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# Annual Environmental Compliance Report 2022/2023

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## Quality statement

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# Summary

This document summarises the findings of the 2022-2023 annual environmental monitoring program conducted between June 2022 and March 2023, pursuant to Condition 6-1 of Ministerial Statement 966 (MS 966).

The report summarises the performance of the farm against the Environmental Protection Authority's (EPA) Environmental Quality Objectives (EQO), which in turn are assessed against Environmental Quality Criteria (EQC), comprising Environmental Quality Guidelines (EQGs) and Environmental Quality Standards (EQSs).

Under the Environmental Monitoring and Management Plan (EMMP), sampling is conducted across three levels of ecological protection: moderate (MEPA), high (HEPA) and maximum (MaxEPA). Water and sediment sampling is conducted monthly between June and October in the dry season and monthly between December and March in the wet season.

The results of the 2022-2023 monitoring program indicated there were no adverse environmental affects that could be attributable to farming operations. Comparison of monitoring data with the EQC found that the EQSs were either met or pending the results of further investigation.

**Based on these results, it was considered that there were no significant risks to the EQOs in the 2022-2023 reporting period.**

# Contents

1	Background .....	1
2	Purpose of this Document.....	1
3	Methods and Approach.....	3
3.1	Management Framework.....	3
3.2	Environmental Quality Criteria .....	6
3.3	Monitoring Sites and Frequency .....	11
4	Results .....	13
5	Audit Table .....	19
6	Environmental Monitoring and Management Plan Compliance .....	22
7	References .....	23

## List of Tables

Table 1-1: Proposal and proponent details. ....	1
Table 3-1: Key elements of ecosystem integrity and their limits of acceptable change.....	3
Table 3-2: Environmental quality guidelines for water quality (Source: DoF 2014).....	7
Table 3-3: Environmental quality standards for water quality (Source: DoF 2014). ....	8
Table 3-4: Environmental quality guidelines for sediment quality (Source: DoF 2014). ....	9
Table 3-5: Environmental quality standards for sediment quality (Source: DoF 2014).....	10
Table 3-6: Water and sediment monitoring parameters .....	11
Table 4-1: Summary report for marine water quality. ....	14
Table 4-2: Summary report for marine sediment quality.....	16
Table 5-1: Summary of compliance (NA=not applicable). ....	19
Table 6-1: Summary of KADZ EMMP compliance (NA=Not Applicable). ....	22

## List of Figures

Figure 2-1: Location of the TG Barramundi Farm, Cone Bay, Western Australia .....	2
Figure 3-1: Environmental Quality Management Framework (Source: EPA 2016). ....	4
Figure 3-2: Environmental quality plan for the KADZ. ....	5
Figure 3-3: Management response protocol (Source: EPA 2016). ....	6
Figure 3-4: Location of the MEPA, HEPA and MaxEPA sampling sites for the monitoring program. .....	12
Figure 4-1: Summary of the legend for the results of the 2022-2023 monitoring program. ....	13



# Abbreviations

Enter Abbreviation	Enter Full Name
<b>CAR</b>	Compliance Assessment Report
<b>CEO</b>	Chief Executive Officer
<b>CHL-A</b>	Chlorophyll A
<b>DIN</b>	Dissolved Inorganic Nitrogen
<b>DPIRD</b>	Department of Primary Industry and Regional Development
<b>DoF</b>	Department of Fisheries (Now DPIRD)
<b>DWER</b>	Department of Water and Environment
<b>EMMP</b>	Environmental Monitoring and Management Plan
<b>EPA</b>	Environmental Protection Authority
<b>EQC</b>	Environmental Quality Criteria
<b>EQG</b>	Environmental Quality Guidelines
<b>EQMF</b>	Environmental Quality Management Framework
<b>EQO</b>	Environmental Quality Objectives
<b>EQP</b>	Environmental Quality Plan
<b>EQS</b>	Environmental Quality Standards
<b>EV</b>	Environmental Value
<b>HEPA</b>	High Ecological Protection Areas
<b>KADZ</b>	Kimberley Aquaculture Development Zone
<b>LAC</b>	Light Attenuation Coefficient
<b>LEP</b>	Levels of Ecological Protection
<b>MaxEPA</b>	Maximum Ecological Protection Areas
<b>MEMP</b>	Management and Environmental Monitoring Plan
<b>MEPA</b>	Moderate Ecological Protection Areas
<b>SWDI</b>	Shannon-Wiener Diversity Index
<b>TOC</b>	Total Organic Carbon
<b>TP</b>	Total Phosphorus
<b>TSS</b>	Total Suspended Solids



# 1 Background

Tassal Group Ltd (TG) (formerly Marine Produce Australia (MPA) is responsible for the management of the Cone Bay Ocean Barramundi Farm (**Table 1-1**) located at the eastern end of the Kimberly Aquaculture Development Zone (KADZ), Cone Bay, Western Australia (**Figure 2-1**). Premium salt-water barramundi (*Lates calcarifer*) has been farmed for the Australian domestic market at this location since 2014.

**Table 1-1: Proposal and proponent details.**

Proposal and proponent details	
Proposal Title	Kimberley Aquaculture Development Zone
Statement Number	MS: 996
Derived Proponent's Name	Tassal Group Ltd
Proponent's Australian Company Number	106 067 270

Prior to its approval, the KADZ was subjected to a rigorous environmental impact assessment (EIA) comprising baseline water and sediment monitoring, marine habitat mapping and carrying capacity modelling. The KADZ was referred to Environmental Protection Authority (EPA) by the Minister of Fisheries on the 12 June 2012, and following the review of the EIA, was approved as a Strategic Assessment on the 12 May 2014 subject to Conditions 1 to 6 of Ministerial Statement (MS) 966.

Farming activities in the KADZ are closely regulated by the Department of Primary Industries and Regional Development (DPIRD) and the Department of Water and Environment (DWER) under Licence Number 1465 and Ministerial Statement (MS) 966, respectively. Under the Conditions of approval, TG is required to conduct an annual marine environmental monitoring program, comprising measurements of water and sediment quality at a number of fixed locations.

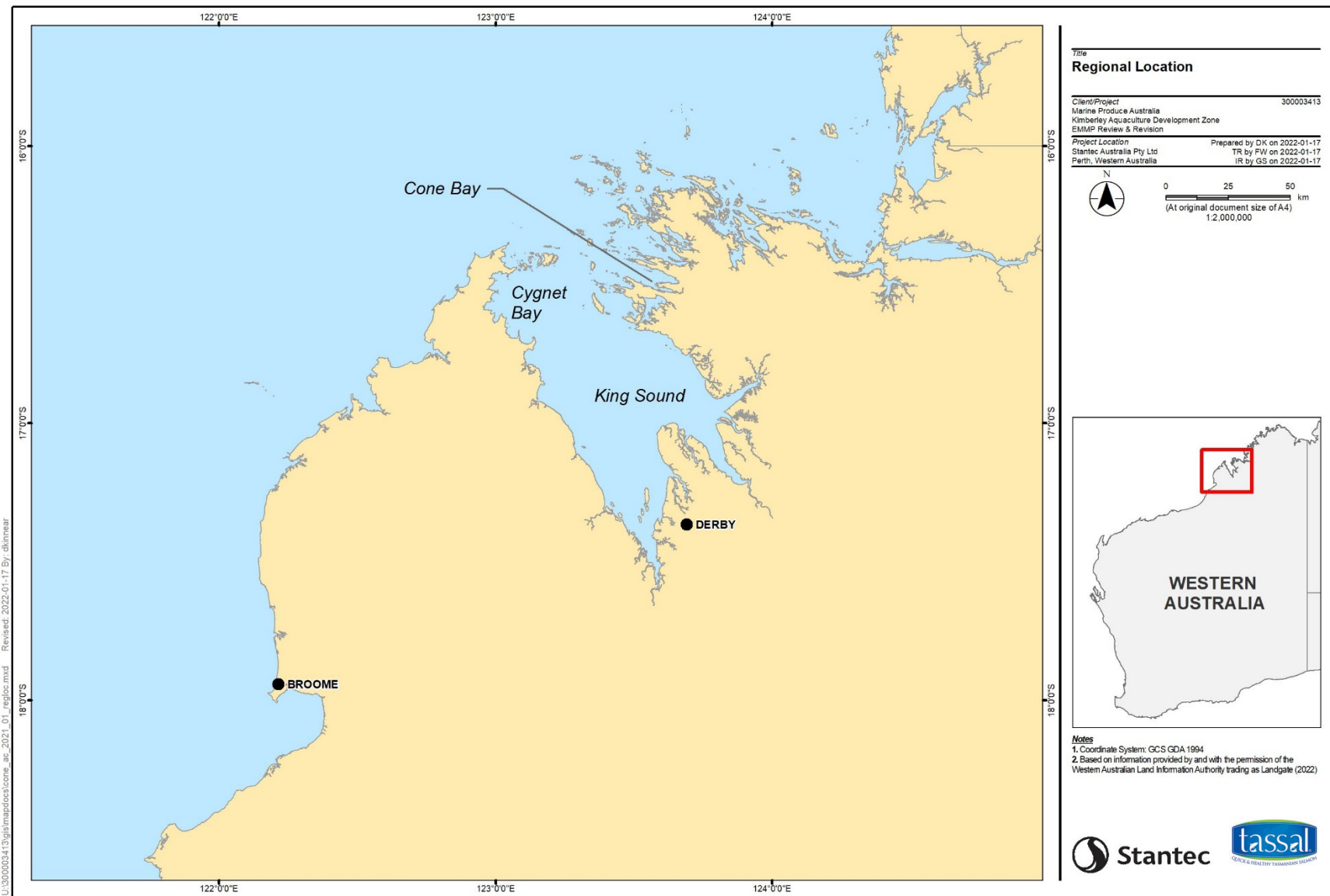
## 2 Purpose of this Document

This document summarises the findings of the 2022 – 2023 annual monitoring program conducted between June 2022 and March 2023 as per the methods described in the EMMP.

As the only derived proponent to have commenced farming in the KADZ, TG is solely responsible for implementing and reporting against the findings of the EMMP. All farming is undertaken at the eastern end of Cone Bay as depicted in **Figure 3-2**.

The results of the annual monitoring program are reported against the EPAs Environmental Quality Objectives (EQOs) for Ecosystem Health and Maintenance of Ecosystem Integrity, respectively.





**Figure 2-1: Location of the TG Barramundi Farm, Cone Bay, Western Australia**





## 3 Methods and Approach

### 3.1 Management Framework

The KADZ is managed under the EPA's Environmental Quality Management Framework (EQMF) as described in EPA (2016). The EQMF relies on the identification of an agreed set of EVs and EQOs, which must be achieved on an annual basis and in perpetuity. Under the EQMF, the KADZ is managed under the EVs and EQOs for Ecosystem Health and Maintenance of Ecosystem Integrity, respectively.

The EQO for Ecosystem Integrity is unique as it allows for the designation of up to four Levels of Ecological Protection (LEP); maximum, high, moderate and low (**Figure 3-1**). The approach is practical because it recognises the competing environmental, societal, and industrial uses of the marine environment, and allows industry to impart small (and inevitable) localised effects, while aiming to maintain overall environmental integrity (EPA 2017). This is important as TG implements strategies to manage the potential reduction in environmental quality beneath and immediately adjacent to the sea-pens, while maintaining broader regional environmental quality.

TG has established an Environmental Quality Plan (EQP) for the Cone Bay farm consisting of a Moderate Ecological Protection Area (MEPA) within concentric High (HEPA) and Maximum Ecological Protection Areas (MaxEPA) (**Figure 2-2**). The framework was designed to be moderately protective of habitats within the MEPA and highly and very highly protective of habitats in the HEPA and MaxEPA, respectively. The EQP is a critical component of the EMMP, because it informs the level of sensitivity applied to the EQC, ranging from very sensitive triggers in the case of the MaxEPA, to moderately sensitive triggers in the case of the MEPA (**Table 3-1**).

**Table 3-1: Key elements of ecosystem integrity and their limits of acceptable change.**

Element	Limits of acceptable change	Level of protection			
		Max	High	Mod	Low
<b>Ecosystem processes</b> (e.g. primary production, nutrients cycles, food chains)	Ecosystem processes are maintained within the limits of natural variation (no detectable change)	✓	✓		
	Small changes in rates, but not types of ecosystem processes			✓	
	Large changes in rates, but not types of ecosystem processes				✓
<b>Biodiversity</b> (e.g. variety and types of naturally occurring marine life)	Biodiversity as measured on both local and regional scales remains at natural levels (no detectable change)	✓	✓		
	Biodiversity on a regional scale remains at natural levels although there may be moderate changes in variety of biota at a local scale			✓	
	Biodiversity on a regional scale remains at natural levels although there may be significant changes in variety of biota at a local scale				✓
<b>Abundance and biomass of marine life</b> (e.g. number or density of individual animals, the total weight of plants)	Abundances and biomasses of marine life vary within natural limits (no detectable change)	✓	✓		
	Small changes in abundances and/or biomasses of marine life			✓	
	Large changes in abundances and/or biomasses of marine life				✓
<b>The quality of water, biota and sediment</b> (e.g. types and levels of contaminants such as heavy metals, dissolved oxygen content, water clarity)	Levels of contaminants and other measures of quality remain within limits of natural variation (no detect. change)	✓			
	Small detectable changes beyond limits of natural variation but no resultant effect on biota		✓		
	Moderate changes beyond limits of natural variation but not to exceed specified criteria			✓	
	Substantial changes beyond limits of natural variation				✓

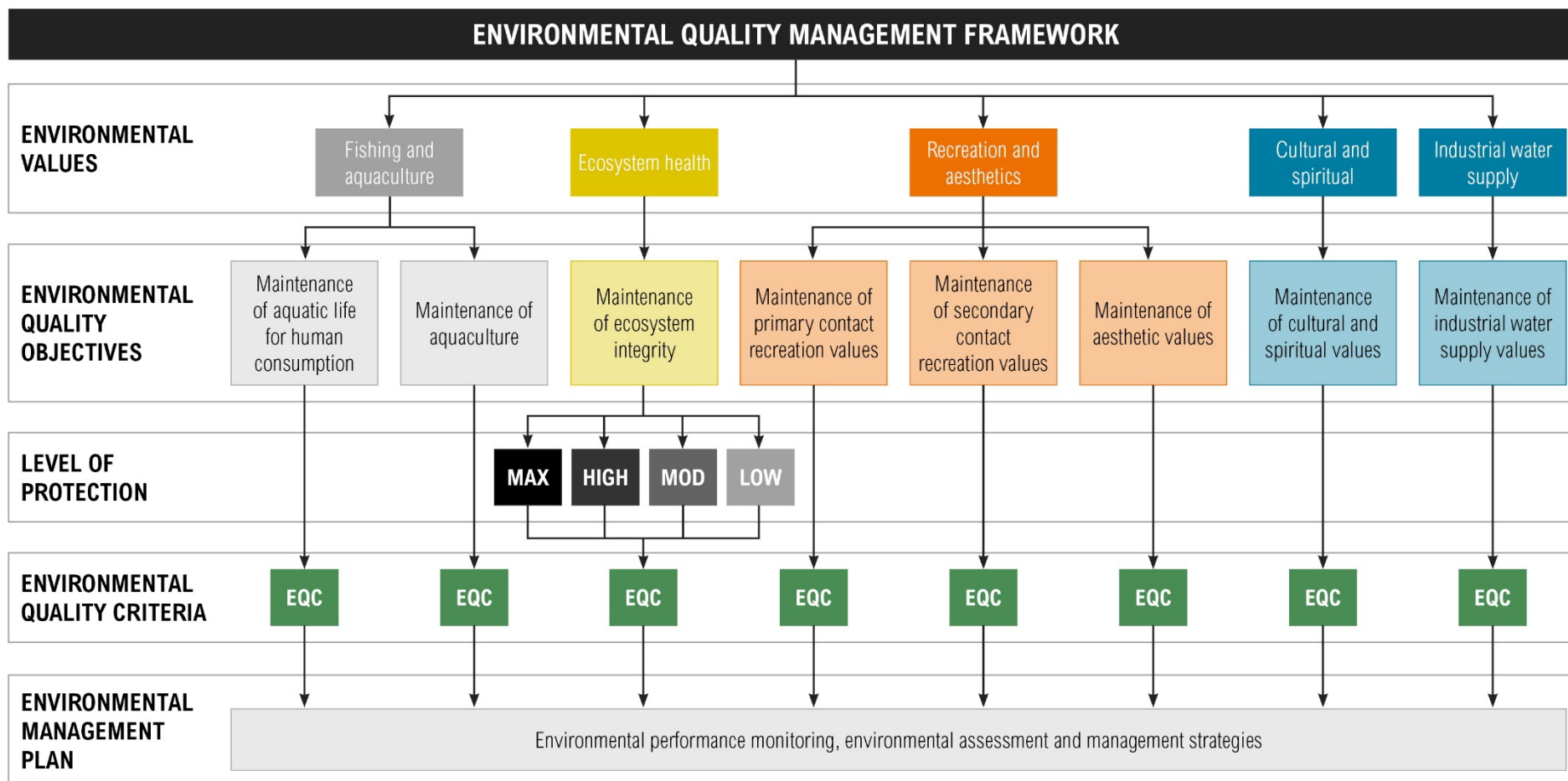


Figure 3-1: Environmental Quality Management Framework (Source: EPA 2016).

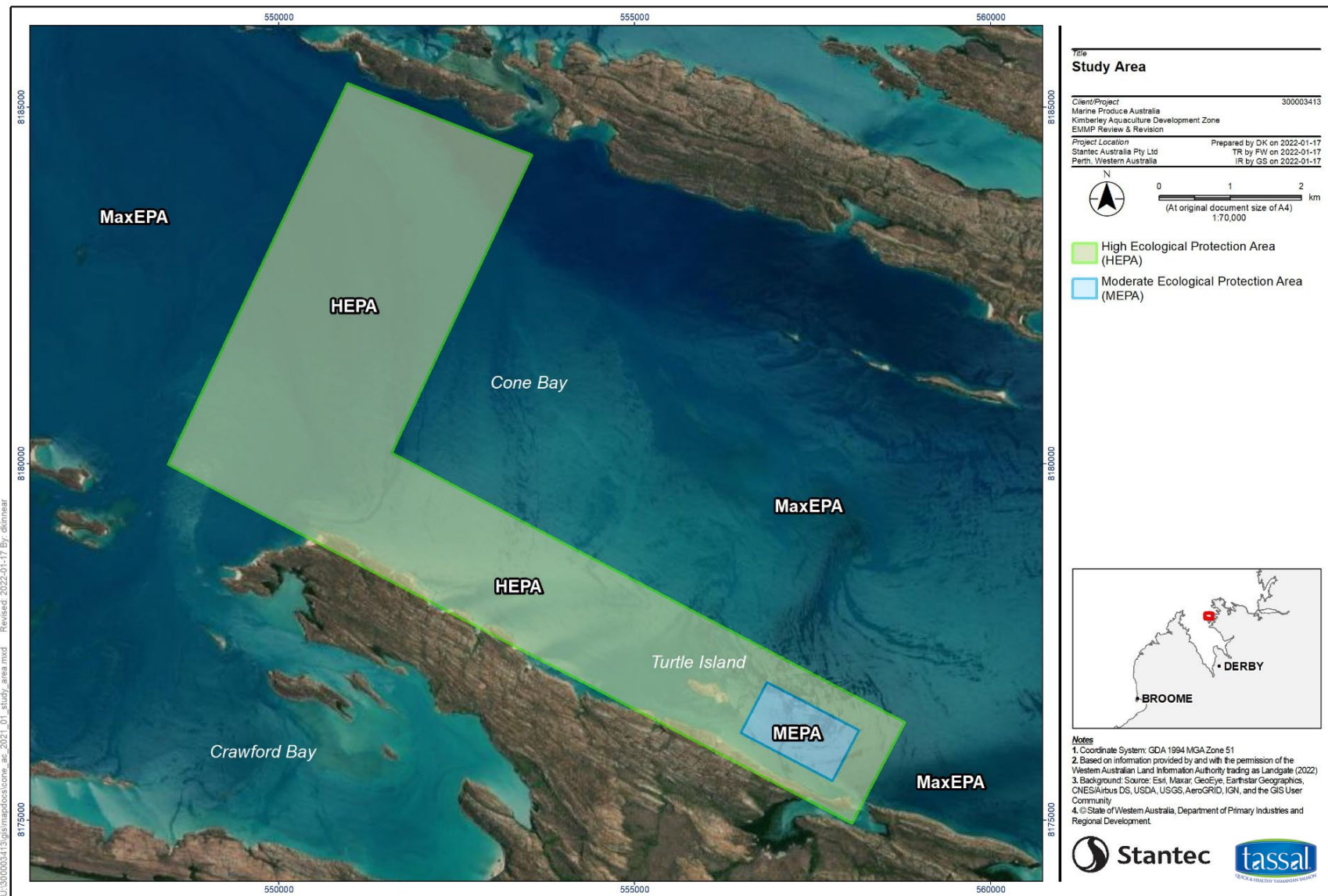


Figure 3-2: Environmental quality plan for the KADZ.

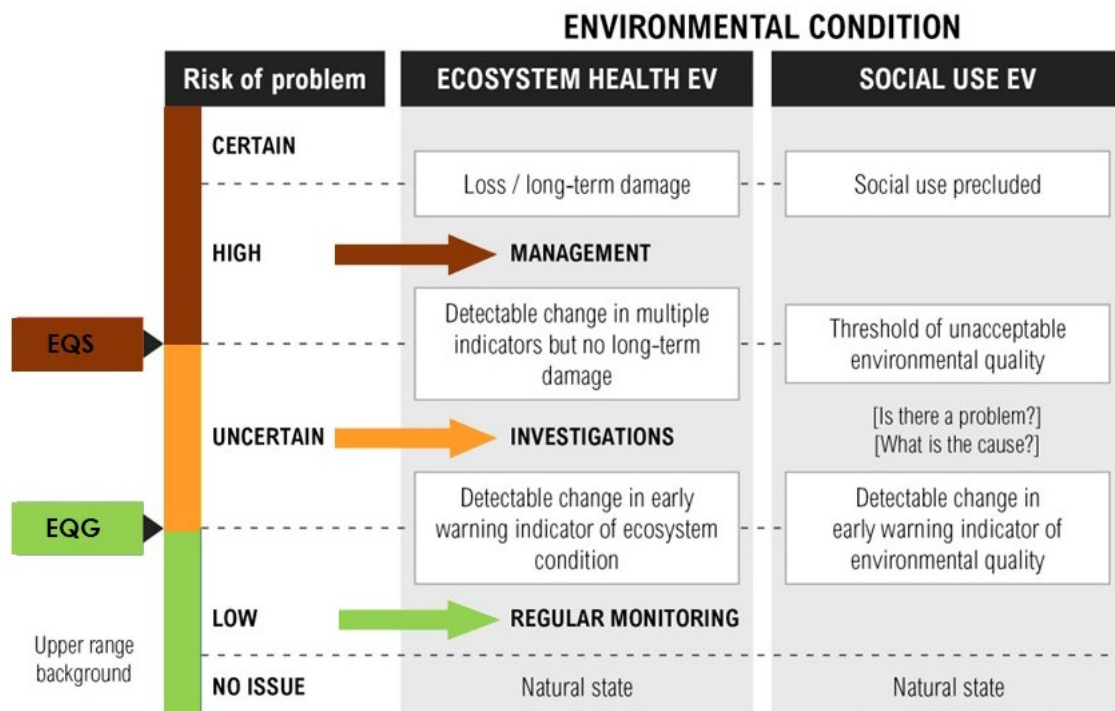


## 3.2 Environmental Quality Criteria

The extent to which the EQO's were met over the reporting period, was assessed against the agreed EQC. EQC comprise of EQGs and EQSs.

EQGs are numerical values or narrative statements **which, if met, indicate there is a high degree of certainty that the associated environmental quality objective has been achieved**. If the guideline is not met, the proponent is obligated to undertake a more detailed assessment against an EQSs (Figure 3-3). EQGs are relatively simple and easy to measure indicators of environmental quality; and typically based on a single indicator e.g. Chlorophyll-a (Chl-a).

EQSs are threshold numerical values or narrative statements which if not met indicate **there is a significant risk that the associated environmental quality objective has not been achieved**. If not met, proponents are obligated to initiate a contingency management response (Figure 3-3). EQSs are typically assessed using a multiple lines of evidence approach, involving one or more types of indicator. e.g. infaunal communities together with visual assessment of sediment quality.



**Figure 3-3: Management response protocol (Source: EPA 2016).**

All the EQC in the EMMP relate to the EQO for Ecosystem Integrity (Table 3-2). The EQC for Ecosystem Integrity are highly conservative and by meeting the EQC it is expected that the EQOs for other EVs – Fishing and Aquaculture, Cultural and Spiritual and Industrial Water Supply EVs – will also be achieved. The EQGs and EQSs are detailed in Tables 2-2 to 2-5, below.

**Table 3-2: Environmental quality guidelines for water quality (Source: DoF 2014).**

Issue	Indicator	Environmental Quality Guidelines		
		Moderate	High	Maximum
Shading or smothering	VSS	Median organic fraction of total suspended solids (TSS) (also known as volatile suspended solids (VSS)) calculated from pooled sites after each sampling occasion and from individual sites after each season, must be less than the 95th percentile of Reference Site data.	VSS calculated from pooled sites after each sampling occasion and from individual sites after each season must be less than the 80th percentile of Reference Site data.	VSS calculated from pooled sites after each sampling occasion and from individual sites after each season, must be less than the 70th percentile of Reference Site data.
Ammonia toxicity	DIN	Median Dissolved Inorganic Nitrogen (DIN) calculated from pooled sites after each sampling occasion and from individual sites after each season, must be less than 1200 µg/L.	Median DIN calculated from pooled sites, after each sampling occasion and from individual sites after each season, must be less than 500 µg/L.	Median DIN calculated from pooled sites, after each sampling occasion and from individual sites after each season, must be less than 250 µg/L
Deoxygenation	DO	Median bottom water dissolved oxygen (DO) calculated from pooled sites after each sampling occasion and from individual sites after each season, must be greater than 80% saturation.	Median bottom water DO calculated from pooled sites after each sampling occasion and from individual sites after each season, must be greater than 80% saturation.	Median bottom water DO calculated from pooled sites after each sampling occasion and from individual sites after each season, must be greater than 80% saturation.
Phytoplankton biomass/shading (due to increased nutrients)	Chlorophyll-a	N/A	Median Chl-a calculated from pooled sites, after each sampling occasion and from individual sites after each season, must be less than 3 x 50 <sup>th</sup> ile of the Reference Site data.	Median Chl-a calculated from pooled sites, after each sampling occasion and from individual sites after each season, must be less than 3 x 50 <sup>th</sup> ile of the Reference Site data.



**Table 3-3: Environmental quality standards for water quality (Source: DoF 2014).**

Issue	Indicator	Environmental Quality Standards	
		Moderate	High Maximum
Shading or smothering	VSS	<p>If EQG for VSS is exceeded at the moderate protection level then;</p> <p>(1) the sediment infauna monitoring program is instigated. The sediment infauna community diversity, measured using the Shannon-Wiener Diversity Index (SWDI), must not be less than 50% of the Reference Sites, and</p> <p>(2) An evaluation of seabed images from a 10m transect taken at the edge of the sea cage and at each of the MEPA transect sites where the EQG was exceeded must not indicate presence of white bacterial mats, black sediments, bubbles of hydrogen sulfide or a significant reduction in the presence of animal tracks, or bioturbator burrows, or benthic macrofauna (i.e. filter feeders) relative to Reference Sites.</p>	<p>If EQG for VSS is exceeded at the high or maximum protection level then;</p> <p>(1) the sediment infauna monitoring program is instigated. The sediment infauna community diversity, measured using the SWDI, must not be less than 80% of the Reference Sites, and</p> <p>(2) that the median of the impact site should be less than the 80th percentile of the Reference Site for a HEPA and MaxEPA.</p>
Ammonia toxicity	DIN	<p>If EQG for DIN is exceeded at the moderate protection level then;</p> <p>(1) the sediment infauna monitoring program is instigated. The sediment infauna community diversity, measured using the SWDI, must not be less than 50% of the Reference Sites<sup>4</sup>; and</p> <p>(2) An evaluation of seabed images from a 10m transect taken at the edge of the sea cage and at each of the MEPA transect sites where the EQG was exceeded must not indicate presence of white bacterial mats, black sediments, bubbles of hydrogen sulfide or a significant reduction in the presence of animal tracks, or bioturbator burrows, or benthic macrofauna (i.e. filter feeders) relative to Reference Sites.</p>	<p>If EQG for DIN is exceeded at the high or maximum level of protection then;</p> <p>(1) the sediment infauna monitoring program is instigated. The sediment infauna community diversity, measured using the SWDI, must not be less than 80% of the Reference Sites; and</p> <p>(2) no observed mortalities of benthic macrofauna, such as filter feeders, attributable to ammonia toxicity.</p>
Physical and chemical stressors	DO	Median bottom water DO on each sampling occasion and after each season at individual sites, must be greater than 60% saturation in all areas of ecological protection and not the result of a regional event as indicated by similar reductions in DO at the Reference Sites.	
Phytoplankton biomass/shading	Chlorophyll-a	N/A	If EQG for chlorophyll-a is exceeded at the high or maximum protection level then mean light attenuation coefficient (LAC) over an 8 week period (based on fortnightly sampling) is not significantly greater than the mean LAC at the Reference Sites, as determined by ANOVA.

**Table 3-4: Environmental quality guidelines for sediment quality (Source: DoF 2014).**

Issue	Indicator	Environmental Quality Guidelines		
		Moderate	High	Maximum
Sediment nutrient enrichment	TP	Median Total Phosphorous concentration calculated from pooled sites after each sampling occasion and from individual sites after each season, must be less than the 95%ile of Reference Site data.	Median Total Phosphorous concentration calculated from pooled sites after each sampling occasion and from individual sites after each season, must be less than the 80%ile of Reference Site data.	Median Total Phosphorous concentration calculated from pooled sites after each sampling occasion and from individual sites after each season, must be less than the 70%ile of the Reference Site data.
Organic enrichment	TOC	Median concentration of TOC calculated from pooled sites after each sampling occasion and from individual sites after each season, must be less than the 95%ile of Reference Site data.	Median concentration of TOC calculated from pooled sites after each sampling occasion and from individual sites after each season, must be less than the 80%ile of Reference Site data.	Median concentration of TOC calculated from pooled sites after each sampling occasion and from individual sites after each season, must be less than the 70%ile of Reference Site data.
Contaminants	Trace metals (Cu, Zn, Cd)	Concentration of each individual sampling site not to exceed: Copper 65 mg/kg Zinc 200 mg/kg Cadmium 1.5 mg/kg	Concentration of each individual sampling site not to exceed <sup>5</sup> : Copper 65 mg/kg Zinc 200 mg/kg Cadmium 1.5 mg/kg	Concentration of each individual sampling site must not be significantly different to the concentrations at the Reference Sites for copper, zinc and cadmium, as determined by ANOVA.
Benthic hypoxia /anoxic sediments	Redox dis-continuity layer	(1) Median depth of redox discontinuity layer calculated from pooled sites, on each sampling occasion, must not be less than the 5%ile, or 20%ile of Reference Site data; or  (2) Median depth of the redox discontinuity layer at any site over a four month period must be no less than the 5%ile, or 20%ile of the Reference Site data.	(1) Median depth of redox discontinuity layer calculated from pooled sites, on each sampling occasion, must not be less than the 20%ile of Reference Site data; or  (2) Median depth of the redox discontinuity layer at any site over a four month period must be no less than the 20%ile of the Reference Site data.	(1) Median depth of redox discontinuity layer calculated from pooled sites, on each sampling occasion, must not be less than the 30%ile of Reference Site data; or  (2) Median depth of the redox discontinuity layer at any site over a four month period must be no less than the 30%ile of the Reference Site data.

**Table 3-5: Environmental quality standards for sediment quality (Source: DoF 2014).**

Issue	Indicator	Environmental Quality Standards	
		Moderate	High Maximum
Sediment nutrient enrichment, organic enrichment and contaminants	TP, TOC and trace metals (Cd, Zn and Cu)	<p>If EQG for TP, TOC or trace metals is exceeded at the moderate protection level then;</p> <p>(1) the sediment infauna monitoring program is instigated. The sediment infauna community diversity, measured using the SWDI, must not be less than 50% of Reference Sites; and</p> <p>(2) An evaluation of seabed images from a 10m transect taken at the edge of the sea cage and at each of the MEPA transect sites where the EQG was exceeded must not indicate presence of white bacterial mats, black sediments, bubbles of hydrogen sulfide or significant reduction in the presence of animal tracks, or bioturbator burrows, or benthic macrofauna (e.g. filter feeders) relative to Reference Sites; and</p> <p>(3) Median bottom water DO on each sampling occasion and over a season must be greater than 60% saturation and not the result of a regional event as indicated by similar reductions in DO at the Reference Sites.</p>	<p>If EQG for TP, TOC or trace metals is exceeded at the high or maximum protection level then;</p> <p>(1) the sediment infauna monitoring program is instigated. The sediment infauna community diversity, measured using the SWDI, must not be less than 80% of Reference Sites; and</p> <p>(2) Median bottom water DO on each sampling occasion and over a season must be greater than 60% saturation and not the result of a regional event as indicated by similar reductions in DO at the Reference Sites.</p>
Benthic hypoxia /anoxic sediments	Redox dis-continuity layer	<p>If EQG (1) and/or (2) (pertaining to the redox dis-continuity layer) is exceeded and the exceedance is based on the moderate protection guideline (95%) then;</p> <p>(1) Evaluation of images taken beneath and within 10 m of the sea-cages must not indicate presence of white bacterial mats, black sediments, bubbles of hydrogen sulphide or a significant reduction in the presence of animal tracks, or bioturbator burrows, relative to Reference Sites; or</p> <p>(2) the sediment infauna monitoring program is instigated. The sediment infauna community diversity, measured using the SWDI, must not be less than 50% of Reference Sites; or (3) Median bottom water DO on each sampling occasion must be greater than 60% saturation, and not the result of a regional event as indicated by similar reductions in DO.</p>	<p>If EQG (1) and/or (2) (pertaining to the redox dis-continuity layer) is exceeded at the high or maximum protection level then;</p> <p>(1) the sediment infauna monitoring program is instigated. The sediment infauna community diversity, measured using the SWDI, must not be less than 80% of Reference Sites; or</p> <p>(2) Median bottom water DO on each sampling occasion must be greater than 60% saturation, and not the result of a regional event as indicated by similar reductions in DO at the Reference Sites; or</p> <p>(3) Median bottom water DO at any site over a four month period must be greater than 60% saturation, and not the result of a regional event as indicated by similar reductions in DO at the Reference Sites.</p>



### 3.3 Monitoring Sites and Frequency

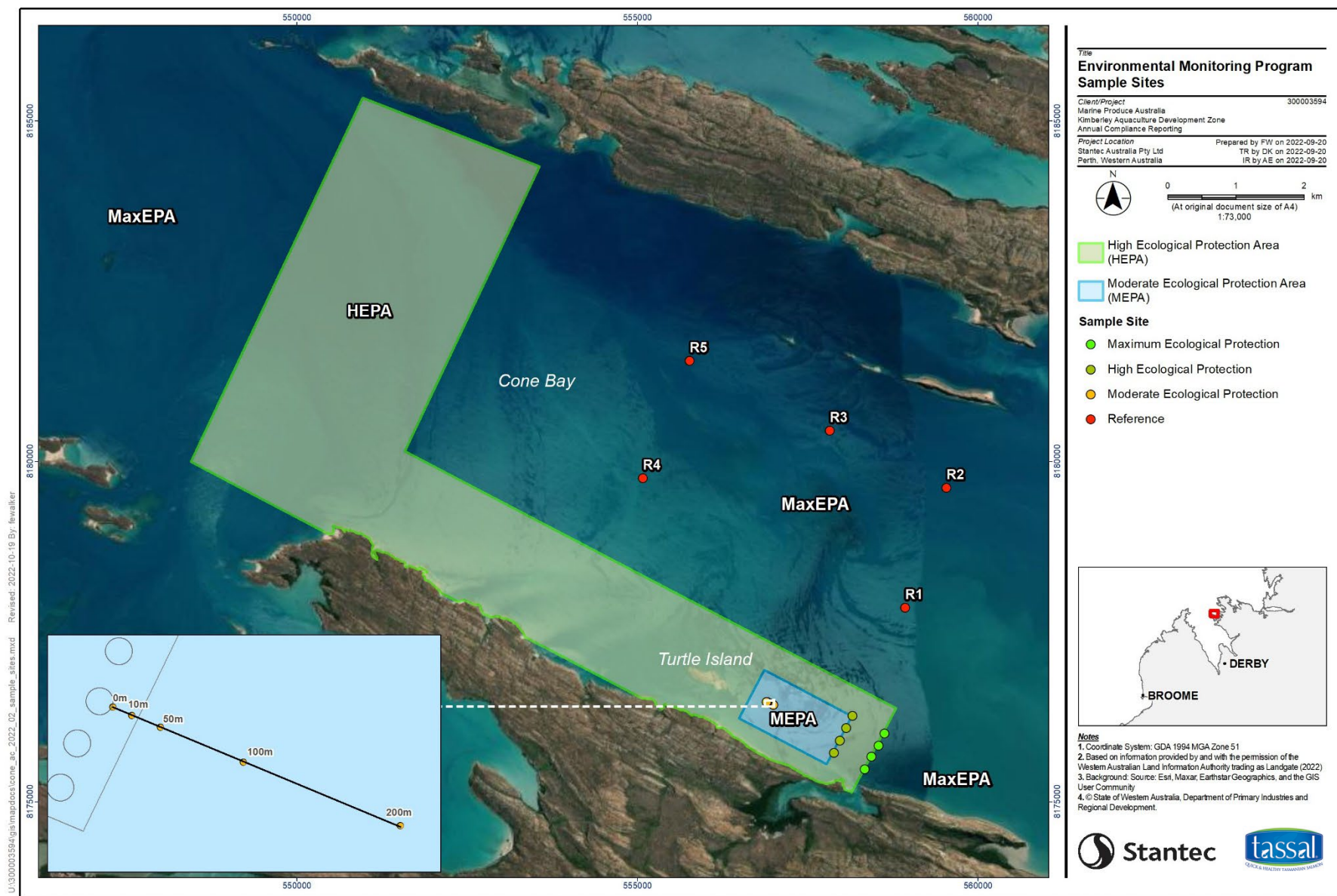
Water and sediment sampling, for the parameters outlined in **Table 3.6**, is conducted monthly between June and October in the dry season and monthly between December and March in the wet season.

**Table 3-6: Water and sediment monitoring parameters.**

Parameter	Analysis
Sediment	Total organic carbon (%c); Total phosphorus (mg/kg); Trace metals (Cu, Zn, Cd)(mg/kg); and Redox dis-continuity layer (cm).
Water	Total Suspended Solids (mg/L) Dissolved Inorganic Nitrogen (mg/L) Dissolved Oxygen (% saturation) Chlorophyll-a (µg/L)

Sampling in the MEPA is conducted at five sites along an assumed contamination gradient, beginning immediately adjacent to the sea pens (0 m) and then at distances of 10 m, 50 m, 100 m and 200 m down-current of the sea-pens. Sampling at the HEPA sites is conducted at five sites positioned perpendicular to the prevailing current approximately 1000 m down-current of the sea-pens. Sampling at the MaxEPA is also conducted at 5 sites located perpendicular to the prevailing current, but at a distance approximately 1500 m down-current of the sea pens (**Figure 3-4**).

Results obtained at the MEPA, HEPA and MaxEPA sites were compared against fixed triggers or the measurements obtained at the reference sites, which are distributed across the central region of Cone Bay (**Figure 3-4**).






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**Figure 3-4: Location of the MEPA, HEPA and MaxEPA sampling sites for the monitoring program.**

## 4 Results

The results of the monitoring program are summarised in **Table 4-2** against the legend shown in **Figure 4-1**. Results are presented in the context of the EQSs for moderate, high and maximum ecological protection. As described in **Section 3.2**, EQSs are threshold numerical values or narrative statements which if not met indicate there is a significant risk that the associated environmental quality objective has not been achieved. If met, it is considered that the EQO was achieved.




Outcome	Legend
<b>Monitor:</b> EQS met (continue monitoring)	
<b>Ongoing Investigation:</b> EQS sampling scheduled (results pending)	
<b>Action:</b> EQS not met (management response required)	


**Figure 4-1: Summary of the legend for the results of the 2022-2023 monitoring program.**

The results of the 2022-2023 monitoring program determined there were no adverse environmental affects that could be attributable to farming operations in Cone Bay. Comparison of monitoring data with the EQC found the EQS were either met or pending the results of further testing.




**Based on these results, it was concluded that there was no significant risk to the Environmental Quality Objectives in the 2022-2023 reporting period.**




**Table 4-1: Summary report for marine water quality.**


Indicator	EQS	Result	Outcome
Volatile Suspended Solids (VSS)	<p>VSS is the organic fraction of the total suspended material in the water column. In high enough quantities, VSS poses a risk to sediment infauna via smothering or interruption to filter feeding processes. The EQS is assessed based on the outcomes of two measurements:</p> <ul style="list-style-type: none"> <li>The median VSS values at the HEPA and MaxEPA sites must be less than the 80<sup>th</sup> percentile of the reference sites, and</li> <li>The diversity of sediment infauna must not be less than 50% (MEPA) or 80% (HEPA and MaxEPA) of the reference sites measured using the Shannon-Wiener Diversity Index (SWDI).</li> </ul> <p>While the median VSS values at some impact sites exceed the 80th percentile of the reference sites, average SWDI scores at the HEPA and MaxEPA in 2021 were greater than 80%. The results of the 2023 infauna monitoring program are pending.</p>		<p>The EQS was met in 2021. Additional infauna monitoring is pending.</p>
Dissolved Inorganic Nitrogen (DIN)	<p>DIN is the aggregate of Ammonia, Nitrite and Nitrate. DIN in aquaculture wastewater is comprised predominantly of Ammonia; which is also the most biologically available form of nitrogen.</p> <p>The EQG for DIN is assessed against the EPA's toxicity criteria for ammonia. The Median DIN concentration calculated from pooled sites after each sampling occasion and from individual sites after each season met the EQGs in the MEPA, HEPA and the MaxEPA. There was therefore no further need to assess against the EQS for this criterion.</p>		<p>The EQG was met. There is a high degree of certainty that the environmental quality objective for a moderate level of ecological protection was achieved during the reporting period.</p>
Dissolved Oxygen (DO)	<p>Dissolved oxygen is assessed in bottom waters to determine the risk of persistent oxygen drawdown due to the accumulation of farm waste.</p> <p>To meet the EQS, dissolved oxygen values must be greater than 60% saturation. Ongoing monitoring determined there were no instances in which the percentage saturation fell below 60%.</p>		<p>The EQS was met. Based on these results, there is a high degree of certainty that the environmental quality objective was achieved during the reporting period.</p>

Indicator	EQS	Result	Outcome
Chlorophyll-a	<p>To meet the EQS, the average Light Attenuation Coefficient (LAC) values at the impact sites over an eight-week period must be less than the average values at the reference sites, as determined by statistical analysis. Assessment against the EQS is pending.</p> <p>In the interim, TG has conducted a detailed investigation based on an analysis of chlorophyll-a data collected since June 2014. Chlorophyll-a is monitored on an ongoing basis in Cone Bay and provides important early warning of the potential for algal blooms.</p> <p>The results are indicative of a seasonally driven system, with chlorophyll-a values peaking consistently in the wet season (November - April), together with a strong spatial gradient between the western and south-eastern regions of the bay. The gradient results in consistently elevated chlorophyll-a concentrations in the SE corner, relative to the central (reference) and western regions of the bay. Exceedances of the EQG for Chlorophyll-a are typically related to this variability (i.e. false positives), and there is no evidence (present or historical) the exceedances are related to farming activities.</p>		<p>The analysis of long-term data suggests the observed variations at the HEPA and MaxEPA sites are (with 95% confidence) attributable to natural variation, and more specifically the naturally occurring productivity gradient within the Bay.</p> <p>Based on these results, there is a high degree of certainty that the EQO was achieved during the 2022-2023 reporting period.</p> <p>TG will continue to communicate with the EPA regarding the timing of the light attenuation coefficient (LAC) assessment, and in the interim, will continue to monitor chlorophyll-a.</p>

**Table 4-2: Summary report for marine sediment quality.**

Indicator	EQS	Result	Outcome
Total Phosphorus (TP)	<p>The EQS for TP uses a 'multiple lines of evidence' approach and incorporates testing against the infauna, DO and visual thresholds. The EQS for TP – incorporating multiple lines of evidence - was assessed for the MEPA, HEPA and MaxEPA.</p> <p>1. To meet the EQS for a moderate level of ecological protection, the diversity of sediment infauna must not be less than 50% (MEPA) or 80% (HEPA and MaxEPA) of the reference sites measured using the Shannon-Wiener Diversity Index (SWDI). In 2021 the average SWDI score at the MEPA was 82% (MPA, 2021). Based on these data, the EQS for the maximum level of ecosystem protection was met. The results of the 2023 infauna surveys are pending.</p> <p>2. To meet the EQS, dissolved oxygen values must be greater than 60% saturation AND dissolved oxygen values at any site over a four-month period must be greater than 60% saturation, and not the result of a regional event as indicated by similar reductions at the reference sites.</p> <p>3. To meet the visual criteria, evaluation of images taken beneath and within 10 m of the sea-cages must not indicate presence of white bacterial matts, black sediments, bubbles of hydrogen sulphide or a significant reduction in the presence of animal tracks, or bioturbator burrows, relative to the reference sites. Towed video assessments are pending.</p>	    	<p>The EQS based on one of the three lines of evidence was met. Testing against the visual criteria and additional infauna monitoring is pending.</p>

Indicator	EQS	Result	Outcome
Total Organic Carbon (TOC)	<p>Total Organic Carbon is the proportion of organic material measured in the sediments. It is typically expressed as a percentage. The EQS for TOC uses a 'multiple lines of evidence' approach and incorporates testing against infauna and dissolved oxygen-based thresholds. The EQS for TOC was assessed in the HEPA and MaxEPA zones.</p> <p>1. To meet the EQS for the high and maximum levels of ecological protection, the diversity of infauna must not fall below 80% of the reference sites, as measured using the SWDI. In 2021, average SWDI scores at the HEPA and MaxEPA sites were &gt;100% compared to the reference site value (MPA,2021). The results of the 2023 infauna surveys are pending.</p> <p>2. To meet the EQS for the high and maximum levels of ecological protection, dissolved oxygen values must be greater than 60% saturation. Ongoing monitoring determined that there were no instances in which the percentage saturation fell below 60%.</p>	 	The EQS for one of the two lines of evidence was met. Additional infauna monitoring is pending.
Trace Metals (Cu, Zn and Cd)	<p>The EQG for Cu, Zn and Cd is assessed against the EPA's toxicity criteria. Median Cu, Zn and Cd concentrations calculated at individual MEPA, HEPA and MaxEPA sites at the completion of the wet and dry sampling periods, met their respective EQGs and there was no further need to assess against the EQS.</p> <p>The EQS for heavy metals is assessed against the same EQS criteria as TP, TOC and DO. Based on the assessments conducted for these indicators, it can be inferred that the EQS for heavy metals was also met.</p>		The EQS was met. There is a high degree of certainty that the environmental quality objective was achieved during the reporting period.

Indicator	EQS	Result	Outcome
Redox Discontinuity Layer	The median depth of the redox discontinuity layer calculated from pooled sites after each sampling occasion and from individual sites after each season, did not exceed the respective EQGs for the moderate, high or maximum levels of ecosystem protection. The EQGs were met.		The EQG was met and there was no further need to assess against the EQS. Based on these results, there is a high degree of certainty that the environmental quality objective was achieved during the reporting period.



## 5 Audit Table

Table 5-1: Summary of compliance (NA=not applicable).

Audit Code / Condition	Section	Requirements	Implementation	Evidence	Timeframe	Status	Further Information
<b>MS 966 Condition 1.1</b>	Derived Proposals	Proposals referred to the EPA and declared to be derived proposals shall not exceed the specifications and characteristics provided for in Schedule 2.  Note: It may be that more than one proponent implements the Proposal identified in Schedule 2.	Project will be implemented in accordance with the specifications and characteristics of this statement	Compliance Assessment Report (CAR)	Life of Proposal - Yearly	Completed	
<b>MS 966 Condition 2.1</b>	Contact Details	The proponent shall notify the Chief Executive Officer (CEO) of any change of its name, physical address or postal address for the serving of notices or other correspondence within 28 days of such change. Where the proponent is a corporation or an association of persons, whether incorporated or not, the postal address is that of the principal place of business or of the principal office in the State.	Notify the CEO of any change to contact name and address	CAR	Within 28 days of such change	Compliant	
<b>MS 966 Condition M3.1</b>	Time Limit for Proposal Implementation	The proponent must ensure that the Proposal is substantially commenced within five years of the date of the section 45A Notice.	Commence proposal within 5 years of June 28, 2014	CAR	25 June 2019	Completed	
<b>MS 966 Condition M3.2</b>	Time Limit for Proposal Implementation	The proponent shall provide the CEO with written evidence which demonstrates that the Proposal has substantially commenced on or before the expiration of five years from the date of the section 45A Notice.	Provide written advice to CEO demonstrating the commencement of the Proposal	CAR	25 June 2019	Completed	
<b>MS 966 Condition M4.1</b>	Compliance Reporting	The proponent shall prepare and maintain a compliance assessment plan to the satisfaction of the CEO.	Submit Compliance Assessment Plan to CEO	Compliance Assessment Plan (CAP)		Completed	
<b>MS 966 Condition M4.2</b>	Compliance Reporting	The proponent shall submit to the CEO the compliance assessment plan required by Condition 4-1 at least six months prior to the first CAR required by Condition 4-6, or prior to implementation, whichever is sooner. The compliance assessment plan shall indicate: 1. The frequency of compliance reporting; 2. The approach and timing of compliance assessments; 3. The retention of compliance assessments; 4. The method of reporting of potential non-compliances and corrective actions taken; 5. The table of contents of CARs; and 6. Public availability of CARs.	Submit Compliance Assessment Plan to CEO	CAP	Submitted to the CEO	Completed	
<b>MS 966 Condition M4.3</b>	Compliance Reporting	The proponent shall assess compliance with conditions in accordance with the compliance assessment plan required by Condition 4-1.	Assess compliance in accordance with the Compliance Assessment Plan	CAR	Annually	Completed	
<b>MS 966 Condition M4.4</b>	Compliance Reporting	The proponent shall retain reports of all compliance assessments described in the compliance assessment plan required by Condition 4-1 and shall make those reports available when requested by the CEO.	Retain digital copies of CARs	Available by direct enquiry to TG	Annually and continued	Compliant	
<b>MS 966 Condition M4.5</b>	Compliance Reporting	The proponent shall advise the CEO of any potential non-compliance within seven days of that non-compliance being known.	Notify CEO (and compliance branch of OEPA) by email of any potential non-compliance	CAR	Within 7 days of potential non-compliance being identified	Compliant	
<b>MS 966 Condition M4.6</b>	Compliance Reporting	The proponent shall submit to the CEO and the Department of Primary Industries and Regional Development the first CAR 15 months from the date of issue of this Statement addressing the 12-month period from the date of issue of this Statement and then annually from the date of submission of the first CAR. The CAR shall:	Prepare and submit CAR to CEO annually	CAR	15 months from date statement issued	Compliant	

Audit Code / Condition	Section	Requirements	Implementation	Evidence	Timeframe	Status	Further Information
		<ol style="list-style-type: none"> <li>1. Be endorsed by the proponent's Chief Executive Officer or a person delegated on the Chief Executive Officer's behalf;</li> <li>2. Include a statement as to whether the proponent has complied with the conditions;</li> <li>3. Identify all potential non-compliances and describe corrective and preventative actions taken;</li> <li>4. Be made publicly available in accordance with the approved compliance assessment plan; and</li> <li>5. Indicate any proposed changes to the compliance assessment plan required by Condition 4-1.</li> </ol>					
<b>MS 966 Condition M5.1</b>	Public Availability of Data	Subject to Condition 5-2, within a reasonable time period approved by the CEO of the issue of this Statement and for the remainder of the life of the Proposal, the proponent shall make publicly available, in a manner approved by the CEO, all validated environmental data (including sampling design, sampling methodologies, empirical data and derived information products (e.g. maps)) relevant to the assessment of this Proposal and implementation of this Statement.	Make data publicly available	Available on the TG website	Within a reasonable time period approved by the CEO	Compliant	<p>The Annual compliance report will be posted on, and downloadable from: <a href="https://www.fish.wa.gov.au/Fishing-and-Aquaculture/Aquaculture/Aquaculture%20Zones/Pages/default.aspx">https://www.fish.wa.gov.au/Fishing-and-Aquaculture/Aquaculture/Aquaculture%20Zones/Pages/default.aspx</a></p> <p>Reports will also be made available upon request from members of the public who are unable to access the website.</p>
<b>MS 966 Condition M5.2</b>	Public Availability of Data	<p>If any data referred to in Condition 5-1 contains particulars of:</p> <ol style="list-style-type: none"> <li>1. A secret formula or process; or</li> <li>2. Confidential commercially sensitive information.</li> </ol> <p>The proponent may submit a request for approval from the CEO to not make these data publicly available. In making such a request the proponent shall provide the CEO with an explanation and reasons why the data should not be made publicly available.</p>	Submit request to CEO	N/A	N/A	Compliant	
<b>MS 966 Condition M6.1</b>	Benthic Communities and Marine Environmental Quality	The proponent shall ensure that implementation of the Proposal causes no irreversible loss of benthic communities and achieves the levels of ecological protection for each of the ecological protection areas as specified in Table 1 of Schedule 3 and referred to in the Kimberley Aquaculture Development Zone Environmental Monitoring and Management Plan (Version 1, January 2014), or its revisions as approved by the CEO.	Assess health of environment by assessing compliance in accordance with KADZ EMMP	CAR	Annually	Compliant	
<b>MS 966 Condition M6.2</b>	Benthic Communities and Marine Environmental Quality	The proponent shall implement the Kimberley Aquaculture Development Zone Environmental Monitoring and Management Plan (Version 1, January 2014), or its revisions as approved by the CEO, and continue implementation until otherwise agreed by the CEO.	Implement EMMP	CAR	Annually	Compliant	
<b>MS 966 Condition M6.3</b>	Benthic Communities and Marine Environmental Quality	<p>In the event that monitoring required by the Kimberley Aquaculture Development Zone Environmental Monitoring and Management Plan (Version 1, January 2014), or its revisions as approved by the CEO, indicates the levels of ecological protection as specified in Table 1 of Schedule 3, environmental quality guidelines or environmental quality standards as specified in the Kimberley Aquaculture Development Zone Environmental Monitoring and Management Plan (Version 1, January 2014), or its revisions as approved by the CEO, are not being met, the proponent shall:</p> <ol style="list-style-type: none"> <li>1. Report such findings to the CEO within two working days of the exceedance(s) being identified;</li> <li>2. Investigate to determine the likely cause(s) of the exceedance(s) of the criteria defined in the Kimberley Aquaculture Development Zone Environmental Monitoring and Management Plan (Version 1, January 2014), or its revisions as approved by the CEO;</li> <li>3. If the exceedance(s) is determined by the CEO to be a result of implementation of the Proposal, the proponent shall immediately implement the mitigation measures identified in the Kimberley Aquaculture Development Zone Environmental Monitoring and Management Plan</li> </ol>	<p>Notify the CEO within two working days;</p> <p>Investigate the likely cause of exceedance;</p> <p>Implement mitigation measures if determined necessary; and</p> <p>Continue implementing as required</p>	Notification to CEO	Within two working days of the exceedance being identified	Compliant	

Audit Code / Condition	Section	Requirements	Implementation	Evidence	Timeframe	Status	Further Information
		(Version 1, January 2014), or its revisions as approved by the CEO; and 4. Continue implementing the mitigation measures required by Condition 6-3(3) until the criteria defined in the Kimberley Aquaculture Development Zone Environmental Monitoring and Management Plan (Version 1, January 2014), or its revisions as approved by the CEO, are no longer being exceeded, or until advised otherwise by the CEO.					
<b>MS 966 Condition M6.4</b>	Benthic Communities and Marine Environmental Quality	The proponent shall submit to the CEO and the Department of Primary Industries and Regional Development annual CARs in accordance with Condition 4-6 and which includes: 1. The monitoring results required by the Kimberley Aquaculture Development Zone Environmental Monitoring and Management Plan (Version 1, January 2014), or subsequent approved revisions, under Condition 6-1; 2. An assessment of the effectiveness of the management and contingency measures implemented to ensure compliance with the requirements of Conditions 6-1 and 6-2; and 3. Evidence that the Moderate Ecological Protection Area defined in Table 1 of Schedule 3 comprises no more than 33 per cent of the proponent's Aquaculture Lease Area.	Submit CAR to CEO	CAR	Annually	Compliant	

## 6 Environmental Monitoring and Management Plan Compliance

Under the EMMP, TG is obligated to achieve the following EQOs:

- Maintain the structure, function, diversity, distribution and viability of benthic communities and habitats at local and regional scales;
- Maintain the quality of water, sediment and biota so that the environmental values, both ecological and social, are protected; and,
- Maintain the diversity, geographic distribution and viability of fauna at the species and population levels.

The extent to which the EQOs have been achieved is assessed annually under the EMMP, which includes a number of proponent commitments. TG's compliance with the commitments is summarised in **Table 6-1**.

**Table 6-1: Summary of KADZ EMMP compliance (NA=Not Applicable).**

Section of EMMP	Commitments	Status
Section 2 Environmental monitoring program	Sample medians will be calculated after each sampling occasion and at the completion of each season's sampling (i.e. on completion of the four-month sampling period).	Completed
	Upon exceeding an Environmental Quality Guidelines (EQG) for Total Suspended Solids (TSS), Dissolved Inorganic Nitrogen (DIN), Total Phosphorus (TP), Total Organic Carbon (TOC) or trace metals (Zn, Cu and Cd), the operators will undertake sediment infauna sampling	Pending
Section 3 Reporting	An annual Management and Environmental Monitoring Plan (MEMP) report which includes validated monitoring data and a summary of the results of all of the environmental monitoring as outlined in this KADZ EMMP for the Zone must be submitted to the DPIRD	Completed
	In the event an EQG trigger level is exceeded, the proponent will report the matter to the Zone Manager (DPIRD) within one working day of determining this has occurred and initiate investigation against the Environmental Quality Standards (EQS) within a timeframe agreed with DPIRD	Compliant
Section 4 Adaptive management and monitoring – the feedback loop	If any EQGs are exceeded, monitoring against the relevant EQS is instigated. If an EQS is exceeded, then a management response is triggered.	Pending
Section 5 Mitigation measures	In the event that an EQS is exceeded, management will be undertaken to reduce the effect of contaminant(s) and restore environmental quality to comply with the specified level of ecological protection.	N/A
Section 6 Decommissioning plan	Should the operation be discontinued the aquaculture gear will be removed from the site.	N/A
Section 7 Marine fauna interaction plan.	The licence holder is responsible for ensuring that potential impacts on other aquatic fauna are managed and minimised by adhering to the requirements and procedures set out in this section.	Compliant

## 7 References

Environmental Protection Authority (2016), Technical Guidance – Protecting the Quality of Western Australia’s Marine Environment (2016), Perth, Western Australia

Environmental Protection Authority (2017), Environmental Quality Criteria Reference Document for Cockburn Sound (2017), Perth, Western Australia

Department of Fisheries (2014), Kimberley Aquaculture Development Zone, Environmental Monitoring & Management Plan, Version 1 (2014), Perth, Western Australia

DHI Water & Environment Pty Ltd (2013), Kimberley Aquaculture Development Zone Environmental Field Studies and Numerical Modelling in Support of an EIS (2013), Perth, Western Australia.

Stantec Pty Ltd (2022) Revised Kimberley Aquaculture Development Zone: Environmental Management and Monitoring Plan (2022), Perth, Western Australia



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