are included in the above summary of quarantine incidents.

The incident classification level for the Maritime Earwig (*A. maritima*) was reviewed in consultation with the QEP. It was changed from a Level 1 quarantine incident to a Level 2 quarantine incident, based on the uncertainty known about the potential impacts the species may have on Barrow Island's biodiversity.

The species status of the Longicorn Beetle (*Coleocoptus senio*) was reviewed in consultation with the QEP. The Panel advised that it was not possible to confirm beyond a reasonable doubt that the longicorn beetle is non-indigenous to Barrow Island and recommended the species status remains as indeterminate. The incident classification was not amended.

After reporting on the detection of the Desert Muscleman Ant (*Podomyrma adelaidae*), and the Australian Iridescent Ant (*Calomyrmex purpureus smaragdinus*), the status of these two species was reviewed in consultation with the QEP. It was recommended that both species were potentially indigenous to Barrow Island. The incident classifications were not amended.

Intercepts Summary

There were 148 quarantine intercepts recorded during the reporting period. The majority of these were associated with NIS invertebrates (42%) and seed material (45%).

Event data: Quarantine detections
Procedural Deviation Summary Procedural Deviation events involved the detection and remediation/ rejection of freight with: • Compromised seals/ doors • Holes/ onion rust preventing inspection • Non compliant packaging (eg used cardboard) • Non compliant commodities (eg unapproved natural materials) • Personnel not following procedures while transiting through Barrow Island
Conclusions
Quarantine NIS Management Plan was developed for the Jumping Spider (*Menemerus nigli*), which has been introduced to Barrow Island. Refer to Section 3.2 (Invertebrate results – NIS Management) for further details. Quarantine Incursion Response remains in place for the Maritime Earwig (*Anisolabis maritima*) and the Ring-legged Earwig (*E. annulipes*). Refer to Section 3.2 (Invertebrate results) for further details. Quarantine First Response and eradication activities for the Indian House Cricket (*Gryllodes sigillatus*) were successfully concluded during the Reporting Period. Area freedom was declared in October 2022. A sentry surveillance program remains in place, with no further crickets detected. All other NIS detected during the Reporting Period were successfully remediated immediately following detection. Surveillance will continue for Kapok Bush (*Aerva javanica*) until CAPL is confident no residual seed bank remains. Following the Quarantine incidents, intercepts, and procedural breaches recorded, actions were taken to: • Issue awareness material to reinforce quarantine requirements amongst workforce and suppliers • Issue toolboxes and fact sheets to promote quarantine reporting culture • Review response activities to align with procedures and identify improvements • Review response equipment and readiness • Review quarantine barriers in place along associated pathways.

3.4 Changes to the Quarantine Management System

The Terrestrial and Marine QMS (GOR-COP-01854) was revised once during the Reporting Period. Revision 2.0 of the QMS (Ref. 5) was submitted to DWER and the Commonwealth Department of the Environment, Energy and Water (DCCEEW) in 2021.

In addition, a review of supporting Quarantine Procedures and Standards documentation has also been undertaken.

3.5 Studies

No QMS-related studies were carried out during the Reporting Period.

3.6 Five-year Overview of Environmental Performance

The 2020–2025 outcome for terrestrial and marine quarantine is summarised in the table below.

Objectives[1]	Outcome
Ensure that there is no introduction or proliferation of Non-indigenous Terrestrial Species and Marine Pests to Barrow Island or the waters surrounding Barrow Island, as a consequence of the Proposal	One NIS was declared as introduced to Barrow Island, as a consequence of the Gorgon Gas Development; The Jumping Spider *(Menemerus nigli)*. This was declared in 2021 following consultation with independent SMEs and the QEP. No other quarantine introductions (including marine pest species or weeds) were recorded on Barrow Island or the waters surrounding Barrow Island.
Prevent the introduction of Non-indigenous Terrestrial Species and Marine Pests	The objective of a Quarantine Response, following the detection of confirmed or suspect NIS is to contain, control and eradicate the species to prevent introduction.

Objectives[1]	Outcome
	Quarantine responses were implemented following the detection of the following NIS on Barrow Island during this reporting period. No NIS survived past that phase, and no proliferations of existing NIS occurred to Barrow Island or the waters surrounding Barrow Island: - Little red tree frog (*Litoria rubella*) - Asian house gecko (*Hemidactylus frenatus*) - Racing pigeon (*Columba livia*) - Red collared dove (*Streptopelia tranquebarica*) - Spotted Pilbara rock gehyra (*Gehyra punctata*) - Lesser Auger Beetle (*Heterobostrychus aequalis*), - Cigarette Bettle (*Lasioderma serricorne*), - Gisborne Cockroach (*Drymaplaneta semivittata*), - Indian Meal Moth (*Plodia interpunctella*), A quarantine First Response was successfully implemented to eradicate the Indian House Cricket (*Gryllodes sigillatus*). This was first detected around the GTP in January 2020 (prior to the Reporting Period) with the last detection of *G. sigillatus* occurring in December 2021. Following recommendations from independent SMEs and the QEP, successful eradication was declared in October 2022 after demonstrating area freedom. The response was therefore closed. A quarantine Incursion Response remains on-going following the February 2021 detection of the Maritime Earwig (*Anisolabis maritima*). The species has expanded into the sandy interface of the x-blocks on Terminal Beach (September 2024) and Bivalve Beach (August 2025). A chemical treatment program and monitoring program is in place with the aim of preventing establishment. Additional consultation with SMEs and the QEP is underway to support the response efforts. A quarantine First Response remains open to detect the presence of the Ring-legged Earwig *(Euborellia annulipes)* around locations of historical detections at the GTP and Butler Park. There have been no detections of NIS during response activities. A quarantine First Response remains in place for the Kapok Bush *(Aerva javanica*) (found in 2016, a previous Reporting Period) until CAPL is confident no residual seed bank remains.
Detect Non-indigenous Terrestrial Species (including weed introduction and/or proliferation) and Marine Pests	The terrestrial NIS and marine pest surveillance programs were implemented successfully to detect NIS invertebrates, vertebrates, marine pest and weeds as described in Section 1.2 monitoring results.
Control and, unless otherwise determined by the Minister, eradicate detected Non-indigenous Terrestrial Species (including weeds) and Marine Pests	Following confirmed species identification of the Jumping spider (*Menemerus nigli*) on Barrow Island in 2021, CAPL initiated a response to determine the extent of the species across tenure and in the natural environment. Advice from SME and QEP indicated that eradication was not possible for *M. nigli* due to potential impacts on native species. In line with Ministerial Statement 800 (Conditions 9.2 & 10.3), in September 2021, the QEP notified the Minister for Environment of this introduction, and the recommendation that eradication was currently not feasible. A response was received in November 2021. Ongoing surveillance and a NIS Management Procedure have been developed and implemented to prevent the proliferation of *M. nigli*, with targets including annual reporting requirements and surveillance of known and potential habitats. No other NIS survived past Quarantine Response phases, and no proliferations of existing NIS occurred on Barrow Island or the waters surrounding Barrow Island.

Objectives[1]	Outcome
Mitigate adverse impacts of any control and eradication actions on indigenous species taken against detected Non-Indigenous Terrestrial Species (including weeds) and Marine Pests.	Quarantine response activities must consider and mitigate against adverse impacts during implementation on Barrow Island. These mitigative actions include complying with Species Action Plans, which identify best practice, complying with product labels when utlising chemicals such as insecticides and herbicides, adhering to standard operating procedures during surveillance and trapping activities, to minimise non-target captures and comply with animal welfare requirements.

1 As defined in Condition 10.3 of MS 800, and Condition 8.3 of EPBC 2003/1294 and 2008/4178.

3.7 Proposed Environmental Management Improvements

No management improvements related to the Terrestrial and Marine QMS (Ref. 5) are proposed as part of this Five-year EPR.

4 Marine Turtles

Table 4-1: EPR Reporting Requirements for Marine Turtles

Item	Source	Section in this EPR
Results of all marine turtle monitoring carried out by the Proponent, including any detected changes to the Flatback Turtle population	MS 800, Schedule 3(3i) EPBC 2003/1294 and 2008/4178, Schedule 3(3i)	4.1, 4.6
Reportable incidents involving harm to marine turtles	MS 800, Schedule 3(3ii) EPBC 2003/1294 and 2008/4178, Schedule 3(3ii)	4.3
Changes to the marine turtle monitoring program	MS 800, Schedule 3(3iii) EPBC 2003/1294 and 2008/4178, Schedule 3(3iii)	4.1
Conclusions about the status of Flatback and other marine turtle populations on Barrow Island	MS 800, Schedule 3(3iv) EPBC 2003/1294 and 2008/4178, Schedule 3(3iv)	4.1, 4.6
Changes (if any) to the Long-term Marine Turtle Management Plan	MS 800, Schedule 3(3v) EPBC 2003/1294 and 2008/4178, Schedule 3(3v)	4.5
Findings of the annual audit and review on the effectiveness of lighting design features, management measures, and operating controls including details of light management initiatives and activities undertaken during the year	MS 800, Schedule 3(3vi) EPBC 2003/1294 and 2008/4178, Schedule 3(3vi)	4.4
Results of studies undertaken	MS 800, Schedule 3(3vii) EPBC 2003/1294 and 2008/4178, Schedule 3(3vii)	4.2
Noise monitoring results and a discussion on the success (or otherwise) in meeting noise emission targets	MS 800, Schedule 3(3viii) EPBC 2003/1294 and 2008/4178, Schedule 3(3viii)	N/A[1]
A five-year overview of environmental performance	MS 800, Condition 5.3(iii) EPBC 2003/1294 and 2008/4178, Condition 4.2(iii)	4.7
Proposed environmental management improvements	MS 800, Condition 5.3(iv) EPBC 2003/1294 and 2008/4178, Condition 4.2(iv)	4.8
A review of whether there are any reasonably practicable management measures, operating controls or design features that can be implemented to reduce or eliminate the alteration of the light horizon on the east coast beaches of Barrow Island as a result of the implementation of the Proposal	MS 800, Condition 5.3(v) EPBC 2003/1294 and 2008/4178, Condition 4.2(v)	4.4

1 *No specific noise emission targets for the Gorgon Gas Development apply to environmental receptors; noise monitoring is considered in relation to monitoring results for the Flatback Turtle population. As reported in the Five-year EPR (Ref. 6): 'Given the results to date, the difficulty in detecting any onshore noise or vibration effects from Gorgon Gas Development activities on the beaches, and endorsement from the Marine Turtle Expert Panel (and subsequent regulatory approval), the noise and vibration monitoring program was suspended after the 2011–2012 season.' Therefore, reporting for this item is not applicable.*

4.1 Monitoring Results

An objective of the Long-term Marine Turtle Management Plan (LTMTMP) (Ref. 7), as defined by Ministerial conditions, is to establish a statistically valid monitoring program to measure and detect changes to the Flatback Turtle population on Barrow Island (Figure 4-2).

Key demographic parameters have been identified as necessary for understanding the population dynamics and population viability of the Flatback Turtle rookery on Barrow Island. A mainland Reference site (Mundabullangana has also been established (Figure 4-1). Where relevant, data related to these key parameters are also captured at Mundabullangana for comparison with the Barrow Island Flatback Turtle data (Ref. 7).

Changes in key demographic parameters are measured using time-series control charts. Trends identified in control charts act as early-warning signals to guide a tiered management approach. A management response is triggered if a demographic parameter demonstrates a trend towards, or changes beyond statistical deviations (±1, ±2, or ±3 SD), standard error (SE), mean or median absolute deviation (MAD) or mean from baseline conditions (Ref. 7).

The 2020–2025 results for the monitoring programs listed in the LTMTMP, including any changes detected to the Barrow Island Flatback Turtle population, are summarised in the following tables.

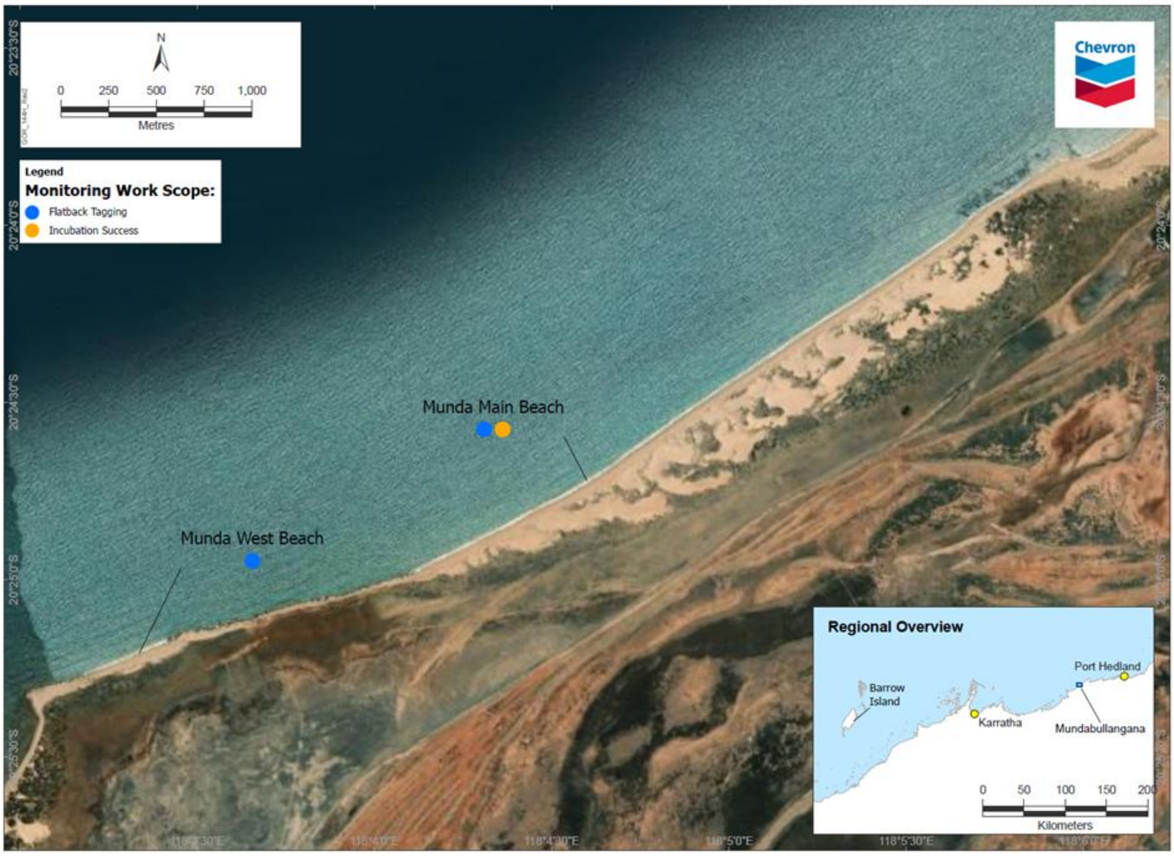


Figure 4-1: Flatback Turtle beaches at Mundabullangana surveyed during the Reporting Period

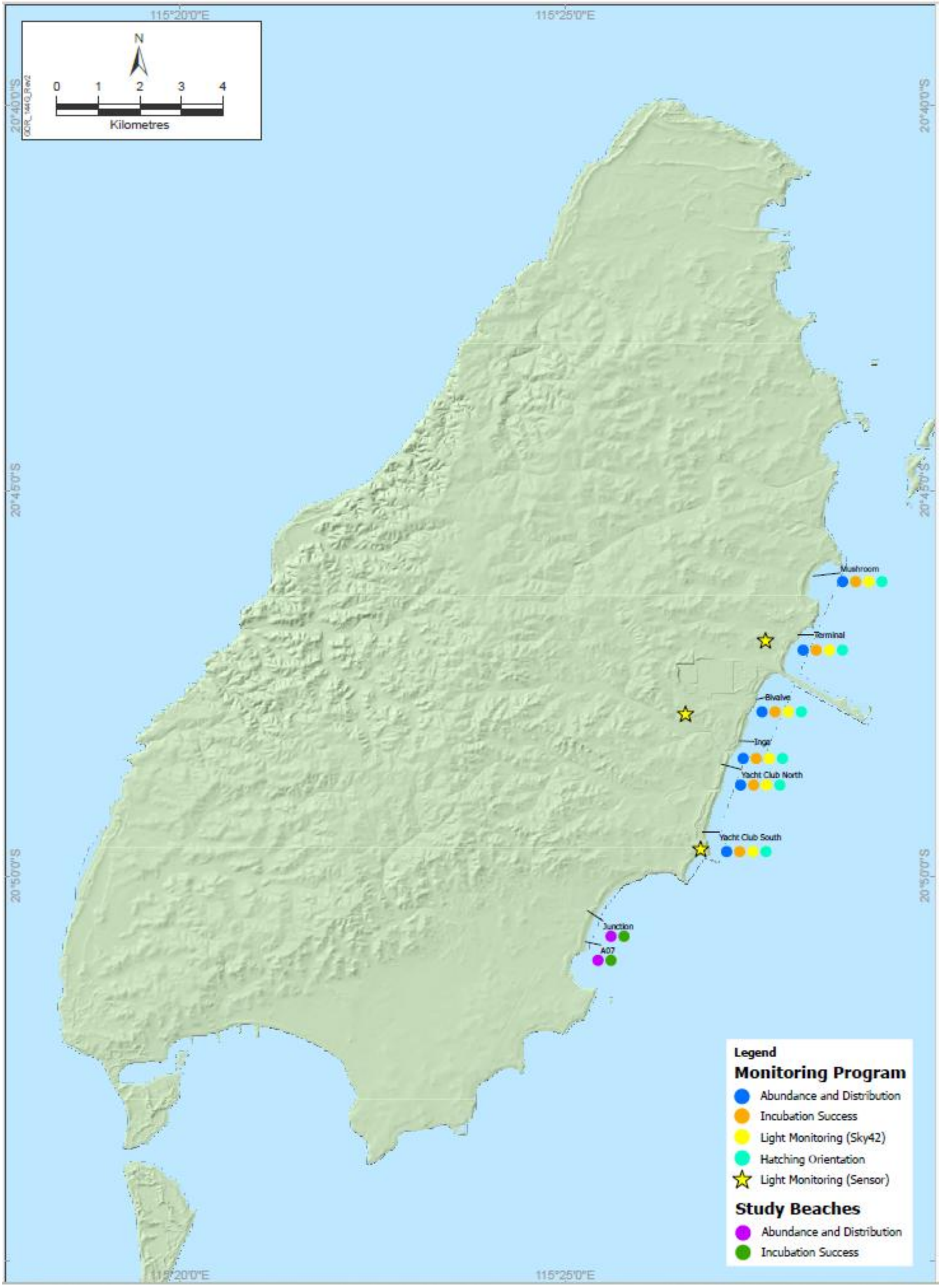


Figure 4-2: Flatback Turtle beaches on Barrow Island surveyed during the Reporting Period

Monitoring program: Flatback Turtle abundance and distribution

Objective

To measure and detect changes to the abundance, distribution, and nesting behaviour of adult Flatback Turtles

Changes to program

No substantial changes were made to the survey method for the Abundance and Distribution Monitoring Program during the Reporting Period. Each year some planned nights were missed due to cyclones, rainfall, lightning or strong winds.

Considerable changes to the analysis method were implemented in 2024 and 2025. In 2024, an error was discovered in the multi-state open robust design (MSORD) model code responsible for filtering the Capture-Mark-Recapture (CMR) dataset. The error related to data collected on Junction, A07 and Camp beaches, which are non-routine monitoring beaches on Barrow Island, and part of a study to investigate turtle movements outside the six routine beaches (see Section 4.2.1). This error led to an overestimation of the annual abundance of adult flatback turtle nesters in each season since 2016/17. DWER and DCCEEW were informed of this error in July 2024.

This filtering error has been corrected, so the MSORD results presented in this EPR use the updated CMR dataset to derive the population demographic estimates. Consequently, the estimates in the control charts for annual nester abundance, breeding omission probability, and clutch frequency will differ from those presented in previous EPRs from 2016/17 to 2022/23, as will the EWMA control chart that compares Barrow Island and Mundabullangana annual nester abundance.

In 2025, the analysis of the 20-year time series data used a modified approach as directed by the Marine Turtle Expert Panel (MTEP). Changes were made to account for variations in spatial and temporal survey effort during the baseline period, and to achieve a more representative measure of biological output using parametric (means) rather than non-parameter (medians) statistics. The baseline data for annual nesters at Barrow Island was revised to account for variations in spatial and temporal survey effort during the baseline period. Since 2010/11, survey effort has remained relatively consistent across the six routinely monitoring beaches, with minor temporal deviations due to weather-related disruptions.

Methodology

Survey method

- Annual monitoring via CMR was undertaken between November and January on six beaches at Barrow Island, as shown in Figure 4-2. Routinely monitored beaches are Mushroom, Terminal, Bivalve, Inga, Yacht Club North (YCN) and Yacht Club South (YCS). Annual monitoring via CMR at Mundabullangana was undertaken between November and January on the beaches shown in Figure 4-1.

Analysis method

- CMR sampling of nesting adult female Flatback Turtles was used to estimate demographic parameters of annual nester abundance, adult female survival probability, adult female breeding omission probability, clutch frequency, internesting interval, and nesting activity.
- An MSORD model uses the CMR dataset to derive the population demographic estimates. To facilitate comparison, the same parameters are estimated for Mundabullangana using the same approach as Barrow Island. Confidence Intervals (CI) and Standard Error (SE) are provided.
- EWMA control charts have been used to compare mean nester abundance between the At Risk site Barrow Island and the Reference site Mundabullangana since 2009/10. Only key demographic parameters are control-charted—including annual nester abundance, adult female breeding omission probability and clutch frequency. The adult survival probability control chart is no longer presented as this parameter has been modelled and plotted as a constant mean value over all seasons and does not have the potential to exceed the control limits.

Monitoring program: Flatback Turtle abundance and distribution
• Variation in modelled estimates can occur when models are re-run each year with additional data. Therefore, minor variations from year to year might occur in the historical control-charted parameter estimates presented in this EPR.
Results
The results of Flatback turtle abundance and distribution monitoring during the Reporting Period are presented in Table 4-2, Figure 4-3, Figure 4-4, and Figure 4-5 (Ref. 45).
Discussion
Annual female abundance was comparatively low in the past two seasons of the Reporting Period following two years of relatively high abundance. The most recent annual flatback turtle nester abundance at Barrow Island (2024/25) was estimated at 1,390 individuals (MSORD Model), the third lowest recorded value, and this exceeded the -3 MAD control limit while the nester abundance at Mundabullangana was approximately the average of the time series. The EWMA control chart that compares Barrow Island and Mundabullangana annual nester abundance remained within control limits but showed a decline in recent years. The causes and ecological significance of the decline in abundance over the past two seasons at both rookeries is presently ambiguous. Annual nesting abundances of sea turtles often exhibit non-monotonic trends with considerable temporal fluctuation due to various biological, environmental and anthropogenic influences. Elucidation of the specific drivers for the observed fluctuations is therefore challenging. One hypothesis is that nesting abundance is influenced by inter-annual variability in food resources and quality given the strong documented links between fat accumulation and reproductive output. Though for flatback turtles, this may be countered by the fact they exhibit lower inter-annual variability than some other species because they feed at a higher trophic level than some sea turtle species. Modelled breeding omission probability at Barrow Island (0.88) has increased over the last two seasons of the Reporting Period, is similar to 2020/21 and is higher on average compared to the baseline period. In 2024/25, the breeding omission probability at Barrow Island was significantly higher than at Mundabullangana, though the reasons for this are not clear. Differences in breeding omission probability may result from site specific differences in multiple biological, environmental or anthropogenic factors, including: one or any combination of changes at foraging grounds, redistribution of nesting to sites, bias from sampling, or changes in energy demands. The Barrow Island inter-nesting area is known to have a higher exposure to anthropogenic threats, and perhaps this increases energetic costs of migration to or nesting at that rookery. The differences in breeding omission between the two rookeries could be explained by differences in distance to foraging grounds. For example, the mean distance to Barrow Island is greater compared to Mundabullangana, with a 300 km shorter migration distance (600 km roundtrip). Clutch frequency is a difficult parameter to estimate accurately at Barrow Island and Mundabullangana due to the incomplete season monitoring, break in monitoring at Christmas, imperfect detection within the survey period and unpredictable temporal changes to monitoring due to cyclonic activity. The clutch frequency parameter estimate at Barrow Island exceeded the - 2 SD control limit. Beach usage by flatback turtles has shifted significantly since the onset of construction and operational activities at Barrow Island. Alterations in coastal geo-morphological dynamics at several beaches, particularly Inga, Bivalve, and Terminal, have affected the availability and spatial distribution of optimal nesting habitats, subsequently leading to shifts and reductions in habitat area. These changes have led to significant alterations in nesting patterns and activity distributions including a notable decline in usage at Bivalve Beach.

Table 4-2: Flatback Turtle Abundance and Distribution Results for Routine Monitoring Beaches During the Reporting Period

Results						
Parameters		**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**
Annual Nester Abundance (MSORD, 95% CI or SE shown)	**BWI**	1,464	1,817	1,819	1,237 ± 22	1,390 ± 29
	MDA	1,195	1,686 (1,573 – 1,799)	1,821 (1,738 – 1,905)	1,259 ± 39	1,547 ± 79
Survival Probability (Mean, % MSORD, 95% CI or SE shown)	**BWI**	0.94 (0.937–0.943)	0.939 (0.936 - 0.942)	0.939 (0.936 – 0.941)	0.922 (0.919–0.925)	0.921 (0.918–0.924)
	MDA	Not available	0.948 (0.944 - 0.953)	0.908 (0.892 – 0.921)	0.942 (0.937–0.945)	0.848 (0.835–0.859)
Breeding Omission Probability (%, MSORD, 95% CI or SE shown)	**BWI**	0.85 (0.83 - 0.87)	0.73 (0.70 - 0.75)	0.57 (0.54 - 0.60)	0.83 ± 0.01	0.88 ± 0.01
	MDA	0.68 (0.61 – 0.75)	0.49 (0.43 - 0.56)	0.28 (0.23 - 0.34)	0.54 ± 0.02	0.39 ± 0.04
Clutch Frequency (MSORD, 95% CI shown)	**BWI**	3.2 (3.2 - 3.5)	3.9 (3.8 - 4.1)	4.2 (4.1 - 4.4)	3.3 ± 0.1	2.9 ± 0.1
	MDA	Not available	3.0 (2.7 – 3.2)	4.0 (3.6 - 4.3)	Not available	Not available
Internesting Interval (days, SE)	**BWI**	12.9 ± 2.2	13.2 ± 1.9	14.1 ± 1.8	14.3 ± 1.8	13.6 ± 2.6
	MDA	12.6 ± 2.9	13.2 ± 3.4	13.8 ± 3.6	12.5 ± 1.8	12.4 ± 3.1
Nesting Activity (spatial and temporal distribution)	**BWI**	When compared to baseline, the nesting population has demonstrated temporal and spatial variation in how they use certain beaches at Barrow Island during the Reporting Period. The nesting population's use of certain beaches has likely varied due to changes in coastal processes, notably at Inga, Bivalve, and Terminal beaches, which have recorded a reduction and redistribution of nesting habitat (see Section 9 on Coastal Stability). Concurrently, the same beaches have recorded a shift in the location and change in the pattern of their nesting activities and, in the case of Bivalve beach, a significant decreasing trend in use of the beach.				
Management Triggers	**None**	Measured parameter remains in control limits.				
	Alert	Measured parameter deviates towards (but remains within) one standard deviation (1 SD) for two consecutive years (above or below the mean) or deviates outside a ±1 SD limit.				
	Review	Measured parameter deviates outside a ±2 SD limit.				
	Action	Measured parameter deviates outside a ±3 SD limit.				

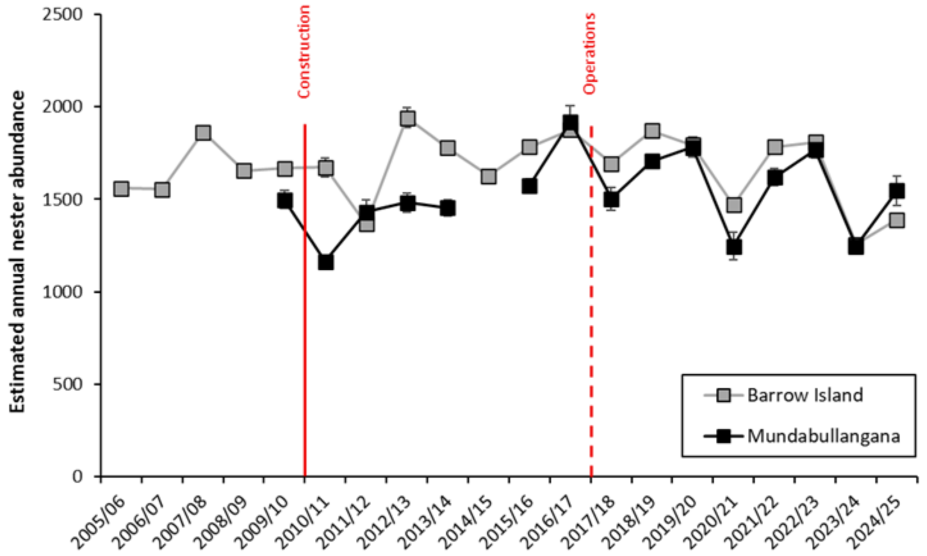


Figure 4-3: Estimated Annual Nester Abundance of Flatback Turtles at Barrow Island (Routine Beaches) and Mundabullangana between 2005/06 and 2024/25.

Error bars indicate standard error. Red line indicates commencement of construction. Red dash line indicates commencement of operations. There is no estimate for 2014/15 at Mundabullangana due to the limited sampling effort in that season.

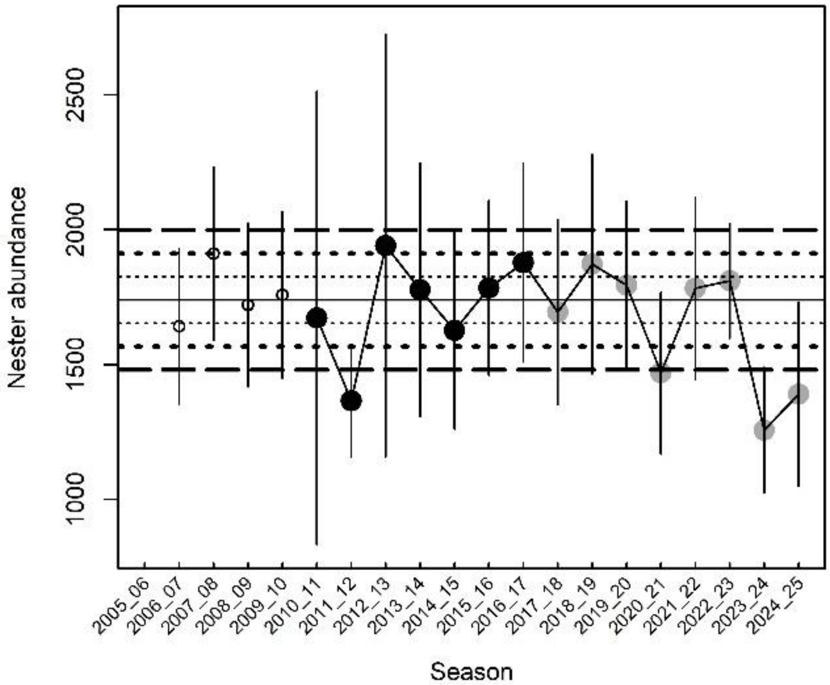


Figure 4-4: Control Chart for Nester Abundance at Barrow Island

Open dots = baseline, black dots = construction, grey dots = operations, solid lines = long-term expected estimate derived from baseline estimates (mean or median), dotted horizontal lines = ± 1 SD (or ± 1 MAD for annual nester abundance), dashed lines = ± 2 SD (or ± 2 MAD), long dashed lines = ± 3 SD (or ± 3 MAD). SD = Standard deviation of the mean, MAD = Median absolute deviation from the median. The lower error bar abundance chart represents the minimum number of turtles based on raw counts, while the upper bar represents the difference between the raw turtle count and the estimated value but in an upwards direction.

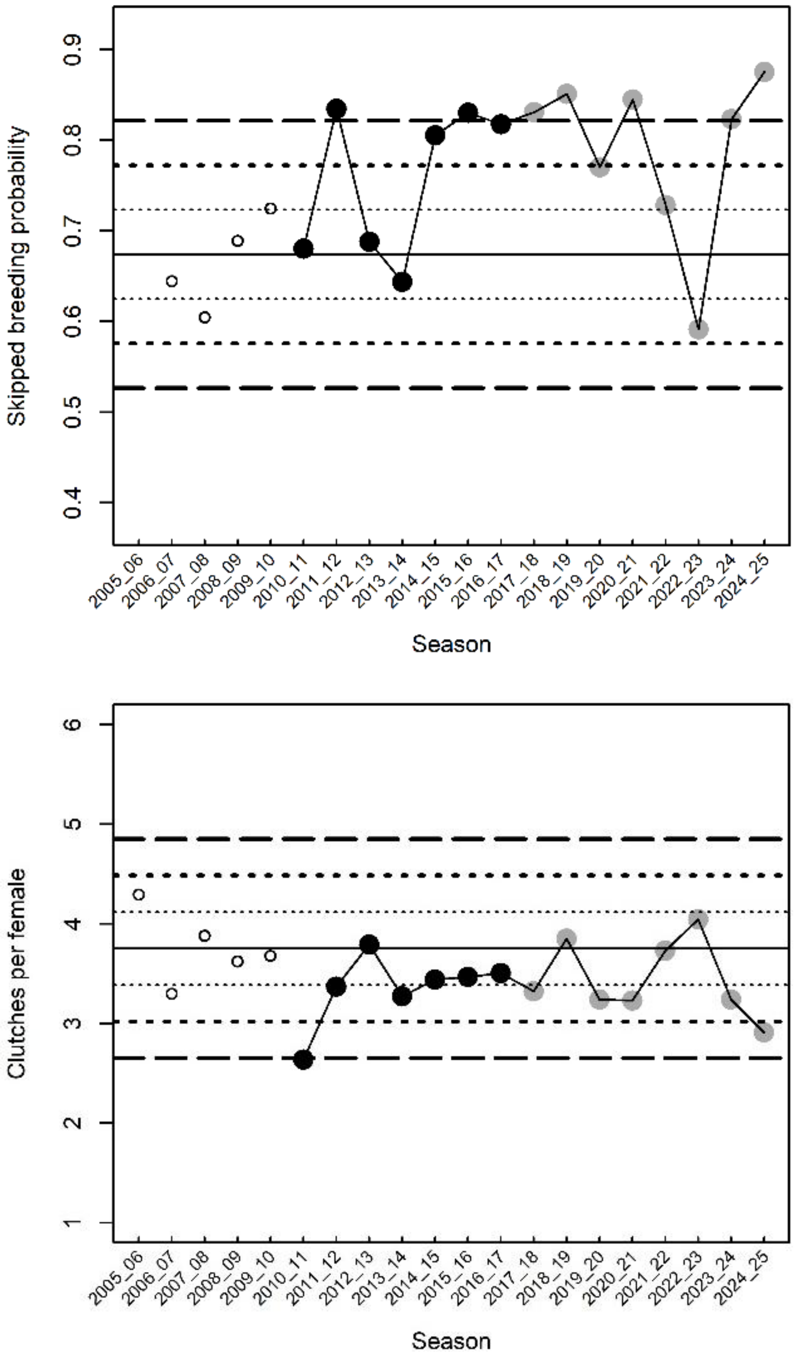


Figure 4-5: Control Charts for Demographic Parameters at Barrow Island: Breeding Omission Probability and Clutch Frequency

Open dots = baseline, black dots = construction, grey dots = operations, solid lines = long-term expected estimate derived from baseline estimates (mean or median), dotted horizontal lines = ± 1 SD (or ± 1 MAD for annual nester abundance), dashed lines = ± 2 SD (or ± 2 MAD), long dashed lines = ± 3 SD (or ± 3 MAD). SD = Standard deviation of the mean, MAD = Median absolute deviation from the median. The lower error bar abundance chart represents the minimum number of turtles based on raw counts, while the upper bar represents the difference between the raw turtle count and the estimated value but in an upwards direction.

Monitoring program: Flatback Turtle incubation success

Objective

To measure and detect changes to Flatback Turtle incubation success.

Changes to program

No changes were made to the survey method of the Flatback turtle Incubation success monitoring program during the Reporting Period.

In 2025 the analysis of the 20-year time series data in 2024/25 used a modified approach as directed by the MTEP. Changes were made to account for variations in spatial and temporal survey effort during the baseline period, and to achieve a more representative measure of biological output using parametric (means) rather than non-parameter (medians) statistics. Egg hatching probabilities and hatchling emergence probabilities are now reported as means rather than medians.

Methodology

Survey method

- Flatback turtle incubation monitoring was undertaken on Routine Beaches: Mushroom, Terminal, Bivalve and Inga between December and March (Figure 4-2). Monitoring at Mundabullangana was undertaken between November and January 2024 (Figure 4-1).
- Flatback turtles encountered while excavating their body pit or undertaking construction of an egg chamber were chosen for study. A temperature logger was placed in the egg chamber of the nest prior to oviposition. To reduce the potential for nests to become lost to the observer (i.e. if their marker post or marking tape was missing at excavation), the location and elevation of marked clutches was recorded using real-time kinematic (RTK) GPS (<5 cm accuracy). Marked clutches were excavated post-hatching to determine their fate and collect data on incubation duration, and egg hatching and hatchling emergence probability.

Analysis method

- Only key demographic parameters for Barrow Island are control-charted; these include mean egg hatchling probability for complete clutches and mean hatchling emergence probability for complete clutches. Incubation duration, incubation temperature and clutch size are also recorded.

Results

The results of Flatback turtle incubation success monitoring during the Reporting Period are presented in Table 4-3, Figure 4-6 and Figure 4-7 (Ref. 45).

Discussion

Incubation success monitoring results have largely remained within control limits during the Reporting Period. During the 2024/25 season storm surge flooding from Tropical Cyclone Sean resulted in the inundation of the majority (62%) of marked clutches, which significantly reduced volume of complete nests available for assessment, and likely biased incubation success parameters due to low sample sizes. (Ref. 45).

Additionally, incubation temperatures reached record highs at Barrow Island during 2024/25 season which subsequently resulted in a short incubation period of less than 46 days. Given this incubation duration, clutches laid before approximately 4 December 2024 may have hatched successfully before the cyclone's impact. Thus, the initiation of nest marking on 6 December 2024 likely resulted in a negative bias for observed incubation success parameters and the reduction in hatching probability caused by the TC Sean is not likely to have been consistent throughout the summer. Therefore, actual incubation success and hatchling production may have been significantly higher than indicated by observation during the monitoring period. Other sea turtle species have demonstrated shifts in phenology which have mitigated adverse impacts of climate change on reproductive output, and the evidence of an earlier nesting season at BWI during 2024/25 season may have reduced the impact of TC Sean (Ref. 45).

Monitoring program: Flatback Turtle incubation success
Overall, the egg hatching probability for complete clutches was low, exceeding the -1SD control limit. Hatching probability was also historically low at Mundabullangana this year likely due to the high incubation temperatures also recorded at that rookery, resulting in clutches spending a greater proportion of development above the thermal tolerance range (TTR) compared to Barrow Island clutches (Ref. 45). Collectively, the low number of turtle encounters, the flooding impacts from TC Sean, and the high incubation temperatures compounded to reduce hatchling productivity during 2024/25 season. Importantly, these impacts are not directly associated to any specific impact of the Gorgon Gas Development on the nesting habitat itself (Ref. 45).

Table 4-3: Flatback Turtle Incubation Success Results During the Reporting Period

Results						
Parameters		**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**
Mean / median Egg Hatching Probability (Complete clutches, %)	**Mushroom**	74.1 ± 28.6	82.5 ± 13.7	86.5 ± 16.1	92.0 ± 7.0	79.3 ± 23.5
	Terminal	77.2 ± 25.3	84.6 ± 17.5	84.7 ± 23.0	86.7 ± 16.4	81.6 ± 24.9
	Bivalve	76.6 ± 25.3	81.9 ± 24.0	90.6 ± 8.1	78.3 ± 36.1	64.7 ± 41.1
	Inga	82.3 ± 15.7	89.3 ± 10.8	80.7 ± 14.3	91.8 ± 6.7	49.0 ± 30.9
	BWI*	77.5 ± 24.0	83.6 ± 18.2	90.5*	94.1*	73.1 ± 31.3
	MDA	79.8 ± 23.7	83.0 ± 21.0	89.0 ± 17.2	82.9 ± 20.3	60.8 ± 31.4
Mean Hatchling Emergence Probability (Complete clutches, %)	**Mushroom**	73.5 ± 28.7	82.5 ± 13.7	85.9 ± 16.5	92.0 ± 7.0	79.3 ± 23.5
	Terminal	76.7 ± 25.6	84.0 ± 17.7	81.1 ± 23.8	86.7 ± 16.4	80.8 ± 25.0
	Bivalve	76.4 ± 25.5	81.2 ± 23.8	89.8 ± 8.5	77.1 ± 37.1	64.7 ± 41.1
	Inga	81.3 ± 16.6	89.0 ± 10.9	78.8 ± 23.7	91.2 ± 6.4	47.3 ± 30.3
	BWI*	76.9 ± 24.3	83.1 ± 18.1	89.9*	93.9*	72.7 ± 31.2
	MDA	N/A	82.6 ± 21.0	88.2 ± 17.2	81.8 ± 20.5	56.1 ± 30.5
Mean Incubation Duration (days)	**Mushroom**	48.3 ± 1.2	49.0 ± 3.1	49.4 ± 1.8	46.3 ± 1.5	45.6 ± 0.5
	Terminal	47.1 ± 1.8	49.0 ± 2.1	49.8 ± 3.2	46.8 ± 1.3	45.4 ± 1.8
	Bivalve	46.8 ± 1.4	47.1 ± 2.3	49.2 ± 2.2	46.2 ± 1.5	45.7 ± 1.2
	Inga	46.1 ± 1.8	46.8 ± 2.1	49.3 ± 3.1	45.9 ± 1.1	45
	BWI*	47.0 ± 1.7	47.2 ± 2.7	48.7 ± 2.6	46.3 ± 2.6	45.6 ± 1.1
	MDA	48.2 ± 1.1	48.3 ± 2.3	49.5 ± 2.4	46.3 ± 1.2	43.0 ± 1.8
Mean Incubation Temperature (°C)	**Mushroom**	31.7 ± 2.0	30.8 ± 1.7	30.5 ± 1.4	31.3 ± 1.3	32.7 ± 0.4
	Terminal	31.6 ± 2.0	30.5 ± 1.8	30.0 ± 1.5	30.8 ± 1.5	32.3 ± 0.3
	Bivalve	31.4 ± 1.8	31.3 ± 1.7	30.5 ± 1.5	31.0 ± 1.3	32.1 ± 0.4
	Inga	31.9 ± 1.8	31.5 ± 1.8	30.8 ± 1.5	31.4 ± 1.4	33.4
	BWI*	32.1 ± 2.2	31.4 ± 1.8	30.8 ± 1.6	31.1 ± 1.3	32.6 ± 0.5
	MDA	31.9 ± 1.8	31.3 ± 1.9	30.7 ± 1.9	32.1 ± 1.2	33.6 ± 0.4
Mean Clutch Size (No. eggs)	**BWI***	49.1 ± 8.7	49.1 ± 7.7	47.3 ± 9.9	44.3 ± 8.9	48.8 ± 8.1
	MDA	49.0 ± 5.6	48.6 ± 7.4	48.6 ± 7.4	48.1 ± 6.1	46.5 ± 8.3

Management Triggers	**None**	Measured parameter remains in control limits.
	Alert	Measured parameter deviates towards (but remains within) one standard deviation (1 SD) for two consecutive years (above or below the mean) or deviates outside a ±1 SD limit.
	Review	Measured parameter deviates outside a ±2 SD limit.
	Action	Measured parameter deviates outside a ±3 SD limit.

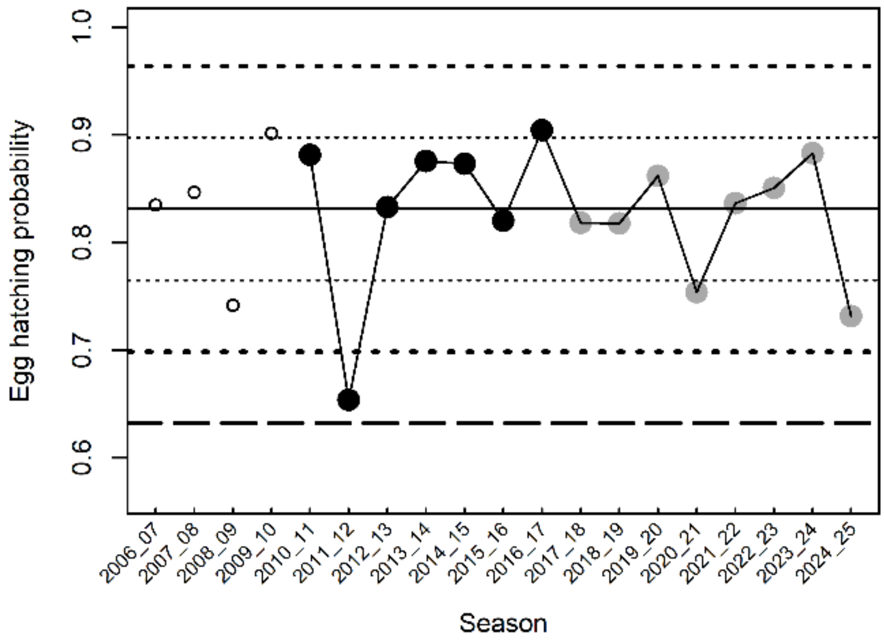


Figure 4-6: Control Chart for Mean Egg Hatching Probability for Complete Clutches at Barrow Island. All Routine Monitored Beaches (Mushroom, Terminal, Bivalve, and Inga are combined)

Open dots = baseline estimate derived from empirical data, black dots = construction parameter estimate, grey dots = operations parameter estimate, solid horizontal lines = long-term expected estimate derived from baseline estimates (median or mean), dotted lines = ± 1 MAD or SD, dashed lines = ± 2 MAD or SD, long dashed lines = ± 3 MAD or SD.

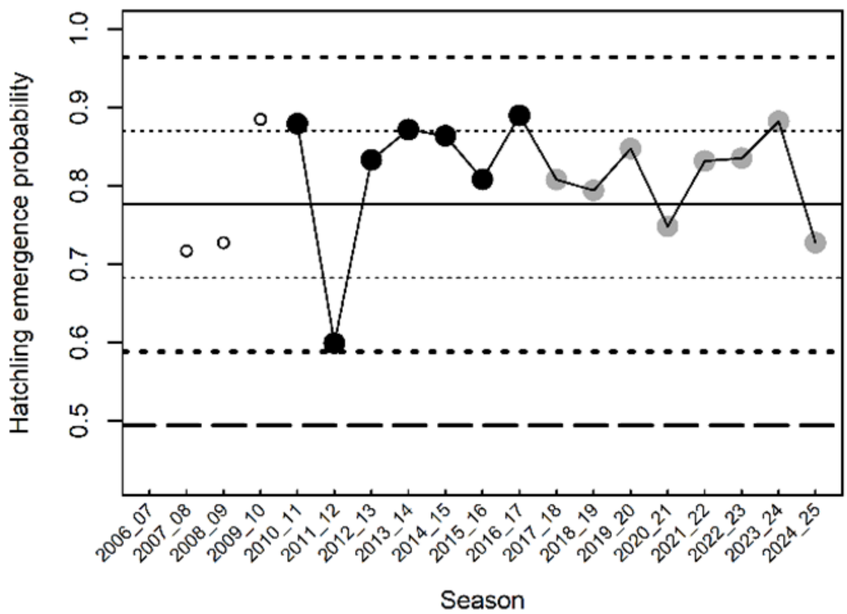


Figure 4-7: Control Chart for Hatchling Emergence Probability for Complete Clutches at Barrow Island All Routine Monitored Beaches (Mushroom, Terminal, Bivalve, and Inga are combined)

Open dots = baseline estimate derived from empirical data, black dots = construction parameter estimate, grey dots = operations parameter estimate, solid horizontal lines = long-term expected estimate derived from baseline estimates (median or mean), dotted lines = ± 1 MAD or SD, dashed lines = ± 2 MAD or SD, long dashed lines = ± 3 MAD or SD.

Monitoring program: Hatchling orientation

Objective

To measure and detect variation in dispersal patterns of Flatback Turtle hatchlings following emergence from the nest.

Changes to program

- No changes were made to the survey method used for measuring the orientation and fan offset angle of marine turtle hatchling tracks during the Reporting Period.
- Continuous light monitoring was implemented in 2023 using sensors installed at three long term locations near the GTP and Flatback turtle rookery.

Methodology

Survey method

- Measure artificial light (magnitude and bearing) on marine turtle nesting beaches using specialised light-measurement cameras (All-Sky Camera, ASC). Each ASC was deployed overnight at a fixed monitoring site on the beach to maintain consistency in camera placement (height and location) across seasons. All captured images were batch-processed using specialised software (Sky Quality Camera; Euromix Pty Ltd). Processing involved converting each image into an isophote (light-level) contour map and calculating mean sky brightness values (Vmag/arcsec²; Vmag) for both the entire sky (whole-of-sky) and the zenith (0–30° field of view).
- Measure the orientation (fan spread angle, disorientation) and fan offset angle (from most direct line to the ocean, misorientation) of marine turtle hatchling tracks on beaches. Selected beaches are Mushroom, Terminal, Bivalve, Inga, YCN and YCS (Figure 4-2).

Analysis method

- The isophote map corresponding to the median sky brightness during the clearest weather night was selected and converted into an equirectangular panorama for inclusion in this report. This panoramic image was then used to identify the bearings of all visible artificial light sources.
- For hatchling orientation parameters, a linear mixed model with fixed effects (season, month, full moon) is fitted to the power transformed (Yeo/Johnson) dispersion data. Parameters are control-charted for Bivalve and Terminal beaches only.

Light Results

- Sources of night-time light emissions remained consistent throughout the 2021–2025 Reporting Period and included the LNG site, POF, ground flare, Butler Park and offshore infrastructure including the MOF, the Jetty Head (with an LNG/condensate tanker present on most monitoring nights). A temporary lighting tower and minor reflected luminance from the pipe rack were occasionally visible from Bivalve beach. The CO_2 injection sites were not visible from any monitoring site.
- Whole-of-sky (WOS) brightness was consistently highest at Bivalve, followed by (in descending order) Inga, Terminal, YCN, YCS, and Mushroom beaches. The WOS value was brightest at monitoring sites situated closest to the LNG site (i.e. Inga and Bivalve) and darkest at monitoring sites situated the furthest away from the LNG site (i.e. YCS and Mushroom). In general, greater variation in sky brightness was reported on nights with cloud cover and/or with increased flaring events. Sky brightness varied most on nights with cloud cover or increased flaring. The darkest (and lowest variance) WOS values were recorded during clear conditions.
- The presence of LNG/condensate tankers at the Jetty Head was a consistent contributor to increased night-time light emissions across the 2021–2025 Reporting Period. The tankers were visible from all monitoring sites and their presence, particularly on cloud-covered nights, was associated with elevated WOS brightness values.

Monitoring program: Hatchling orientation
Hatchling Orientation Results
The results of Flatback turtle hatchling orientation monitoring during the Reporting Period are presented in Table 4-4 and Figure 4-8 (Ref. 45).
Discussion
Hatchling orientation metrics have largely remained within control limits during the Reporting Period, noting the challenges of recording these metrics in the field. Importantly, an increase in offset angle (misorientation) and fan spread (as a potential indication of disorientation) may elevate the risk to hatchling survivourship (for example, due to increased onshore predation, energy expenditure or mortality). However, a relatively small change in offset or spread metrics does not provide evidence of increased hatchling mortality. Hatchling fan angles on Barrow Island are only measurable in a fraction of cases due to the presence of native fauna tracks. This may bias the hatchling offset and spread measured, especially if the presence of animal tracks is correlated with the number of hatchlings emerging from the nest. There were significant correlations between hatchling offset and spread and the number of hatchlings used in fan angles, with increasing spread with increasing hatchling tracks. The mean number of hatchling tracks used in fan angles in 2024/25 was much lower than the mean number of hatchlings emerging per nest suggesting there may be a bias towards lower spread and offset. In 2024/25 only 2% of clutches were above the mean expected emergence for complete clutches of ca. 36 hatchlings, suggesting fan angles and offset angles may be higher than reported. Substantially fewer hatchling fans were recorded during the 2024/25 season across all beaches (n = 90) compared to last season (n = 222). This could not be explained by presence of fauna activity, which was also lower when compared to previous seasons and reflected in the number of obscured fans detected (n = 19 in 2024/25 vs. n = 118 in 2023/24). Consistent with other sites in the Pilbara region including at Ashburton River Delta, the nesting habitat was impacted by severe weather related to TC Sean in mid-January, which resulted in reduced incubation success and consequently lower hatchling emergences. Analysis of the hatchling orientation time series data revealed a statistically significant linear increase in hatchling fan offset and post-emergence spread at Bivalve beach in comparison to the baseline period. This was reflected in the control chart exceedances in the spread angle at Bivalve (+2 SD) and the offset angles at Bivalve (+1 SD) and Terminal (+2 SD). While, nightly visibility of artificial light is variable at Barrow Island based on operational conditions, vessel movements and weather conditions, no new significant sources of artificial light were identified in 2024/25 visible from the nesting beaches. While there is an observed increasing trend in post-emergence spread and offset at Bivalve, continued low sample sizes and changes in the spatial distribution of nests on the beach since baseline reduce the certainty in this result.

Table 4-4: Flatback Turtle Hatchling Orientation Results During the Reporting Period

Results						
Parameters		**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**
Mean Hatchling post-emergence spread (°)	**Mushroom**	48.6 ± 17.1	50.8 ± 13.1	57.5 ± 18.7	61.4 ± 21.7	59.6 ± 18.6
	Terminal	47.3 ± 16.8	55.3 ± 12.7	51.7 ± 18.3	53.2 ± 21.9	65.7 ± 38.2
	Bivalve	61.6 ± 26.8	58.9 ± 24.8	50.2 ± 10.2	53.8 ± 19.4	72.2 ± 30.7
	Inga	54.1 ± 17.9	57.5 ± 23.7	48.7 ± 12.0	53.6 ± 20.9	46.7 ± 18.5
	YCN	60.2 ± 19.1	66.2 ± 20.5	60.2 ± 21.4	58.5 ± 19.1	51.4 ± 19.8
	YCS	70.5 ± 21.0	67.8 ± 19.6	60.5 ± 21.4	58.4 ± 21.4	62.5 ± 30.7
Mean Hatchling post-emergence offset (°)	**Mushroom**	13.2 ± 9.9	7.2 ± 5.9	6.6 ± 4.7	7.0 ± 5.2	9.9 ± 9.1
	Bivalve	10.8 ± 9.5	14.2 ± 7.8	9.4 ± 7.6	10.4 ± 8.8	11.7 ± 8.7
	Terminal	11.9 ± 7.2	10.4 ± 8.6	8.9 ± 7.3	7.8 ± 6.8	16.9 ± 13.8
	Inga	12.6 ± 5.4	7.5 ± 7.2	7.5 ± 4.3	8.0 ± 6.5	11.6 ± 14.6
	YCN	11.2 ± 7.7	11.5 ± 11.0	7.7 ± 6.6	8.8 ± 6.9	11.1 ± 11.3
	YCS	10.3 ± 6.3	7.5 ± 6.4	9.2 ± 6.1	10.6 ± 8.7	25.0 ± 25.6
Management Triggers	**None**	Measured parameter remains in control limits.				
	Alert	Measured parameter deviates towards (but remains within) one standard deviation (1 SD) for two consecutive years (above or below the mean) or deviates outside a ±1 SD limit.				
	Review	Measured parameter deviates outside a ±2 SD limit.				
	Action	Measured parameter deviates outside a ±3 SD limit.				

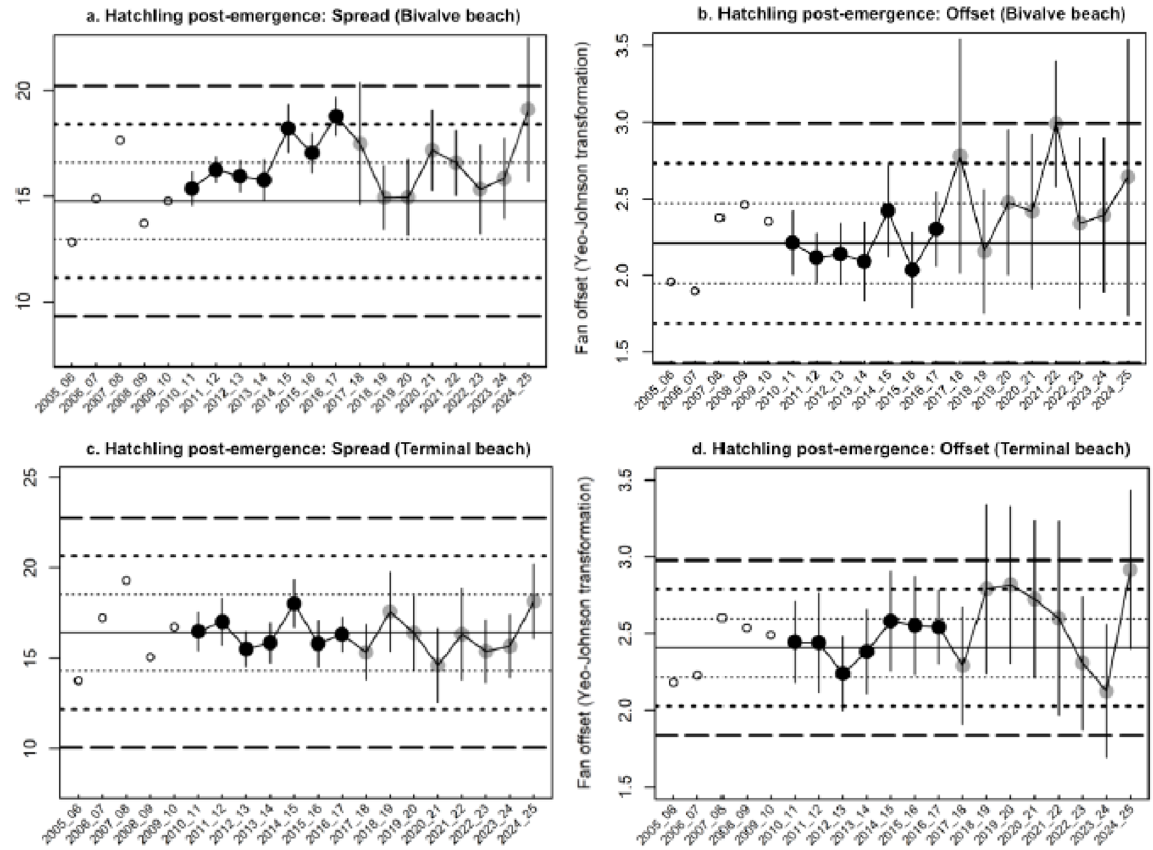


Figure 4-8: Control Charts for Hatchling Post-emergence Dispersion: Fan Spread and Offset Estimates at Terminal and Bivalve Beaches

Open dots = baseline estimate derived from empirical data, black dots = construction parameter estimate, grey dots = operations parameter estimate, solid horizontal lines = long-term expected estimate derived from baseline estimates, dotted lines = ± 1 SD, dashed lines = ± 2 SD, long dashed lines = ± 3 SD. Error bars indicate 95% confidence intervals.

4.2 Studies

4.2.1 Flatback Turtle Abundance and Distribution – Additional Beaches

Due to a reduction of optimal flatback turtle nesting habitat at Terminal, Bivalve, and Inga beaches, and related shifts in nesting distribution, a recommendation was made by Chevron (and supported by the MTEP) to extend the scope of the existing Flatback Turtle Abundance and Distribution Monitoring Program to include the monitoring of three additional beaches on the east coast of Barrow Island, south of the routine monitored beaches (see Figure 4-2).

A study commenced in 2016/17 to detect potential movements of Flatback turtles away from the Routine Beaches to those beaches that are not routinely monitored, specifically A07, Junction, and Camp beaches (Additional Beaches). This study aimed to provide a better understanding of spatial and temporal variation in nesting beach usage and beach fidelity for those turtles encountered at A07, Junction, and Camp beaches. Based on the low nesting activity observed on Camp Beach, it was acknowledged by MTEP that it was not essential to continue studies on this beach and the additional beach scope was reduced to A07 and Junction beaches from 2018/19 onwards. The Abundance and Distribution Study at Additional Beaches was concluded in 2023/24 with agreement from MTEP.

The results of this study provide valuable data to the overall monitoring of Flatback turtles at Barrow Island. Table 4-5 summarises the key results showing the number of sighted individual flatback turtles, new (untagged) and remigrant (previously tagged) turtles recorded each season of the Reporting Period (Ref. 45).

One key finding was that turtles sighted at A07 and Junction Beaches demonstrated strong fidelity to these two most southerly beaches. This pattern has persisted, likely due to the spatial separation from the six Routine Beaches further north and no significant nesting beaches to the south except for Stokes Beach, about 7 km away (see Section 4.2.3.1 for track census study results).

The relative use of the Junction and A07 remained consistent, with Flatback turtle sightings occurring at these beaches ranging from 20-25% of the total (Routine plus Additional beach sightings combined) Flatback turtle sightings from 2017/18 to 2023/24. The data indicates that when turtles did move away from Junction or A07, they were most frequently resighted on the next adjacent beaches, YCS and YCN.

Table 4-5: Flatback Turtle Abundance and Distribution Study at Additional Beaches - Results During the Reporting Period

Results						
Parameter	**Location**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	**2023/24**
Total turtles	**Routine Beaches(1)**	1,475	1,167	1,446	1,596	1,024
	Additional Beaches(2)	468	388	411	497	250
New turtles	**Routine**	242	169	203	153	110
	Additional	59	38	31	22	11
Remigrant turtles	**Routine**	1,233	998	1,243	1,443	914
	Additional	409	350	380	475	239

1 *Routine = YCS, YCN, Inga, Bivalve, Terminal, Mushroom.*

2 *Additional = A07, Junction, Camp.*

4.2.2 Incubation Success – Additional Beaches

With a potential shift in Flatback nesting distribution, Chevron and the MTEP sought to further understand the nest incubation environment at the Additional Beaches, as well as beaches within the routine Abundance and Distribution Monitoring Program but not routinely monitoring for incubation success – namely Inga, YCN and YCS.

A parallel study commenced in 2016/17 to investigate beach sand temperature, then incubation success (from 2017/18 onwards). Survey and analysis methods followed those used for the routine Incubation Success Monitoring program and included clutch size; incubation duration; egg hatching probability; hatchling emergence probability; incubation temperature; and clutch fate as parameters. The Incubation Success Study at Junction and A07 Beaches was concluded in 2023/24 with agreement from MTEP. Chevron continued the study at Inga, YCS and YCN in 2024/25.

The results of this study provide valuable data to the overall monitoring of Flatback turtles at Barrow Island. Table 4-6 summarises the key Incubation Success parameters recorded for Additional Beaches each season of the Reporting Period (Ref. 45).

Table 4-6: Flatback Turtle Incubation Success Results from Additional Beaches During the Reporting Period

Results						
Parameters		**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**
Mean Egg Hatching Probability (Complete clutches, %)	**YCN**	71.3 ± 25.6	79.4 ± 11.5	84.9 ± 8.9	92.8 ± 5.7	50.3 ± 46.0
	YCS	67.2 ± 31.6	88.4 ± 8.2	81.8 ± 16.9	92.7 ± 8.4	93.9 ± 1.2
	Junction	78.0 ± 27.7	67.4 ± 33.6	77.2 ± 32.6	80.3 ± 29.6	N/A
	A07	69.3 ± 32.2	88.1 ± 16.3	88.1 ± 14.1	88.6 ± 26.9	N/A
	BWI	77.5 ± 24.0	83.6 ± 18.2	90.5*	94.1*	73.1 ± 31.3
Mean Hatchling Emergence Probability (Complete clutches, %)	**YCN**	70.9 ± 25.4	78.0 ± 10.8	81.9 ± 13.1	92.8 ± 5.7	49.7 ± 45.5
	YCS	66.3 ± 32.1	87.5 ± 9.1	79.9 ± 17.8	92.7 ± 9.4	92.7 ± 2.8
	Junction	77.5 ± 27.7	67.4 ± 33.6	77.0 ± 32.6	80.3 ± 29.6	N/A
	A07	69.3 ± 32.2	88.1 ± 16.3	87.4 ± 13.7	88.6 ± 26.9	N/A

	BWI	76.9 ± 24.3	83.1 ± 18.1	89.9*	93.9*	72.7 ± 31.2
Mean Incubation Duration (days)	**YCN**	44.8 ± 1.5	45.6 ± 1.8	47.2 ± 2.1	44.8 ± 1.6	46.0 ± 1.0
	YCS	47.0 ± 2.5	46.6 ± 2.7	48.2 ± 2.4	47.2 ± 1.9	45.5 ± 0.6
	Junction	45.8 ± 1.0	46.3 ± 2.4	47.6 ± 2.3	47.0 ± 2.3	N/A
	A07	47.0 ± 1.6	46.2 ± 3.4	47.4 ± 2.4	45.8 ± 1.0	N/A
	BWI	47.0 ± 1.7	47.2 ± 2.7	48.7 ± 2.6	46.3 ± 2.6	45.6 ± 1.1
Mean Incubation Temperature (°C)	**YCN**	32.4 ± 1.7	32.2 ± 1.6	31.6 ± 1.5	31.7 ± 1.1	33.1 ± 0.5
	YCS	31.6 ± 1.8	31.9 ± 1.7	30.9 ± 1.6	30.8 ± 1.1	32.7 ± 0.2
	Junction	32.1 ± 1.7	32.2 ± 1.9	31.0 ± 1.7	30.8 ± 1.3	N/A
	A07	32.2 ± 1.8	31.5 ± 1.5	31.0 ± 1.5	31.0 ± 1.1	N/A
	BWI	32.1 ± 2.2	31.4 ± 1.8	30.8 ± 1.6	31.1 ± 1.3	32.6 ± 0.5

Note: Median values presented

4.2.3 Track Census and Beach Temperature Assessment

A Marine Turtle Track Census and Beach Temperature Assessment was undertaken annually between 2004/05 to 2017/18 and concluded in 2018 given that objectives of the study were completed, and it was determined that no adverse impacts attributable to construction activities were detected relating to distribution and abundance of marine turtle nesting activity. However, a commitment was made to complete an additional survey after a 5-year period to determine whether any changes had occurred over that period of time (Ref. 47).

A survey was undertaken in 2022/23 which involved an assessment of marine turtle nesting activity (via track counts) and measuring of beach sand temperatures. Analysis of results focused on Flatback turtles, however all species of turtle track were recorded.

A total of 22 beaches were monitored for marine turtle nesting activity via counting downward tracks daily over a period of five days (8-12 December 2022). Sand and air temperature loggers were deployed at four beaches for a period of 48 days (7 December 2022 – 25 January 2023). Turtle track data from eight beaches routinely monitored for nesting activity, along with beach temperature data from the eight beaches recorded during the Incubation Success Monitoring Program and additional beaches study were also compared.

4.2.3.1 Track Census

The survey highlighted the relatively low level of turtle activity at the additionally monitored beaches. Track counts showed notable spatial and temporal variations within and between species, and from a geographical perspective, beaches in the east and south-east contained more Flatback Turtle tracks, while those in the north-west and south-west were dominated by Green Turtle tracks. This was expected as there is a dominant Flatback Turtle rookery to the east of the island.

Of the 16 beaches with long-term Flatback Turtle track census data (including routine nesting activity data), 14 beaches showed an overall increase over time. At the eight beaches routinely monitored for nesting activities, seven beaches (87.5%) showed an overall increase in Flatback Turtle track counts over time. Terminal Beach showed a weak increase; A07, Yacht Club South and Inga Beaches showed moderate increases; while Junction, Yacht Club South and Mushroom Beaches showed notable increases. Bivalve Beach showed a weak reduction in track counts over time, although this relationship was largely driven by high variation in mean daily track counts over time, with tracks counts made in 2022/23 similar to those recorded in 2008/09, 2016/17 and 2017/18.

At the additionally monitored beaches for those of which long-term data is available for, seven beaches showed an overall increase in Flatback Turtle track counts over time. Camp Beach showed a weak increase; Pillow Beach and Dove Bay North showed a moderate increase; while Oystercatcher Beach, Dove Bay South and Mattress beaches exhibited notable increases. Surf Point Beach showed a long-term reduction in track counts, however, it is important to note that this beach has historically recorded low Flatback Turtle track density. The proportional use of additionally monitored beaches by Flatback Turtles in 2022/23 was highly variable with 11 of the 14 beaches showing various levels of declines and others showing various levels in increases compared to that during construction.

Collectively considered, the 2022/23 survey results, long-term trend data analysis, comparisons between monitoring and baseline stages, and proportional beach use calculations for 2022/23 suggest that there hasn’t been a significant change in Barrow Island beach use for nesting Flatback Turtles since baseline surveys. Based on the available data, it is not apparent that Flatback Turtles from the eight beaches routinely monitored for nesting activity are moving to other adjacent beaches, with Flatback Turtle track density having concurrently increased across most surveyed beaches.

4.2.3.2 Beach Sand Temperature

The 2022/23 survey recorded sand temperatures that were generally consistent across the four additionally monitored beaches over the 48-day monitoring period. In comparison, sand temperatures at the eight beaches routinely monitored for Flatback Turtle nesting activities in the east were typically warmer than the four additionally monitored beaches located towards the southern and northern ends of the island. These differences in sand temperatures between beaches should be interpreted with a degree of caution given that point-source data can be influenced by a number of variables, including methodological factors, meteorological factors as well as microclimatic factors (Ref. 47).

In a conservative approach using pivotal temperatures from regional studies, it could be inferred that Surf Point Beach and Bed Beach may have produced a higher proportion of female Flatback Turtle hatchlings while Stokes Beach and South End West Beach may have produced a higher proportion of male Flatback Turtle hatchlings, while all eight routinely monitored beaches may have produced a higher proportion of female hatchlings during the 2022/23 nesting season (Ref. 47)

4.2.4 Population Viability Modelling

The development of a mathematical age-structured model for the Barrow Island Flatback Turtle population was completed in 2022 (Ref. 44). This model helps inform ongoing studies into the distribution and incubation success of Flatback Turtles on Barrow Island, and the dispersal and survivorship of Flatback Turtle hatchlings. The model was developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the University of Tasmania, and tracks the age-distribution of turtles distributed among a finite number of sites (beaches) within the Barrow Island Flatback Turtle rookery. The model aims to demonstrate population trajectories based on a range of scenarios and risks, and parametrised with data for Flatback Turtles collected as part of Flatback Turtle and coastal stability monitoring programs and other published data.

4.2.5 Flatback Turtle Hatchling Dispersal and Survivorship

4.2.5.1 Particle Modelling

Following in-water tracking studies of Flatback Turtle hatchlings between 2009 and 2019, a coastal hydrodynamic motile particle tracking model was developed and refined to explore turtle hatchling dispersal behaviour on the east coast of Barrow Island, by comparing simulated against observed hatchling tracks. The model was primarily used to assess the likelihood of hatchling interactions with infrastructure and artificial light.

In the model, environmental variables that influence turtle hatchling motility such as light, waves, wind, currents and tides were explored during hypothesis testing. Three hundred simulated hatchlings were released into the model over a one-minute period to test a total of 19 different motility hypotheses against hatchlings tracks observed in the field from 2009 to 2019. The closeness of fit of the simulated tracks in each scenario to the observed tracks was evaluated by several model metrics, including X and Y error, root mean square error and an overall model score. Other factors were also considered such as predominant tidal state (ebb or flood), degree of moon illumination, and whether an LNG tanker was present at the jetty head providing a source of artificial light.

The results of the hypothesis testing indicated that there was no single scenario that could capture a majority of observed hatchling tracks for all beaches, however, each hypothesis captured a proportion of the dispersal patterns. Scenarios that had the best fit to all observed tracks and all beaches were ultimately selected, and a constant travel speed of 0.3 m/s was subsequently adopted for predictive simulations.

Predictive scenario modelling involved analysing 500,000 simulated hatchlings to attempt to understand hatchling dispersal behaviour, and the level of interaction the hatchlings are likely to have with coastal infrastructure (namely the causeway, LNG Jetty and light spill zone around the LNG tanker berth at the LNG jetty head).

Seven predictive scenarios, selected based on the results of the hypothesis testing, were simulated for nine east coast beaches, including Mushroom, Terminal, Bivalve, Inga, YCN, YCS, Camp, Junction and A07 beaches.

The scenarios simulated a 30-day period during the peak flatback turtle nesting season (10 January–9 February 2019). For each scenario, hatchlings were simulated as motile particles released at 50 m intervals along the beaches, with one particle released at each location every 15 minutes. Hatchling densities were then weighted using nesting habitat zones (defined as optimal, sub-optimal or unsuitable nesting habitat) determined by nesting distribution data and other physical characteristics of the beaches.

Results of the predictive simulations indicated that a composite scenario best captured the range of observed turtle hatchling behaviours and simulated the hatchling fan after leaving the beach. This was particularly evident at the most southern beaches (Yacht Club North, Yacht Club South, Camp, Junction and A07 beaches) and at Mushroom Beach. This scenario also indicated simulated hatchlings released from beaches closest to the causeway (Terminal, Bivalve, Inga and Yacht Club beaches) were more likely to interact with infrastructure and the light spill zone. In contrast, simulated hatchlings released from the southern beaches (Camp, Junction and A07 beaches) and Mushroom Beach (furthest north) were less likely to interact with infrastructure.

When weighted for all beaches, the total interaction percentage of simulated hatchlings with all infrastructure was ~34% under the composite scenario. For the other scenarios, this weighted interaction with all infrastructure ranged from 23%–51%. All of the scenarios modelled recorded the greatest infrastructure interactions occurring at Terminal, Bivalve and Inga beaches, and the lowest interactions occurring at the southern beaches (Camp, Junction and A07 beaches). This suggests that the degree of interaction with infrastructure is related to the proximity of the release location to the causeway and jetty. It was also evident that hatchlings originating from beaches with the smallest area of available nesting habitat, such as Terminal, Bivalve and Inga beaches, were less likely to achieve a dispersal fan pattern, with the peak hatchling density typically remaining orientated to the initial release bearing.

4.2.5.2 Acoustic Telemetry and Marine Predator Observations

In February 2024, a pilot study was undertaken into using alternative methods for studying the dispersal and survivorship of Flatback Turtle hatchlings as they leave the beach and swim through the nearshore marine environment at Barrow Island. Acoustic telemetry was trialled using 69 kHz receivers and nano transmitters, revealing improved range detection from previous applications of the technology (Ref. 41). In parallel, investigations into marine predator species that may prey on Flatback Turtle hatchlings in the nearshore environment continued with further field studies involving gut content analysis and a trial of cloacal swabs for subsequent DNA analysis (Ref. 41).

4.2.6 Onshore Predation and Nesting Success

During the Reporting Period, a student Masters' degree project was completed investigating the onshore survivorship of Flatback Turtle hatchlings and the nesting success of adult female Flatback Turtles (Ref. 49). The study used continuous recording from 16 video cameras on four solar powered stations on Terminal and YCS beaches between December 2023 and March 2024.

Cameras collectively captured 761 nester emergences and 1139 hatchlings over 92-101 days, along with numerous hatchling predation events. Nesting success within the field of view was 34.2%, meaning that most females that emerged were not observed laying eggs, but may have nested successfully elsewhere the same night or on subsequent nights. Around 80% of hatchlings avoided on-shore predation and appeared to reach the water alive. Of the predated hatchlings, golden bandicoots (11.6%) and seabirds (8.2%) were the main predators, and mortality decreased as the hatchling group size increased.

4.3 Event Data

Incidents involving harm to marine turtles reported during the Reporting Period are summarised in the following table.

Event data: Harm to marine turtles
Reporting requirement
Reportable incidents[1] involving harm to marine turtles.
Results

Event data: Harm to marine turtles
There were no reportable incidents during the Reporting Period involving harm to marine turtles as a result of the Gorgon Gas Development.

1. *Reportable incidents as defined in the LTMTMP (Ref. 7) "Harm or mortality to listed marine turtles attributable to the Gorgon Gas Development, and significant impacts detected by the monitoring program on matters of NES relevant to this Plan"*

4.4 Audit and Review

Findings of the annual audit and review of lighting design features, management measures, and operating controls, including details of light management initiatives and activities undertaken during the Reporting Period, are summarised in the following table.

Stressor: Light
Audit results
CAPL completed one audit of the LTMTMP during the Reporting Period and five Lighting Effectiveness Reviews and Audits. These Lighting Effectiveness Reviews and Audits included verifying compliance with lighting design features, management measures, and operating controls, as described in the LTMTMP (Ref. 173) and Condition 16.5 of Ministerial Statement 800. The requirements specified in Ministerial Statement 800 and the LTMTMP were fulfilled except for one finding: Finding #1: Permanent onshore task lighting will be normally 'off' and will be manually switched 'on' to provide the necessary task lighting required when work is taking place. During a night inspection of the GTP a significant number of permanent task lights were left in the "on" position when no activities were taking place. A follow-up inspection the following day identified that some of the task lighting was still on during the day. The ongoing use of task lighting (white) may have resulted from other amber permanent/emergency lighting not being operational. It was not established during the audit if lighting was compliant with the Emergency Lighting Standards and also whether the process to raise a work order to fix permanent (or emergency) amber lights is functional. Actions; • Perth HSE Specialist to distribute 'Gorgon Operations: Environmental Guidance for Lighting Management (2022)', Green Guide, etc, prior to Turtle Season e.g. to business partners in particular.(Complete) • Investigate with the GTP operators, why permanent task lighting has been left on (e.g., if other permanent or emergency lighting is not operational, can't be used or is not meeting the Emergency Lighting Standard). (Complete) • Discuss lighting management with Operators during pre-starts. (Complete) • Conduct an additional inspection of task lighting at the GTP prior to turtle season. (Complete) • Prior to turtle season, deliver an awareness program to relevant staff or issue site notice regarding permanent task lighting management. (Complete) No direct impacts to marine turtles were identified during the audits.
Light management initiatives, activities, and reasonably practicable lighting improvements
The lighting requirements specified in the LTMTMP (Ref. 7) were fulfilled except for the audit finding identified above. The following lighting management initiatives and activities were implemented during the 2020–2025 Reporting Period: **Lighting Management Initiatives** • 2020-2025: A Digital Lighting Inspection Checklist was implemented to record inspections and closeout of activities on a Power BI Dashboard. • 2020-2025: Marine turtle awareness, highlighting the relationships between lighting management and impacts to marine turtles, were incorporated into Pre-Start Meetings, OE Forums, HSE Contractor Communication meetings, Site Notices and on TV Screens at OCB and Camp. • 2020-2025: Personnel engagement via workforce turtle tours to raise awareness of the environmental commitments associated with marine turtles. • 2020-2025: Targeted inspections of lighting towers as set up/ moved. • 2023-2025: Implementation and operation of a Continuous Light Monitoring program.

Stressor: Light
• 2023-2025: Direct engagement with cargo vessels visiting the Port of Barrow providing recognition of effective lighting minimisation practices and improvement actions undertaken. Vessel lighting cheat sheet developed, rolled out included in pre-loading meetings.
Reasonably Practicable Lighting Improvements
• 2025: Installation of the world's first 'Dark Sky Alliance' certified hazardous areas LED lighting which are custom made specifically for Gorgon lighting compliance requirements.
• 2020- 2025: Mobile solar-powered lighting towers are gradually replacing traditional diesel-powered lighting towers. These towers have been programmed to meet optimal turtle lighting requirements for wavelength and light intensity.
• 2022: Oval at Butler Park lighting had timers installed to coincide with nighttime curfew.
• 2021: Installation of additional solar bollards (customized for directional light, LED with blue wavelength removed) on walkways around Butler Park.
Conclusions on the effectiveness of lighting design features, management measures, and operating controls
• CAPL considers lighting design features, management measures, and operating controls are 'effective' if they meet the environmental objectives of the LTMTMP (Ref. 7), and if they reduce potential adverse lighting impacts to Barrow Island marine turtle populations.
• There were no internal audit findings for lighting that represented Material or Serious Environmental Harm to the marine turtle populations on Barrow Island.
• Sources of night-time light emissions were similar during the 2015–2020 Reporting Period
• Control chart outputs for modelled parameters during the 2020–2025 Reporting Period indicate that the Flatback Turtle population nesting on Barrow Island remains stable and demographically healthy.
• Overall, there were no indications of adverse impacts to the marine turtle populations that use the east coast beaches of Barrow Island during the 2020–2025 Reporting Period for nesting and hatching due to artificial lighting.

4.5 Changes to the Long-term Marine Turtle Management Plan

Revision 1.0 of the LTMTMP (Ref. 7) was approved by DWER and DotEE in July 2018. It was revised and submitted for approval during the 2023-2024 Reporting Period. In accordance with the variation to EPBC 2003/1294 and 2008/4178 conditions issued 7 August 2023, Revision 1.1 of the LTMTMP was submitted to DCCEEW on 28 June 2024. This revision was also provided to DWER for information on 1 August 2024, with the intention of formally submitting once any comments from DCCEEW have been received and addressed. CAPL is yet to receive approval for the updated LTMTMP and continues to engage with DWER on this matter

Included in Revision 1.1 were updates to background information, consultation process, summary of current and future activities in alignment with operational focus, risk assessments and associated management measures.

4.6 Conclusion

Focusing on the most recent survey results, the estimated number of annual flatback turtle nesters at Barrow Island was significantly lower in 2024/25 than baseline. The relative abundance of annual nesters at Barrow Island compared to Mundabullangana shown through the EWMA charts has recently decreased and the causes for this are currently unknown. Whether these trends are due to environmental or anthropogenic changes or simply cyclic is uncertain (Ref. 45).

The recent decline in breeding population abundance at both sites is likely related to broader environmental or anthropogenic factors influencing the northwest shelf flatback turtle population as a whole, such as changes in cumulative anthropogenic threat exposure, oceanographic conditions, regional climate variability, trophic ecology, or alterations in foraging ground productivity. Why the decline in annual nester abundance has been proportionally greater at Barrow Island is unknown (Ref. 45).

Distribution of nesting activity by the nesting flatback turtle population along the eastern coast of Barrow Island has demonstrated distinct variations due to alterations in coastal dynamics which has likely been driven by the marine infrastructure installation for the Gorgon Gas Development. Beaches such as Inga, Bivalve, and Terminal have notably experienced shifts in both the availability and spatial distribution of optimal nesting habitats, leading to shifts and reductions in habitat area. These habitat modifications have consequently caused significant alterations in nesting patterns and activity distributions. Furthermore, Bivalve Beach has shown a significant decline in sightings over the previous monitoring years (Ref. 45).

Incubation success monitoring results have largely remained within control limits during the Reporting Period. During the 2024/25 season storm surge flooding from Tropical Cyclone Sean resulted in the inundation of the majority (62%) of marked clutches, which significantly reduced volume of complete nests available for assessment, and likely biased incubation success parameters due to low sample sizes (Ref. 45).

Additionally, incubation temperatures reached record highs at Barrow Island during 2024/25 season which subsequently resulted in a short incubation period of less than 46 days. Given this incubation duration, clutches laid before approximately 4 December 2024 may have hatched successfully before the cyclone’s impact. Thus, the initiation of nest marking on 6 December 2024 likely resulted in a negative bias for observed incubation success parameters and the reduction in hatching probability caused by the TC Sean is not likely to have been consistent throughout the summer. Therefore, actual incubation success and hatchling production may have been significantly higher than indicated by observation during the monitoring period. Other sea turtle species have demonstrated shifts in phenology which have mitigated adverse impacts of climate change on reproductive output, and the evidence of an earlier nesting season at BWI during 2024/25 season may have reduced the impact of TC Sean (Ref. 45).

Overall, the egg hatching probability for complete clutches was low, exceeding the -1SD control limit. Hatching probability was also historically low at Mundabullangana this year likely due to the high incubation temperatures also recorded at that rookery, resulting in clutches spending a greater proportion of development above the thermal tolerance range (TTR) compared to Barrow Island clutches (Ref. 45).

Collectively, the low number of turtle encounters, the flooding impacts from TC Sean, and the high incubation temperatures compounded to reduce hatchling productivity during 2024/25 season. Importantly, these impacts are not directly associated to any specific impact of the Gorgon Gas Development on the nesting habitat itself.

The severe storm surge inundation from TC Sean substantially impacted nest success, significantly lowering hatchling productivity across multiple beaches and leading to fewer viable nests available for incubation success analysis. In addition, record high temperatures at Barrow Island also likely impacted egg hatching probability. Barrow Island traditionally has high egg hatching probability but was more aligned with Mundabullangana in the 2024/25 season due to these factors. Hatchling emergence probability was significantly higher at Barrow Island than Mundabullangana, showing that the incubation environment are Barrow Island is still favourable to successful nest success. (Ref. 45). However collectively, the low number of turtle encounters, the flooding impacts from TC Sean, and the high incubation temperatures compounded to reduce hatchling productivity during 2024/25 season.

Overall, the hatchling orientation analyses showed control chart exceedances in spread angle at Bivalve and offset angle at Bivalve and Terminal. Furthermore, the time series shows a statistically significant linear increase in hatchling fan offset and post-emergence spread at Bivalve since baseline. However, these results must be interpreted cautiously given low and variable sample sizes, increased variance, and changes in nest distribution across the beach since the baseline period. Whilst there was no observed difference in artificial light sources, additional sources of uncertainty include the influence of variable light intensity and the absence annual time series data, which together constrain our ability to critically compare baseline and operational periods. The current data do not provide sufficient certainty to draw strong ecological conclusions (Ref. 45).

As required by the LTMTMP (Ref. 7), CAPL will continue to routinely monitor key marine turtle demographic parameters to detect and evaluate potential implications for marine turtle nesting. If exceedances of LTMTMP management triggers or performance standards are detected, these will be assessed in accordance with the requirements identified in the LTMTMP and relevant Ministerial conditions (Ref. 45).

4.7 Five-year Overview of Environmental Performance

The 2020–2025 outcome for marine turtles is summarised in the table below.

Objectives[1]	Outcome
Address the long-term management of the marine turtles that utilise the east coast beaches and waters where there are Proposal-related stressors to marine turtles.	Monitoring of marine turtles and stressors, as per the requirements of the approved LTMTMP (Ref. 7), throughout the five-year Reporting Period did not detect any adverse changes to the population of Flatback Turtles that can be attributed to the Gorgon Gas Development.
Establish baseline information on the populations of marine turtles that utilise the beaches adjacent to the east coast facilities identified in Conditions 6.3 and 14.3;	
Establish a monitoring program to measure and detect changes to the Flatback Turtle population in accordance with Condition 16.4(ii); and	Section 3 of the approved LTMTMP (Ref. 7) provides baseline information on marine turtle populations at Barrow Island.
Specify design features, management measures, and operating controls to manage, and where practicable, avoid adverse impacts to marine turtles, with specific reference to reducing light and noise emissions as far as practicable.	Section 6 of the approved LTMTMP (Ref. 7) describes the management strategies and measures for lighting control. These are updated (if required) after the annual lighting effectiveness reviews.

1 *As defined in Condition 16.3 of MS 800, and Condition 12.3 of EPBC 2003/1294 and 2008/4178.*

4.8 Proposed Environmental Management Improvements

No management improvements related to the LTMTMP (Ref. 7) are proposed as part of this Five-year EPR.

5 Short-range Endemics and Subterranean Fauna

Table 5-1: EPR Reporting Requirements for Short-range Endemics and Subterranean Fauna

Item	Source	Section in this EPR
Results of survey and studies to locate outside the GTP footprint and Additional Support Area (ASA) those remaining short-range endemics (SRE) and subterranean fauna species previously found only within the GTP footprint and ASA	MS 800, Schedule 3(4i)	5.1
A five-year overview of environmental performance	MS 800, Condition 5.3(iii) EPBC 2003/1294 and 2008/4178, Condition 4.2(iii)	5.2
Proposed environmental management improvements	MS 800, Condition 5.3(iv) EPBC 2003/1294 and 2008/4178, Condition 4.2(iv)	5.3

5.1 Monitoring Results

The Short-Range Endemics and Subterranean Fauna Monitoring Plan (SRESFMP; Ref. 9) focuses on surveys to locate and identify those SREs and subterranean fauna species that had only previously been located within the GTP footprint and the ASA. Several of these species were confirmed outside the GTP footprint and ASA before construction commenced, and a further two subterranean fauna species were identified during construction (Ref. 9).

The 2020–2025 results for the surveillance and study of SRE fauna species are summarised in the following tables.

<table>
<tr><th colspan="2">Ecological Element: Fauna/ habitat: Short-range endemic</th></tr>
<tr><th colspan="2">Taxon, feature or species</th></tr>
<tr><td>The terrestrial short-range endemic (SRE) trapdoor spider, Idiommata sp.</td><td></td></tr>
<tr><th colspan="2">Objective</th></tr>
<tr><td colspan="2">Detect Idiommata sp. outside of the GTP footprint and Additional Support Area (ASA).</td></tr>
<tr><th colspan="2">Changes to Program</th></tr>
<tr><td colspan="2">A request was made to DWER and DBCA in 2023 to remove five yearly monitoring requirements from the SRESFMP based on the reclassification of Idiommata sp. through DNA analyses to Aurecocrypta sp. MYG319, a species recorded widely throughout the Western Pilbara.</td></tr>
<tr><th colspan="2">Methodology</th></tr>
<tr><td colspan="2">Survey Method
Five yearly targeted surveillance using burrow searches and excavation, and night searches using torches to scan the bare ground and vegetation for wandering individuals.
Opportunistic survey effort included in current NIS surveillance program during pitfall and nighttime surveillance.</td></tr>
<tr><th colspan="2">Results and discussion</th></tr>
<tr><td colspan="2">The five yearly targeted surveillance of Idiommata sp. was planned to occur in 2023. Between 2020 and 2023 opportunistic surveillance was undertaken as part of the ongoing NIS surveillance program including 57 and 379 hours of night surveillance in 2020/2021 and 2021/2022 reporting years respectively.
Prior to the commencement of the five-yearly survey, the Idiommata sp. (Brush-footed Trapdoor Spider) was reclassified as Aurecocrypta ep. MYG319. The specimen found on Barrow Island matched with genetic sequences from other individuals recorded widely throughout the Western Pilbara. Based on previous reports and the confirmation of wider distribution, SRE monitoring was not included in the 2023 survey and is not planned for future surveys (Ref. 19).</td></tr>
<tr><th colspan="2">Conclusions</th></tr>
<tr><td colspan="2">Aurecocrypta sp. MYG319, formally Idiommata sp. is no longer considered an SRE as its distribution is not restricted to the GTP footprint or ASA. No further monitoring is required.</td></tr>
</table>

Ecological Element: Fauna/ habitat: Subterranean Fauna

Taxon, feature or species

The SRE stygofauna, isopod, Oniscidea sp. nov. 1.(Right image) and ostracod, *Pilbaracandona* sp. nov. 1.

The SRE troglofauna *Symphyla*, *Symphyla* sp.

Objective

Survey for, and identify, subterranean fauna only reported within the GTP footprint and ASA.

Changes to monitoring

A comprehensive desktop assessment was undertaken in conjunction with the targeted five yearly monitoring to aggregate all historical subterranean fauna data from Barrow Island. This included analysing available DNA from collected historical specimens where morphological review was unable to ascertain species identification.

Environmental DNA (eDNA) sampling was also incorporated into the survey methodology.

Methodology

Survey method

June 2023

- Ten stygofauna haul nets and troglofaunal scrape samples collected from ten sites (five central and five northern sites) (Figure 5-1).
- Five northern sites were sampled for eDNA (Figure 5-1).
- Nine troglofauna litter traps were deployed (Figure 5-2).
- August 2023
- Nine troglofauna litter traps collected after 44 days(Figure 5-2).
- Six troglofauna litter traps were deployed at three central sites (two per site) (Figure 5-2).
- September 2023
- Six troglofauna litter traps were retrieved after 50 days (Figure 5-2)

Results and discussion

***Oniscidae* sp. nov. 1**

One of the two historical specimens originally collected was unable to have further morphological and genetic comparison with other Barrow Island stygofauna and troglofauna isopods as it has been deemed lost at the WAM. An image of the specimen, however, indicated it may have likely belonged to the Philosciidae family and not the Oniscidae family as previously thought.

The genetic analysis of the damaged second specimen resulted in a misleading identification as "*Melitidae* unknown sp.1". Firstly, there was a mix up in taxon names, and secondly, the genetic analysis was confounded by contamination or 'junk DNA' sequences (e.g., possible non-functional gene copy). The entire specimen was used for DNA sequencing so no further genetic analysis is possible. Investigation into the previous identification and nomenclature changes to date suggest the damaged second specimen should be considered indeterminate amphipod material. The damaged specimen was identified as a member of the family Melitidae prior to the taxonomic reclassification of *Nedsia* genus from Melitidae to the family Eriopisidae. Therefore, the specimen originally identified as *Melitidae unknown sp. 1* is considered to now be Eriopisidae material and is treated as indeterminate *Nedsia*. It is considered likely that the damaged specimen was *Nedsia hurlberti*, the only amphipod species to be recorded from the same bore, with four *N. hurlberti* specimens reliably sequenced from this site. *Nedsia* species have been shown to have relatively broad distributions on Barrow Island and in the Robe Valley region of the Pilbara.

***Pilbaracandona* sp. nov**

The updated identification of *Pilbaracandona* sp. nov. as *P. rosa* confirms the distribution of this target species is not confined to the very southern boundary of the ASA as previously identified but extends outside the GTP/ASA footprint to areas north of the GTP.

***Pilbaracandona* sp. nov**

The updated identification of *Pilbaracandona* sp. nov. as *P. rosa* confirms the distribution of this target species is not confined to the very southern boundary of the ASA as previously identified but extends outside the GTP/ASA footprint to areas north of the GTP.

Ecological Element: Fauna/ habitat: Subterranean Fauna
***Symphyla* sp.**
Despite extensive searching, only two symphylans have been collected (12 km apart) on Barrow Island since monitoring began. Morphological identification was limited due to the poor condition of each specimen; however, DNA analysis confirmed the original specimen located in the GTP buffer zone was genetically identified to belong to a Symphylan of the Scutigerellidae family, prompting a name change to Scutigerellidae sp. 1. Unfortunately the second specimen failed to sequence. Although relatedness between specimens could not be established genetically or morphologically, the distribution of Scutigerellidae sp. 1 is considered likely to extend well beyond the GTP buffer for several kilometres, based on the demonstrated distribution of Pilbara Symphylan species. This is evidenced by the only other troglofauna species collected from the same well, *Draculoides bramstokeri*, which has been recorded across most of Barrow Island. Although the broader distribution extent of Scutigerellidae sp. 1 has not been demonstrated, the extent of the distribution range is considered to be wider within the broader expanse of karstic subterranean habitat present across much of Barrow Island, and not confined to the immediate vicinity of the GTP buffer Ref. 20).
Conclusion
No target subterranean fauna specimens were collected during the 2020-2025 reporting period. The comprehensive data review completed did establish that the target species were likely misidentified originally, with the updated species identification suggesting that individuals are not likely confined to the GTP or the ASA footprints. Further targeted sampling as part of future SRESFMP survey rounds would have a low likelihood of collecting any additional species, considering that over 700 litter trap and scrapes samples have managed to only collect two specimens to date. The documented distributions of species of the stygofauna and troglofauna assemblages that range across much of Barrow Island are consistent with the geological and hydrogeological assessments that the subterranean fauna habitats present within the karstic and fractured geology are relatively well interconnected and broadly contiguous across most of the island. The ongoing operation of the GTP is considered to pose a very low risk to species of the subterranean fauna assemblages of Barrow Island.

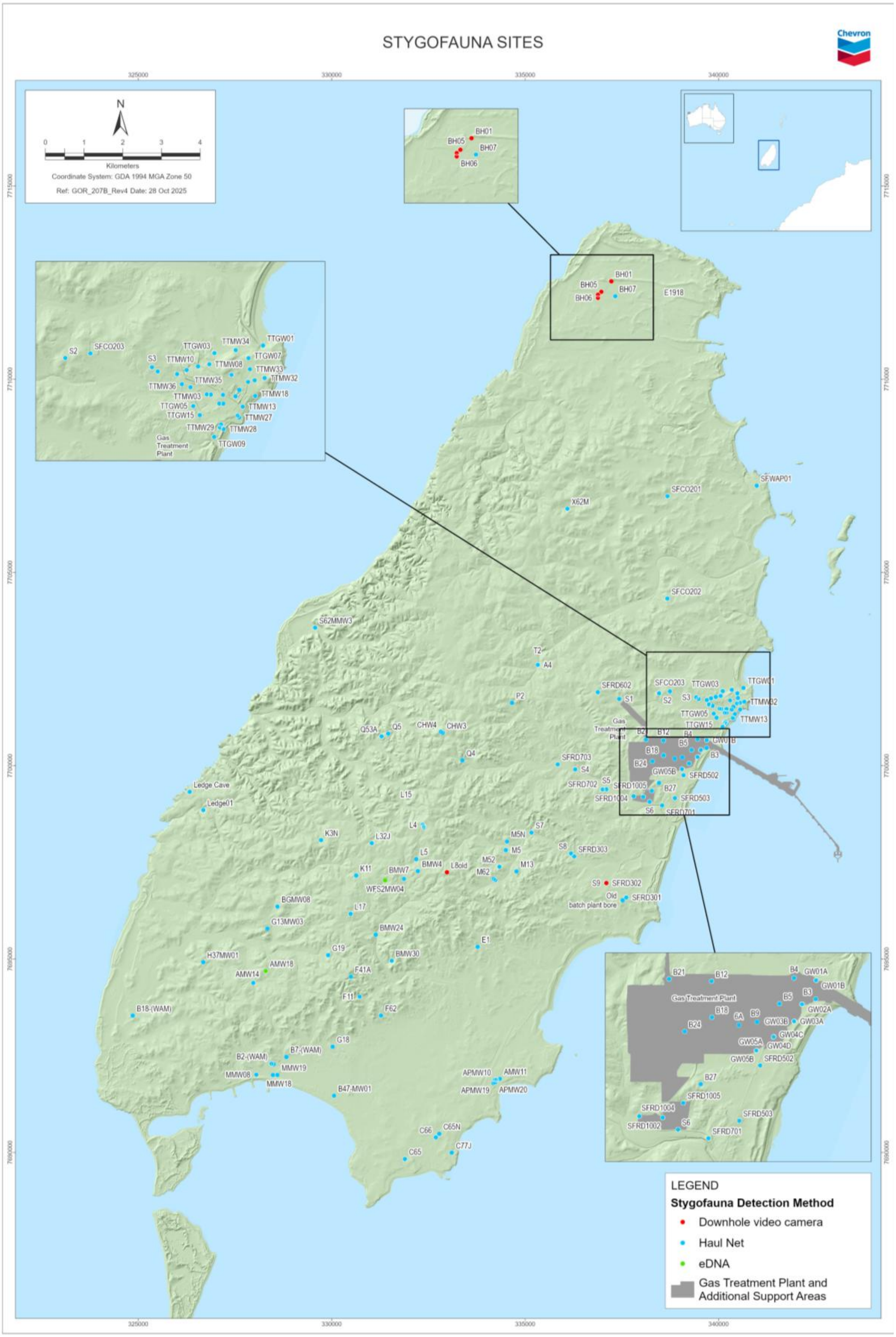


Figure 5-1: Locations of stygofauna haul net and eDNA sample sites on Barrow Island in 1999-2023

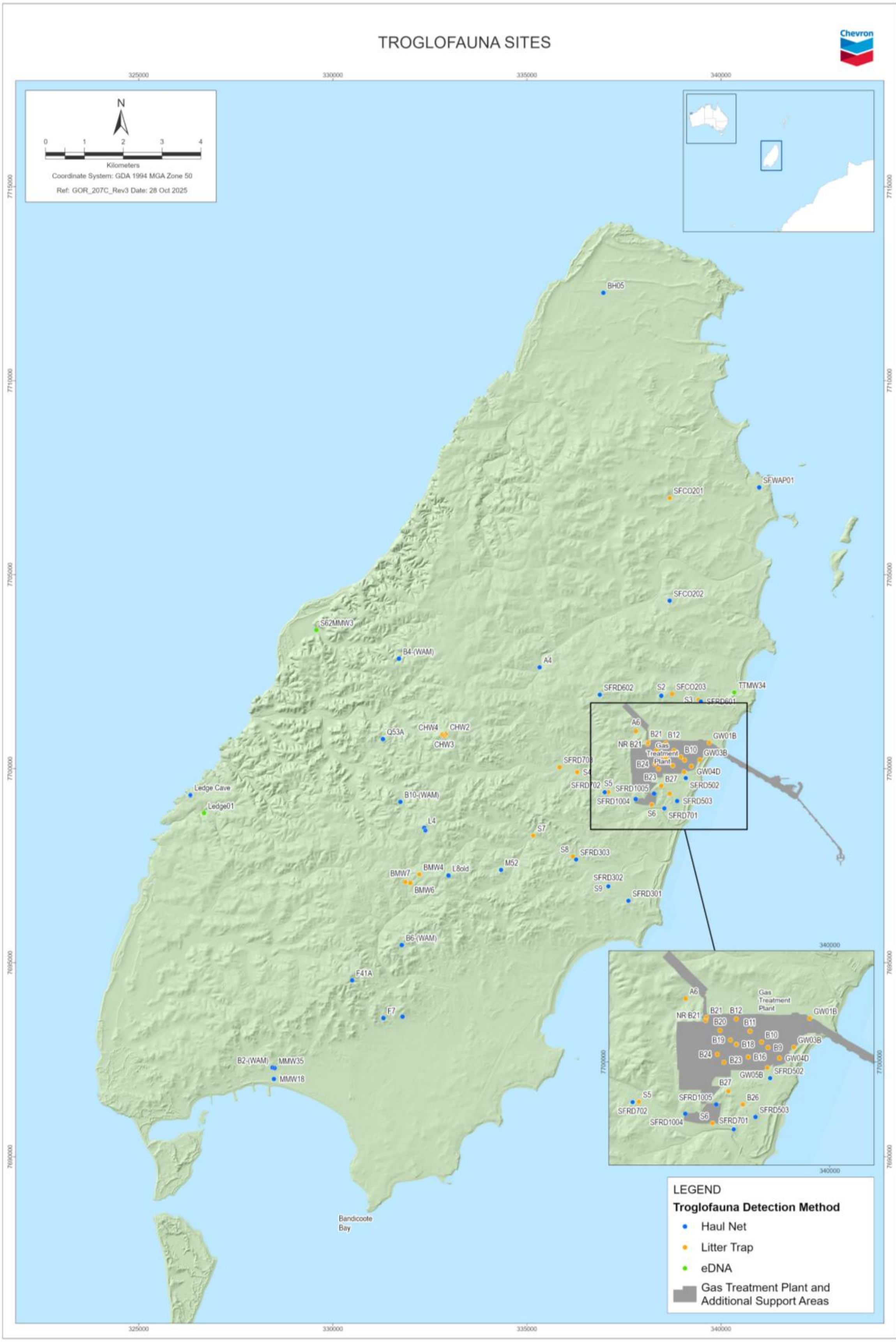


Figure 5-2: Locations of troglofauna litter trap sample sites on Barrow Island in 1999-2023

5.2 Five-year Overview of Environmental Performance

The 2020–2025 outcome for SREs and subterranean fauna is summarised in the table below.

Objectives[1]	Outcome
To locate those SRE and subterranean fauna species that have only previously been located on the GTP site and Additional Support Area.	Targeted five yearly monitoring was completed as per the requirements of the SRESFMP for subterranean fauna. No targeted fauna was reported. No targeted survey was undertaken for SRE fauna as genetic analyses confirmed targeted species were originally misidentified and not SRE. Comprehensive data review and genetic analyses established targeted SRE terrestrial and subterranean fauna are not likely confined to the GTP or ASA footprints. No further monitoring as per requirements of SRESFMP is recommended.

1 As defined in Condition 11.1 of MS 800.

5.3 Proposed Environmental Management Improvements

Condition 11.1 of MS800 requires the further survey and identification of those short range endemics and subterranean fauna species which have previously only been located on the GTP. Given that a comprehensive data review supported by further DNA analyses established that the target species were likely misidentified originally, with the updated species identification suggesting that individuals are not likely confined to the GTP, no further SRE and subterranean fauna surveys under the SRESFMP (Ref. 9) are proposed as part of this Five-year EPR.

6 Fire Management

Table 6-1: EPR Reporting Requirements for Fire Management

Item	Source	Section in this EPR
Incidence of fires caused by the Proposal, and fires that impact on the Proponent's facilities, including details of cause, lessons learnt, and recommended actions	MS 800, Schedule 3(5i) MS 769, Schedule 3(2i) EPBC 2003/1294 and 2008/4178, Schedule 3(4i)	6.1
Material or Serious Environmental Harm caused by fire directly attributable to the Proposal	MS 800, Schedule 3(5ii) MS 769, Schedule 3(2ii) EPBC 2003/1294 and 2008/4178, Schedule 3(4ii)	N/A[1]
Any changes to the Gorgon Gas Development Fire Management Plan (Ref. 10) including: management responses to address Material or Serious Environmental Harm caused by fire directly attributable to the Proposal improvement to fire management practices.	MS 800, Schedule 3(5iii) MS 769, Schedule 3(2iii) EPBC 2003/1294 and 2008/4178, Schedule 3(4iii)	6.2
A five-year overview of environmental performance	MS 800, Condition 5.3(iii) MS 769, Condition 5.3(ii) EPBC 2003/1294 and 2008/4178, Condition 4.2(iii)	6.3
Proposed environmental management improvements	MS 800, Condition 5.3(iv) MS 769, Condition 5.3(iii) EPBC 2003/1294 and 2008/4178, Condition 4.2(iv)	6.4

1. No Material or Serious Environmental Harm caused by fire was recorded during the Reporting Period.

6.1 Event Data

Incidences of fire caused by the Gorgon Gas Development, or fires that impacted on Gorgon Gas Development facilities during the Reporting Period, including details of cause, lessons learnt, and recommended actions, are provided in the following table.

Event Data: Fires	
Results:	No fire events occurred during the Reporting Period that caused Material or Serious Environmental Harm outside the TDF. Table 6-2 summarises the event cause, completed actions, and lessons learnt for fire events attributable to Gorgon Gas Development activities during the Reporting Period.

Table 6-2: Causes, Completed Actions, and Lessons Learnt for Fire Events Attributable to Gorgon Gas Development Activities during the Reporting Period

Date	Event Cause	Completed Actions[1]	Lessons Learnt
11 April 2021	Lightning strike on Acid Gas Removal Unit 3 resulting in minor stack fire.	• Lightning strike was observed by outside operator (and later on CCTV) and reported to the CCR via radio. • Subsequently flames were visible from AGRU 3 CO2 Vent stack.	Gorgon LNG Plant has moved to a fully automated lightning notification system and updated the Barrow Island Adverse Weather

Date	Event Cause	Completed Actions[1]	Lessons Learnt
		• The AGRU was shut down for turnaround at the time of the lighting strike. • Flames were extinguished by closure of vent stack valves by the CCR, and the scene was attended by the ERT. • A structural and earthing survey was completed. • An inspection of the stack was conducted after the event to ensure the area was safe for work and operations to continue.	Procedure to specify activities that pause during each lightning phase (60km, 30km, 15km etc.)
28 August 2023	Water trailer engine ignited due to a malfunction whilst in use at a maintenance workshop. The small flame was immediately extinguished by the operator. There was no impact to vegetation.	• Condition of remaining small diesel-powered water trailers were assessed. • Review completed on inspection and maintenance schedule for water trailer assets.	Small diesel-powered water trailers should be adequately maintained to reduce the risk of introducing hazards, such as fire.
11 May 2024	A small fire occurred on a telehandler due to an electrical malfunction on the starter motor while parked at an equipment storage yard. The bonnet on the telehandler had been damaged previously and was impacting on the wiring. The small flame was immediately extinguished by the operator. There was no impact to vegetation.	• Telehandler was removed from service and repaired.	External damage to assets should be repaired promptly. The damage may impact on the internal electrical components of the asset which has the potential to introduce hazards, such as fire.
30 July 2024	A small amount of residual paint on pipework ignited and immediately self-extinguished during a post-weld heat treatment (PWHT) as part of the shutdown of LNG Train 2 for turnaround activities. The activity was being completed under an open flame hot work permit with fire watch and fire extinguisher in place. There was no impact to vegetation.	• Review underway of relevant work packs to increase area of paint removal in proximity to PWHT. • Review underway of schedule for future PWHT activities to include a verification step for confirming a suitable amount of paint has been removed in proximity to PWHT.	Removal of sufficient paint in proximity to PWHT is important to reduce the risk of introducing hazards, such as fire.
21 August 2024	During commissioning of a mud pump, a leak of transmission fluid resulted in a localized	• Fire was extinguished and the pump was isolated for inspection.	Review was conducted and no specific pattern with previous events was identified. Concluded as an isolated event.

Date	Event Cause	Completed Actions[1]	Lessons Learnt
	fire. There was no impact to vegetation.		
26 August 2024	Small fire on scaffold board due to exhaust heat near to Heating Medium Header. There was no impact to vegetation.	• Emergency response team (ERT) responded and extinguished the fire. • Criteria for removal of scaffold to assist with turnaround planning and scheduling and methods to systemise this were reviewed.	Existing practice was to only dismantle scaffold pre-start up, which had a direct impact on safe access and operability. Criteria for removal of scaffold necessary to assist with turnaround planning and scheduling was defined and incorporated into the appropriate Control of Work manuals.
1 October 2024	Fire under a minibus, caused by a clump of spinifex which had adhered to the exhaust igniting.	• Incident was reported and went through a structured incident reporting and review process.	Ensure vehicles are regularly cleaned of dry vegetation.
16 February 2025	During hot work activities on the main deck, welders experienced a minor gas ignition due to a small leak in the oxy/acetylene hose. A second leak and ignition were experienced a short while after, and all work was stopped. There was no impact to vegetation.	• The on-site supervisor immediately stopped all activities, and the leaking system was isolated. • Inspection of all oxy/acetylene hoses were conducted, and inadequate hoses were scrapped.	JSA has been updated to include additional fire watch during the oxy-cutting operation.
22 February 2025	Dead short of a Variable Speed Drive for a HVAC unit lead to its catastrophic failure and subsequent fire on the drive unit. There was no impact to vegetation.	• Building alarm was sounded and building occupants were evacuated. • Reviewed fire and gas performance standard for the building, including the maintenance strategy.	Two Dry Chemical Powder fire extinguishers in the corridor were switched to CO_2 extinguishers, consistent with the electrical hazards in the area.
14 June 2025	Whilst welding aluminium handholes as part of maintenance activities, a section of the adjacent insulation beneath the fire blanket ignited. A small amount of accelerant, possibly kerosene which was used as a lubricant for cutting of the handholes, had leaked onto the surface of the insulation leading to ignition There was no impact to vegetation.	• Firewatch was notified, and the flame was extinguished with a dry powder extinguisher. • Use of Kerosene for this operation was reviewed, and alternative lubricants were identified and reviewed as possible substitutions.	Utilise on a trial basis alternative liquid lubricant which are not flammable or combustible and assess their effectiveness compared to kerosene. Install sheet metal protective barriers between exposed insulation surfaces which might have the potential to absorb liquids.

1 Schedule 3(5i) of MS 800, Schedule 3(2i) of MS 769, and Schedule 3(4i) of EPBC 2003/1294 and 2008/4178, requires 'Recommended Actions' to be reported; this was changed to 'Completed Actions' because the actions from the fire event have been completed.

6.2 Changes to the Fire Management Plan

The Gorgon Gas Development Fire Management Plan (FMP; Ref.10) was revised once during the Reporting Period.

In accordance with the variation to EPBC 2003/1294 and 2008/4178 conditions issued 7 August 2023, Revision 1.2 of the FMP was submitted to the DCCEEW on 28 June 2024. Subsequently it was also submitted to DWER on 5 August 2024.

The key changes made in this revision included:

- Updates to background information.
- Updates to descriptions of relevant facilities and activities.
- Summary of FMP interface with the Major Hazard Facility Report and Safety Case regime.
- Updates to risk assessments and associated management measures.

Revision 1.2 of the FMP is under review by both DCCEEW and DWER, and CAPL continues to engage with the regulators on this matter.

6.3 Five-year Overview of Environmental Performance

The 2020–2025 outcome for fire management is summarised in the table below.

Objectives[1]	Outcome
Ensure that the Proposal does not cause Material or Serious Environmental Harm outside the Terrestrial Disturbance Footprint due to fire	Fire risk-reduction and management measures have been implemented, as per the approved FMP (Ref. 10), throughout the five-year Reporting Period. No fires attributable to Gorgon Gas Development activities on Barrow Island have resulted in Material or Serious Environmental Harm outside the TDF.
Fire risk reduction measures are built into the design of the facilities to protect the Proponent's assets from the impact from fire on Barrow Island.	

1 As defined in Condition 12.4 of MS 800, Condition 11.4 of MS 769, and Condition 9.4 of EPBC 2003/1294 and 2008/4178.

6.4 Proposed Environmental Management Improvements

No management improvements related to the FMP (Ref. 10) are proposed as part of this Five-year EPR.

7 Carbon Dioxide Injection Project

The Gorgon Carbon Dioxide Injection Project is the largest of its kind in the world and the largest GHG abatement project undertaken by industry to date.

As at the date of this EPR, the Gorgon Joint Venture Participants remain committed to safely reducing the Gorgon Gas Development's GHG emissions and have:

- injected more than 11.5 million tonnes of GHG to date
- invested more than AU$3.2 billion in the Carbon Dioxide Injection System with further investment planned to improve system performance and increase injection rates
- commenced projects that aim to expand the Carbon Dioxide Injection System's capacity to manage water found within the reservoir where carbon dioxide is stored, thereby reducing reservoir pressure and enabling increased carbon dioxide injection rates over the life of the Gorgon Gas Development
- committed A$40 million to the Western Australian Government's Lower Carbon Grants Program – Gorgon Fund and GreenTech Hub.

Table 7-1 lists the matters related to the Carbon Dioxide Injection Project to be reported on in this EPR.

Table 7-1: EPR Reporting Requirements for Carbon Dioxide Injection Project

Item	Source[2]	Section in this EPR
Volume of reservoir carbon dioxide and other acid gases removed from the incoming natural gas stream and available for injection	EPBC 2003/1294 and 2008/4178, Schedule 3(5i)	1
Volume of reservoir carbon dioxide and other acid gases injected	EPBC 2003/1294 and 2008/4178, Schedule 3(5ii)	7.2
Results of environmental monitoring and identified Material or Serious Environmental Harm, if any, resulting from the seepage of injected carbon dioxide to the surface or near-surface environments including those which may support subterranean fauna (including the Blind Gudgeon [*Milyeringa veritas*])	EPBC 2003/1294 and 2008/4178, Schedule 3(5iii)	7.3
Reasons for shortfall between the volume of reservoir carbon dioxide extracted and injected	EPBC 2003/1294 and 2008/4178, Schedule 3(5iv)	7.4
If the amount of carbon dioxide injected falls significantly below the target levels specified in Condition 26.2 CAPL shall report on: • measures that could be implemented that would ensure the target level is met or, if injection is not considered feasible for all or some of the gas, measures to otherwise offset • which if any of these measures the Proponent intents to implement	EPBC 2003/1294 and 2008/4178, Schedule 3(5v)	7.5
If monitoring[1] shows there is an elevated risk of Material or Serious Environmental Harm and/or risk to human health associated with the injection of reservoir carbon dioxide, the Proponent shall report to the Minister on the efficacy of continuing to geo-sequester and alternative offsets considered instead of continuing injection of reservoir carbon dioxide	EPBC 2003/1294 and 2008/4178, Schedule 3(5vi)	N/A

Item	Source[2]	Section in this EPR
A five-year overview of environmental performance	EPBC 2003/1294 and 2008/4178, Condition 4.2(iii)	7.6
Proposed environmental management improvements	EPBC 2003/1294 and 2008/4178, Condition 4.2(iv)	7.7

1. *Environmental monitoring was not required during the Reporting Period as seepage of injected CO_2 to the surface or near surface environments was not detected. Therefore, no elevated risk of Material or Serious Environmental Harm and/or risk to human health was identified.*
2. *Ministerial Statement 1198, published 20 October 2022, amended Condition 5.2 of Ministerial Statement 800 removing the requirement for environmental performance reporting of Carbon Dioxide Injection System.*

7.1 Volume of Reservoir Carbon Dioxide Removed

The Commonwealth *National Greenhouse and Energy Reporting Act 2007* (NGER Act) contains provisions for reporting emissions from transporting and injecting GHGs and storing them underground. This EPR includes data on the volumes of reservoir CO_2 extracted for the previous five financial years (1 July 2020 to 30 June 2025), which aligns with CAPL's NGER Act reporting obligations. This enables the processes and procedures (including quality assurance, audit, and sign-off checks) developed for NGER Act compliance to be applied to these data.

Volume of Reservoir Carbon Dioxide Removed and Available for Injection
1,620,124 × 10^3 standard cubic metres of reservoir carbon dioxide was removed from the incoming natural gas stream during the 2020–2021 financial year. This equates to 3,169,705 tonnes carbon dioxide equivalent (CO_2e)
2,696,305 × 10^3 standard cubic metres of reservoir carbon dioxide was removed from the incoming natural gas stream during the 2021–2022 financial year. This equates to 5,299,794 tonnes CO_2e.
2,595,630 × 10^3 standard cubic metres of reservoir carbon dioxide was removed from the incoming natural gas stream during the 2022–2023 financial year. This equates to 5,104,239 tonnes CO_2e.
2,732,686 × 10^3 standard cubic metres of reservoir carbon dioxide was removed from the incoming natural gas stream during the 2023–2024 financial year. This equates to 5,371,172 tonnes CO_2e.
2,660,647 × 10^3 standard cubic metres of reservoir carbon dioxide was removed from the incoming natural gas stream during the 2024–2025 financial year. This equates to 5,229,836 tonnes CO_2e.

7.2 Volume of Reservoir Carbon Dioxide Injected

This EPR includes data on the volumes of reservoir carbon dioxide injected for the 2020–2025 Reporting Period; these data align with CAPL's NGER Act reporting obligations.

Volume of Reservoir Carbon Dioxide Injected
1,098,651 × 10^3 standard cubic metres of reservoir carbon dioxide was injected during the 2020–2021 financial year. This equates to 2,170,594 tonnes CO2e.
856,924 × 10^3 standard cubic metres of reservoir carbon dioxide was injected during the 2021–2022 financial year. This equates to 1,693,004 tonnes CO2e.
870,583 × 10^3 standard cubic metres of reservoir carbon dioxide was injected during the 2022–2023 financial year. This equates to 1,717,840 tonnes CO2e.
807,635 × 10^3 standard cubic metres of reservoir carbon dioxide was injected during the 2023–2024 financial year. This equates to 1,594,340 tonnes CO2e.
673,407 × 10^3 standard cubic metres of reservoir carbon dioxide was injected during the 2024–2025 financial year. This equates to 1,330,994 tonnes CO2e.

7.3 Monitoring Results

During the Reporting Period there was no evidence of seepage of injected reservoir carbon dioxide to the surface or near-surface environments.

7.4 Reasons for Shortfall Between Volume Extracted and Injected

The key reason for the shortfall between the volume of reservoir CO_2 extracted and injected for the 2024–2025 financial year is the careful management of reservoir CO_2 injection rates. This ensures reservoir pressure in the Dupuy Formation remains within an acceptable range while the pressure management capacity of the CO_2 Injection System is constrained.

7.5 Measures Being Implemented

Early reservoir performance and modelling indicates that additional pressure management capacity is needed to manage reservoir pressures in the Dupuy Formation.

A project is underway which aims to expand the system's capacity to manage water found within the reservoir where carbon dioxide is stored, thereby reducing reservoir pressure and enabling increased carbon dioxide injection rates.

The project consists of optimising existing infrastructure through the:

- modification of four existing water producing wells to expand reservoir water extraction capability
- installation of new surface infrastructure to enhance water processing
- modification of two existing water injection wells to increase the volume and flow rate of water that can be processed, and
- drilling of two new water injection wells to increase the total volume of water that can be processed.

In addition to this project, CAPL plans to proceed with an additional project to further increase carbon dioxide injection rates within the system which will involve:

- drilling three new water production and two new water injection wells at a new pressure management drill centre on previously cleared land; installation of associated surface infrastructure for water processing
- drilling two new CO_2 injection wells from an expanded existing CO_2 injection drill centre.

While these measures are being implemented, CAPL will continue to inject as much reservoir CO_2 as practicable.

In accordance with Condition 26.4 of MS1198, CAPL will offset the quantity of reservoir CO_2 that was not injected underground.

7.6 Five-year Overview of Environmental Performance

The safe start-up and operation of the CO_2 injection system commenced on 6 August 2019. Following a staged commissioning and start-up of all three compressor modules, the system was injecting at full injection rates by the end of February 2020.

In the 2020–2025 Reporting Period, >10.4 million tonnes of CO_2e was injected, thus confirming the Carbon Dioxide Injection Project as one of the world's largest GHG abatement projects to be undertaken by industry.

7.7 Proposed Environmental Management Improvements

Although the CO_2 Injection System has operated reliably during the 2020–2025 Reporting Period, CAPL is taking the necessary time to safely address system performance, with a focus on long-term reliable operation over the life of the Gorgon Gas Development.

Refer to Section 7.5 for the key proposed management improvements.

8 Air Quality

Table 8-1: EPR Reporting Requirements for Air Quality

Item	Source	Section in this EPR
Air quality monitoring results, with a discussion on the success (or otherwise) in meeting emissions targets	MS 800, Schedule 3(7i)	8.1
A five-year overview of environmental performance	MS 800, Condition 5.3(iii)	8.2
Proposed environmental management improvements	MS 800, Condition 5.3(iv)	8.3

8.1 Monitoring Results

The objectives of the Gorgon Gas Development Air Quality Management Plan (AQMP; Ref. 11), as defined by Ministerial conditions, are to:

- ensure air quality meets the appropriate standards for human health in the workplace
- ensure air emissions from GTP operations do not pose a risk of Material or Serious Environmental Harm to the flora, vegetation communities, terrestrial fauna, and subterranean fauna of Barrow Island.

The air quality monitoring program measures both ambient air quality and point source air quality at major emission sources (stack monitoring).

Ambient air quality monitoring measures select atmospheric pollutants and air toxics emissions associated with the commissioning, start-up, and operation of the GTP, and then compares these data against the applicable assessment (ambient) criteria defined in the AQMP (Ref. 11).

Stack air quality monitoring measures select atmospheric pollutants and air toxics at the point of discharge from major GTP emission sources (Frame 9 Gas Turbine Generators [GTGs] and Frame 7 Liquefaction Compressor Gas Turbines [LCGTs]). These emissions are assessed against the targets specified in the AQMP (Ref. 11).

The monitoring program completed during the Five-year Reporting Period is summarised below.

Table 8-2: Summary of Ambient Air Quality and Stack Air Quality Monitoring Completed during the Five-year Reporting Period

	Ambient Air Quality	Stack Air Quality (Major Emission Sources)
Locations:	Butler Park (workforce accommodation) Air Quality Monitoring Station (AQMS) Communications Tower (CT) AQMS (close to the GTP) Other locations beyond the GTP	5 x GTGs 6 x LCGT
Frequency:	Continuous	Quarterly
Parameters	Varied per location, but includes: NO, NO_x, NO_2 PM_{10}, H_2S, SO_2 NMVOC (non-methane volatile organic compounds) CO, O_3, weather	NO_x CO NMVOC

Figure 8-1: Ambient Air Quality Monitoring Locations August 2020 to August 2025

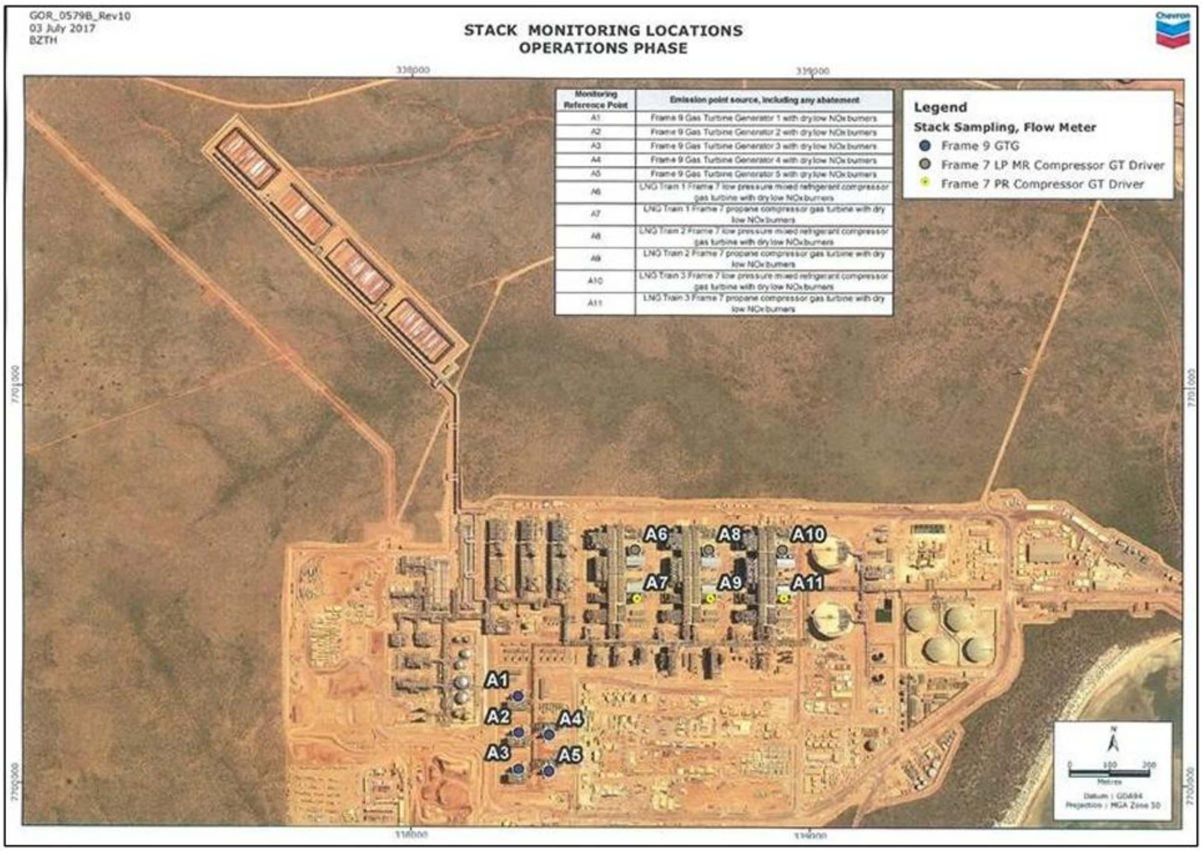


Figure 8-2: Stack Air Quality Monitoring Locations August 2020 to August 2025

Air quality monitoring results, including assessment of exceedances, are summarised in the tables below; data is presented for both the full Reporting Period (2020-2025) and for the last year of the Reporting Period (2024-2025). Note: The assessment of whether a test result exceeds a given guideline is based solely on the numeric value and does not take in to account the measurement uncertainty associated with the numeric value or values. Inherent within this approach is a risk of a false positive when the test result minus the measurement uncertainty is less than or equal to the guideline.

Monitoring program: Ambient air quality

Results

NO_2, SO_2, CO

There were no exceedances recorded for nitrogen dioxide (NO_2), sulphur dioxide (SO_2), carbon monoxide (CO) against the relevant National Environmental Protection Measure (NEPM) guidelines (Ref. 48) during the reporting period.

PM_{10}

There were eight exceedances of the daily PM_{10} guideline and no exceedances of the annual PM_{10} guideline at Butler Park during the 2024–2025 reporting period. The 2024–2025 results returned to levels consistent with the 2020–2023 periods, following a temporary spike in exceedances observed in 2023–2024. The elevated results during 2023–2024 were attributed to increased vehicular movement associated with JIC works, as well as the use of the area adjacent to the AQMS for laydown and construction activities.

There were 91 exceedances of the daily PM_{10} guideline at CT, which also contributed to an exceedance of the annual PM_{10} guideline during the 2024-2025 reporting period. PM_{10} levels have been consistently elevated, with annual exceedances also recorded in 2020–2021, 2022–2023, and 2023–2024. These elevated levels can be attributed to road works and increased activity on unsealed roads in the local vicinity of the monitoring station. The gas turbine generators have stacks approximately 50 m in height, making it unlikely that particulate emissions from the stacks would affect the AQMS at CT. Therefore, the most probable source of particulates at CT is construction-related activities, such as vehicular movements, rather than production operations.

O_3

There were no exceedances of the O_3 guidelines during the 2024-2025 reporting period. 14 exceedances were recorded at CT and 11 at BP between 5-7 November 2023. These measurements coincided with an extreme weather event across the northwest of Australia, with NEPM exceedances also measured at the Onslow Townsite during the period. As such, the exceedances measured for ozone are not deemed to be as a result of GTP operation. The profile at both CT and BP shows little change over the reporting period.

H_2S

At Butler Park, no exceedances of H_2S were recorded from 2020 to 2024. Three exceedances were recorded in 2024-2025 on two dates, 13 January 2025 and 22 February 2025. Elevated readings on 13 January 2025 were influenced by low wind speeds at the time of measurement, resultingly the recorded wind direction is not an accurate marker of pollutant origin. The source of the exceedances on 13 January 2025 was most likely resultant of localised camp activities including waste treatment. Elevated readings on 22 February 2025 occurred during different environmental conditions, winds were moderate (5.3 m/s) and NE. Historically, elevated readings have occurred under similar environmental conditions most likely as a contribution from waste treatment infrastructure located ~100-200 m NE of the BP AQMS.

At CT, 399 exceedances were recorded in 2024–2025, down from the 654 recorded in 2023–2024. Most exceedances occurred between September and January, aligning with the summer months. These exceedances were associated with light winds (less than 5 m/s) predominantly from the south-westerly to westerly directions. Under such conditions, pollutant dispersion is limited, making localised sources the most probable contributors. The highest H_2S readings typically occur during warmer periods, suggesting a seasonal pattern in H_2S concentrations.

Table 8-3: Summary of Exceedances against Guideline Values during the Five-year Reporting Period

Guideline Value				No. of Exceedances 2020-2025	
Parameter	Guideline	Concentration	Averaging Period	CT[2]	BP[3]
PM_{10}[4]	NEPM[5]	50 µg/m³	1 day	201	68
		25 µg/m³	1 year[6]	4	1
O_3[4,8]	NEPM[5]	0.065 ppm	8 hours	14	11
H_2S[4]	WHO[7]	7 µg/m³	30 minutes	2147	3
Benzene	NSW DEC[10]	0.009 ppm	1 hour	65	0

Monitoring program: Ambient air quality

Table 8-4: Summary of Exceedances against Guideline Values during the 2024–2025 Reporting Period

Guideline Value				No. of Exceedances 2024–2025	
Parameter	**Guideline**	**Concentration**	**Averaging Period**	**CT[2]**	**BP[3]**
PM_{10}[4]	NEPM[5]	50 µg/m³	1 day	91	8
		25 µg/m³	1 year[6]	1	0
O_3[4,8]	NEPM[5]	0.065 ppm	8	0	0
H_2S[4]	WHO[7]	7 µg/m³	30 minutes	399	3
Benzene	NSW DEC[10]	0.009 ppm	1 hour	8	0

1. *The last 12 months is the period 10 August 2024 to 9 August 2025.*
2. *CT is Communications Tower AQMS co-ordinates 50K 0339536E 7701048S.*
3. *BP is Butler Park AQMS co-ordinates 50K 0337244E 7697094S.*
4. *The following parameter abbreviations are used in this table: PM_{10} = particulate matter with an aero-equivalent diameter of less than 10 microns; NO^2 = nitrogen dioxide; O^3 = ozone; SO^2 = sulphur dioxide; H^2S = hydrogen sulphide; and CO = carbon monoxide.*
5. *NEPM is the National Environmental Protection Measure.*
6. *In NEPM, the annual averaging period is based on a calendar year. For the purposes of this report, the period 10 August to 9 August of the following year is used as the yearly averaging period.*
7. *WHO is the World Health Organisation. To calculate a valid annual average, it is a NEPM requirement that there is a minimum data capture of 75 % for each quarter. In Quarter 3 of the reporting year (i.e. 10 Feb 2025 to 9 May 2025), the data capture rate did not meet this requirement. Based on the available data, the average PM10 for the year (10 Aug 2024 to 9 Aug 2025) was above the NEPM guideline.*
8. *NEPM Guidelines for SO^2, O^3 and NO^2 were changed as of 18 May 2021.*
9. *NEPM Guideline for SO^2 was changed from 1 January 2025.*
10. *The Department of Environment and Conservation (DEC) is now NSW Planning and Environment. Note, the NSW DEC refers to the Victorian Government Gazette (S 240 21 December 2001) which provides intervention levels for benzene (1-hour) of 75 µg/m3.*

Conclusions

- Ambient air quality monitoring across Butler Park and Communications Tower locations during the 2024–2025 reporting period indicates that most pollutants remained within acceptable limits.
- There were no exceedances recorded for nitrogen dioxide, sulphur dioxide or carbon monoxide, attributable to GTP operations.
- PM_{10} levels at Communications Tower which exceeded both daily and annual guidelines, were primarily due to construction-related activities indicating that PM_{10} emissions from the GTP continue to be minimal.
- Hydrogen sulphide levels at Communications Tower showed a reduction in exceedances compared to the previous year, and seasonal patterns in wind speed demonstrated that localised sources remain influential.

Monitoring Program: Stack Air Quality (Major Emission Sources)
Results:

All air quality parameters, except nitrogen oxides (NO_x) and CO, were below the relevant emission targets in the Reporting Period for the emission sources considered (Table 8-5).

There were no exceedances of the target emissions for the Frame 7 LCGT during the Reporting Period (Ref. 12).

Table 8-5: Summary of Exceedances against Stationary Source Emissions Targets during the Five-year Reporting Period

Emission Source	Emission Targets [1]		No. of Exceedances [4]
	Parameter	Concentration (mg/m^3) [2]	
GTG 1	NO_x [3]	70	6
	CO	125	0
	NMVOC	40	0
GTG 2	NO_x [3]	70	4
	CO	125	1
	NMVOC	40	0
GTG 3	NO_x [3]	70	2
	CO	125	0
	NMVOC	40	0
GTG 4	NO_x [3]	70	9
	CO	125	0
	NMVOC	40	0
GTG 5	NO_x [3]	70	2
	CO	125	0
	NMVOC	40	0
LCGTs	NO_x [3]	350	0
	CO	125	0
	NMVOC	40	0

1. *Emission targets apply at the point of discharge to the environment.*
2. *The concentrations are at standard temperature and pressure (0 °C and 1013.25 hectopascals), dry and referenced to 15% oxygen.*
3. *NOX is oxides of nitrogen calculated as NO2.*
4. *Target does not apply when GTGs are operating under low loads (<55% capacity).*

Conclusions

- A total of 24 exceedances were recorded across the GTGs during the reporting period. The majority of these exceedances were primarily linked to low-load operations where emission targets and licence conditions do not apply.
- Only three exceedances occurred under normal operating conditions, with the GTGs operating at loads greater than 55% of capacity. NO_x remained the primary pollutant of concern.

8.2 Five-year Overview of Environmental Performance

The 2020–2025 outcome for air quality is summarised in the table below.

Objectives[1]	Outcome
Ensure air quality meets appropriate standards for human health in the workplace	*Ambient air quality* There were no exceedances recorded for nitrogen dioxide, sulphur dioxide, carbon monoxide, or BTEX against the relevant NEPM guidelines. There

Objectives[1]	Outcome
	were NEPM guideline exceedances recorded for O_3, but these coincide with an extreme weather event across the northwest of Australia and hence are not a result of GTP operation. Overall, results of the ambient air quality monitoring, excepting ozone, were below the relevant NOHES guidelines during the reporting period. This indicates that air emissions fell within appropriate standards for human health in the workplace. PM_{10} levels at Communications Tower which exceeded both daily and annual guidelines, were primarily due to construction-related activities indicating that PM_{10} emissions from the GTP continue to be minimal.
Ensure air emissions from the GTP operations do not pose a risk of Material or Serious Environmental Harm to the flora, vegetation communities, fauna, and subterranean fauna of Barrow Island.	Stack emissions from GTs and GTGs were largely compliant, with exceedances primarily linked to low-load operations where licence conditions do not apply. Only three exceedances occurred under normal operating conditions, with NO_x remaining the primary pollutant of concern. Measured ambient air data at CT AQMS showed no exceedances of the NOAEL (No Observable Adverse Effects Level) criteria, and all values remained well below the LOAEL[2] (Lowest Observable Adverse Effects Level) and LOAEL × 2 thresholds. This indicates that there is no potential for material or serious environmental harm during the reporting period. Due to the location and the frequency of the south westerly winds, in practice the CT AQMS detects higher concentrations of emissions and may be assumed to be a near worst case permanent monitoring location scenario outside the GTP boundary on a seasonal basis for prevailing wind conditions. Given there were no NOAEL exceedance at CT AQMS it is reasonable to deduce there was no exceedance at BP.

1 As defined in Condition 29.2 of MS 800.

2 The LOAEL is the lowest published concentration at which adverse health effects could still be observed.

8.3 Proposed Environmental Management Improvements

The key proposed management improvements for the AQMP (Ref. 11) are summarised in the table below.

Proposed environmental management improvement	Justification
Remove PM_{10} monitoring at all locations	Exceedances are strongly related to regional weather events, local dust, and not GTP emissions. PM_{10} monitoring is not required per Licence L/9102/2017/1 (S10.1.1; (Ref. 26).
Remove Passive Diffuse Samplers (PDS)(NMVOC) at all locations	Monitoring data has demonstrated that ambient concentration of NMVOCs are negligible and monitoring via PDSs is not required. Given that there is a continuous instrumental VOC analyser at CT, it is recommended that continued deployment of PDS should be reviewed.
Remove SO_x, O_3, and CO monitoring at all ambient locations	Monitoring data has demonstrated that ambient concentration of these parameters are below the relevant criteria.

9 Coastal Stability

Table 9-1: EPR Reporting Requirements for Coastal Stability

Item	Source	Section in this EPR
Results of beach and sediment monitoring	MS 800, Schedule 3(8i) EPBC 2003/1294 and 2008/4178, Schedule 3(6i)	9.2
Any mitigation measures applied in response to Proposal-related impacts of beach profile	MS 800, Schedule 3(8ii) EPBC 2003/1294 and 2008/4178, Schedule 3(6ii)	9.3
All exceedances of management triggers	Approval letter from the former WA Department of Environment and Conservation to CAPL (Ref. 13)	9.2
A five-year overview of environmental performance	MS 800, Condition 5.3(iii) EPBC 2003/1294 and 2008/4178, Condition 4.2(iii)	9.5
Proposed environmental management improvements	MS 800, Condition 5.3(iv) EPBC 2003/1294 and 2008/4178, Condition 4.2(iv)	9.6

9.1 Coastal Stability Management and Monitoring Plan

The objectives of the Gorgon Gas Development Coastal Stability Management and Monitoring Plan (CSMMP; Ref. 14), as defined by Ministerial conditions, are to:

- ensure that the Marine Offloading Facility (MOF) and LNG Jetty do not cause significant adverse impacts to the beaches adjacent to those facilities
- establish a monitoring program to detect adverse changes to the beach structure and beach sediments that could have implications for marine turtles nesting on the beaches adjacent to the MOF and LNG Jetty.
- nesting on the beaches adjacent to the MOF and LNG Jetty.

The CSMMP has been revised twice from the original, which was published in September 2009.Updates to the monitoring program were designed to improve beach structure monitoring, and to quantitatively track changes in the availability of suitable nesting habitat for marine turtles, based on the physical characteristics of each beach (Table 9-2). Revision 1 of the CSMMP was implemented between October 2014 and May 2016 (Ref. 30); and Revision 2 of the CSMMP (Ref. 14) and Revision 1 of the CSMMP Supplement (Ref. 15) were implemented from May 2016.

Results of the CSMMP monitoring program since installing the Marine Infrastructure (Causeway, MOF and LNG Jetty) have indicated that changes to Terminal, Bivalve, and Inga Beaches have been greater than initially predicted. In response to these findings, a new revision (Revision 0.3) of the CSMMP was developed and submitted to DWER and DCCEEW in March 2019. The revision proposed new management triggers for coastal stability and marine turtle nesting habitat. Further improvements were proposed in Revisions 0.4 and 0.5, submitted to DWER and DCCEEW in June 2020 and August 2023 respectively.

The CSMMP was again revised and submitted for approval during the Reporting Period. Revision 0.8 of the CSMMP was submitted to DCCEEW on 28 June 2024 to address the variation to EPBC 2003/1294 and 2008/4178 conditions issued to CAPL on 7 August 2023. This revision was also provided to DWER for information on 1 August 2024.

Table 9-2: Summary of Coastal Stability Monitoring Program

	Monitoring Program		
	Jul 2008 to Apr 2014	**Oct 2014 to May 2016**	**May 2016 onward**
Location	Potential impact beaches: Terminal and Bivalve Reference beaches: Inga, YCN, YCS		
Frequency	Four times a year After a major event	Twice a year After a major event	
Beach Structure	*Beach Morphology* RTK GPS beach profiles measured along 25 transects on Terminal, 24 transects on Bivalve, and two transects each on Inga, YCN, and YCS beaches	*Beach Morphology* Remote sensing surveys to generate digital surface elevation models over entire beach	
Beach Sediments	*Sediment Sampling* Four locations (CBF, FA, BD, PD[1]) and at four depths (0.0 m, 0.3 m, 0.6 m, 1.0 m) along selected transects (seven on Terminal, six on Bivalve, two each on Inga, YCN, and YCS beaches) analysed for: • particle size distribution (PSD) • moisture content	*Sediment Sampling* Two locations (CBF, FA) and up to two depths[2] (0.0 m, 0.6 m) along selected transects (seven on Terminal, six on Bivalve, two each on Inga, YCN, and YCS beaches, Figure 9-1) analysed for PSD	
	In Situ Sediment Characteristics Profile of vertical compaction collected at four locations (CBF, FA, BD, PD[1]) along selected transects (seven on Terminal, six on Bivalve, two each on Inga, YCN, and YCS beaches)	N/A	
Visual Record	*In Situ Photography* Photographs taken looking north, south, east, and west from each CBF sediment sampling site on all five beaches. Alongshore photographs taken from elevated views along Terminal and Bivalve beaches.	*In Situ Photography* Photographs taken looking north and south from each CBF sediment sampling site on Inga, YCN, and YCS beaches. Alongshore photographs taken from elevated views along Terminal and Bivalve beaches.	
	N/A	*Aerial Photography* Aerial imagery collected annually extending over full length of coastline from north of Terminal Beach to south of YCS Beach	
Marine Turtle Nesting Habitat	N/A		*Turtle Nesting Zones* Turtle nesting zones on Terminal, Bivalve, Inga, YCN, and YCS beaches are defined and categorised as ‘optimal’, ‘sub-optimal’ or ‘unsuitable’ based on physical beach characteristics

1. *CBF = Crest of Beach Face; FA – Foredune Area; BD = Base of Primary Dune; PD = Primary Dune. Note: PD location only sampled annually*
2. *0.6 m depth sampled at FA location only*

Coastal stability management triggers have been established for beach volume, beach slope, and sediment particle size, and data from each monitoring event are compared against the management triggers. The actions required if a management trigger exceedance occurs are set out in the CSMMP Supplement: Management Triggers (Ref. 15). Management triggers specific to changes in turtle nesting habitat, based on the amount of suitable area quantified through habitat mapping, have also been defined. These marine turtle nesting habitat management triggers only apply to the beaches adjacent to the Marine Infrastructure (Terminal and Bivalve beaches), and only to data collected during the end of dry season monitoring event (Ref. 14; Ref. 15).

Figure 9-1 Site Locations for the Coastal Stability Monitoring Program

9.2 Monitoring Results

The 2020–2025 monitoring results, including any detected exceedances and major event monitoring, are summarised in the following tables.

Monitoring program: Beach structure

Objective

Detect changes to the beaches adjacent to the marine facilities that may affect the stability of those beaches by measuring beach profile, beach volume, and quantifying the extent of any erosion or accretion of sediment over time.

Methodology

- Remote sensing surveys are completed twice each year (at the end of the dry and wet seasons where practicable, typically October and April). These surveys capture horizontal (x,y-plane) and vertical (z-plane) data to generate digital surface models over the entire beach (landward of the primary dune to the waterline) at Terminal, Bivalve, Inga, YCN, and YCS beaches.
- Topographic surveys (using remote sensing or RTK GPS methods) to record beach morphology are also undertaken, where practicable, after a major event.

Survey timing

Beach structure was monitored by routine twice-yearly surveys using remote sensing (lidar) during the 2020–2025 Reporting PeriodTable 9-3Table 9-3, in accordance with Revision 2 of the CSMMP (Ref. 30; Ref. 14). There was one exceedance of the major event trigger, which resulted in remote sensing survey mobilisation during the Reporting Period (July 2025, Table 9-3).

Table 9-3: Coastal Stability Monitoring Program: Beach Structure Surveys (Aug 2020–Aug 2025).

Reporting Period[1]	Routine Monitoring	Major Event Monitoring
	Remote Sensing	Remote Sensing
2020–2021	Oct 2020, May 2021	
2021–2022	Oct 2021, May 2022	
2022–2023	Oct 2022, May 2023	
2023–2024	Nov 2023, April 2024	
2024–2025	Oct 2024, Mar 2025	Jul 2025[2]

1. *Annual EPR period includes those surveys undertaken between 10 August–9 August each year.*
2. *The trigger for major event monitoring was reached on 31 May 2025, and a remote sensing survey was subsequently mobilised on 11 July 2025.*

Results

Surface Elevation – Patterns of Erosion and Accretion

Measurements of surface elevation are presented using data from the post-dry season surveys (typically captured in October each year). The results represent changes between the most recent post-dry season survey and:

- baseline conditions (October 2009–October 2024)
- five years prior (November 2019–October 2024)
- the previous year (November 2023–October 2024).

Surface elevation changes can highlight areas where erosion and accretion have occurred on the beaches between two time periods and are presented for all Impact and Reference beaches. Results indicate a realignment of sediment towards the Marine Infrastructure at Terminal, Bivalve, Inga and the Yacht Club Beaches.

Terminal Beach

Between October 2009 and October 2024, Terminal Beach eroded over the northern two thirds of the beach and accreted at the southern third, adjacent to the Marine Infrastructure, with some accretion also evident in the creek bed (approximately halfway along the beach, Figure 9-2).

Between November 2019 and October 2024, change was much less pronounced but followed the same trend as that observed for the baseline comparison. Most of the overall change occurred before 2015. Accretion was recorded at the southern end of Terminal Beach on the mid-beach face. Erosion was recorded at the northern section of the beach, immediately north of the creek (Figure 9-2).

Monitoring program: Beach structure
Between November 2023 and October 2024, some erosion and accretion occurred at the southern end of Terminal Beach, indicating some cross-shore redistribution, and there was accretion in the creek bed (Figure 9-2Figure 9-2). *Bivalve Beach* Between October 2009 and October 2024, Bivalve Beach accreted at the northern third of the beach, adjacent to the MOF, and eroded over the southern two thirds (Figure 9-3). Between November 2019 and October 2024, Bivalve Beach exhibited minor accretion at the northern end, following a similar trend to the baseline comparison (Figure 9-3). Most of the overall change at Bivalve Beach occurred before 2015. Between November 2023 and October 2024, elevation differences indicated erosion had occurred along the length of the beach at the base of the FA, with some patchy accretion over the beach face (Figure 9-3). *Inga Beach* Between October 2009 and October 2024, Inga Beach exhibited similar trends to Bivalve Beach, with accretion over the northern third. Erosion to the south extends to the northern boundary of the natural subaerial[1] rock platform (Figure 9-4). Between November 2019 and October 2024, Inga Beach exhibited patchy accretion at the northern end of the beach and erosion along the edge of the foredune (Figure 9-4). Between November 2023 and October 2024, erosion was recorded along the edge of the foredune, with some patchy accretion over the beach face (Figure 9-4). *YCN Beach* Between October 2009 and October 2024, YCN Beach mainly exhibited erosion at the southern end and accretion at the northern end (Figure 9-5). YCN Beach can be variable at the northern boundary, where the Terminal Creek sandbar is frequently redistributed by wave action. Between November 2019 and October 2024, YCN Beach recorded patchy accretion on the active beach face in the northern section of the beach (Figure 9-5). Small areas of erosion occurred on the beach face and edge of the foredune in the southern half of the beach. Between November 2023 and October 2024, YCN Beach exhibited minimal change (Figure 9-5). Small patches of erosion were observed along the edge of the foredune in the southern half of the beach. *YCS Beach* Between October 2009 and October 2024, YCS Beach exhibited accretion at the base of the foredune and erosion on the active beach face (Figure 9-6). This erosion is linked to the erosion at the southern end of YCN Beach, with the Yacht Club Beaches falling within one sediment cell bounded by Camp Point to the south and Terminal Creek to the north. Between November 2019 and October 2024, YCS Beach recorded predominantly erosion in pockets along the active beach zone, and along the edge of the foredune (Figure 9-6). Between November 2023 and October 2024, there were patches of accretion over the beach face and minor erosion along the edge of the foredune.

[1] A rock platform permanently exposed to the air

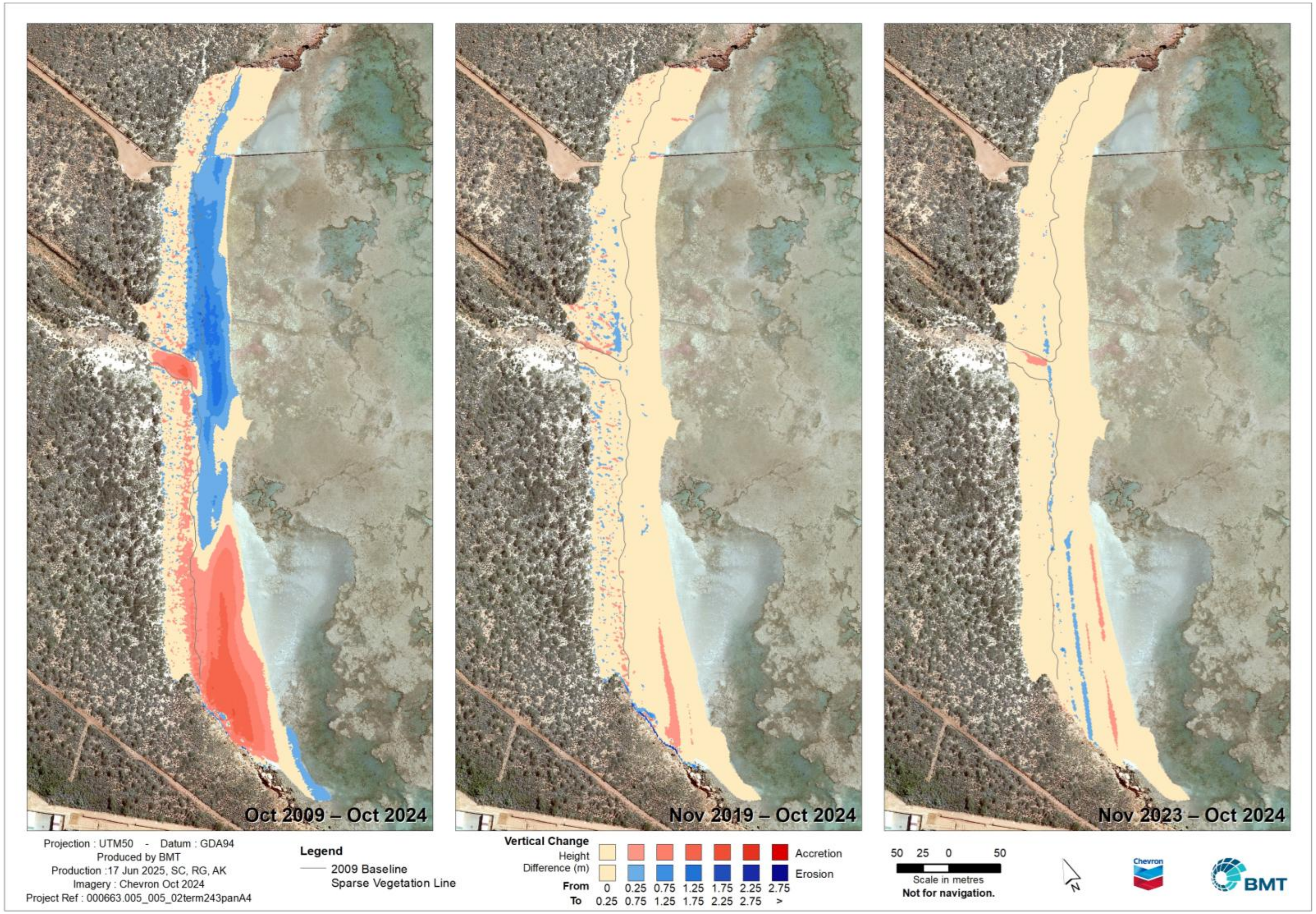


Figure 9-2: Surface Elevation Changes at Terminal Beach; baseline to October 2024 (left), November 2019 to October 2024 (middle) and November 2023 to October 2024 (right)

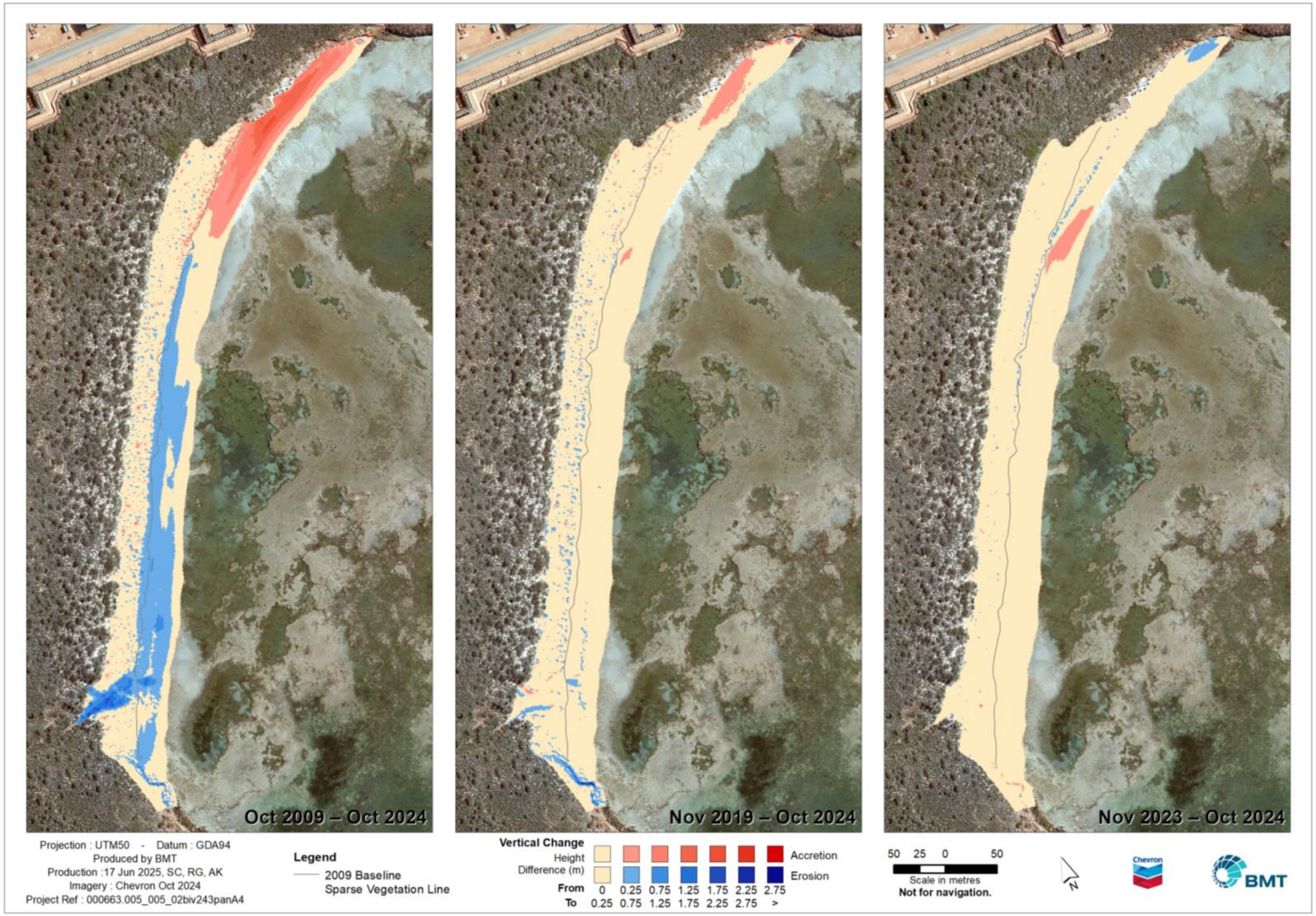


Figure 9-3: Surface Elevation Changes at Bivalve Beach; baseline to October 2024 (left), November 2019 to October 2024 (middle) and November 2023 to October 2024 (right)

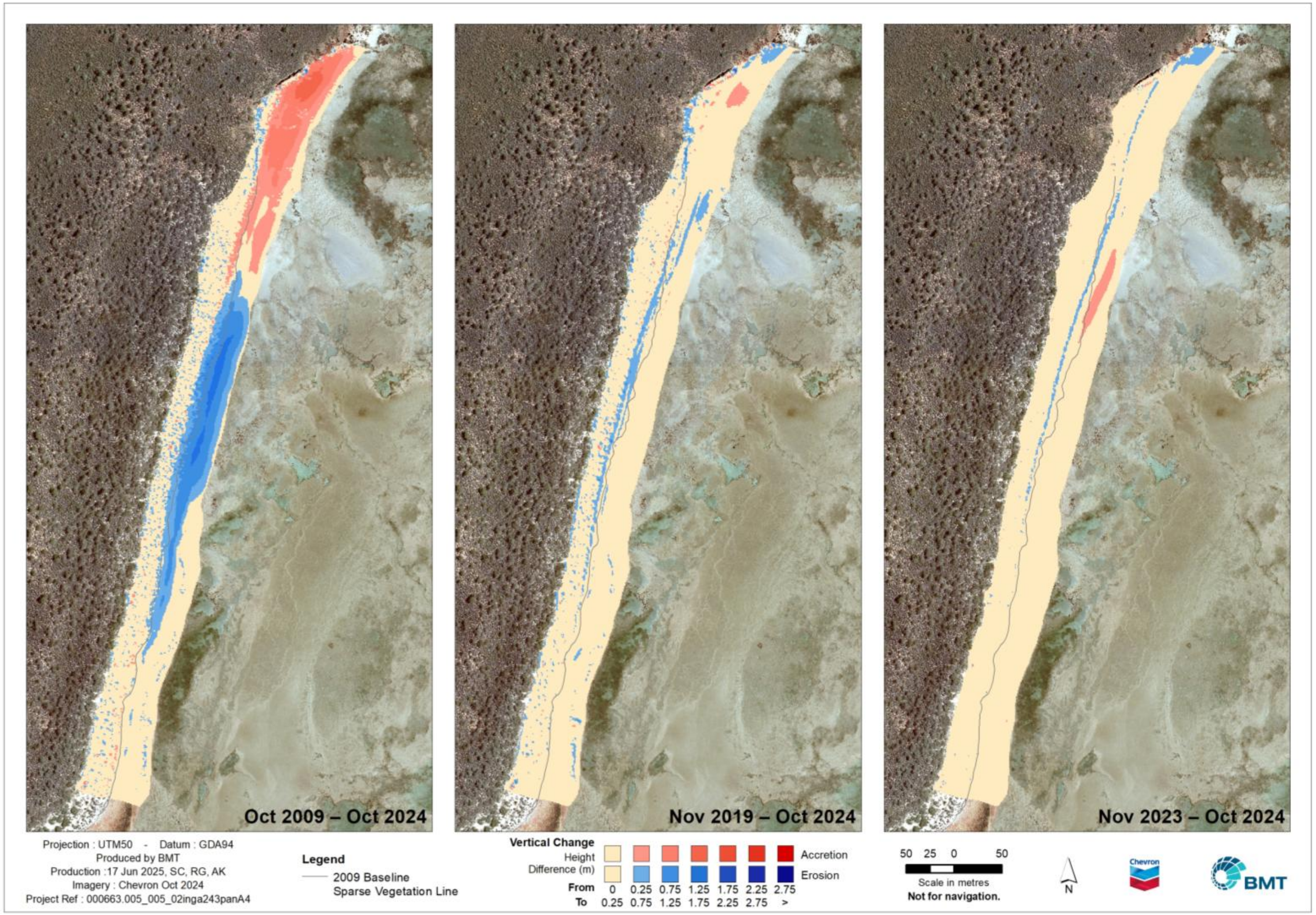


Figure 9-4: Surface Elevation Changes at Inga Beach; baseline to October 2024 (left), November 2019 to October 2024 (middle) and November 2023 to October 2024 (right)

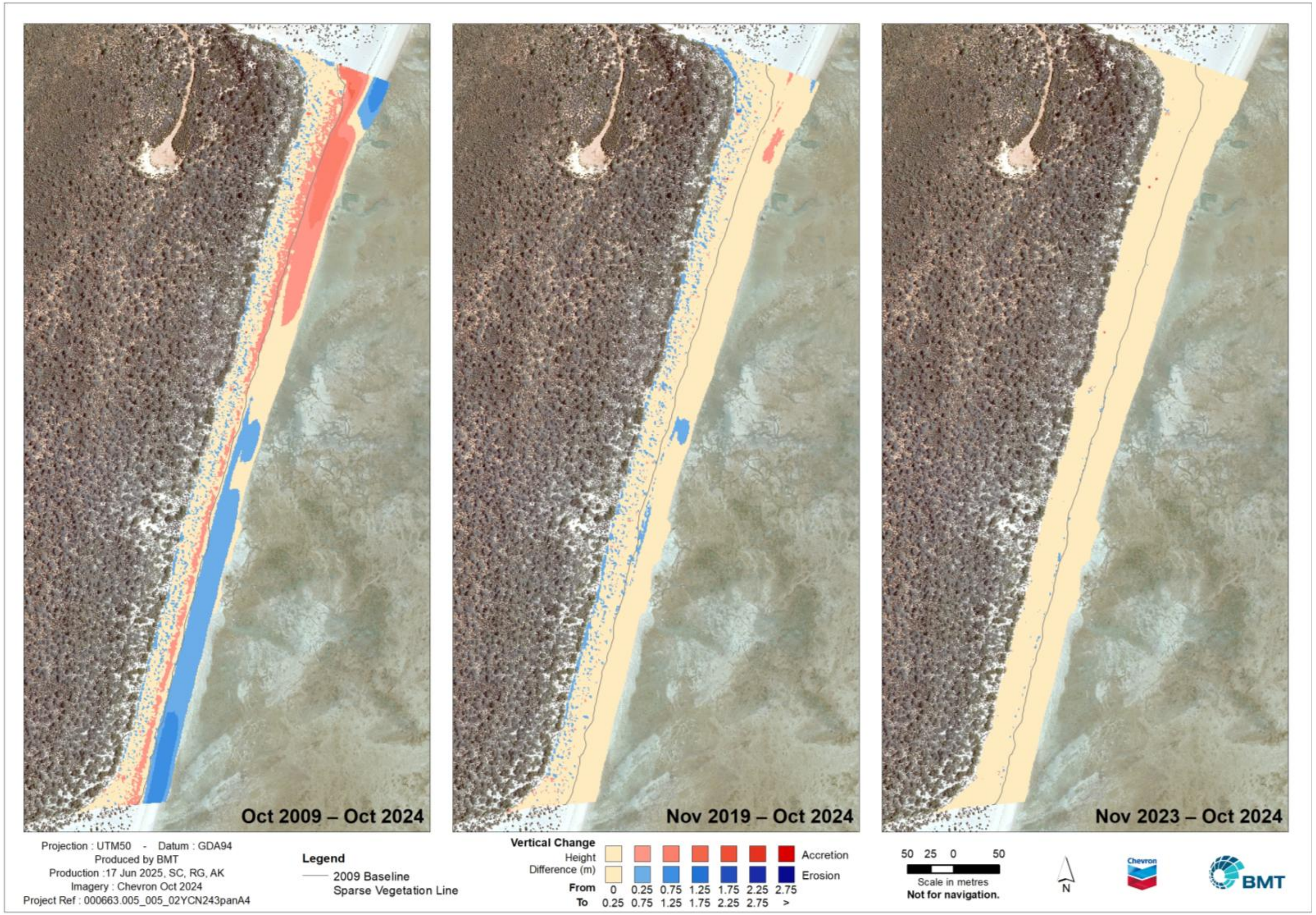


Figure 9-5: Surface Elevation Changes at YCN Beach; baseline to October 2024 (left), November 2019 to October 2024 (middle) and November 2023 to October 2024 (right)

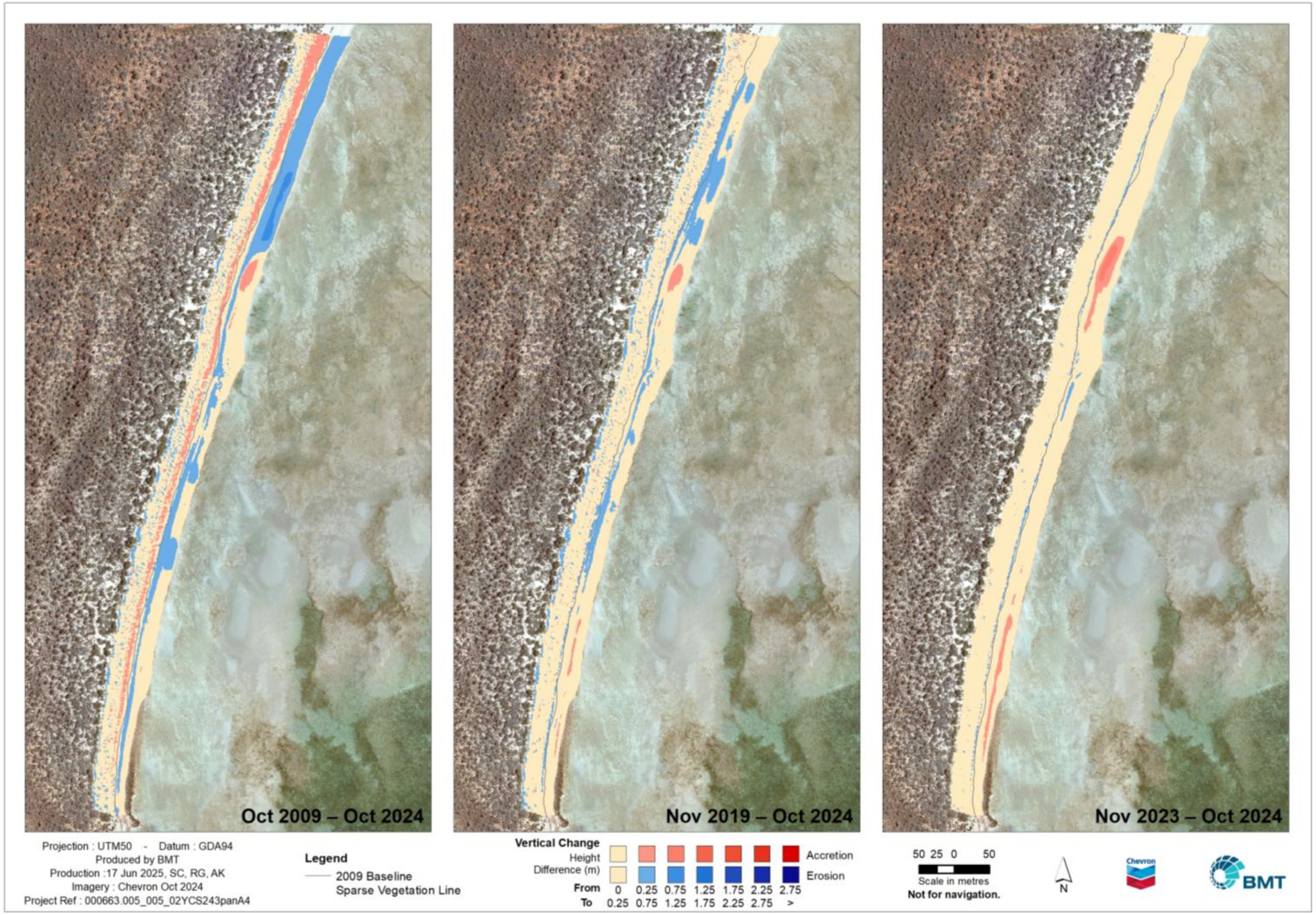


Figure 9-6: Surface Elevation Changes at YCS Beach; baseline to October 2024 (left), November 2019 to October 2024 (middle) and November 2023 to October 2024 (right)

Monitoring Program: Beach Structure	
Results:	**Major Event Monitoring** During the 2020–2025 Reporting Period, major event (a sustained period, four days or longer, of winds with an easterly component, NNE to SSE, during which the total duration of winds >18 knots is ≥96 hours recorded at Barrow Island) monitoring was completed for one storm event that exceeded the major event wind trigger, in May 2025. The winds during the event originated from the NE quadrant and peaked at ~30 knots on 29 May 2025. All beaches exhibited signs of southward sediment transport between March 2025 and July 2025, with erosion typically observed to the north and accretion to the south (Figure 9-7, Figure 9-8 and Figure 9-9). At Bivalve and Inga Beaches there were signs of deposition of sediment over previously exposed rocky areas. Both beaches also exhibited erosion at the seaward edge of the vegetated foredune. At YCN and YCS erosion was observed over the beach face over much of the beach. Accretion was observed immediately north of the rocky barriers formed by Camp Point (at the southern end of YCS) and the outcropping rock in the middle of YCS. These observations are consistent with the signs of southward sediment transport. At YCN, and the very northern part of YCS, accretion was also evident along the seaward edge of the vegetated foredune (opposite to the observations at Bivalve and Inga Beaches). At Terminal Beach, sand was manually redistributed in June 2025 (Section 9.3), which negated any effects of the major event and which dominated the change in sand levels (Figure 9-7). Visual observations in the days following the major event indicated a large amount of seagrass and macroalgal wrack had been deposited and transported to the southern corner of Terminal Beach.
Management Trigger Exceedances	Exceedances of Management Triggers at Terminal and Bivalve Beaches have been detected since July 2010. Investigations of these exceedances attributed the cause to both natural variability and beach realignment due to the presence of the Marine Infrastructure. ***Terminal Beach*** During the Reporting Period, management trigger exceedances were recorded for both volume and slope at monitored transects on Terminal Beach (T11 and T22; Figure 9-1); however, the number of exceedances recorded varied between surveys (Table 9-4, Table 9-5). Key observations include: – Volume exceedances at T11 at both the CBF and FA for all surveys over the Reporting Period, corresponding to an increase in volume across the profile. – Slope exceedances at T11 FA for all surveys, corresponding to a decrease in the angle of the slope (i.e. flattening). – Volume exceedances at T22 CBF and FA for all surveys over the Reporting Period, corresponding to a decrease in volume at the CBF, and an increase in volume at the FA. – Slope exceedances at T22 FA for all surveys over the Reporting Period, corresponding to an increase in the angle of the slope (i.e. steepening).

Table 9-4: Management Trigger Exceedances at Terminal Beach Transect 11 During the Five-year Reporting Period

T11	CBF								FA							
	Volume				Slope				Volume				Slope			
Date	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Oct 2020																
May 2021																
Oct 2021																
May 2022																
Oct 2022																
May 2023																
Nov 2023																
Apr 2024																
Oct 2024																
Mar 2025																

1. *Trigger 1 = single point ±3 SD from the baseline mean; Trigger 2 = two out of three consecutive points ±2 SD from the baseline mean; Trigger 3 = four out of five consecutive points ±1 SD from the baseline mean; Trigger 4 = eight consecutive points on the same side of the baseline mean.*

2 *Orange shading = exceedance (increase from baseline), green shading = exceedance (decrease from baseline), no shading = no exceedance.*

Table 9-5: Management Trigger Exceedances at Terminal Beach Transect 22 During the Five-year Reporting Period

T22	CBF								FA							
	Volume				Slope				Volume				Slope			
Date	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Oct 2020																
May 2021																
Oct 2021																
May 2022																
Oct 2022																
May 2023																
Nov 2023																
Apr 2024																
Oct 2024																
Mar 2025																

1 *Trigger 1 = single point ±3 SD from the baseline mean; Trigger 2 = two out of three consecutive points ±2 SD from the baseline mean; Trigger 3 = four out of five consecutive points ±1 SD from the baseline mean; Trigger 4 = eight consecutive points on the same side of the baseline mean.*

2 *Orange shading = exceedance (increase from baseline), green shading = exceedance (decrease from baseline), no shading = no exceedance.*

Bivalve Beach

During the Reporting Period, management trigger exceedances were recorded for both volume and slope at monitored transects on Bivalve Beach (B11 and B22; Figure 9-1); however, the number of exceedances recorded varied between surveys (Table 9-6, Table 9-7).

Key results include:

- Volume exceedances at B11 CBF for all surveys over the Reporting Period, corresponding to an increase in volume in the active zone of the beach.
- Slope exceedances at B11 FA for most surveys over the Reporting period, corresponding to a decrease in the angle of the slope (i.e. flattening).

Monitoring Program: Beach Structure

- Volume exceedances at B22 CBF for all surveys over the Reporting Period, corresponding to a decrease in volume in the active zone of the beach.
- Slope exceedances at B22 FA for all surveys over the Reporting Period, corresponding to an increase in the angle of the slope (i.e. steepening).

Table 9-6: Management Trigger Exceedances at Bivalve Beach Transect 11 During the Five-year Reporting Period

B11	CBF								FA							
	Volume				Slope				Volume				Slope			
Date	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Oct 2020																
May 2021																
Oct 2021																
May 2022																
Oct 2022																
May 2023																
Nov 2023																
Apr 2024																
Oct 2024																
Mar 2025																

1. *Trigger 1 = single point ±3 SD from the baseline mean; Trigger 2 = two out of three consecutive points ±2 SD from the baseline mean; Trigger 3 = four out of five consecutive points ±1 SD from the baseline mean; Trigger 4 = eight consecutive points on the same side of the baseline mean.*
2. *Orange shading = exceedance (increase from baseline), green shading = exceedance (decrease from baseline), no shading = no exceedance.*

Table 9-7: Management Trigger Exceedances at Bivalve Beach Transect 22 During the Five-year Reporting Period

B22	CBF								FA							
	Volume				Slope				Volume				Slope			
Date	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Oct 2020																
May 2021																
Oct 2021																
May 2022																
Oct 2022																
May 2023																
Nov 2023																
Apr 2024																
Oct 2024																
Mar 2025																

1. *Trigger 1 = single point ±3 SD from the baseline mean; Trigger 2 = two out of three consecutive points ±2 SD from the baseline mean; Trigger 3 = four out of five consecutive points ±1 SD from the baseline mean; Trigger 4 = eight consecutive points on the same side of the baseline mean.*
2. *Orange shading = exceedance (increase from baseline), green shading = exceedance (decrease from baseline), no shading = no exceedance.*

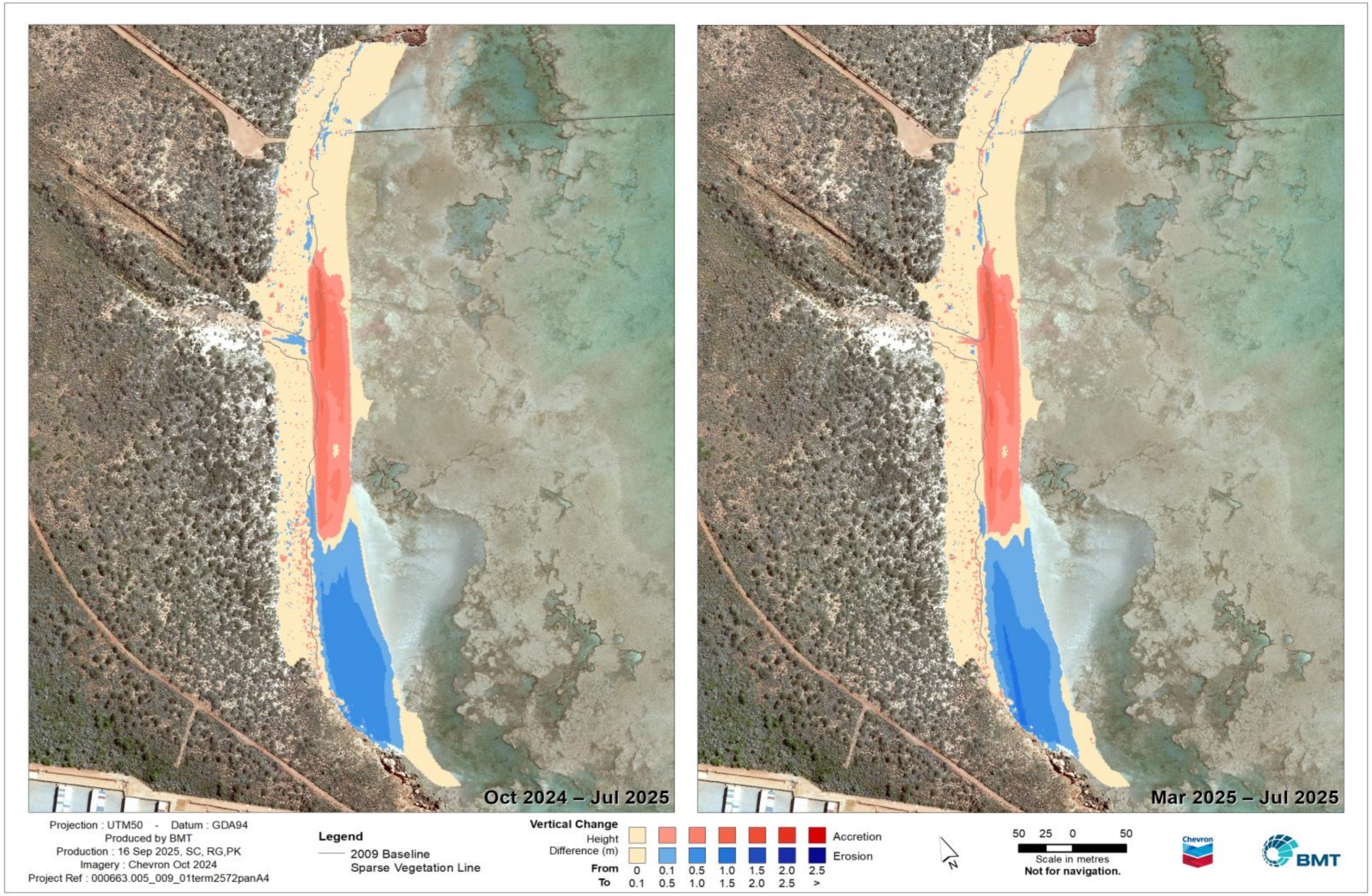


Figure 9-7: Surface Elevation Changes at Terminal Beach After the Major Event Recorded 27–31 May 2025

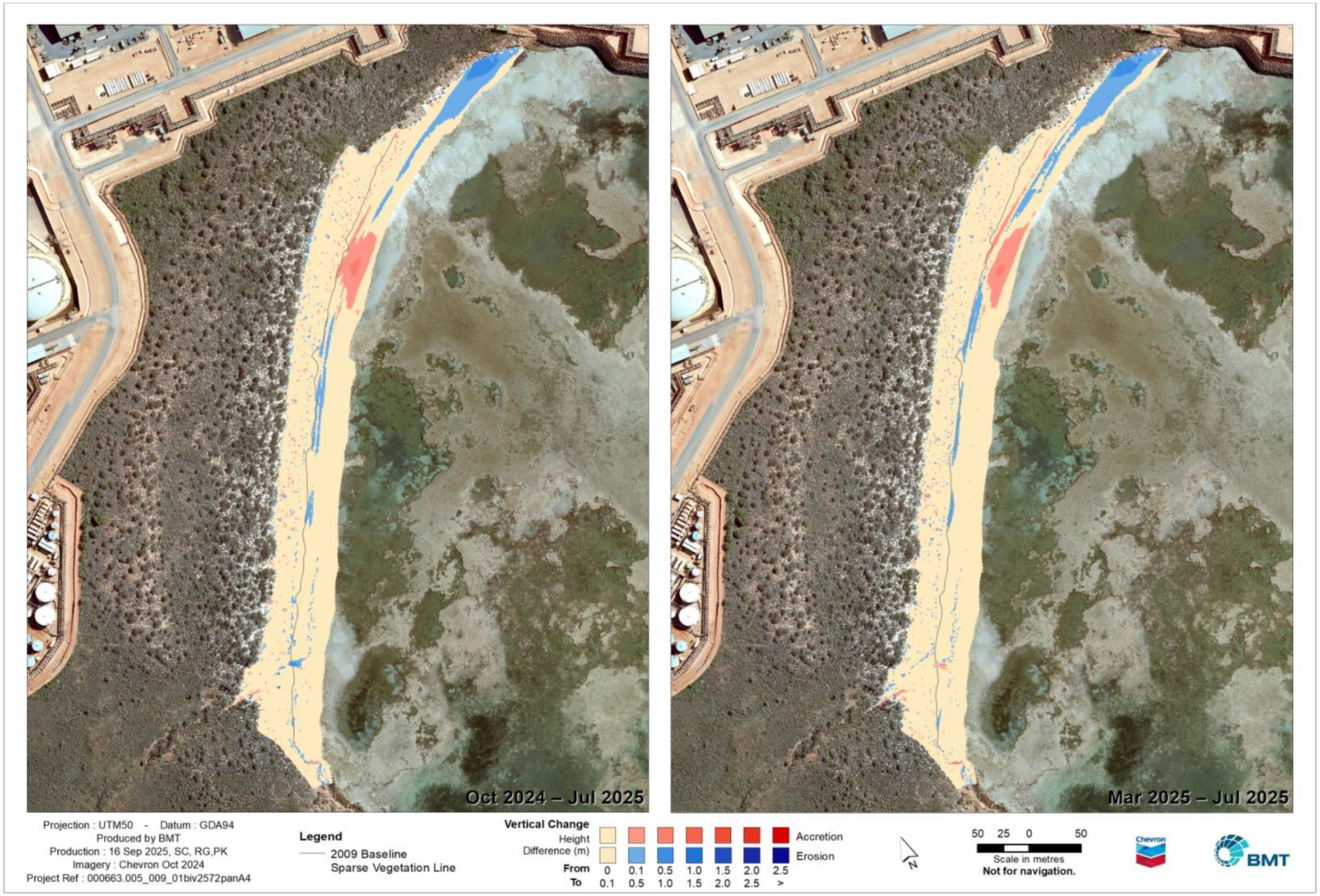


Figure 9-8: Surface Elevation Changes at Bivalve Beach After the Major Event Recorded 27–31 May 2025

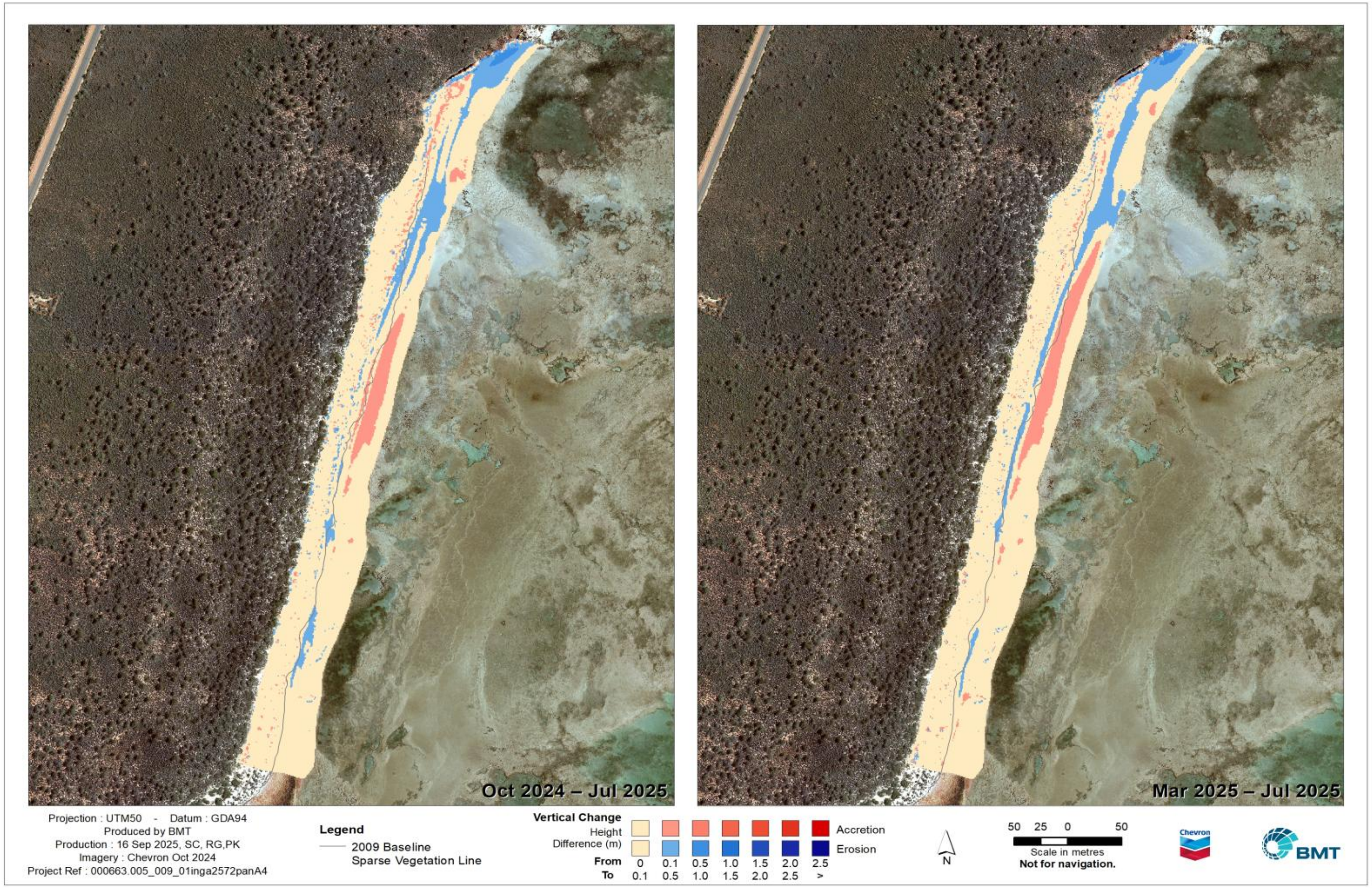


Figure 9-9: Surface Elevation Changes at Inga Beach After the Major Event Recorded 27–31 May 2025

Monitoring program: Beach sediments
Objective
Detect changes to beach sediments as a result of the presence of the MOF and LNG Jetty.
Methodology
Sediment sampling is completed once per year (at the end of the dry season where practicable, typically October) at two locations (CBF and FA), and up to three depths (0.0 m, 0.3 m, 0.6 m) along selected transects (seven on Terminal, six on Bivalve, and two each on Inga, YCN, and YCS beaches). Samples are analysed to measure changes in PSD over time. Beach sediment sampling is also undertaken after a major (weather) event, where practicable.
Results
PSDs of surface samples (0.0 m) are displayed in Figure 9-10or monitoring transects at Terminal Beach (T11, T22) and Bivalve Beach (B11, B22) to demonstrate sediment composition changes occurring at the southern and northern sections of each beach over the Reporting Period (Figure 9-10–Figure 9-13). Summaries of sediment composition changes at Inga, YCN, and YCS beaches are also provided, and additional graphs are displayed in Figure 9-14–Figure 9-19. Sediment samples collected at FA 0.6 m sites are used to inform the placement of nesting zones in the marine turtle nesting habitat maps (see Figure 9-21–Figure 9-25). **Seasonal Monitoring** *Terminal Beach* Over the Reporting Period, minor variations in PSD have been observed at T11 CBF (southern end of Terminal Beach), with fines and gravel portions contributing <5% to the distribution for each survey in the Reporting Period (Figure 9-10Figure 9-10). Sediment coverage at the northern end of Terminal Beach has decreased and bedrock has become exposed at the most northern CBF sites, including T22, which has had no sediment coverage since May 2018 (Figure 9-10, (Ref. 8)). At the southern end of Terminal Beach (T11), no notable changes in PSD have occurred in FA samples (Figure 9-10). At the northern end (T22), there has been minor variability in the amount of gravel in FA samples since October 2020 (Figure 9-11).

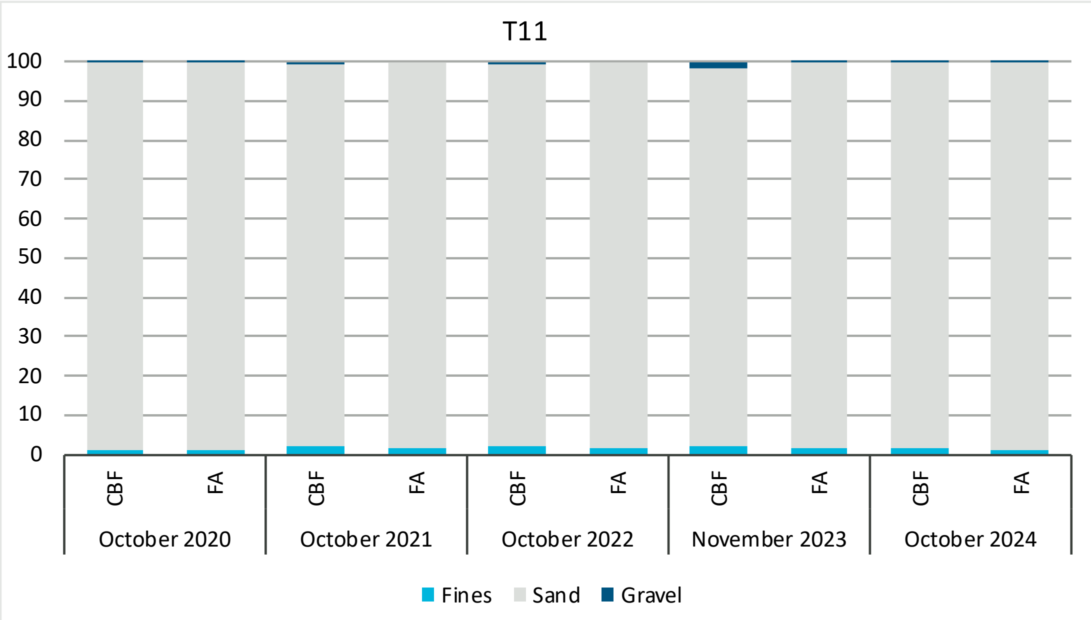
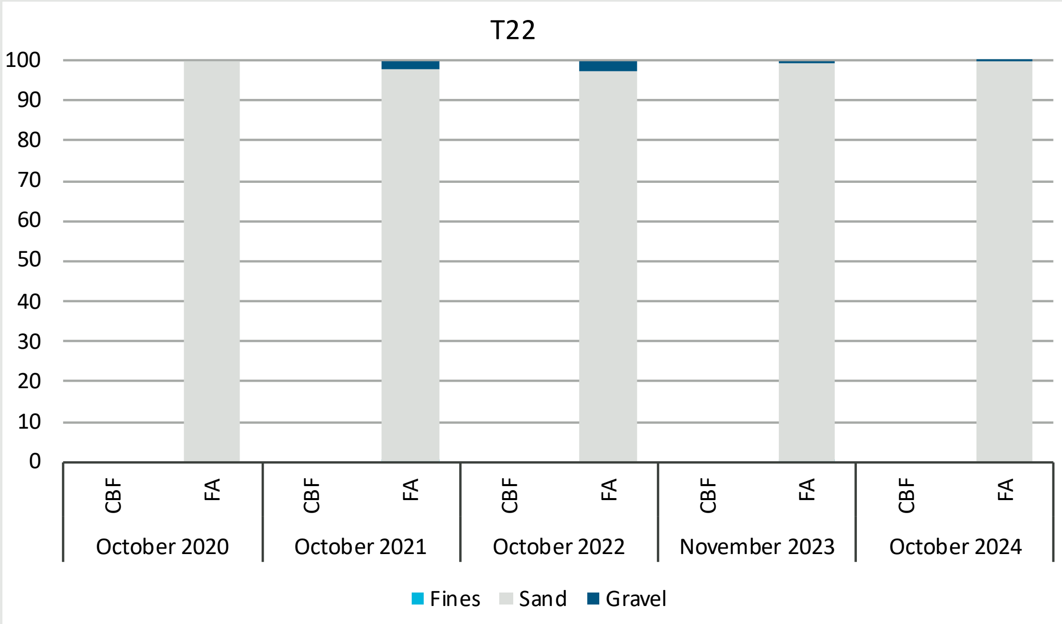


Figure 9-10: PSD of Sediment Samples at T11 (southern end of Terminal Beach) for Routine Biannual Surveys, October 2020–October 2024

Monitoring program: Beach sediments



Note: Blank values = sediment sample could not be collected due to insufficient sediment coverage

Figure 9-11: PSD of Sediment Samples at T22 (northern end of Terminal Beach) for Routine Biannual Surveys, October 2020–October 2024

Bivalve Beach

At the northern end of Bivalve Beach (B11), minor variability in the gravel component of CBF sediments has been recorded over the Reporting Period (Figure 9-12). At the southern end of the beach, CBF sediments have been variable. On two occasions, there was no sediment available to be collected, and gravel varied from ~0% to ~10% over the Reporting Period (Figure 9-13).

No notable trends have occurred at B11 and B22 FA sites on Bivalve Beach in the Reporting Period (Figure 9-12 and Figure 9-13). A marked increase in gravel was observed at B22 FA in October 2022, but results were in the usual range in the following two years.

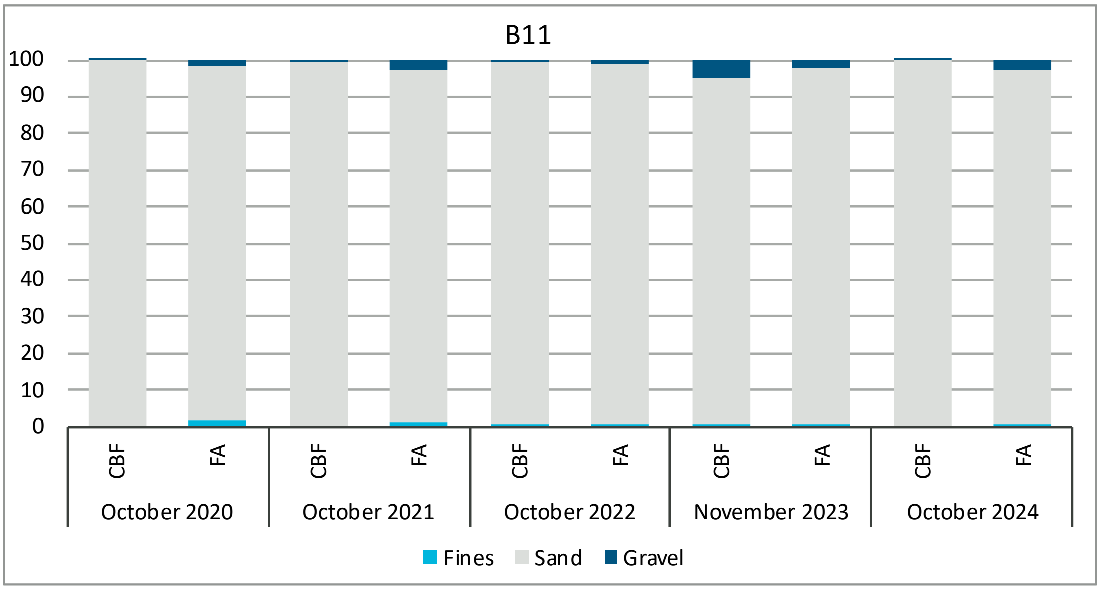
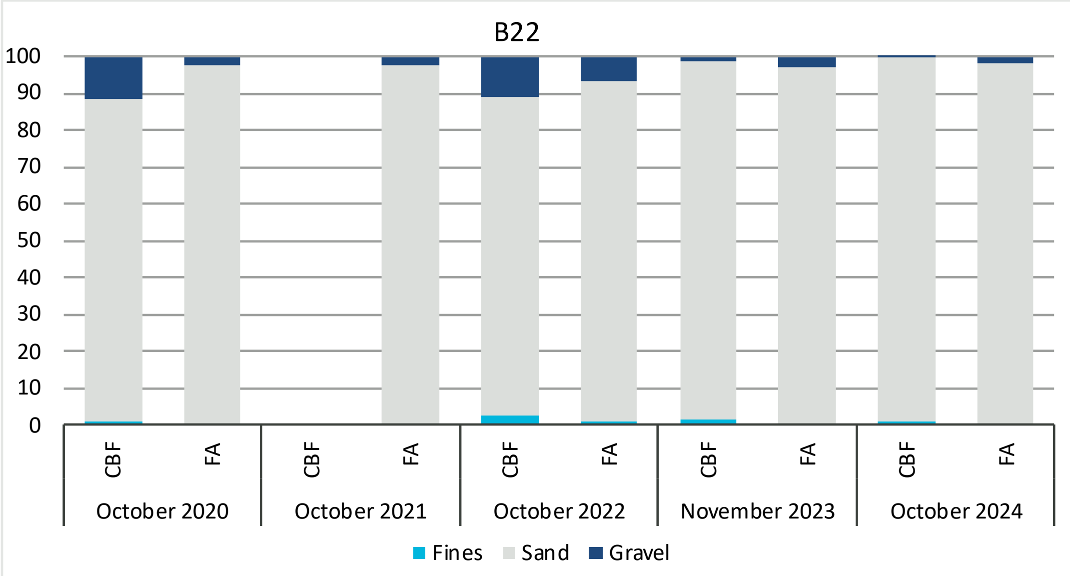


Figure 9-12: PSD of Sediment Samples at B11 (northern end of Bivalve Beach) for Routine Biannual Surveys, October 2020–October 2024

Monitoring program: Beach sediments



Note: Blank = sediment sample could not be collected due to insufficient sediment coverage

Figure 9-13: PSD of Sediment Samples at B22 (southern end of Bivalve Beach) for Routine Biannual Surveys, October 2020–October 2024

Inga, YCN, and YCS Beaches

At the northern transect at Inga Beach (I1), the gravel portion in CBF sediments varied from ~10% in 2020 to ~0% in 2021, 2023 and 2024 (Figure 9-14). FA sediments in the north have recorded small variations in the portions of gravel, but no longer-term trend is evident. There has been no notable change in PSD at the southern transect (I2) for both CBF and FA sediments over the Reporting Period (Figure 9-15).

At YCN and YCS beaches there has been little notable change in PSD over the Reporting Period, with minor fluctuations in composition observed year-to-year (Figure 9-16–Figure 9-19).

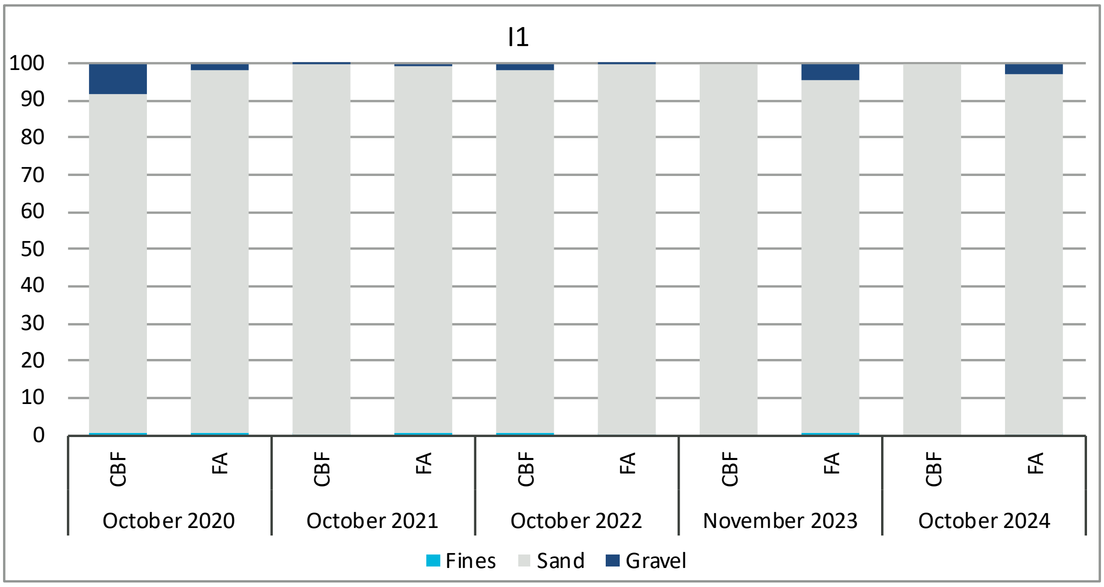
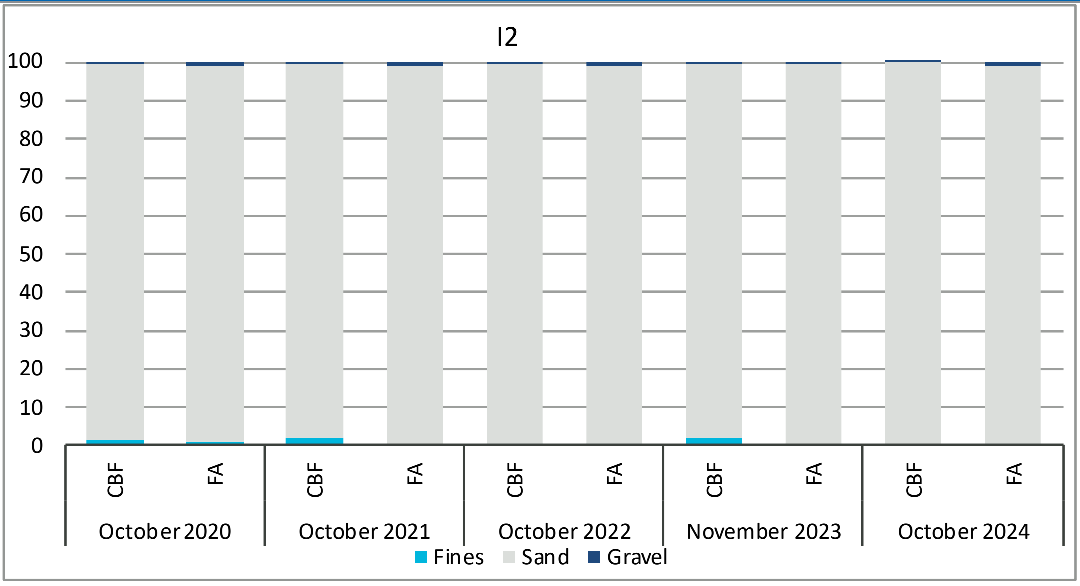


Figure 9-14: PSD of Sediment Samples at I1 (northern end of Inga Beach) for Routine Biannual Surveys, October 2020–October 2024

Monitoring program: Beach sediments



Note: Blank = sediment sample could not be collected due to insufficient sediment coverage

Figure 9-15: PSD of Sediment Samples at I2 (southern end of Inga Beach) for Routine Biannual Surveys, October 2020–October 2024

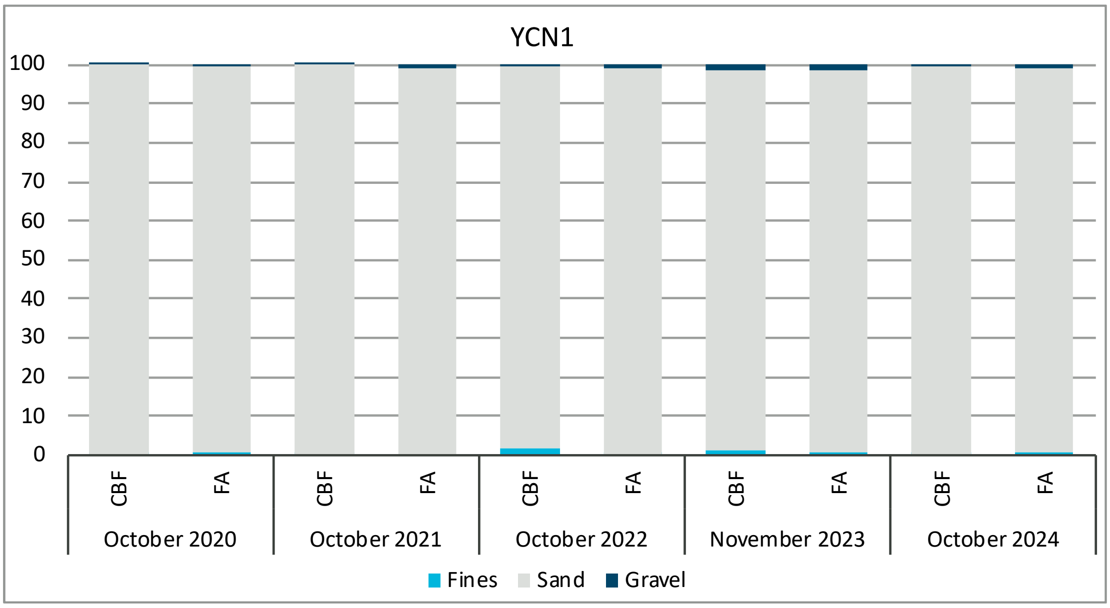


Figure 9-16: PSD of Sediment Samples at YCN1 (northern end of YCN Beach) for Routine Biannual Surveys, October 2020–October 2024

Monitoring program: Beach sediments

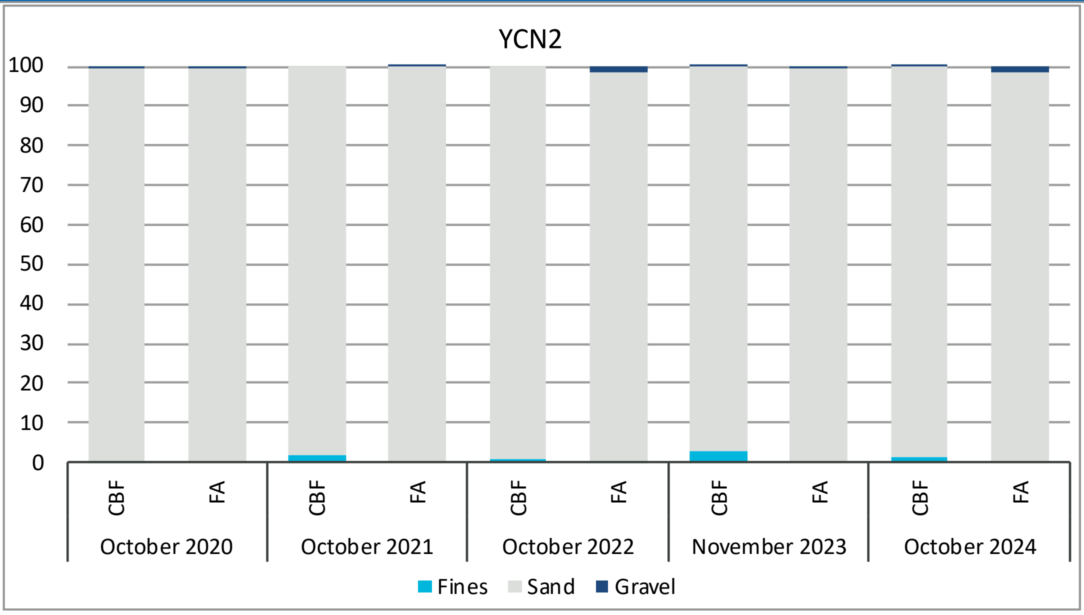


Figure 9-17: PSD of Sediment Samples at YCN2 (southern end of YCN Beach) for Routine Biannual Surveys, October 2020–October 2024

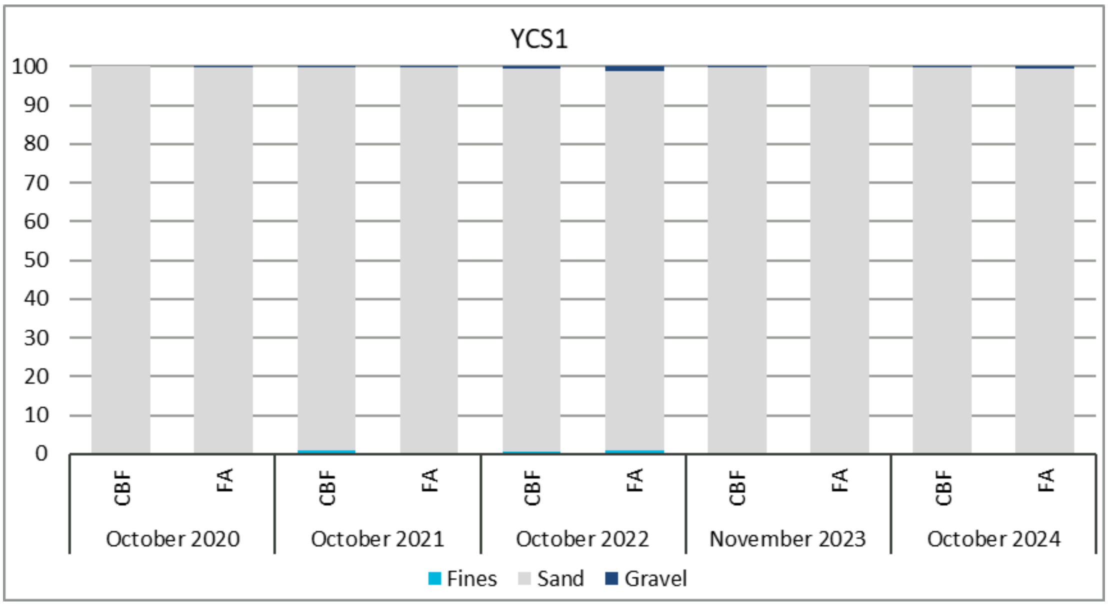


Figure 9-18: PSD of Sediment Samples at YCS1 (northern end of YCS Beach) for Routine Biannual Surveys, October 2020–October 2024

Monitoring program: Beach sediments

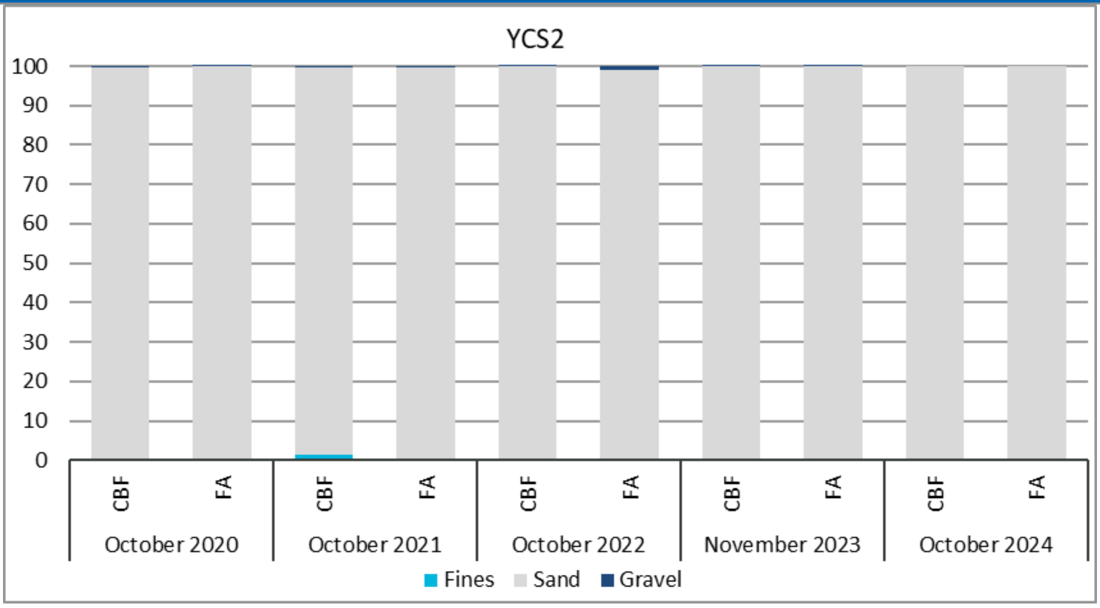


Figure 9-19: PSD of Sediment Samples at YCS2 (southern end of Yacht Club South Beach) for Routine Biannual Surveys, October 2020–October 2024

Management trigger exceedances

The beach sediment management trigger is qualitative and based on a change from baseline sediment characteristics. At some sites, the management trigger can no longer be assessed due to erosion. Due to this, and the qualitative nature of the management trigger, no exceedances of management triggers for sediment PSD were identified during the Reporting Period.

Monitoring program: Marine turtle nesting habitat
Objective
Detect adverse changes to the beach structure and beach sediments (as a result of the presence of the MOF and LNG Jetty) that could have implications for marine turtle nesting on the beaches adjacent to these marine facilities.
Methodology
Multiple physical characteristics of the beaches are used to categorise and map the suitability of areas on each beach for marine turtle nesting. Areas were categorised as one of three zones, based on the characteristics of the measured physical parameters within the study area: • Optimal Nesting Zone: considered ideal for marine turtle nesting • Sub-optimal Nesting Zone: considered less than ideal but may still allow successful marine turtle nesting • Unsuitable Nesting Zone: unlikely to allow successful marine turtle nesting. Physical characteristics used to classify the nesting habitat zones include: landward and seaward boundaries, presence of rock (e.g. intertidal rock, subaerial rock), sediment composition, sand depth, and other (e.g. presence of infrastructure, discontinuous nesting areas within otherwise unsuitable area).
Results
The total available (i.e. optimal + sub-optimal) Flatback Turtle nesting area for the mapped Barrow Island beaches in October 2009 was 14.7 ha, with 89% of this area defined as optimal nesting habitat. In October 2024, the total available nesting area was 12.9 ha, with 73% defined as optimal nesting habitat. Changes in the size of nesting areas since baseline (October 2009) have varied between individual beaches, with the greatest changes observed on beaches closest to the Marine Infrastructure (Terminal, Bivalve, and Inga). Changes are primarily attributable to increases in the amount of intertidal rock exposed on the beach face over time, resulting in optimal nesting habitat being reclassified as either sub-optimal or unsuitable as sandy access pathways to the FA are eroded. Progressive exposure of intertidal rock since baseline is due to the ongoing realignment of Terminal, Bivalve, and Inga beaches towards the Marine Infrastructure via longshore sediment redistribution. Realignment has resulted in a gain in optimal nesting area on each beach at the end closest to the Marine Infrastructure (northern end for Bivalve and Inga Beaches, southern end for Terminal Beach), and a reduction in optimal nesting area at the end furthest from the Marine Infrastructure. *Terminal Beach* The area of mapped optimal nesting habitat at Terminal Beach progressively reduced between 2009 and 2012, from 2.2 ha in October 2009 to 0.81 ha in October 2012. Since 2012, optimal nesting habitat has stabilised and averaged 0.85 ha (0.81 ha in October 2024). The greatest change has occurred in the northern two-thirds of the beach, where intertidal rock has been exposed. In the southern third of the beach, optimal habitat has been created further south of the baseline nesting area on the accreted sections of beach (Figure 9-21). Since November 2019, fluctuations in rock exposure in the middle third of Terminal Beach has caused variability in the sub-optimal nesting area (ranging between 0.03 ha in 2021 and 0.77 ha in 2023) but optimal nesting habitat was relatively stable (ranging between 0.81 ha in 2024 and 0.92 ha in 2023). Typically, the northern third of Terminal Beach is classified as unsuitable nesting habitat, the middle third as sub-optimal nesting habitat, and the southern third as optimal nesting habitat. *Bivalve Beach* The area of mapped optimal nesting habitat at Bivalve Beach progressively reduced between 2009 and 2015, from 2.1 ha in October 2009 to 0.78 ha in October 2015. Since 2015, optimal nesting habitat has stabilised and averaged 0.80 ha (0.89 ha in October 2024). Optimal nesting habitat has been reclassified to sub-optimal or unsuitable along the southern two-thirds of the beach where intertidal rock has been exposed. In the northern third of the beach, optimal habitat has been created further north of the baseline nesting area on the accreted section of beach (Figure 9-22). Since November 2019, fluctuations in rock exposure in the mid-section of Bivalve Beach has caused variability in the sub-optimal nesting area (ranging between 0.17 ha in 2022 and 0.97 ha in 2020), but optimal nesting habitat was relatively stable (ranging between 0.79 ha in 2023 and 0.90 ha in 2022). Typically, the northern third of Bivalve Beach is classified as optimal nesting habitat, the middle third as sub-optimal nesting habitat, and the southern third as unsuitable nesting habitat. *Inga Beach* The area of mapped optimal nesting habitat at Inga Beach has decreased over time from 1.86 ha in October 2009 to 0.79 ha in October 2024. Optimal nesting habitat has been reclassified to either sub-optimal or unsuitable habitat along the southern two-thirds of the beach, due to the exposure of intertidal rock

Monitoring program: Marine turtle nesting habitat

(consolidated and unconsolidated, i.e. loose pebbles and cobbles). At the northern end of the beach, optimal habitat has been created further north of the baseline nesting area on the accreted section of beach (Figure 9-23).

Since November 2019, fluctuations in rock exposure in the mid-section of Inga Beach has caused variability in the optimal nesting area (ranging between 0.21 ha in 2023 and 0.79 ha in 2024), but sub-optimal nesting habitat was relatively stable (ranging between 0.83 ha in 2020 and 0.99 ha in 2021). Typically, the northern third of Inga Beach is classified as optimal nesting habitat, the middle third as sub-optimal nesting habitat, and the southern third as unsuitable nesting habitat.

YCN Beach

The area of mapped optimal nesting habitat at YCN Beach has had minor fluctuations since baseline, with changes relating to the annual position of the MHWS line, which is influenced by patterns of erosion and accretion. No intertidal rock has been exposed at YCN Beach since baseline, and no areas of sub-optimal or unsuitable nesting habitat have occurred since baseline (Figure 9-24). In October 2009, 3.5 ha of optimal nesting area was recorded; this had increased to 3.7 ha in October 2024. Since November 2019, the variability in optimal nesting habitat has been the same as the long-term trend, with minor fluctuations up and down.

YCS Beach

The area of mapped optimal nesting habitat at YCS Beach has decreased slightly, from 3.4 ha in October 2009 to 3.2 ha in October 2024. Sub-optimal nesting habitat has increased slightly, from 1.0 ha in October 2009 to 1.3 ha in October 2024. Changes in the area of nesting habitats relate to exposure of intertidal rock, particularly in the central section of beach (Figure 9-25). Since November 2019, the variability in optimal and sub-optimal nesting habitat has been similar to the long-term trend, with minor fluctuations relating primarily to the amount of exposure of intertidal rock.

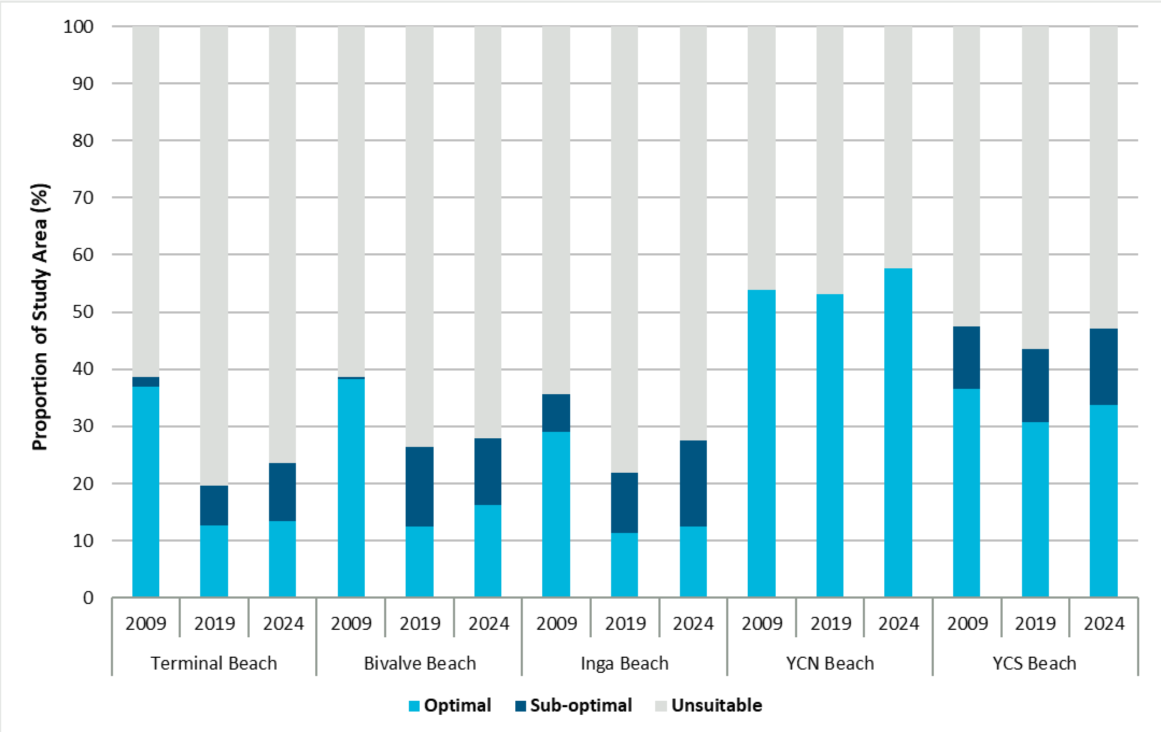


Figure 9-20: Proportions (%) of Marine Turtle Nesting Habitat Zones for Monitored Beaches in October 2009 (Baseline), November 2019 and October 2024

Management trigger exceedances

No exceedances of the interim marine turtle nesting habitat management triggers occurred during the Reporting Period at Terminal or Bivalve beaches.

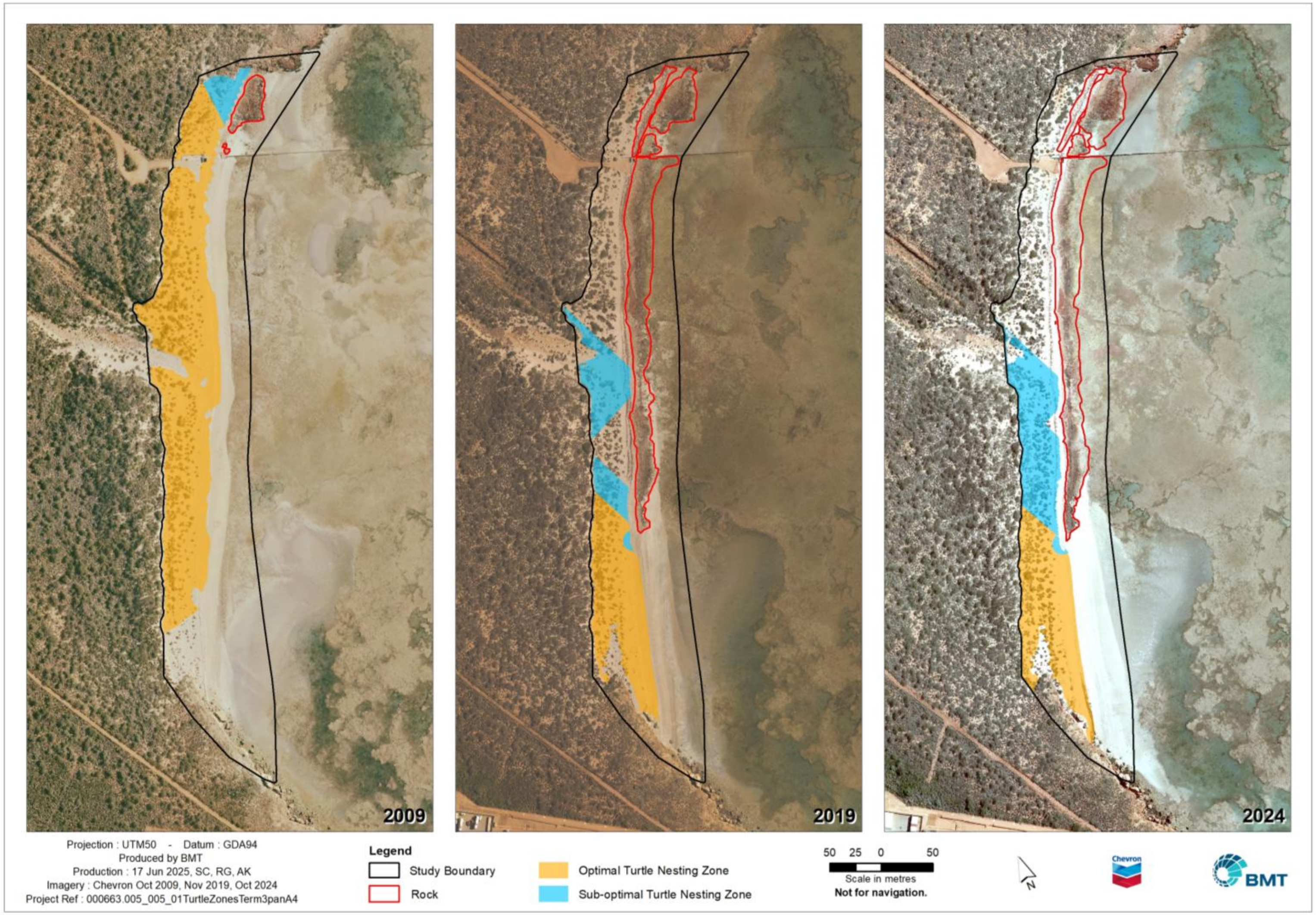


Figure 9-21: Marine Turtle Nesting Habitat Zones for Terminal Beach

Figure 9-22: Marine Turtle Nesting Habitat Zones for Bivalve Beach

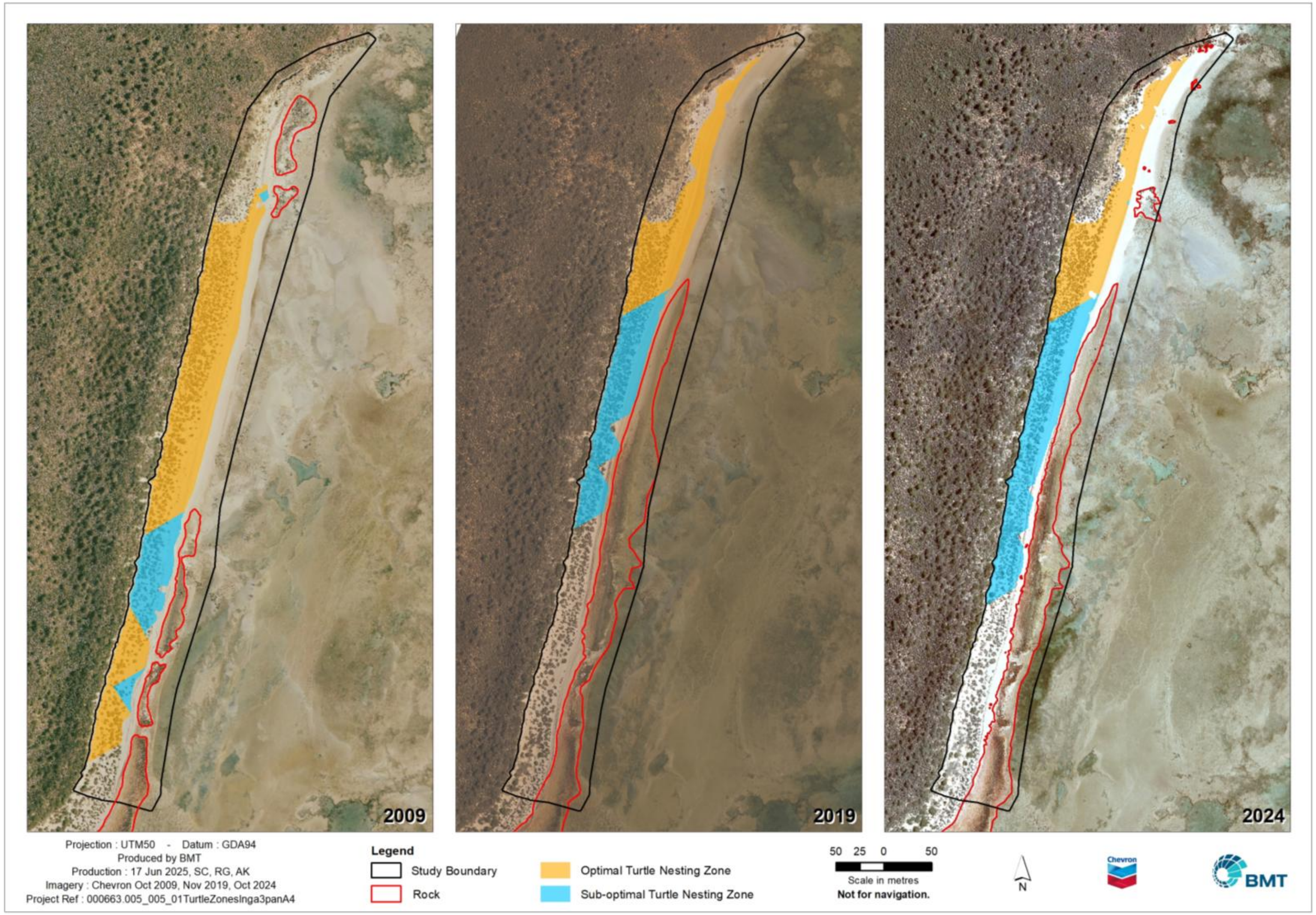


Figure 9-23: Marine Turtle Nesting Habitat Zones for Inga Beach

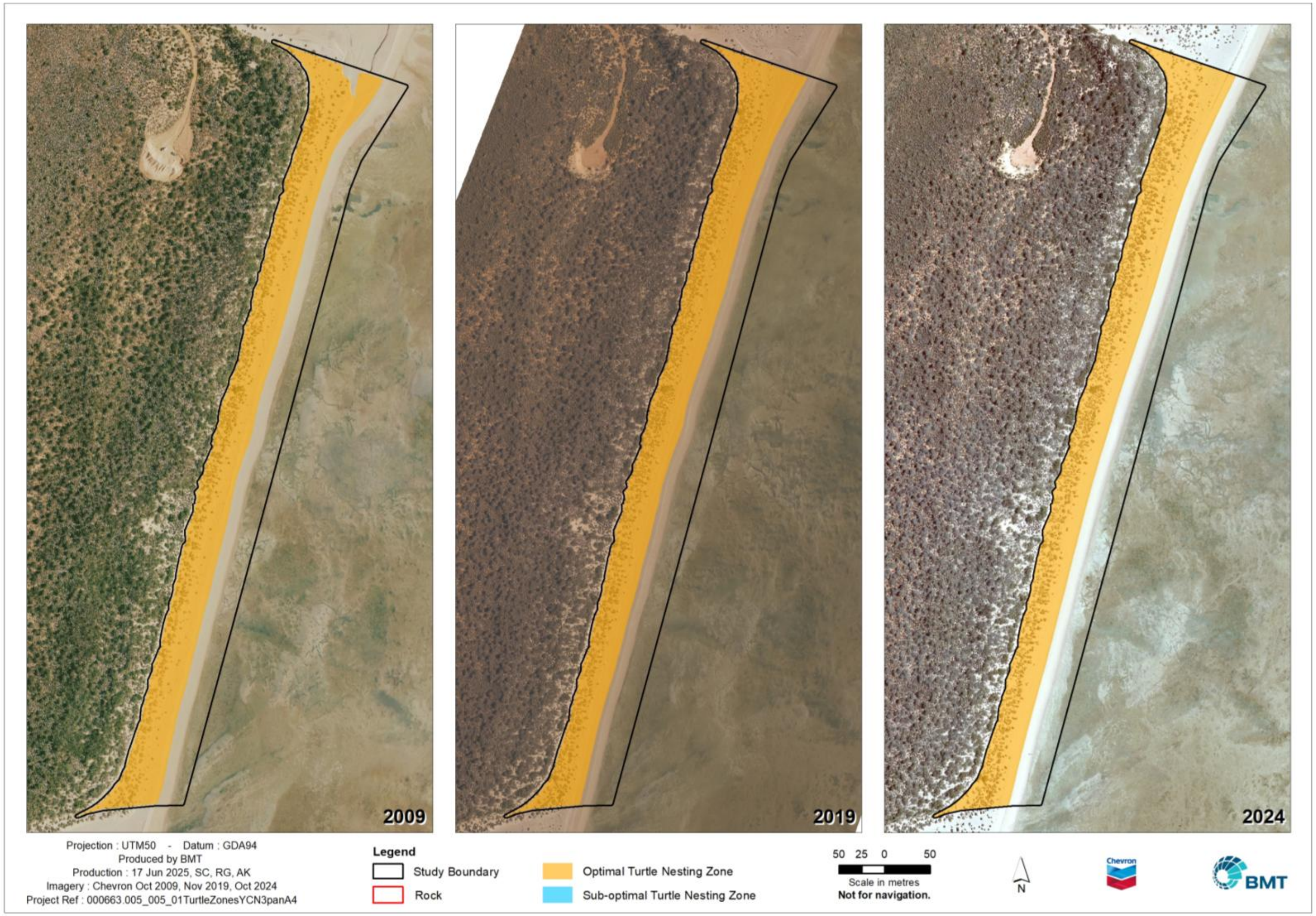


Figure 9-24: Marine Turtle Nesting Habitat Zones for YCN Beach

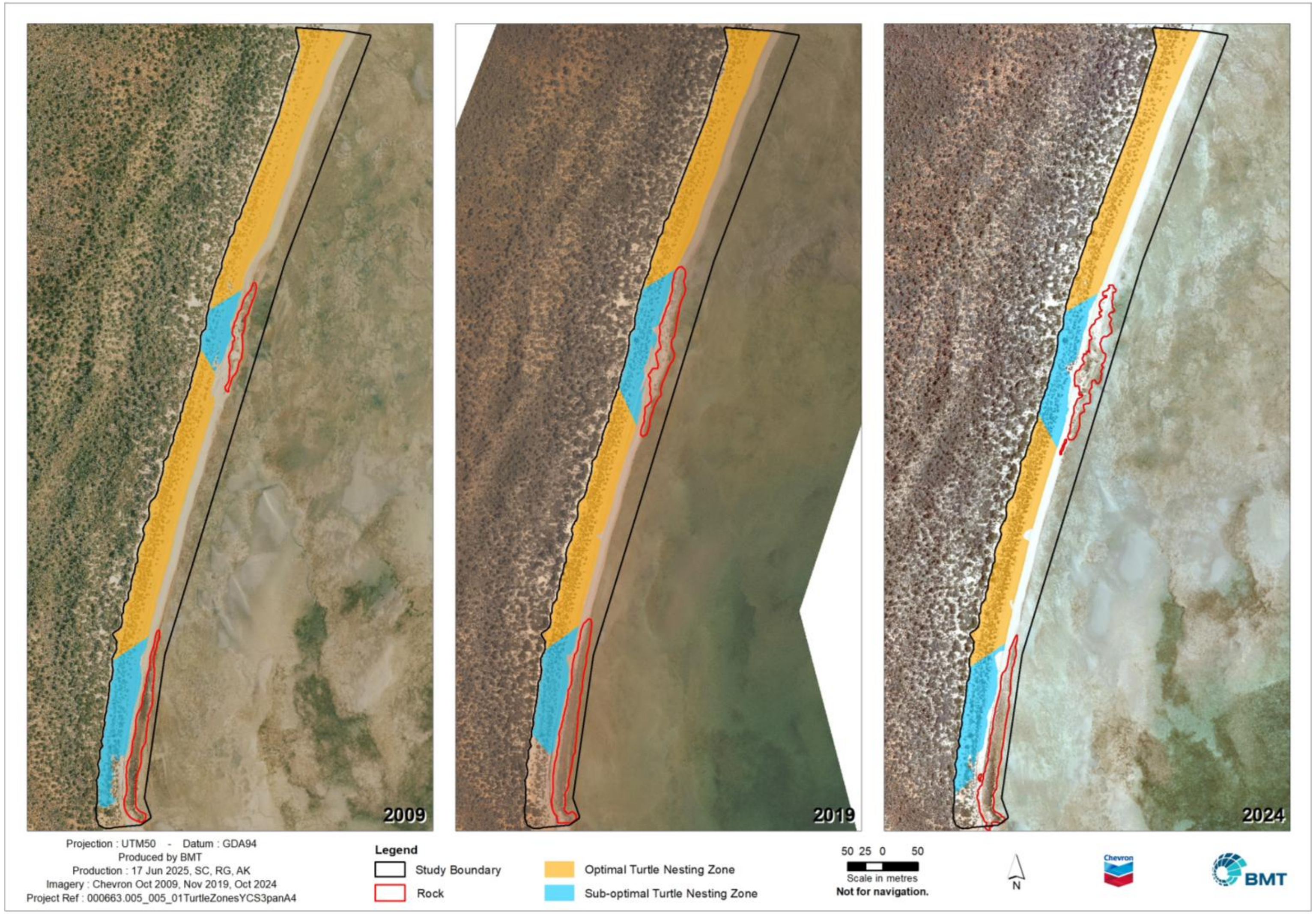


Figure 9-25: Marine Turtle Nesting Habitat Zones for YCS Beach

9.3 Mitigation

In June 2025, CAPL carried out a voluntary coastal mitigation action, endorsed by the Marine Turtle Expert Panel, in response to changes detected on Terminal Beach. The action was a trial to determine whether redistribution of sand that had accreted near the Marine Infrastructure would increase the area of optimal marine turtle nesting habitat (as described in Ref. 21). The DBCA issued an authorisation for the trial to be carried out on 1 May 2025 (PILCALMR4-010/2025).

Site preparation works commenced on 12 May 2025, which included demarcating areas not to be disturbed, setting up laydown areas and capturing pre-sand redistribution topographic surveys. Excavation of accreted sand commenced on 3 June 2025 and continued until 16 June 2025. The sand was transported to eroded areas and stockpiled. Following completion of excavation, the stockpiled sand was spread and profiled to create a natural beach profile. All earthworks were completed by 22 June 2025 and site reinstatement was completed by 30 June 2025. A total volume of 5,800 m^3 was excavated, which was slightly lower than the planned volume of 6,500 m^3.

Environmental monitoring before, during and after sand redistribution is being carried out in accordance with a Sand Redistribution Monitoring Plan (SRMP, Ref. 22). The SRMP includes Assessment Criteria to help determine the success of the trial over a three-year period. Results from the first year of monitoring (March 2025–April 2026) will be reported in the first SRMP Outcome Report, alongside consideration of the Assessment Criteria and confirmation of future monitoring and reporting requirements.

9.4 Conclusion

During the Reporting Period, exceedances of the slope and volume management triggers were detected for all sites at monitored transects on Terminal and Bivalve beaches, with the exception of the FA at B22, which did not record a volume exceedance for any survey. Despite exceeding management triggers for beach volume and beach slope, it is considered unlikely that the shoreline changes occurring on Terminal and Bivalve beaches are currently having significant adverse impacts on the stability of these beaches.

Terminal and Bivalve beaches are inherently stable through geological control; that is, they are underpinned by rock and bounded at each end by rock headlands. Changes to these beaches has been generally limited to the beach face. Most of the FA on Terminal and Bivalve beaches have accreted or remained the same, although erosion has encroached into the seaward edge of the foredune in some sections of those beaches over the Reporting Period, causing some vegetation loss (Ref. 16). Although currently stable, these changes may increase the vulnerability of the FA and PDs to extreme metocean conditions, and the presence of the Marine Infrastructure will likely restrict the capacity for natural recovery after such events.

Inga, YCN, and YCS beaches are bounded by rock headlands at the northern end of Inga Beach and the southern end of YCS Beach, and are intersected by subaerial and intertidal rock outcrops and creeks. These features have a greater capacity for sediment exchange into and out of the study area boundaries, which results in lower capacity for trapping sediments than on Terminal and Bivalve beaches.

In addition to routine twice-yearly surveys, one significant weather event prompted remote sensing surveys during the Reporting Period (July 2025). Results from the storm analysis indicated that there were signs of southward sediment transport on all beaches. At Bivalve and Inga Beaches, there was also erosion at the seaward edge of the vegetated foredune and signs of deposition of sediment over previously exposed rocky areas. There was erosion at Yacht Club North and Yacht Club South Beaches over the beach face but no sign of foredune erosion.

Alongshore sand redistribution at the beach face has exposed sections of the underlying rock platform on Terminal, Bivalve, and Inga Beaches since construction of the Marine Infrastructure. This has reduced the preferred beach access for Flatback turtles, by eroding sandy access pathways to the foredune nesting areas. Over the Reporting Period, the largest reductions in suitable nesting habitat have occurred at Terminal, Bivalve, and Inga Beaches, which have seen an increase in optimal nesting area closest to the Marine Infrastructure (northern ends of Bivalve and Inga beaches, southern end of Terminal Beach), and a decrease furthest from the Marine Infrastructure. However, no management triggers for marine turtle nesting habitat (which apply to Terminal and Bivalve Beaches only) were exceeded during the Reporting Period as a result of the changes. Note: The current management triggers under the current approved Plan (Rev. 2) for marine turtle nesting habitat were designed to detect large changes from year to year and do not adequately detect progressive smaller changes at Impact Beaches. Revised, more suitable, and sensitive management triggers for marine turtle nesting habitat have been proposed in the revised CSMMP, most recently submitted to State and Commonwealth regulators in 2024.

The redistribution of sand towards the Marine Infrastructure on these beaches has shifted nesting distribution and reduced the area used for nesting, reflecting a preference for those areas of beach where sandy access to nesting habitat remains. New areas of beach (created through accretion) have formed that were previously inaccessible or unsuitable for nesting.

Results of the CSMMP since construction of the Marine Infrastructure have indicated that changes to Terminal, Bivalve, and Inga Beaches have been greater than predicted, prompting the last five-year EPR to recommend a revision of the coastal stability management triggers. CAPL has since submitted revisions of the CSMMP to DWER and DCCEEW addressing comments and recommendations.

As required by the CSMMP (Ref. 14), CAPL will continue to monitor changes in beach morphology to detect and evaluate any potential implications for marine turtle nesting. If exceedances of CSMMP management triggers or performance standards are detected, they will be assessed in accordance with the requirements identified in the current approved CSMMP and relevant Ministerial Conditions.

9.5 Five-year Overview of Environmental Performance

The 2020–2025 outcome for coastal stability is summarised in the table below.

Table 9-8: Summary of the Environmental Performance for Coastal Stability during the Five-year Reporting Period

Objectives[1]	Outcome
Ensure that the MOF and LNG Jetty do not cause significant adverse impacts to the beaches adjacent to those facilities	Monitoring of beach structure and beach sediment, as per the requirements of Revision 2 of the CSMMP (May 2016–present), throughout the five-year Reporting Period did not detect a significant adverse impact on the stability of Impact beaches (Terminal and Bivalve) either side of the MOF and LNG Jetty.

Establish a monitoring program to detect adverse changes to the beach structure and beach sediments that could have implications for marine turtles nesting on the beaches adjacent to the MOF and LNG Jetty on Barrow Island	An approved monitoring program (as part of the CSMMP) for beach structure and beach sediments has been in place since 2009. The monitoring program was revised in October 2014 (Revision 1) and again in May 2016 (Revision 2) to quantitively track changes in the availability of suitable nesting habitat based on the physical characteristics of the beach. Data collected from the monitoring program is being used to inform new revisions of the CSMMP and Supplement[2] which proposes coastal stability and marine turtle nesting habitat management triggers better placed to meet the objectives to the CSMMP. The proposed changes also aim to better identify major weather events that are likely to cause significant change to the beaches, and to assess coastal stability in a more accurate and meaningful way.

1 *As defined in Condition 25.3 of MS 800, and Condition 18.3 of EPBC 2003/1294 and 2008/4178*

2 *The separate document 'Coastal Stability Management and Monitoring Plan Supplement: Management Triggers' has been incorporated into the recent revisions of the CSMMP. Therefore, the whole coastal stability condition (Condition 24 for State, Condition 18 for Commonwealth) is addressed in one document.*

9.6 Proposed Environmental Management Improvements

Since construction of the Marine Infrastructure, monitoring has shown that changes to beach structure through longshore and cross-shore sediment redistribution on Terminal, Bivalve, and Inga Beaches have surpassed the predictions made before construction commenced. As a result, CAPL has developed a revised CSMMP to better meet its objectives (Section 9.1). The key improvements proposed include:

- reclassify Inga Beach as an Impact Beach, and add Mushroom Beach as a Reference Beach
- review coastal stability, marine turtle nesting habitat and sediment particle size management triggers
- review Performance Standards to align with management triggers
- change the method for identification of significant weather events that require additional monitoring.

Data from routine and contingency monitoring has been used to identify and justify these proposed improvements (Table 9-9).

Table 9-9: Proposed environmental management improvement

Proposed environmental management improvement	Justification
Re-classify Inga Beach as an Impact Beach and add Mushroom Beach as a Reference Beach	The results of monitoring since construction of the Marine Infrastructure have indicated that Inga Beach falls within the metocean shadow zone created by the Marine Infrastructure and thus cannot be considered a Reference Beach. Mushroom Beach, which has been proactively monitored since 2012, does not exhibit signs of change induced by the metocean shadow zone.
Review coastal stability management triggers	The current coastal stability management triggers assess volume and slope changes at four fixed points on Terminal and Bivalve Beaches and compare the variation to a very small baseline dataset (2 years). These fail to capture the dynamic nature of coastal processes across the whole beach.
Review marine turtle nesting management triggers	The current marine turtle nesting management triggers can only detect very large changes in turtle nesting habitat, and not incremental trends toward a threshold of loss which instigates management intervention.
Review CSMMP Performance Standards	The CSMMP are linked closely with the management triggers and thus should be reviewed in parallel.

Proposed environmental management improvement	Justification
Remove sediment particle size management triggers	Sediment particle size (sand grain size) is relevant to turtle nesting site characteristics but has little bearing on coastal stability. Sediment particle size is already incorporated into the parameters for annual mapping of marine turtle nesting habitat (in conjunction with topographic data and aerial imagery) and there is no value in a stand-alone management trigger for sand grain size.
Change how significant weather events are identified	Weather events are assessed via multiple metocean variables, not solely wind, to determine the potential risk to Impact beaches. The importance of changing the significant weather event definition (formerly termed a ‘major event’) was illustrated by TC Veronica, which caused the greatest recorded changes to beach morphology over the previous five-year Reporting Period (Ref. 8). Although TC Veronica did not exceed the major event trigger, the combination of wind, tide and wave conditions caused a significant storm surge and regional-scale erosion across the east coast beaches of Barrow Island. In contrast, only small volume reductions were observed following the May 2025 major event. These observations indicate that beaches respond differently to individual storm events, and the potential impact of a significant weather event should be assessed via multiple metocean variables.

10 Terrestrial Rehabilitation

Table 10-1: EPR Reporting Requirements for Terrestrial Rehabilitation

Item	Source	Section in this EPR
A description of any rehabilitation activities undertaken	MS 800, Schedule 3(9i)	10.1
Results of the rehabilitation monitoring program including performance against completion criteria targets	MS 800, Schedule 3(9ii)	10.2
Results of any studies to address knowledge gaps as referenced in Condition 32.5(x) and proposals for further studies (if any)	MS 800, Schedule 3(9iii)	10.3
Recommended changes, if any, to the Gorgon Gas Development Post-Construction Rehabilitation Plan (PCRP) (Ref. 17)	MS 800, Schedule 3(9iv)	10.6
A figure identifying areas rehabilitated during the reporting period, areas	PCRP (Ref. 17), Section 7.2.2	10.1
Topsoil usage and topsoil balances	Gorgon Gas Development Topsoil Management Plan (TMP) (Ref. 18, Section 3.3)	10.4
Changes to volume of soil stockpiled as a result of rehabilitation or clearing activities	TMP (Ref. 18, Section 3.3)	10.4
Results of the Topsoil Monitoring Program, topsoil performance reviews, and topsoil volume reconciliation	TMP (Ref. 18, Section 5.0)	10.5
Progress against rehabilitation objectives in Table 5–2 of the PCRP (Ref. 17)	PCRP (Ref. 17, Table 5–2)	10.1, 10.2, 10.3, 10.4, 10.5
A five-year overview of environmental performance	MS 800, Condition 5.3(iii)	10.7
Proposed environmental management improvements	MS 800, Condition 5.3(iv)	10.8

10.1 Rehabilitation Activities

During the reporting period, CAPL installed additional umbilicals in the existing Feed Gas Pipeline (FGP) right of way that extends between the offshore fields and the GTP. Most of the previously monitored rehabilitation was disturbed and rehabilitated again between 2024 and 2025 (Figure 10.1). Due to these activities, most of monitoring sites were also re-disturbed. Establishing monitoring transects, and monitoring of these newly rehabilitated areas is due to commence in the next annual reporting period.

The CO_2 pipeline (COP) right of way was also re-disturbed for operational purposes and to comply with relevant operational standards it will not be rehabilitated.

Rehabilitation Activities
Rehabilitation activities along the FGP, including laydown areas and access tracks, were completed in May 2025. Figure 10-1 shows the location of current rehabilitation areas; the FGP, OWA and triangle gravel pit (TGP). As mentioned above, the majority of the FGP rehabilitation was disturbed and rehabilitated again between 2004 and 2005.

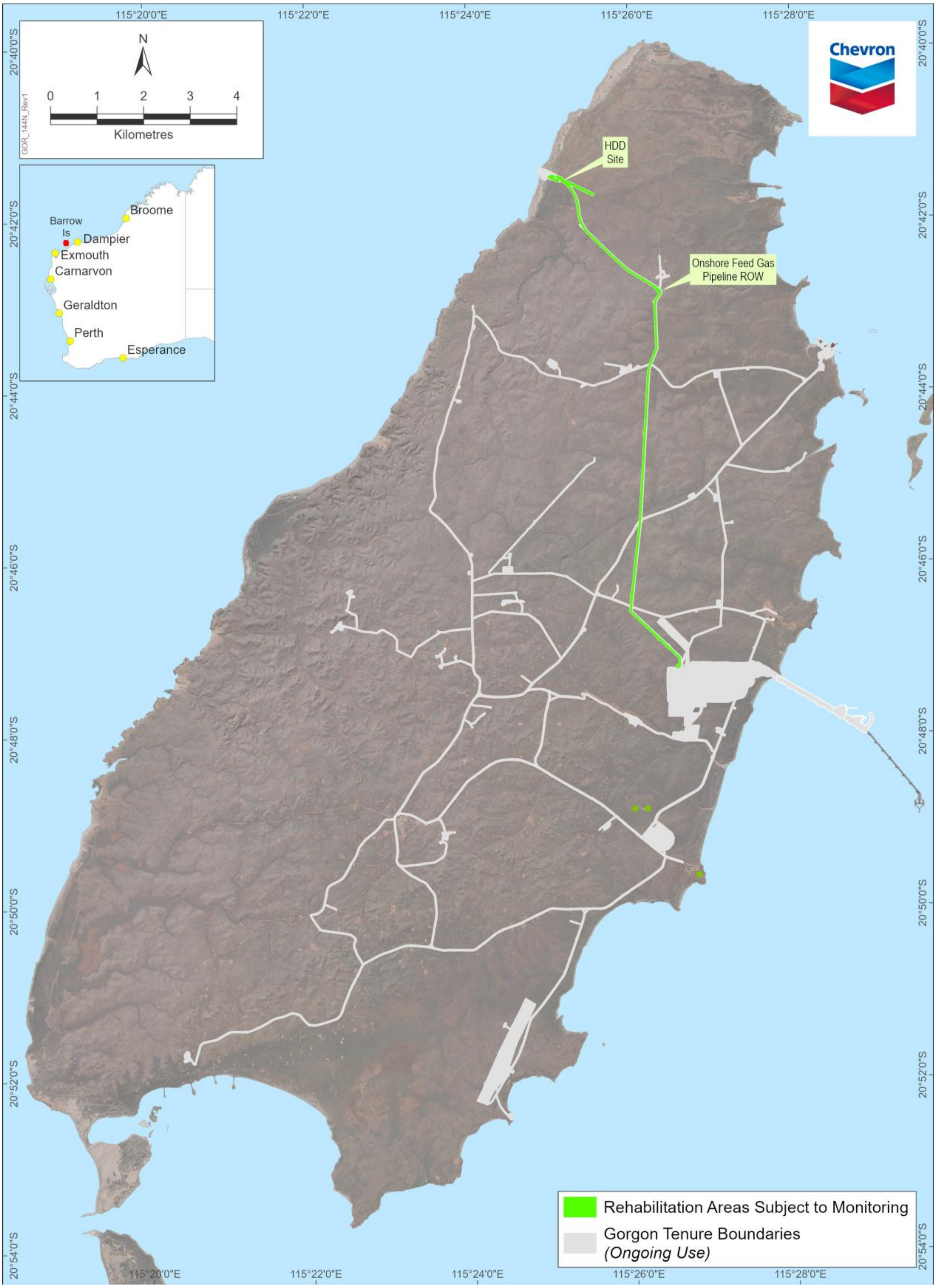


Figure 10-1: Areas Rehabilitated for the Gorgon Gas Development 2020-2025

10.2 Rehabilitation Monitoring

The PCRP (Ref. 17) details the rehabilitation methodology and completion criteria for rehabilitating temporarily disturbed lands on the Gorgon Gas Development. The rehabilitation monitoring methodology is Ecosystem Function Analysis (EFA), a method that has been used on Barrow Island since 2004.

The rehabilitation monitoring methodology and results are summarised in the following table.

Monitoring program: Rehabilitation
Objectives
To meet the intent of the Ministerial objectives for rehabilitation, the PCRP (Table 5–2 in Ref. 17) further defines specific objectives for the rehabilitation of temporarily disturbed areas: • The rehabilitated land surface and soil properties are appropriate to support the target ecosystem. • Vegetation in rehabilitated areas will have equivalent values as surrounding natural ecosystems. • The rehabilitated ecosystem has equivalent functions and resilience as the target ecosystem. • Rehabilitated areas provide appropriate habitat for fauna and fauna recruitment including EPBC Act listed species. • The rehabilitated area should be able to be managed in the same way as surrounding land.
Methodology
• EFA will be used as the rehabilitation assessment methodology. EFA is based on a methodology developed by the CSIRO, originally described as landscape function analysis (LFA), which uses indicators that assess and determine functional status of the landscape. EFA differs from LFA in that ecosystem components such as vegetation composition, cover, and habitat complexity are also recorded and assessed to provide a quantitative measure of the ecological function of the site. LFA is a core component of EFA, and primarily focuses on stability, water infiltration, and nutrient indices. For arid environments, permanent EFA transects are set up to follow a line of resource flow, typically up to 50 m long. • Rehabilitation monitoring sites were monitored in August 2024. These sites include two FGP sites (transects FGP_LT7, FGP LT15), the OWA and the TGP (transects TGP1 and 2). • Reference sites (corresponding to limestone, drainage, or plain habitats) were also monitored to allow assessment against the completion criteria in the PCRP. Broadly, the monitoring gathered data on: – landscape function (stability, infiltration, and nutrient cycling) – vegetation (*Triodia* cover, species diversity, density, cover and height, floristic composition, and functional structure) – erosion and visual amenity. • Monitoring sites will be established and monitored on newly rehabilitated sites (i.e. FGP) in the next annual reporting period.
Results
• None of the 4 monitoring sites (FGP_LT7, FGP LT15, TGP and OWA) met all completion criteria in 2024 or over the 5 year reporting period. • FGP_LT7 on the limestone broadscale landform performed better against completion criteria targets compared to FGP_LT15 (Valley) although neither met the landscape function target for nutrient cycling. FGP_LT7 met the landscape function for stability and infiltration in comparison to FGP_LT15 which only met the landscape function for infiltration. FGP_LT7 also achieved the native perennial plant density (plant density) target. • OWA and TGP transects met all species richness and erosion targets with no weeds detected. TGP1 met all vegetation parameters but only met the infiltration criteria for landscape function. TGP2 and OWA did not meet any of the vegetation-based criteria • *Triodia* cover was below target at all sites • LFA indices have slightly increased over this reporting period (2020-2025) at all sites. The last couple of years shows plateauing of these values and suggests the sites are stable, although they exhibit lower values than corresponding analogue sites. • Plant cover at all 4 sites had been increasing until 2024 when prevailing dry conditions caused a decrease in coverage at several sites. Species richness has generally been higher than analogue sites over the reporting period.

Monitoring program: Rehabilitation
• Assessment • of soil anthropods was suspended for 2023 and 2024 due to access issues associated with site operations. However, results collected during the reporting period showed that the rehabilitated sites hosted comparable levels of arthropod diversity (abundance and richness) to the reference sites. Annual comparisons suggest a strong seasonal correlation between anthropod numbers, temperatures and rainfall. • Dicot seedlings were recorded at their highest volumes in 2020 . Dicot seedlings are predominant in the seed bank of rehabilitated areas which is consistent with a recovering disturbed ecosystem.
Conclusions
• Monitored areas have not yet met all relevant completion criteria as detailed in the PCRP. • Most sites have further stabilised over the reporting period, however progress towards meeting criteria has recently been influenced by well below average annual rainfall in 2023 and 2024 .The presence of the keystone genus *Triodia* suggests ecosystems in rehabilitated areas are developing although they are not yet self-sustaining.

10.3 Studies

No studies to address knowledge gaps were carried out during the Reporting Period.

10.4 Topsoil Activities

Topsoil stockpile volumes are summarised in Table 10-2. Topsoil stored at P13 and X62J increased by 440 m3 and 153 m3 respectively. Topsoil was recovered during clearing activities associated with earthworks along the COP right-of-way

Topsoil Activities

Table 10-2: Monitored Topsoil Stockpile Volume Summary (2020–2025)

Topsoil Stockpile	Original Topsoil Source Location	Changes to Volume Stockpiled During the Reporting Period (m^3)	Total Volume Stockpiled (m^3)
A28	GTP Site	None	7,483
Q31	GTP Site	None	7,984
X62J	GTP Site	153	17,808
R Station	GTP Site	None	3,481
P13	CO_2 pipeline right-of-way (ROW)	440	9,893
ASA Stage 3	ASA Stages 3 and 4	None	2,272
ASA Stage 2	ASA Stages 1 and 2	None	3,550
Perentie II	GTP Site and ASA	None	8,884

10.5 Monitoring Results

The TMP (Ref. 18) complements the PCRP (Ref. 17), and describes the stripping, transport, and re-use of recovered topsoil. The TMP also includes a monitoring program to measure topsoil viability.

The topsoil monitoring results are summarised in the following table.

Monitoring program: Topsoil
Objectives
• Measure and record the physical, chemical, and biological attributes, and the overall integrity, of the stored topsoil from the Gorgon Gas Development. • Provide assurance that the topsoil remains viable and stable.
Methodology
Methodologies used to assess the stockpiles Included: • Germinable seed assessment. • Object Based Image Analysis (OBIA) to assess vegetation - Since 2019, remote sensing has also been applied at 16 topsoil stockpiles to assess vegetation cover via OBIA from imagery collected in October/November of the previous year • On-ground integrity assessment to assess stability, vegetation condition and presence of weeds.
Results
• Overall, topsoil stockpiles have stabilised and have continued supporting growing vegetation communities • Topsoil stockpile integrity assessments have found that vegetation coverage has generally been good to excellent. • Changes in vegetation cover is strongly influenced by annual rainfall with a decrease in vegetative cover recorded in 2024 (based on 2023 image analysis). • Two new stockpiles at P13 were assessed in 2024 for germinable soil-stored seed. With numbers of monocot and dicot germinats considered adequate to establish appropriate vegetation cover. • Stockpile vegetation has developed to be primarily dominated by Triodia. • Stockpiles over the reporting period have been stable with little erosion.
Conclusion
• The Topsoil Monitoring Program has met its key objectives. • As long as the stockpiles remain undisturbed it is reasonable to expect that seed production from standing vegetation on the stockpiled soils will be maintained. • Given the consistent quantity of soil-stored seed in the topsoil stockpiles, sampling of soil stored seed will only occur on new stockpiles (such as those at P13.3 & P13.4) or disturbed stockpiles. • No maintenance of the stockpiles has been required based on the monitoring program results. • As the commitment for five years of field-based monitoring has now been met, the program will pivot toward assessing vegetation cover, using aerial imagery and remote sensing.

10.6 Changes to the Post-Construction Rehabilitation Plan

No changes to the post construction rehabilitation plan have been made over the reporting period.

10.7 Five-year Overview of Environmental Performance

The 2020–2025 outcome for terrestrial rehabilitation is summarised in the table below.

Objectives[1]	Outcome
Ensure that the rehabilitation of terrestrial areas following construction is properly planned in a manner that promotes self-sustaining ecosystems able to be managed as part of their surroundings consistent with the conservation objectives of a Class A Nature Reserve.	Rehabilitation of disturbed areas has been planned and executed to produce a surface to promote self-sustaining ecosystems that can also be managed as part of the surrounding Class A Nature Reserve. Monitoring of the current monitoring sites suggests that these sites are fundamentally stable but the vegetation communities are not yet self-sustaining.

Objectives[1]	Outcome
Design rehabilitation of native vegetation to ultimately develop into viable ecological systems that are comparable and compatible with surrounding native vegetation and its land uses, and restore as closely as practicable the pre-disturbance biodiversity and ecosystem functional values.	Rehabilitation of disturbed areas has been planned and executed to support development into viable ecological systems that are comparable and compatible with surrounding native vegetation and its land uses, and pre-disturbance biodiversity and ecosystem functional values. Monitoring of the current monitoring sites suggests that these sites are fundamentally stable but the vegetation communities are not yet self-sustaining.
Ensure planning, implementation, monitoring, and reporting on rehabilitation is carried out consistent with industry best practice.	
Ensure management of rehabilitation continues until affected areas are self-sustaining.	Management, monitoring, and potential remedial works will be ongoing in rehabilitated areas until the completion criteria in the PCRP are met.
Better inform any ongoing rehabilitation and post-closure rehabilitation.	

1 As defined in Condition 32.4 of MS 800.

10.8 Proposed Environmental Management Improvements

The key proposed management improvements for the PCRP and TMP are summarised in the table below.

Proposed Management Improvement	Justification
Adoption OBIA based rehabilitation assessment	The adoption of Object Based Image Analysis (OBIA) to assess rehabilitation vegetative performance over larger areas is planned with the next 5 year reporting period. This method has been used with success for other BWI based rehabilitation assessment. As vegetative communities become established, this methodology will help support the assessment of rehabilitation allowing greater spatial coverage than discrete transect locations
Investigation into the development of a seed bank and seed treatments to promote rehabilitation outcomes	Investigate the potential benefit of development of a seed bank and seed treatments to promote rehabilitation outcomes in underperforming rehabilitation areas.

11 Spill Management

Table 11-1: EPR Reporting Requirements for Spill Management

Item	Source	Section in this EPR
Incidence of spills caused by the Proposal, and spills that impact on the Proponent's facilities including details of cause and recommended actions	MS 769, Schedule 3(3i)	11.1
A five-year overview of environmental performance	MS 800, Condition 5.3(iii) MS 769, Condition 5.3(ii)	11.2
Proposed environmental management improvements	MS 800, Condition 5.3(iv) MS 769, Condition 5.3(iii)	11.3

11.1 Event Data

No spills caused by the Jansz Feed Gas Pipeline, or spills that impacted on Jansz Feed Gas Pipeline facilities and met the threshold of a recordable or reportable incident occurred during the 2020-2025 Reporting Period.

11.2 Five-year Overview of Environmental Performance

No spills caused by the Jansz Feed Gas Pipeline, or spills that impacted on Jansz Feed Gas Pipeline facilities and met the threshold of a recordable or reportable incident, occurred during the 2020-2025 Reporting Period.

11.3 Proposed Environmental Management Improvements

No further improvements to spill management are proposed as part of this Five-year EPR.

12 Terminology

Table 12-1 defines the acronyms, abbreviations, and terminology used in this document.

Table 12-1: Terminology

Acronym/ Abbreviation/Term	Definition
~	Approximately
<	Less/fewer than
>	Greater/more than
°C	Degrees Celsius
µg	Microgram
ABU	Australian Business Unit
Action trigger	Measured parameter deviates outside a 3 SD limit
Adult female breeding omission probability	Annual probability estimate of skipped breeding for adult female marine turtle nesters in a nesting population
Adult female survival probability	Annual estimated survival rate for adult female marine turtle nesters in a nesting population
AGRU	Acid Gas Removal Unit
Alert trigger	Measured parameter deviates towards (but remains within) one SD for two consecutive years, or deviates outside a 1 SD limit
aMDEA	Activated methyl diethanolamine
Annual nester abundance	Estimate of total female marine turtle nesters per season at a rookery
ANZECC	Australian and New Zealand Environment and Conservation Council
APC	Advanced Process Control
AQMP	Air Quality Management Plan
AQMS	Air Quality Monitoring Station
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
ASA	Additional Support Area
At Risk	Being at risk of Material Environmental Harm or Serious Environmental Harm and/or, for the purposes of the EPBC Act relevant listed threatened species, threatened ecological communities, and listed migratory species, at risk of Material Environmental Harm or Serious Environmental Harm
At Risk zone/site/island/well	An area where potential impacts are predicted to occur
BD	Base of Primary Dune; sampling site located at the base of the Primary Dune
BP	Butler Park (monitoring site)
BTEX	Benzene, toluene, ethylbenzene, and xylene compounds
Butler Park	Barrow Island accommodation village (formerly known as the Construction Village)
BWI	Barrow Island
CAPL	Chevron Australia Pty Ltd
CBF	Crest of Beach Face; sampling site located at the change in slope at the transition between the beach face and foredune area
CDS	Conventional Distance Sampling

Acronym/ Abbreviation/Term	Definition
CI	Confidence Interval: an interval that is likely to contain the true value of a population parameter but reflects the inherent uncertainty in estimating this parameter from a sample. The level of confidence reflects the likelihood that the constructed interval contains the true parameter value, so a 95% Confidence Interval is an interval that will include the true parameter value 95% of the time. By convention, 95% Confidence Intervals are usually used to define reasonably upper and lower bounds for parameter estimates.
Clutch frequency	The mean number of clutches laid per female marine turtle nester per season
cm	Centimetre
CMR	Capture-mark-recapture
CO	Carbon monoxide
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
COPC	Chemicals of Potential Concern
CSMMP	Coastal Stability Management and Monitoring Plan
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CT	Communications Tower
DAWE	The Commonwealth Department of Agriculture, Water and the Environment, now the Department of Agriculture, Fisheries and Forestry from 1 July 2022.
DCCEEW	Commonwealth Department of the Environment, Energy and Water
DIN	Double Island North
DIS	Double Island South
DLN	Dry Low NOx
DNA	Deoxyribonucleic Acid
DO	Dissolved oxygen
DOC	Dissolved organic carbon
DomGas	Domestic Gas
DotEE	Former Commonwealth Department of the Environment and Energy (now the Department of Agriculture, Water and the Environment; DotEE dates: from 19 Jul 2016 to 31 Jan 2020)
DPaW	Former Western Australian Department of Parks and Wildlife (now part of Western Australian Department of Biodiversity, Conservation, and Attractions [from 1 July 2017])
DSM	Density Surface Modelling
EARS	Environmental Acoustic Recognition Sensors
EC	Electrical Conductivity (of groundwater)
eDNA	Environmental DNA; DNA that can be extracted from environmental samples
EFA	Ecosystem Function Analysis
EMP	Environmental Management Plan
Environmental Harm	Has the meaning given by Part 3A of the Environmental Protection Act 1986 (WA)
ENSO	El Nino Southern Oscillation Cycle
EP Act	Western Australian *Environmental Protection Act 1986*

Acronym/ Abbreviation/Term	Definition
EPA	Western Australian Environmental Protection Authority
EPBC 2003/1294	Commonwealth Ministerial Approval (for the Gorgon Gas Development) as amended or replaced from time to time.
EPBC 2008/4178	Commonwealth Ministerial Approval (for the Revised Gorgon Gas Development) as amended or replaced from time to time
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
EPR	Environmental Performance Report
EWMA	Exponentially Weighted Moving Average
FA	Foredune Area; area between the beach face and the primary dune, which is populated by scattered vegetative hummocks and marine turtle body holes
First Response	Quarantine activities that occur immediately after the detection of a suspect NIS or Marine Pest. The aim is to contain, control, and eliminate.
FMP	Fire Management Plan
FGP	Feed Gas Pipeline
GHG	Greenhouse Gas
Gorgon Gas Development	Gorgon Gas Development and Jansz Feed Gas Pipeline
GPS	Global Positioning System
GTG	Gas Turbine Generator
GTP	Gas Treatment Plant
H_2S	Hydrogen sulphide
ha	Hectare
Hatchling	Newly hatched marine turtle
Hatchling Disorientation	The range of dispersion (nest fan spread angle) of marine turtle hatchling tracks from the emergence point
Hatchling Misorientation	The degree of deflection (nest fan offset angle) of marine turtle hatchling tracks from the most direct line to the ocean
HAZID	Hazard Identification
HDD	Horizontal Directional Drilling
HES	Health, Environment, and Safety (now known as HSE)
Hg	Mercury
HSE	Health, Safety, and Environment (was HES)
Incursion Response	Coordinated quarantine activities that aim to delineate, delimit, and eliminate positively identified NIS and Marine Pests.
Index beach	Key beach that is used as an index for monitoring
Infestation	The presence and proliferation of non-indigenous species (NIS)—such as plants, invertebrates, or vertebrates—in an area where they are not native, and where their establishment poses a risk to biodiversity, ecological integrity, or operational safety. Triggers quarantine response and reporting, delineation surveillance, eradication/control measures and regulatory notifications.
Internesting interval	Period between a successful nest and subsequent nest or nesting attempt in a single breeding season. The females move to offshore internesting grounds while they form the next clutch of eggs. Internesting grounds may be close to or remote from the nesting beach.

Acronym/ Abbreviation/Term	Definition
IR	Infrared
JHA	Job Hazard Analysis
J-IC	Jansz-Io Compression
km	Kilometre
km^2	Square kilometre
L	Litre
LCGT	Liquefaction Compressor Gas Turbine
LFA	Landscape Function Analysis
LiDAR	Light Detecting and Ranging
LNG	Liquefied Natural Gas
LOR	Limit of Reporting (also known as the detection limit)
LRR	Log Response Ratio
LTMTMP	Long-term Marine Turtle Management Plan
m	Metre
m^2	Square metre
m^3	Cubic metre
MAD	Median Absolute Deviation
MAH	Monocyclic Aromatic Hydrocarbon
Management triggers	Quantitative, or where this is demonstrated to be not practicable, qualitative matters above or below which relevant additional management measures must be considered
Marine Pest	Species other than the native species known or those likely to occur in the waters of the Indo–West Pacific region and the Pilbara Offshore marine bioregion
Mast seeding	Mass, synchronous seed production by a plant species every two or more years on a regional scale
Material Environmental Harm	Environmental Harm that is neither trivial nor negligible
MDA	Mundabullangana (Reference site on the WA mainland)
MEG	Monoethylene glycol; used as a hydrate inhibitor
Metocean	Meteorological and oceanographic conditions
mg	Milligram
mm	Millimetre
MOF	Materials Offloading Facility
MS	(Western Australian) Ministerial Statement
MS 769	Western Australian Ministerial Statement 769 (for the Jansz Feed Gas Pipeline) as amended from time to time
MS 800	Western Australian Ministerial Statement 800 (for the Gorgon Gas Development) as amended from time to time
MS 965	Western Australian Ministerial Statement 965, issued for the Additional Support Area, as amended from time to time
MSORD	Multi-state Open Robust Design

Acronym/ Abbreviation/Term	Definition
N/A	Not Applicable
NATA	National Association of Testing Authorities
NEPM	National Environmental Protection Measure
NGER Act	Commonwealth *National Greenhouse and Energy Reporting Act 2007*
NIS	Non-indigenous Terrestrial Species; any species of plant, animal, or microorganism not native to Barrow Island
NMVOC	Non-methane Volatile Organic Compound
NNE	North-North-East
NO	Nitrogen oxide, nitric oxide
NO2	Nitrogen dioxide
NOHES	National Occupational Health Exposure Standards
NSW DEC	The Department of Environment and Conservation (DEC) is now NSW Planning and Environment. Note, the NSW DEC refers to the Victorian Government Gazette (S 240 21 December 2001)
NOx	Nitrogen oxides (NO and NO2)
O3	Ozone
O_2	Oxygen
OBIA	Object-based Image Analysis
OCB	Operations Centre Building
OEMS	Operational Excellence Management System
OEPA	Former Office of the (Western Australian) Environmental Protection Authority (now Department of Water and Environmental Regulation [DWER] [from 1 July 2017])
ORP	Oxidation-reduction Potential (also known as redox)
PAH	Polycyclic Aromatic Hydrocarbon
PAWS	Print Acquisition for Wildlife Sensors
PCRP	Post-Construction Rehabilitation Plan
PD	Primary Dune; sampling site located on the primary dune beyond the permanent vegetation line
PDS	Passive Diffusive Sampler
PFC	Percentage foliage cover
pH	Measure of acidity or basicity of a solution
PIP	Performance Improvement Package
$PM_{2.5}$	Particulate matter less than 2.5 microns
PM_{10}	Particulate matter less than 10 microns
PPE	Personal Protective Equipment
ppm	Parts per million
Project	Gorgon Gas Development

Acronym/ Abbreviation/Term	Definition
Proliferation	Increase of a species, attributable to the Gorgon Gas Development, by frequent and repeated reproduction: NIS plants (excluding those considered to be naturalised) proliferation: an increase in the distribution of NIS plants producing propagules outside existing Weed Hygiene Zones. NIS animals' proliferation: an increase in reproductively capable offspring dispersing outside the known distribution. Marine Pest proliferation: an increase in reproductively capable offspring dispersing outside the known distribution in the waters surrounding Barrow Island.
PSD	Particle Size Distribution
PWD	Permanent Wastewater Disposal
Q1, Q2, etc.	Three-month quarter of a calendar year
QEP	Quarantine Expert Panel
QMS	Quarantine Management System
Quarantine Incident	A quarantine incident is declared (declaration is subject to positive identification*) by the CAPL Quarantine Manager following: a detection of NIS or Marine Pest on Barrow Island after Final Quarantine Clearance, or the proliferation of a NIS population on Barrow Island or Marine Pest in the waters surrounding Barrow Island. **Level 1 Quarantine Incident** A confirmed detection of NIS on Barrow Island, after Final Quarantine Clearance, where the risk of the species to the biodiversity of Barrow Island is considered by CAPL, on advice of the Quarantine Expert Panel (QEP), to be low, or A proliferation of existing NIS on Barrow Island as a consequence of Gorgon Gas Development activities. **Level 2 Quarantine Incident** A confirmed detection of NIS on Barrow Island, after Final Quarantine Clearance, where: uncertainty exists (as determined by CAPL on advice of the QEP) as to the risk of the species to the biodiversity of Barrow Island due to a range of factors (e.g. the ability of the species to survive on Barrow Island, availability of suitable habitats), or the risk to the biodiversity of Barrow Island is considered to be high (as determined by CAPL, on advice of the QEP), but the ability to detect and eradicate is considered readily achievable (due to factors such as visibility, fecundity, slow dispersal etc.). **Level 3 Quarantine Incident** **Terrestrial NIS**: A confirmed detection of NIS on Barrow Island, after Final Quarantine Clearance, where: the risk to the biodiversity of Barrow Island is considered to be high and the ability to detect and eradicate is difficult (as determined by CAPL, on advice of the QEP), and/or the consequence of eradication/control actions on the biodiversity of Barrow Island is considered to be high (as determined by CAPL, on advice of the QEP). **Marine Pests**: A confirmed detection of a Marine Pest on marine infrastructure or in the waters surrounding Barrow Island. Note: A Marine Pest that has only been detected on the wetsides of a vessel and not on marine infrastructure and/or in the waters surrounding Barrow Island is not considered an incident (see Quarantine Intercept). ** Positive identification is taxonomic (morphologic or molecular) confirmation in every instance except where there is high certainty of species identification in the expert judgement of the CAPL Quarantine Manager.*

Acronym/ Abbreviation/Term	Definition
	Note: An introduction of a Marine Pest is classified as a Level 3 Incident only.
Quarantine Intercept	**Terrestrial NIS**: The detection, containment, and removal of suspected NIS prior to Final Clearance. **Marine Pest**: The detection, containment, and removal of a Marine Pest on a vessel (including barges etc.) wetsides after Final Quarantine Clearance is granted and when the vessel is within the limited access zone or controlled access zone.
Quarantine Introduction	The presence of viable NIS on Barrow Island, or of a Marine Pest in the waters surrounding Barrow Island (excluding on vessel wetsides—see Quarantine Intercept). In both instances, the species will be considered introduced if the species has survived First Response and Incursion Response.
Quarantine Near Miss	**Terrestrial NIS**: The detection, containment, and removal of suspected NIS prior to Final Clearance. **Marine Pest**: The detection, containment, and removal of a Marine Pest on a vessel (including barges etc.) wetsides after Final Quarantine Clearance is granted and when the vessel is within the limited access zone or controlled access zone.
Quarantine Procedural Breach	Any case where a quarantine observation, inspection, or audit detects a failure to comply with Barrow Island quarantine procedures, standards, or concessions. **Level 1 Quarantine Procedural Deviation** Upon arrival of a vessel or material at Barrow Island, it is determined that a quarantine procedure, or part thereof, has not been followed and the potential impact of the deviation has low risk to the biodiversity of Barrow Island and surrounding waters. **Level 2 Quarantine Procedural Deviation** Upon arrival of a vessel or material at Barrow Island, it is determined that a quarantine procedure, or part thereof, has not been followed and the potential impact of the deviation has high risk to the biodiversity of Barrow Island and surrounding waters.
Redox	*See* ORP
Reference zone/site/island/well	Specific areas of the environment that are not at risk of being affected by the Project or existing developments, that can be used to determine the natural state, including natural variability, of environmental attributes.
Rehabilitation Impact Site	A transect or other monitoring method located within an area that has been subject to anthropogenic disturbance and has since been rehabilitated according to the methodology in the PCRP (Ref. 17)
Rehabilitation Reference Site	A transect or other monitoring method located within an area that has not been subject to recent anthropogenic disturbance
Remigration interval	The frequency (in years) between breeding seasons at which marine turtles return to the nesting ground to reproduce
Reporting Period	The period from 10 August 2015 to 9 August 2020 covered by this EPR
ROV	Remotely Operated Vehicle
ROW	Right-of-way
RTK	Real-time Kinematic
SAP	Sampling and Analysis Plan
SAQP	Sampling and Analysis Quality Plan
Scope 1	Defined under the Greenhouse Gas Protocol (a Corporate Accounting and Reporting Standard) as ‘all direct GHG emissions, where direct GHG emissions are emissions from sources that are owned or controlled by the reporting entity’

Acronym/ Abbreviation/Term	Definition
SD	Standard deviation (statistical variation); a measure used to quantify the amount of variation or dispersion of a set of data values
SE	Standard error (statistical variation); a measure used to quantify the accuracy with which a sample mean represents a population mean
Serious Environmental Harm	Environmental harm that is: a) irreversible, of a high impact or on a wide scale; or b) significant or in an area of high conservation value or special significance and is neither trivial nor negligible.
SGC	Silica Gel clean-up
SO2	Sulfur dioxide
SRE	Short-range Endemics; taxonomic group of invertebrates that are unique to an area, found nowhere else, and have naturally small distributions (i.e. <10 000 km^2).
SRESFMP	Short-range Endemics and Subterranean Fauna Monitoring Plan
SSC	Surveillance System Components
TAPL	Texaco Australia Pty Ltd
TC	Tropical cyclone
TDF	Terrestrial Disturbance Footprint The area to be disturbed by construction or operations activities associated with the Terrestrial Facilities listed in Condition 6.3 of MS 800, Condition 6.3 of MS 769, and Condition 5.2 of EPBC 2003/1294 and 2008/4178, and set out in the Terrestrial and Subterranean Baseline State and Environmental Impact Report required under Condition 6.1 of MS 800, Condition 6.1 of MS 769, and Condition 5.1 of EPBC 2003/1294 and 2008/4178.
TEOM	Tapered Element Oscillating Microbalance
Threatened Species	Species listed as extinct, extinct in the wild, critically endangered, endangered, vulnerable or conservation dependent under section 178 of the Commonwealth EPBC Act.
TLT	Temporary Lighting Tower
TMP	Topsoil Management Plan
Topsoil	The top layer of soil that stores seed and acts as the growth medium in which vegetation can establish itself
Transect	The path along which a researcher moves, counts, and records observations
TRH	Total Recoverable Hydrocarbons
TSBSEIR	Terrestrial and Subterranean Baseline State and Environment Impact Report
TSEMP	Terrestrial and Subterranean Environment Monitoring Program
TSEPP	Terrestrial and Subterranean Environment Protection Plan
TT	Terminal Tanks (monitoring site)
TTR	Thermal Tolerance Range
TWD	Temporary Wastewater Disposal
TWIP	Temporary Wastewater Injection Plant
UPL	Upper Percentile Limit
UV	Ultraviolet
VOC	Volatile Organic Compound

Acronym/ Abbreviation/Term	Definition
WA	Western Australia
WAPET Landing	Proper name referring to the site of the barge landing existing on the east coast of Barrow Island prior to the date of MS 800.
Waters surrounding Barrow Island	Refers to the waters of the Barrow Island Marine Park and Barrow Island Marine Management Area (~4169 ha and 114 693 ha respectively), as well as the Port of Barrow Island representing the Pilbara Offshore Marine Bioregion.
Weed	Non-indigenous plant species; a plant that establishes in natural ecosystems, subsequently adversely affecting natural processes and ultimately resulting in the decline of the native vegetation community
Weed Hygiene Zone	An area within which non-indigenous plant species, assessed to be high-risk species, have established populations and/or where a seedbank of a high-risk species is present.
WHO	World Health Organization
YCN	Yacht Club North (beach)
YCS	Yacht Club South (beach)

13 References

Table 13-1 lists the documentation referenced in this EPR.

Table 13-1: References

Ref. No.	Description	Document IDChe
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Table 13-2: Image and Map Credits

Image	Source
Section 2: Vegetation, Barrow Island Euro, Bridled Tern, Flatback Turtle Hatchling, Claypan	Julian Kalau
Section 2: White-winged fairy-wren	Mike Edmondson
Section 2: Boodie	Shannon Lange
Section 2: Spectacled Hare-wallaby	Abbie Milne
Section 2: Wedge-tailed Shearwater	Luke Jenkins
Section 4: Flatback turtle	Stantec
Map Figures	Mandy Van Ross, Doug Szczecinski