

Learmonth Pipeline Fabrication Facility
APFAC017
Environmental Quality Plan

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REVISION RECORD SHEET

Revision	Issue Date	Purpose	Description of Updated/Modified Sections (if any)
Draft	06.03.2019	Client Review	NA
Draft	07.03.2019	External Review	Updated to address Subsea 7 comments
Final Draft V0	03.05.2019	External Review	Updated to address peer review comments
Final Draft V1	26.06.2019	External Review	Minor revisions to reflect amended Development Envelope and Development Footprint

Executive Summary

Table 1 provides a summary of the Proposal and the purpose of the Environmental Quality Plan (EQP) (this document) in context of EPA objective for marine environmental quality.

Summary of the Proposal	
Proposal Title	Learmonth Pipeline Fabrication Facility
Proponent Name	Subsea 7 Australia Contracting (Subsea 7)
Short Description	Construction and operation of an onshore pipeline fabrication facility at Heron Point.
Ministerial Statement No.	NA
Purpose of EQP (This document)	<ul style="list-style-type: none"> To document the management measures to be implemented to manage potential impacts to marine environmental quality. To support the Public Environmental Review submitted under the <i>Environmental Protection Act 1986</i> and <i>Environment Protection and Biodiversity Conservation Act 1999</i>.
Key Environmental Factor/Objective	Marine Environmental Quality EPA Objective: To maintain the quality of water, sediment and biota so that environmental values are protected.
Condition Clauses	NA

Table 1: Summary of the Proposal

TABLE OF CONTENTS

EXECUTIVE SUMMARY	III
1. CONTEXT, SCOPE AND RATIONALE	6
1.1 PROPOSAL	6
1.2 STATE WATER QUALITY MANAGEMENT STRATEGY	8
1.3 ENVIRONMENTAL QUALITY MANAGEMENT FRAMEWORK FOR EXMOUTH GULF ...	9
1.3.1 Environmental Values.....	9
1.3.2 Environmental Quality Objectives	10
1.3.3 Levels of Ecological Protection	11
1.3.4 Environmental Quality Criteria.....	11
2. ECOSYSTEM HEALTH	13
2.1 OBJECTIVE OF EQ01	13
2.2 IMPACT PREDICTIONS.....	13
2.2.1 Launchway construction	13
2.2.2 Bundle launch and tow	13
2.2.3 Chemical leak or spill	14
2.3 PROPOSED MANAGEMENT BOUNDARIES	14
3. FISHING AND AQUACULTURE	17
3.1 OBJECTIVES OF EQ02 AND EQ03.....	17
3.2 IMPACT PREDICTIONS.....	17
3.3 PROPOSED MANAGEMENT BOUNDARIES	18
4. RECREATION AND AESTHETICS	19
4.1 OBJECTIVES OF EQ04, EQ05 AND EQ06.....	19
4.2 IMPACT PREDICTIONS.....	19
4.3 PROPOSED MANAGEMENT BOUNDARIES	19
5. CULTURAL AND SPIRITUAL VALUES	21
5.1 OBJECTIVES OF EQ07	21
5.2 IMPACT PREDICTIONS.....	21
5.3 PROPOSED MANAGEMENT BOUNDARIES	21
6. REFERENCES.....	22

TABLES

Table 1: Summary of the Proposal.....	iii
Table 2: Environmental Values and Environmental Quality Objectives for the marine waters of Exmouth Gulf	10
Table 3: Levels of ecological protection	13
Table 4: Environmental Quality Objectives.....	17
Table 5: Environmental Quality Objectives.....	19

FIGURES

Figure 1: Proposal Location.....	7
Figure 2: Current levels of ecological protection within Exmouth Gulf	12
Figure 3: Zone of Potential Temporary Impacts to Water Quality (Turbidity) during Launchway Construction	15

Figure 4: Modelling of turbidity associated with a Bundle launch and tow.....	16
Figure 5: Modelled Exceedance of EQG for Maintenance of Recreation and Aesthetics During Bundle Launch and tow	20

1. Context, Scope and Rationale

This Environmental Quality Plan (EQP) is submitted in support of the Environmental Review Document (ERD) (Assessment Number 2208 / EPBC 2017-8079) developed by Subsea 7 Australia Contracting Pty Ltd (Subsea 7) for the Learmonth Pipeline Fabrication Facility (the Proposal).

The EQP is designed to spatially define the Environmental Values (EVs), Environmental Quality Objectives (EQOs) and Levels of Ecological Protection (LEPs) that will apply following the implementation of the Proposal.

1.1 PROPOSAL

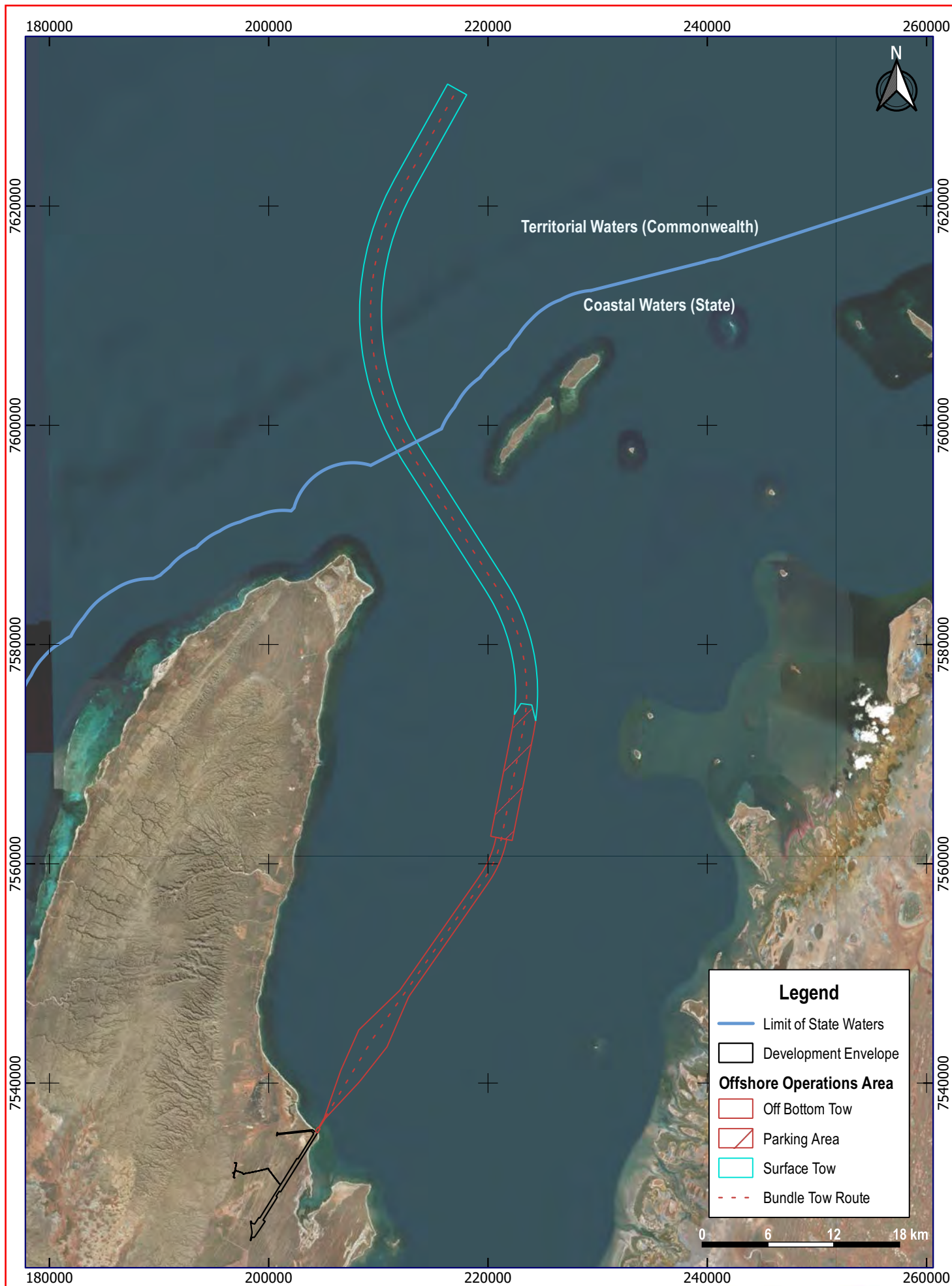
Subsea 7 proposes to build and operate a new pipeline Bundle fabrication site in Learmonth, Western Australia (the Proposal) (Figure 1).

The Proposal is to construct and operate a new pipeline fabrication facility, in order to build Bundles for the offshore oil and gas industry. A pipeline Bundle, used in the development of offshore gas fields, co-locates a number of services within a single pipeline, which is constructed onshore before being launched and towed offshore to the field under development.

The proposal includes the construction of a fabrication shed, where the Bundles will be constructed, a storage area where the Bundle materials will be stored prior to use, and two approximately 10 km long Bundle tracks along which each Bundle will be constructed and then launched. A Bundle launchway, crossing the beach and extending into the shallow subtidal area, will facilitate the launch of each Bundle.

The construction and operation of the Proposal has the potential to impact marine environmental quality within the immediate and surrounding areas, as follows:

- Temporary impacts to water quality during construction of the launchway through the release of fines, nutrients or contaminants from sediments or due to the release of fines from construction materials (quarry rock).
- Temporary impacts to water quality during Bundle launch and tow.
- Impacts to water and/or sediment quality in the event of a loss of control of the Bundle or support vessel (e.g. from a chemical spill).



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Grid: GDA 94 / MGA Zone 50

Notes: Data sourced from Subsea 7 (2018).

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Figure 1: Offshore Operations Area and Indicative Tow Route

1.2 STATE WATER QUALITY MANAGEMENT STRATEGY

The State Water Quality Management Strategy (Government of Western Australia 2004) provides for the establishment of environmental values and environmental quality objectives as the goals for environmental quality management to protect the environment from the effects of waste inputs and pollution.

The State Water Quality Management Strategy requires that thorough public consultation be undertaken to develop environmental values and environmental quality objectives prior to their submission to the Environmental Protection Authority (EPA) for review and endorsement, to guide environmental impact assessment and natural resources management.

The EPA has more recently published '*Technical Guidance - Protecting the Quality of Western Australia's Marine Environment*' (EPA 2016) to:

- Assist proponents to design fit-for-purpose modelling and monitoring programs to spatially define, assess and manage potential impacts of their proposal on marine environmental quality.
- Ensure proposals that have the potential to significantly affect marine environmental quality are described and assessed in a sound and consistent manner that demonstrates how the EPA's objective for the Factor 'marine environmental quality' will be met.

1.3 ENVIRONMENTAL QUALITY MANAGEMENT FRAMEWORK FOR EXMOUTH GULF

An Environmental Quality Management Framework (EQMF) provides an environmental quality management framework to protect the environmental values relevant to the local marine environment.

An EQMF is based on:

- Identifying Environmental Values (EVs).
- Establishing and spatially defining Environmental Quality Objectives (EQOs) that need to be maintained to ensure the associated Environmental Values are protected.
- Monitoring and managing to ensure the EQOs are achieved and/or maintained in the long-term in the areas they have been designated.
- Establishing Environmental Quality Criteria (EQC), which are quantitative benchmarks against which monitoring results can be compared.

There are two levels of EQC:

- Environmental Quality Guidelines (EQGs) are quantitative, investigative guidelines which signify low risk of an environmental effect if they are met, and trigger further investigations if an exceedance occurs.
- Environmental Quality Standards (EQSs) are management guidelines based on multiple lines of evidence, which if exceeded signify that the Environmental Quality Objective is not being met and that a management response is required.

The EPA (2018) has identified the *'Pilbara Coastal Water Quality Consultation Outcomes: Environmental Values and Environmental Quality Objectives'* (DoE 2006) as the existing EQMF for the region.

The *'Pilbara Coastal Water Quality Consultation Outcomes: Environmental Values and Environmental Quality Objectives'* (DoE 2006) has also been identified as the EQP for the broader region (EPA 2016).

1.3.1 Environmental Values

The waters from Exmouth Gulf to Cape Keraudren and the biota they support are highly valued by the community for active and passive recreational opportunities and because they provide economic value by supporting commercial fishing, aquaculture, and tourism industries.

In 2004 the Department of Environment (DoE) ran a planned and targeted public consultation process to obtain comment on environmental values, environmental quality objectives and how they should be applied geographically within the State marine waters from Exmouth Gulf to Cape Keraudren. The resulting report, the *'Pilbara Coastal Water Quality Consultation Outcomes: Environmental Values and Environmental Quality Objectives'* (DoE 2006) recommends the Levels of Ecological Protection (LEPs) from the outlined interim Environmental Values (EVs) and Environmental Quality Objectives (EQOs) agreed upon during consultation.

To sustain recreational activities, commercial fishing, aquaculture, and tourism industries, four of the five EVs that the EPA generally expects to be protected throughout Western Australia's coastal waters are expected to apply (*Industrial Water Supply* excluded), as follows:

- Ecosystem health.
- Fishing and aquaculture.
- Recreation and aesthetics.
- Cultural and spiritual.

1.3.2 Environmental Quality Objectives

Table 2 outlines the EQOs associated with the four EVs (DoE 2006).

Environmental Values	Environmental Quality Objectives
Ecosystem Health (ecological value)	<p>EQO1:</p> <p>Maintain ecosystem integrity at a:</p> <ul style="list-style-type: none"> • Maximum level of ecological protection. • High level of ecological protection. • Moderate level of ecological protection. • Low level of ecological protection. <p>This means maintaining the structure (e.g. the variety and quantity of life forms) and functions (e.g. the food chains and nutrient cycles) of marine ecosystems.</p>
Fishing and Aquaculture (social use value)	<p>EQO2: Seafood (caught or grown) is of a quality safe for eating</p> <p>EQO3: Water quality is suitable for aquaculture purposes.</p>
Recreation and Aesthetics (social use value)	<p>EQO4: Water quality is safe for primary contact recreation (e.g. swimming and diving)</p> <p>EQO5: Water quality is safe for secondary contact recreation (e.g. fishing and boating)</p> <p>EQO6: Aesthetic values of the marine environment are maintained</p>
Cultural and Spiritual (social use value)	<p>EQO7: Cultural and spiritual values of the marine environment are protected.</p>

Table 2: Environmental Values and Environmental Quality Objectives for the marine waters of Exmouth Gulf

1.3.3 Levels of Ecological Protection

The Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC & ARMCANZ 2000) recognises and provides guidelines for three levels of ecological protection: undisturbed; slightly to moderately disturbed; and highly disturbed.

These have been adapted into the four LEP that apply to WA coastal waters (EPA 2016):

- Maximum (levels of contaminants and other measures of quality remain within limits of natural variation (no detectable changes)).
- High (small detectable changes beyond limits of natural variation but no resultant effect on biota)
- Moderate (moderate changes beyond limits of natural variation but not to exceed specified criteria).
- Low (substantial changes beyond limits of natural variation).

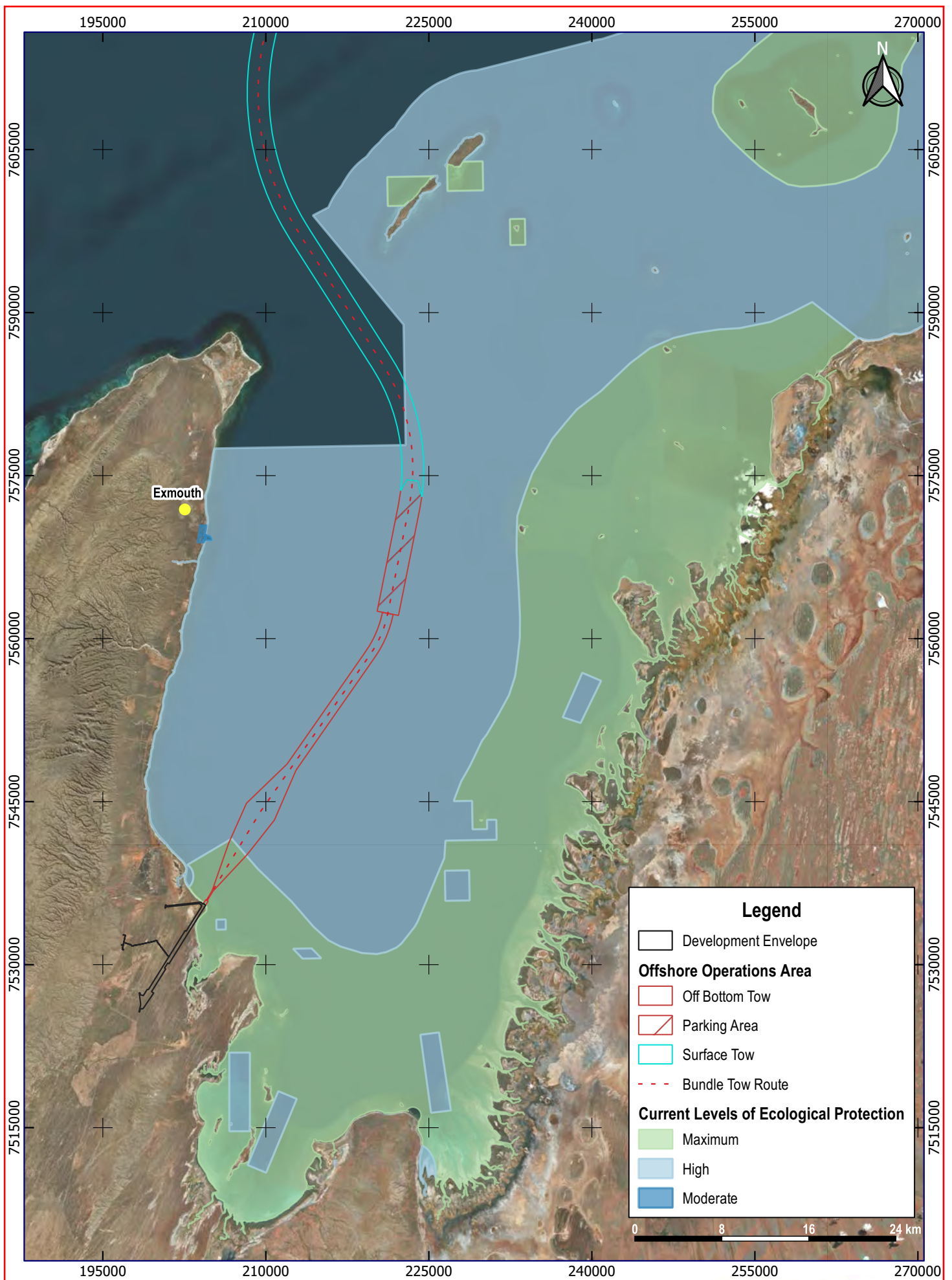
A maximum LEP has been set for waters along the southern and eastern margins of Exmouth Gulf. The majority of the remained of Exmouth Gulf waters have been designed a high LEP, with small areas surrounding aquaculture leases designated a moderate LEP (Figure 2).

1.3.4 Environmental Quality Criteria

No EQC have formally been developed for the region.

For most environmental quality indicators, the approach adopted for comparing monitoring data with the EQG and determining when a significant and unacceptable change has occurred, is consistent with ANZECC & ARMCANZ (2000).

For physical stressors, such as turbidity or total suspended sediment (TSS), the approach for high ecological protection areas (the majority of Exmouth Gulf) is to compare the median of the test-site data (or modelled impact data) with the 80th percentile of the unimpacted reference distribution (EPA 2017). For maximum ecological protection areas no changes beyond natural variation in ecosystem processes, biodiversity, abundance and biomass of marine life or in the quality of water sediment and biota are permitted.



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 Aerial Photo: ESRI Satellite
 Grid: GDA 94 / MGA Zone 50

Notes: Data sourced from EPA (2018). Maximum level of Ecological Protection areas the same as those identified by CALM as 'Recommended for Reservation (1994)'.

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Figure 2: Levels of Ecological Protection in Exmouth Gulf

2. ECOSYSTEM HEALTH

2.1 OBJECTIVE OF EQ01

Four levels of ecological protection (LEP) are defined for ecosystem integrity, based on whether a low, moderate, high or maximum LEP applies (Table 3).

Level of Ecological Protection	Definition
Low	Allows large changes in abundance to marine life, biodiversity and rates of ecosystem processes, but only within a confined area.
Moderate	Applied to relatively small areas within inner ports and adjacent to heavy industrial premises where pollution from current and/or historical activities may have compromised a high level of ecological protection.
High	Allows for small measurable changes in the quality of water, sediment and biota, but not to a level that changes ecosystem processes, biodiversity or abundance and biomass of marine life beyond the limits of natural variation.
Maximum	Activities to be managed so that there were no changes beyond natural variation in ecosystem processes, biodiversity, abundance and biomass of marine life or in the quality of water sediment and biota.

Table 3: Levels of ecological protection

2.2 IMPACT PREDICTIONS

2.2.1 Launchway construction

Temporary impacts to water quality (turbidity) are expected immediately adjacent to the launchway during construction, with potential short-term and reversible impacts to Benthic Communities and Habitat (BCH) within 50 m of the construction footprint (Figure 3) (refer also to the Marine Construction Monitoring and Management Plan). Long-term ecosystem processes, biodiversity, abundance and biomass of marine life or the quality of water sediment and biota are not expected to be impacted. The current Maximum and High LEP will be met.

2.2.2 Bundle launch and tow

Temporary impacts to water quality (turbidity) are expected immediately adjacent to the Bundle tow route during a Bundle launch due to the Bundle chains. Ballast chains are attached at intervals along the length of the Bundle to provide stability control during the launch and lift during the offshore Controlled Depth Tow Method (CDTM) tow out to the production field. Typically the ballast chains that hang beneath the Bundle vary between short and long lengths, with the longer Bundle chain lengths expected to have some contact (4-5 links) with the seabed along the length of the tow route out to the Bundle parking area (approximately 30 km).

Modelling of the turbidity associated with a Bundle launch was completed, and the predicted median depth-averaged turbidity over 24 hours compared to the 80th percentile of baseline data (RPS 2019). The 80th percentile of baseline TSS was calculated to be 4.10 mg/L, based on the conservative (worst-case) use of the average baseline turbidity measured at a site 2 km offshore along the tow route. In both the flood-tide and ebb-tide launch cases,

the threshold (or EQG) was forecast to be exceeded in a zone mainly confined to the shallowest half of the Bundle tow route and its surroundings (Figure 4). Areas of BCH within this zone (predominantly 'Soft sediment' with some 'Reef with macroalgae and filter feeders', 'Soft sediment with filter feeders' and 'Seagrass') are expected to be tolerant to short-term increases in turbidity (as occur naturally) and temporary minor changes in environmental quality are considered unlikely to result in a detectable impact on benthic biota. The current Maximum and High LEP will be met.

2.2.3 Chemical leak or spill

The Bundle pipelines can be split in two categories, the internal pipelines, and the outside carrier pipe that sleeves the internal pipelines. The internal Bundle pipelines are designed for high-pressure, high-temperature environments, and therefore have a pipe wall thickness and design strength much higher than what is required for the Bundle launch and tow. The carrier pipe is designed to physically protect these internal pipelines, provide an environmental barrier, and transfer the loads from the launch and tow from the towheads, dissipating these forces along the length of the Bundle.

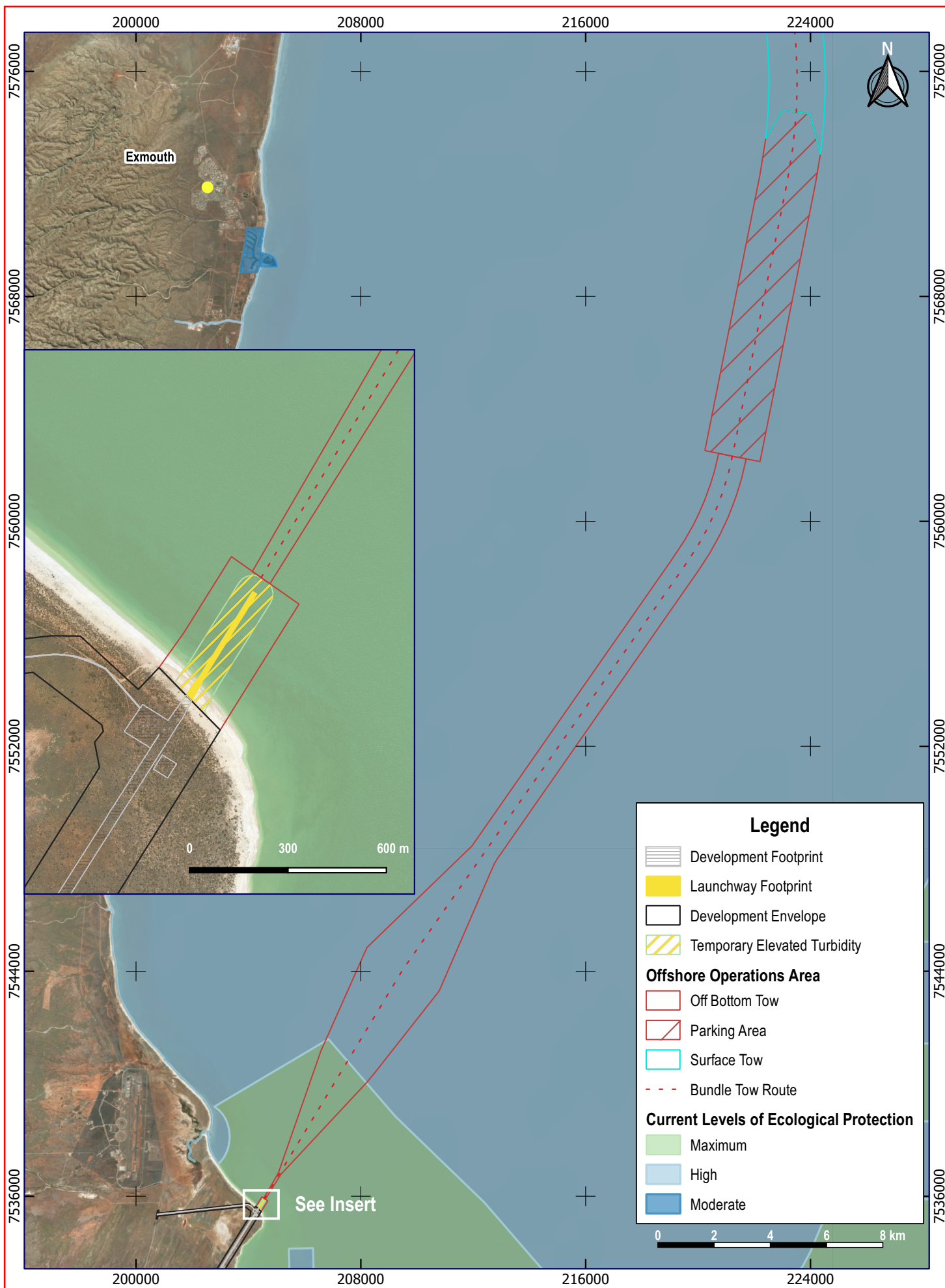
All fabrication processes of the internal pipelines and the carrier pipe sections are subject to extensive material selection, production and testing criteria, in accordance to a number of Subsea 7 and industry standards. The risk of material damage or loss of containment of the internal pipelines is considered to be low, due to the high-pressure design and the regulated control of the fabrication process. The risk of material damage or failure of the carrier pipe, that has a lower strength capacity than the internal pipelines, is also considered as low.

The Bundle pipeline will contain no hydrocarbons during fabrication, launch and tow activities. The carrier pipe will be charged with nitrogen gas, and this allows the Bundle to be positively buoyant during the tow. The carrier pipe will contain solid chemical packs, designed to dissolve in the seawater that floods the carrier pipe once the Bundle is in the final position offshore. These chemical packs create a non-corrosive environment for the internal pipelines.

Material damage to the carrier pipe, leading to a leak would result in a release of nitrogen gas. The carrier pipe internal pressure is monitored during the launch and tow, and any change in pressure will be immediately reported. Such a leak would result in the Bundle becoming positively buoyant (as the weight of nitrogen is reduced) and it would rise to the water surface. If left untreated, the carrier pipe could eventually take on enough seawater to cause the Bundle to become negatively buoyant and sink (depending on the extent of the damage). The seawater within the carrier pipe would mix with the solid chemical packs, but any discharge would be limited and localised. Significant impacts to water or sediment quality are considered extremely unlikely. The current Maximum and High LEP will be met.

2.3 PROPOSED MANAGEMENT BOUNDARIES

Given the limited spatial extent and severity of the turbidity generated, the short-term nature of the turbidity generating activity and the lack of adjacent sensitive BCH, no impact to ecosystem processes, biodiversity, abundance and biomass of marine life or the quality of water sediment and biota is expected, and no change to the LEP is proposed. This approach is consistent with that applied to other projects causing short-term and reversible impacts to marine environmental quality associated with marine construction programmes (e.g. the designation of the shipping channel and dredge disposal areas for Anketell Port as areas of high protection (Ministerial Statement 930) and the Onslow Marine Support Base Harbour Approach Channel as an area of high protection (Ministerial Statement 1077)).



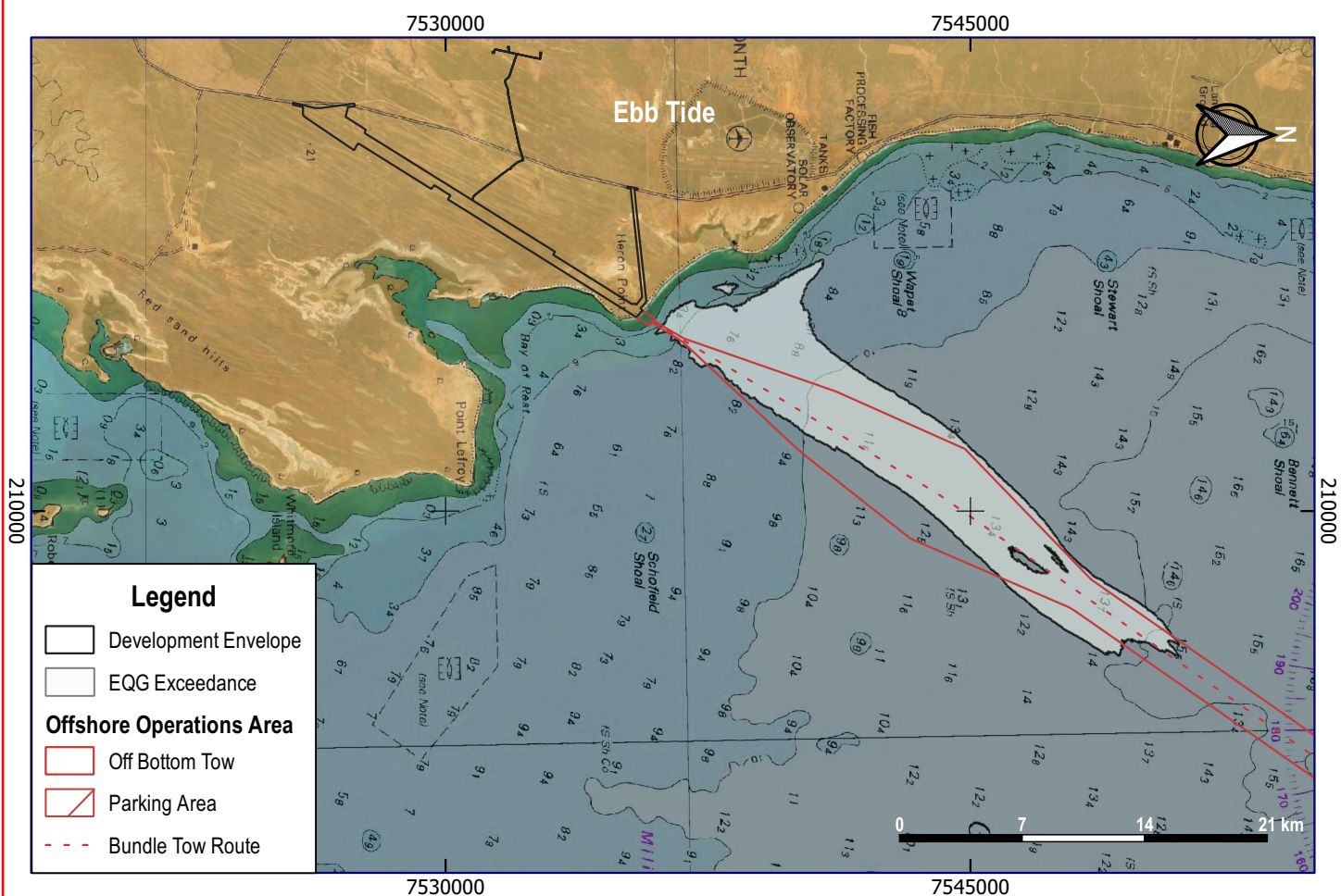
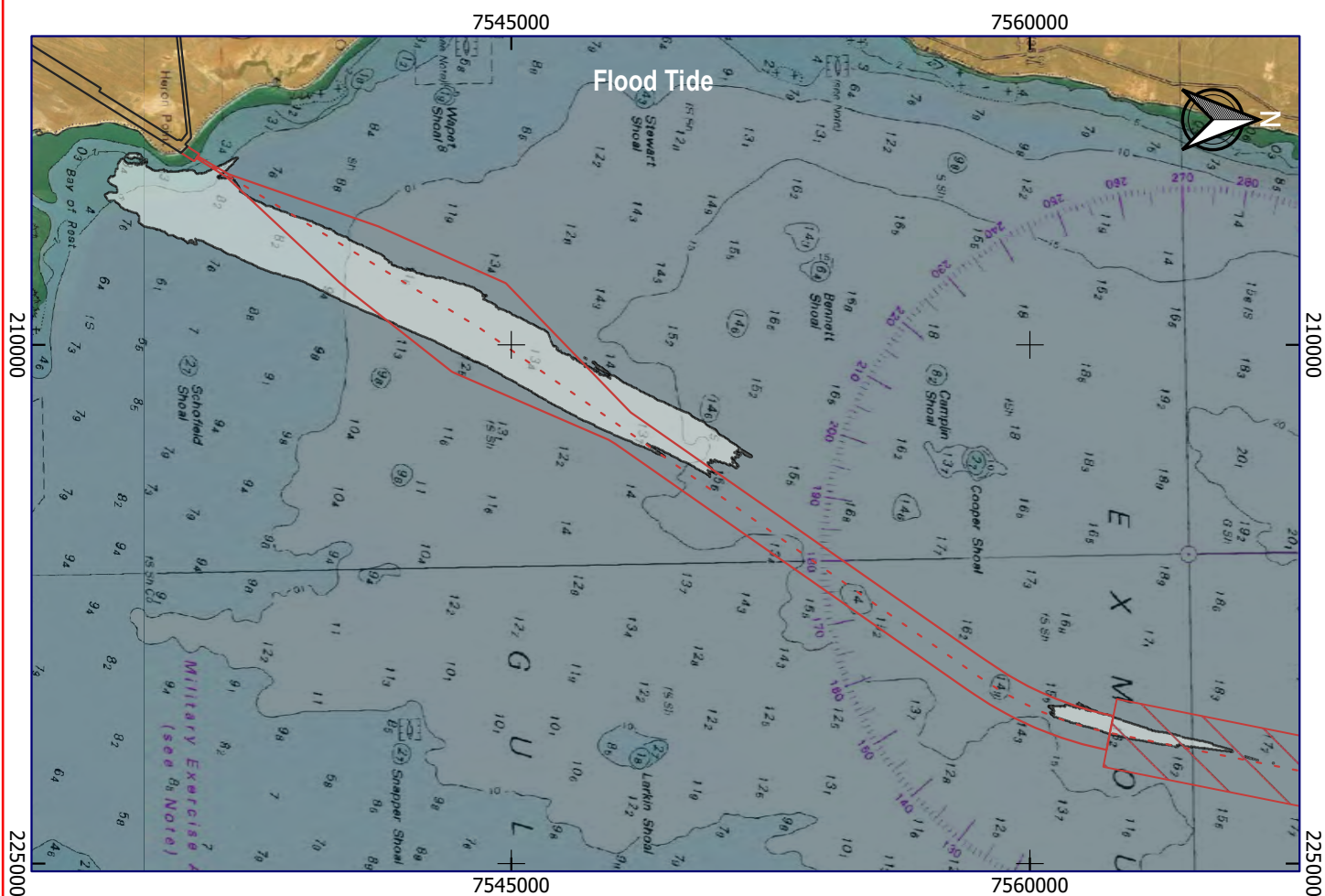
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 Grid: GDA 94 / MGA Zone 50

Notes: Data sourced from EPA (2018). Maximum level of Ecological Protection areas the same as those identified by CALM as 'Recommended for Reservation (1994).

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Figure 3: Zone of Potential Temporary Impacts to Water Quality (Turbidity) during Launchway Construction



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Aerial Photo: ESRI Satellite
Grid: GDA 94 / MGA Zone 50

Notes: Data sourced from Commonwealth of Australia (2018) and RPS (2019).

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Figure 4: Modelled Exceedance of EQG for the Maintenance of Ecosystem Health During Bundle Launch and Tow

3. FISHING AND AQUACULTURE

3.1 OBJECTIVES OF EQ02 AND EQ03

Two objectives relate to the Environmental Value of Fishing and Aquaculture (Table 4).

Environmental Value	Environmental Quality Objectives
Fishing and Aquaculture	EQ02: Seafood (caught or grown) is of a quality safe for eating.
	EQ03: Water quality is suitable for aquaculture purposes.

Table 4: Environmental Quality Objectives

3.2 IMPACT PREDICTIONS

There is negligible potential for the quality of seafood to be compromised by the construction of the launchway or launching of Bundles given the lack of sediment contamination in the areas likely to be disturbed and the absence of any wastewater discharges.

A recent study (Wenger et al. 2018) was undertaken to assess the potential vulnerability of coastal fish and fisheries to dredging activities on a global scale. The study included the development of threshold reference values for suspended sediment. Threshold reference values required to protect 99% of species from either physical damage or lethal impacts from suspended sediment were relatively similar, ranging from 4 to 9 mg/L, respectively. Among all life history stages, there was a clear relationship between suspended sediment concentration and exposure duration. For example, exposure of larvae to concentrations up to 60 mg/L did not have a lethal impact until after 24 hours (Wenger et al. 2018).

To assess the risk of impact to aquaculture, and wild fish populations, from the generation of elevated turbidity during a Bundle launch, the modelled turbidity was compared to the threshold value necessary for the protection of 80% of fish species from physical damage (Wenger et al. 2018). The area within which potential impacts to fish could occur during Bundle launch and tow was modelled against a potential impact threshold of 'average TSS concentration over 24 hours exceeds 60 mg/L'. Under both flood-tide and ebb-tide launch scenarios the threshold was not exceeded at any time (RPS 2019).

Aquaculture in northwestern Australia is dominated by the production of South Sea pearls from the pearl oyster (*Pinctada maxima*). A number of licences are currently held within Exmouth Gulf. Effects of suspended sediments can include abrasion and clogging of gills, impaired respiration, clogging of filter mechanisms, and reduced feeding and pumping rates. Decreased growth rates in epifauna species experimentally exposed to suspended sediment have been reported (Lawrence 1993), although other reports claim that effects are generally small (Mackin 1961, Saila et al. 1972). Studies have shown that the pearl oyster (*Pinctada maxima*) can adapt and survive under a wider range of suspended particle loads and still show positive scope for growth under 30 to 40 mg/L of suspended particulate matter (Yukihira et al. 1999). Given the limited spatial extent of elevated TSS concentrations, the short-term nature and low frequency of the Bundle launch activities (up to two days, up to three times a year) negligible impacts to any oyster culture operations are expected. The current Maximum and High LEP will be met.

3.3 PROPOSED MANAGEMENT BOUNDARIES

Temporary impacts to water quality (turbidity) are expected immediately adjacent to the launchway (50 m) during construction, and immediately adjacent to the Bundle tow route during a Bundle launch, but the growth and/or harvesting of seafood within these areas will not be impacted. No change to the current management boundaries is proposed.

4. RECREATION AND AESTHETICS

4.1 OBJECTIVES OF EQ04, EQ05 AND EQ06

Three objectives relate to the Environmental Value of Recreation and Aesthetics (Table 5).

Environmental Value	Environmental Quality Objectives
Recreation and Aesthetics	EQ04: Water quality is safe for primary contact recreation (e.g. swimming and diving).
	EQ05: Water quality is safe for secondary contact recreation (e.g. fishing and boating).
	EQ06: Aesthetic values of the marine environment are protected.

Table 5: Environmental Quality Objectives

4.2 IMPACT PREDICTIONS

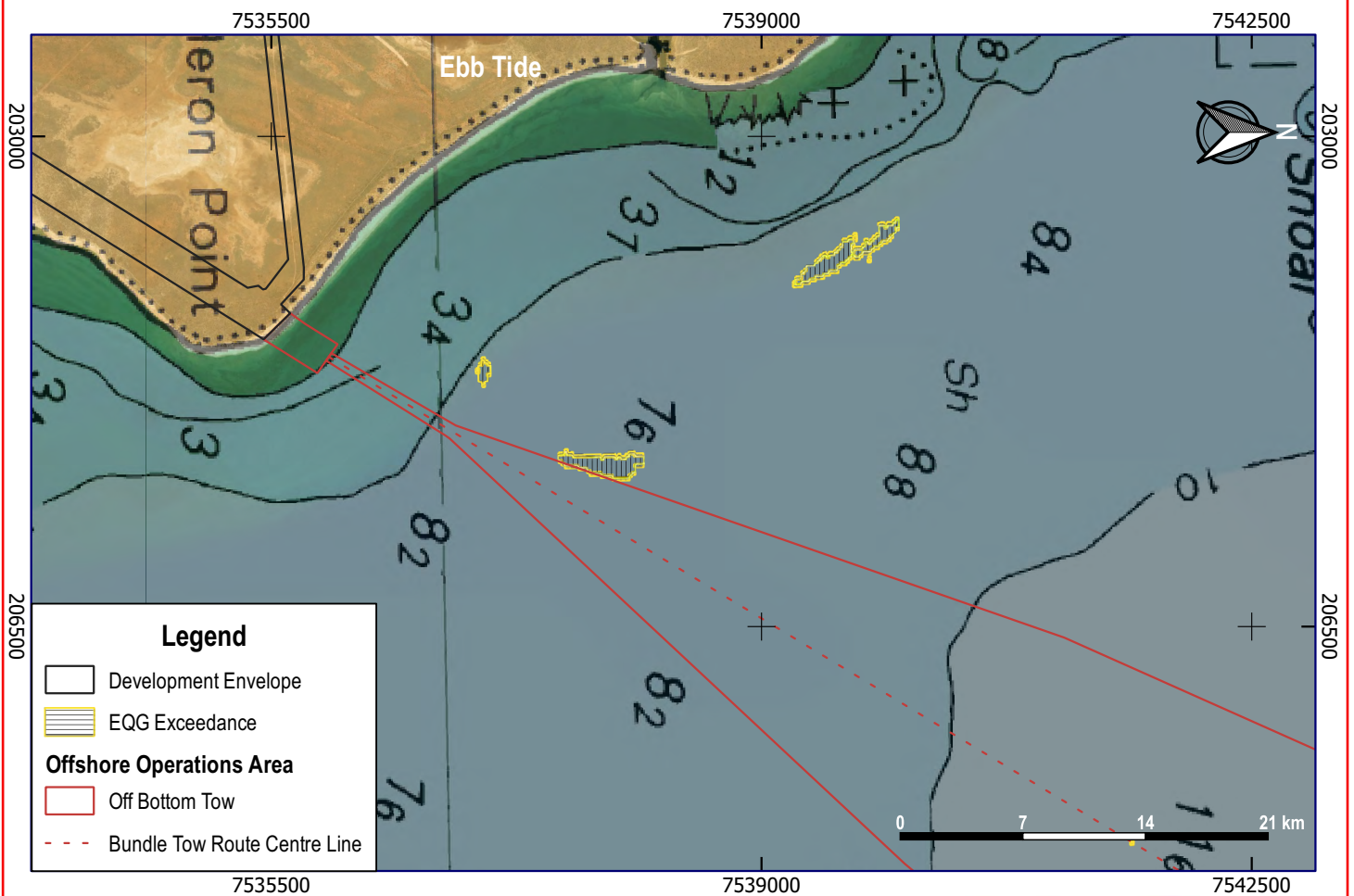
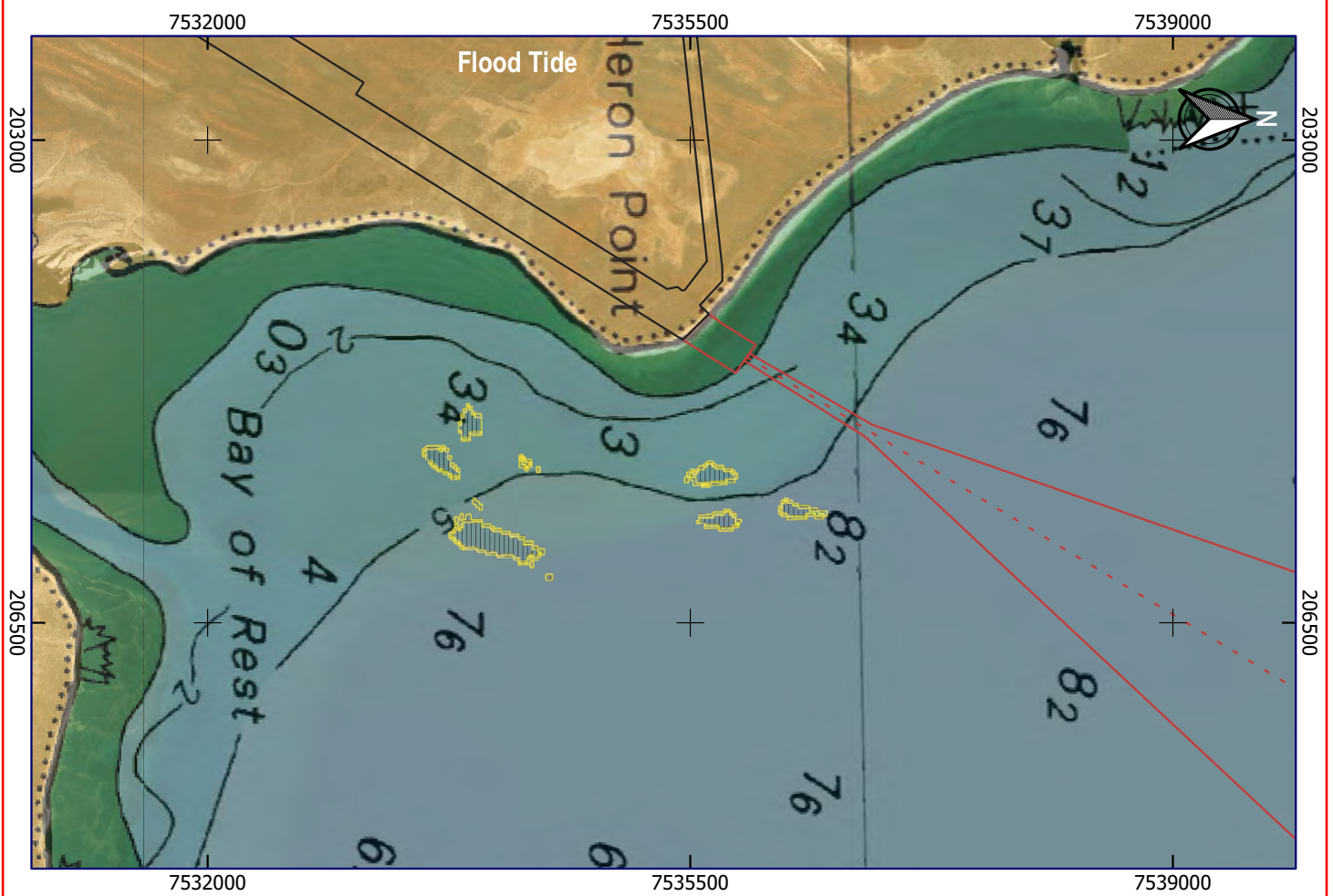
There is negligible potential for the water quality to become unsafe for primary or secondary recreation given the absence of any wastewater discharges.

Temporary impacts to water quality (turbidity) are expected immediately adjacent to the launchway during construction. Water quality beyond 50 m of the construction footprint will remain within natural variation.

Temporary impacts to water quality (turbidity) are expected immediately adjacent to the Bundle tow route during a Bundle launch. Sediment fate modelling was completed to predict the magnitude and extent of visible turbidity generated during a Bundle launch and tow. The threshold used to assess potential impacts to the environmental value of 'Recreation and Aesthetics (social use value)' was '20% (or greater) increase in turbidity in the top 6 m of the water column'. In both the flood-tide and ebb-tide launch cases, the threshold (or EQG) for aesthetic quality was forecast to be exceeded only in isolated patches near the launch site, with the location of the exceedances dependent on the tidal state at launch time (Figure 5). Thus a significant impact to recreational users of Exmouth Gulf, from an aesthetic point of view, is not expected. The current Maximum and High LEP will be met.

4.3 PROPOSED MANAGEMENT BOUNDARIES

Given the limited spatial extent and severity of the turbidity generated, the short-term nature of the turbidity generating activity and the lack of recreational activities in the construction and operational areas during the turbidity-generating works (due to safety issues), no change to the LEP is proposed.



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Aerial Photo: ESRI Satellite
Grid: GDA 94 / MGA Zone 50

Notes: Data sourced from Commonwealth of Australia (2018) and RPS (2019).

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Figure 5: Modelled Exceedance of EQG for Maintenance of Recreation and Aesthetics During Bundle Launch and Tow

5. CULTURAL AND SPIRITUAL VALUES

5.1 OBJECTIVES OF EQ07

The EQO to protect cultural and spiritual values applies to Aboriginal cultural and spiritual values.

In the absence of any specific environmental quality requirements for protection of this value it is assumed that if water quality is managed to protect ecosystem integrity, primary contact recreation, the quality seafood for eating and maintain aesthetic values, then this may go some way toward maintaining cultural values (EPA 2016).

5.2 IMPACT PREDICTIONS

Temporary impacts to water quality (turbidity) are expected immediately adjacent to the launchway during construction. Water quality beyond 50 m of the construction footprint will remain within natural variation.

Temporary impacts to water quality (turbidity) are expected immediately adjacent to the Bundle tow route during a Bundle launch due to the Bundle chains. Modelling of the turbidity associated with a Bundle launch indicated that the threshold (or EQG) for ecosystem health was forecast to be exceeded in a zone mainly confined to the shallowest half of the Bundle tow route and its surroundings (Figure 4). Significant impacts to primary contact recreation, seafood quality and aesthetic values are not expected. The current Maximum and High LEP will be met.

5.3 PROPOSED MANAGEMENT BOUNDARIES

Given the limited spatial extent and severity of the turbidity likely to be generated during construction and operations and the lack of impact on cultural and spiritual values, no change to the LEP is proposed.

6. REFERENCES

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