ENVIRONMENTAL IMPACT STATEMENT

TO ACCOMPANY Draft No. 4

To D'Entrecasteaux Channel MFDP 2002

A request to:

AMEND ZONE 18B

AS PRESCRIBED BY THE D'ENTRECASTEAUX CHANNEL MARINE FARMING DEVELOPMENT PLAN FEBRUARY 2002

Prepared By:

tassal®

QUICK & HEALTHY TASMANIAN SALMON

Glossary

AGD	Amoebic Gill Disease
ASC	Aquaculture Stewardship Council
BAP	Best Aquaculture Practices
BEMP	Broadscale Environmental Monitoring Program
CAMBA	China-Australia Migratory Bird Agreement
DO	dissolved oxygen
DPIW	Department of Primary Industries and Water
DPIPWE	Department of Primary Industries, Parks, Water and the Environment
EIS	Environmental Impact Statement
EPA	Environmental Protection Authority
EPBCA	Environmental Protection and Biodiversity Conservation Act 1999
FCR	Feed Conversion Ratio
GAA	Global Aquaculture Alliance
HAB	Harmful Algal Bloom
HOG	head on gutted
IMAS	Institute of Marine and Antarctic Studies
JAMBA	Japan-Australia Migratory Bird Agreement
MAST	Marine and Safety Tasmania
MFDP	Marine Farming Development Plan
MFPA	Marine Farming Planning Act 1995
MIC	Marine Inspector Cleaner
ppm	parts per million
ppt	parts per thousand
RSPCA	Royal Society for Prevention of Cruelty to Animals
ROKAMBA	Republic of Korea-Australia Migratory Bird Agreement
ROV	remote operated vehicle
SCUBA	Self Contained Underwater Breathing Apparatus
TARFish	Tasmanian Association for Recreational Fishing
TPDNO	Total Permissible Dissolved Nitrogen Output
TSPA	Threatened Species Protection Act
WH&S	workplace health and safety
WIP	Wildlife Interaction Plan
WWF	World Wildlife Fund for Nature

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2 Executive Summary

2.1 Introduction

This executive summary focuses on the most material items contained in the following Environmental Impact Statement (EIS); it is not a comprehensive summary of all sections and should not be a substitute for reviewing the entire document.

Tassal is a vertically integrated company that includes freshwater hatcheries, saltwater aquaculture, processing and value adding, and retail outlets. Tassal is committed to being the industry leader in sustainable aquaculture production in Australia and currently produces approximately 24 000 T of Atlantic salmon (*Salmo salar*) per annum in Tasmania. Tassal is the largest producer of Atlantic salmon in Australia and is a publicly listed company on the Australian Stock Exchange. Tassal employs over 800 staff, over 90% of whom are based in Tasmania.

The Tasmanian Government is supportive of the need to investigate the potential for new marine farming areas for possible further aquaculture expansion in the medium term. This is an approach that is consistent with Tassal's 'South East Optimisation Program'.

This document will cover the proposed amendment to Zone 18B within the D'Entrecasteaux Channel MFDP - the second amendment in Tassal's 'South East Optimisation' process.

As part of Tassal's ongoing commitment to environmental and social best practice, the company recently gained Global Aquaculture Alliances Best Aquaculture Practices (BAP) certification of its Marine Farming Operations and its Primary Processing Facility.

Tassal is in the second year of a partnership with WWF Australia (World Wildlife Fund for Nature), underpinning Tassal's mission to continue to improve environmental practices throughout its operations.

Feed input to the D'Entrecasteaux Channel and Huon Estuary is regulated by a government enforced total permissible dissolved nitrogen output (TPDNO) for each area (D'Entrecasteaux Channel and Huon & Port Esperance Marine Farming Development Plan [MFDP] Areas respectively). The proposed amendment will not compromise Tassal's ability to comply with either of these caps.

2.2 Proposed Amendment Description

The Huon Farming Region comprises of three smolt leases (Butlers Point – the subject of this proposed amendment - Brabazon Point and Killala Bay), and two grow out leases (Tin Pot Point and Partridge Island) in Great Taylors Bay (see maps in Appendix 2).

Killala Bay and Brabazon Point are sheltered shallow sites in the Huon Estuary that are subject to naturally occurring high levels of organic loading, making them more sensitive to organic impacts derived from fish-farming activities. The purpose of this amendment is to increase capacity at Butlers Point marine lease to allow greater fallowing options, improving fish performance, fish health and the management of environmental impacts.

The proposed amendment would:

- add 10 cage pen bays to the lease area

- add approximately 18.5 ha to the current lease area
- add approximately 93 ha to the zone area
- allow flexibility to annually fallow one of the two Huon Estuary sites, and
- move the lease approximately 150 m offshore to the northeast.

2.3 Stakeholder Consultation

Tassal has developed a stakeholder engagement program (SEP) to ensure that there are opportunities for communities, interest groups and other stakeholders to be engaged in a range of consultative processes and discussions in relation to the proposed amendment at Butlers Point. Details of the program are outlined in Section 4. The ongoing strategy assists in raising community awareness and identifies issues and concerns. Previous stakeholder engagement has provided information that has also assisted in the development of this proposal, and it is anticipated that the formal lodging of this EIS will prompt further dialogue and consultation with key stakeholder groups and individuals who may wish to make representations regarding particular aspects.

2.4 Existing Environment

The proposed zone and lease are located in the waters of Great Taylors Bay on the north east coast of the Labillardiere Peninsula. This is located on southern Bruny Island and within the D'Entrecasteaux Channel MFDP Area.

The Butlers Point lease is dominated by saline oceanic waters with some freshwater influences from the Huon River system.

An assessment of the proposed zone undertaken by IMAS in 2013 found the area to range in depth from 20-25 m and to be largely dominated by sandy substrates, (see Appendix 7). The survey assessment area of approximately 2 km^2 (which is larger than the proposed zone) was comprised mostly of sand habitat (95.58%) with a fringing reef to the inshore edge covering the remaining 0.09 km^2 (4.42 %). There was no reef coverage within the proposed zone area.

There are no marine reserves within the Great Taylors Bay area.

Typical marine and coastal recreational activities occur in and around the Great Taylors Bay area.

The majority of the land-based tourism in the immediate vicinity of the proposed zone occurs in and around the South Bruny National Park.

2.5 Potential Effects and Their Management

The proposed development intends to build upon Tassal's existing record of environmental compliance within the Huon Farming Region.

The impact of increased feed input at the proposed lease is expected to result in minor environmental impacts to water quality, restricted to localised areas within and around the lease boundary. These impacts are not anticipated to result in significant or adverse effects to the water quality characteristics of the D'Entrecasteaux Channel or Great Taylors Bay. Increased feed inputs into the proposed Butlers Point lease will remain within Tassal's regulatory TPDNO for the D'Entrecasteaux Channel MFDP Area.

The proposed amendment will have a localised impact on a greater area of seabed under the proposed Butlers Point lease due to the proposed increase in the maximum leasable area to cater for an additional 10 cages. These impacts are not anticipated to result in unacceptable or adverse effects to the sediment condition beneath cages and within the proposed lease area.

As previously stated in 2.2, the proposed amendment will allow for improved fallowing options, leading to better fish health and enhanced farm performance in the Huon Farming Region. The proposed offshore shift of the lease is also expected to result in improved water flows, leading to greater dilution and dispersal of farm derived emissions.

With the company's transition to Kikko design nets across a number of farming regions in the past two years, net cleaning activities have declined by two thirds. As Kikko nets are phased in at this site, net cleaning frequency is expected to show a similar decrease; related emissions derived from this activity are also expected to decrease. An additional benefit from the transition to Kikko nets is a decrease in rope usage; the inbuilt weighting system of the net results in a decrease of 1.4 km of rope required to configure one pen. This equates to a potential reduction of up to 28.8 km of rope for the proposed lease at Butlers Point.

While there are no reef habitats within the proposed lease area, marine vegetation on adjacent fringing reef has the potential to be influenced by soluble nutrients arising from fish farm activities. Such impacts are expected to be localised (i.e. between 100 m to 400 m from the lease boundary) and limited to increased abundance of opportunistic species (filamentous and other opportunistic green algae). Given that the vegetation communities described from the adjacent fringing reef are limited in extent and considered typical of sheltered water habitats in the southern D'Entrecasteaux Channel, the proposed amendment is not expected to result in any significant environmental effects on marine vegetation communities within the broader southern D'Entrecasteaux Channel and Great Taylors Bay region, The proposed amendment area is also situated in a more exposed location, which will result in improved dilution and dispersion of soluble emissions.

A number of listed threatened and migratory species (under the Environmental Protection and Biodiversity Conservation Act [EPBCA] and Threatened Species Protection Act [TSPA]) are known to occur within the proposed zone, and surrounding areas. An assessment of the known risks to these species has been carried out and indicated that the proposed amendment does not pose any significant impact to these species or require additional mitigation measures to be implemented.

Birds potentially can have a negative impact on salmon farming operations due to predation of farmed salmon and pose a potential biosecurity risk. Marine farms can have general impacts on birds ranging from habitat modification to entanglement. Tassal has stringent bird protocols with an aim of mitigating interactions around its marine farms. Tassal maintains bird monitoring data for each of their farming regions, and publicly reports these interactions annually in its Sustainability Report. The Huon Farming Region, with the assistance of Tassal's dedicated Wildlife Officer and resultant improved practices, has not had a bird entanglement in exclusion netting for the duration of farming operations at the existing Butlers Point lease.

Seals have been interacting with fish farms in Tasmania for more than 25 years and are common in the Huon Farming Region. It is considered that seal interactions will continue to occur at the proposed Butlers Point lease and will be managed through active exclusion measures. As with the bird monitoring, interactions with seals are publicly reported in Tassal's annual Sustainability Report.

Tassal's Wildlife Interaction Plan encompasses bird and marine mammal management strategies for all Tassal operations. Tassal has incorporated the management of these, and other key environmental issues into its Environmental Management Systems (EMS) framework.

Relatively few chemicals are used at Tassal's marine sites. Tassal ceased using antifoulants on netting in the Huon Farming Region in 2010; antifouled nets have never been used at the Butlers Point lease. The main chemicals used on site are fuels, cleaning agents and disinfectants. Procedures have been implemented to manage the use of all chemicals, prevent spills and respond to incidents should they occur, including the effective use of onsite spill kits.

Tassal maintains records of escape events for all of its Marine Farming Regions dating back to January 2000. Over this 14 year period there has been no significant escape event within the Great Taylors Bay region of the D'Entrecasteaux Channel MFDP Area. In 2012 Tassal developed and implemented an Escape Prevention and Response Protocol. Escapes due to this proposed amendment are not anticipated to occur and thus no impact is expected.

Amoebic Gill Disease is the main fish health issue in the Huon Farming Region, and is an industry wide issue that has periodic yet significant impacts on fish performance in south eastern Tasmania. It is proactively managed by Tassal through their program of continuous surveillance and freshwater bathing practices.

Harmful algal blooms (HAB) and jellyfish presence are monitored daily through algal trawls and associated observational on site surveillance. Salmon Orthomyxovirus (SOMV) has never been detected at the Butlers Point lease; however, the disease Yersiniosis has been detected in the last 12 months.

The addition of 10 cages to the site will create an increased visual impact, and a full visual assessment has been conducted and is included in this document. Tassal will ensure that all structures and nets comply with marine farming regulatory controls.

Following discussions with Marine and Safety Tasmania (MAST), navigation impacts are considered to be low and will be managed by regulatory lighting on the farm.

Noise impacts resulting from the proposed amendment are expected to be low. The two main sources of noise, freshwater bathing and net cleaning, are expected to occur less over time due to advances in the Selective Breeding Program and the rollout of Kikko nets, respectively. Coupled with these, there will also be a shift of farming operations approximately 150 m further offshore into Great Taylors Bay; moving noise making equipment further from the South Bruny National Park.

2.6 Conclusions

In conclusion this amendment is being proposed to support the sustainable ongoing operation of Tassal's Huon Farming Region. In Tassal's opinion this proposal creates minor additional impacts to the receiving environment while providing a material improvement in rearing capacity, and greater rotational fallowing options for its stock.

This amendment supports the sustainable development of Tassal's operations which in turn protects jobs and economic value on a regional and state level.

3 Proposed Amendment Description

3.1 Proposal Overview

3.1.1 Proponent Details

Tassal Operations Pty Ltd (Tassal), 20 Glen Road, Huonville TAS 7109.

Tassal is a vertically integrated company that includes freshwater hatcheries, saltwater aquaculture, primary processing and value adding. Tassal is committed to being the industry leader in sustainable aquaculture production in Australia. Tassal currently produces approximately 24 000 T of Atlantic salmon (*Salmo salar*) per annum, with all of the stock produced in Tasmania. Tassal is the largest producer of Atlantic salmon in Australia and is a publicly listed company on the Australian Stock Exchange.

Tassal is committed to the transparency of all its operations, and has voluntarily released two sustainability reports. This will continue on an annual basis; Tassal's third sustainability report will be available for public viewing early 2014. Tassal has certified all of its marine farming regions and its primary processing facility to Global Aquaculture Alliance's (GAA) Best Aquaculture Practices (BAP – see Appendix 1).

Tassal is in the second year of a partnership with WWF Australia (World Wildlife Fund for Nature). This partnership underpins Tassal's mission to continually improve environmental practices throughout its operations, with the company currently working towards certifying all operations to the Aquaculture Stewardship Council's ASC Standard.

Tassal currently holds licences in six marine farming regions in four different marine farming development plan (MFDP) areas within the State.

3.1.2 Proposed Development

This document will address the proposed amendment to Zone 18B - the second amendment in Tassal's 'South East Optimisation' process.

The existing Butlers Point lease sits within Zone 18B in Great Taylors Bay, South Bruny Island (Figure 3.2). The Butlers Point lease has been in its current location since it was commissioned in 1987 and is currently licensed to farm Atlantic salmon (see Appendix 3). Stocking at the Butlers Point lease commenced in March 2013, following submarine installation of a government granted freshwater pipeline to the site, when it became economically viable to rear smolt at this site.

The proposed amendment will provide for the extension of the Butlers Point lease by approximately 450 m to the north west, 100 m to the north east, and shift 150 m further offshore (accessing more exposed and deeper water). This would result in an increase in maximum leasable area (MLA) of 18.5 ha; from 10.01 ha to 28.5 ha.

Table 3.1 provides the dimensions for the current and proposed zone and lease at Butlers Point.

Table 3.1 Current and proposed zone and lease dimensions of Butlers Point lease

	Current (m)		Proposed (m)	
Lease	500	200	950	300
Zone	553	252	1525	700

Currently, the Butlers Point lease holds 10 pen bays; this proposed amendment seeks to increase this capacity to 20 pen bays.

To achieve this increase in lease size, an amendment is required for Zone 18B. The zone area would need to be increased from approximately 14.08 to 106.7 ha. This will:

- allow for an area of up to 290 m around the proposed lease to encompass the mooring system and define its position in Great Taylors Bay,
- provide scope for establishing a mooring system better suited to the prevailing north west through north east weather conditions, and
- provide longitudinal stabilisation to the proposed mooring system.

All surface infrastructure (e.g. sea cages) and stock will be housed exclusively within the proposed lease area, which complies with regulatory requirements.

Tassal's production in the Huon River & Port Esperance MFDP area and the D'Entrecasteaux Channel MFDP area is regulated by a limit on the amount of nitrogen released, based on the protein content contained in fish feed that can be introduced to a plan area in any rolling 12 month period.

Tassal intends to continue its production in the D'Entrecasteaux Channel MFDP area within the limits of this Total Permissible Dissolved Nitrogen Output (TPDNO) determined by the Secretary (DPIPWE). The proposed amendment will not result in an increase of fish numbers introduced to the Great Taylors Bay grow out leases (Partridge Island and Tin Pot Point marine farming leases within Zone 18A).

3.1.3 Rationale / Need for the Proposal

Tassal's Butlers Point marine farming Lease No. 109 is currently operated as part of the Huon Farming Region. This farming region consists of the active marine farming Lease Nos. 186 (Brabazon Point), 189 (Killala Bay), 185 (Tin Pot Point), and 203 (Partridge Island) (see Appendix 2).

Currently, Tassal uses three marine farming leases for the introduction of smolt to the Huon Farming Region. These leases are:

Lease No.	Location	Zone	Lease Area	MFDP
186	Brabazon Point (Huon Estuary)	3	12.5 ha	Huon River & Port Esperance
189	Killala Bay (Huon Estuary)	5	11.97 ha	Huon River & Port Esperance

109	Butlers Point (Great Taylors Bay)	18B	10.01 ha	D'Entrecasteaux Channel

From these smolt leases, juvenile salmon are transferred for the grow-out phase to the more exposed leases in Great Taylors Bay.

Smolt are introduced during March and April each year. These fish are grown until they reach 1 - 2 kg. During this initial growing period the fish are graded and split into further cages and eventually moved off the smolt leases to the grow-out leases at Great Taylors Bay between August and November each year.

The grow-out sites consist of:

Lease No.	Location	Zone	Lease Area	MFDP
185	Tin Pot Point (Great Taylors Bay)	18A	74.9 ha	D'Entrecasteaux Channel
203	Partridge Island (Great Taylors Bay)	18A	75 ha	D'Entrecasteaux Channel

The Huon Farming Region smolt leases are not all used simultaneously. Tassal routinely fallows sites depending on assessments of benthic health through routine environmental monitoring. The proposed amendment would allow fallowing of at least one lease per stocking cycle. For example, Killala Bay and the proposed Butlers Point lease could be stocked one year, allowing Brabazon Point to fallow. Rotational fallowing is beneficial to long term farming operations and sustainability; fallowing regimes are strictly dependent on benthic condition.

The proposed amendment supports the sustainable optimisation of the Huon Farming Region and Tassal's marine farming operations in the southern D'Entrecasteaux Channel area. The benefits include, but are not limited to:

- increased benthic and fish health for the farming region,
- increased biosecurity and risk management, resulting from greater segregation between stock in the southern D'Entrecasteaux Channel and the Huon Estuary, and
- extension of fallowing periods and sediment recovery times for smolt sites, resulting from more pen bay positions to both the site and the Huon Farming Region.

3.1.4 Anticipated Establishment Costs

Tassal will be required to purchase additional mooring infrastructure for the proposed amendment and repositioning of the lease. These costs are estimated to be approximately $5.34 million (see Table 3.2). This cost includes the movement of the existing herringbone mooring system, the additional mooring equipment for the increase of ten pen bays, the customisation of a purpose built feed barge, and the removal of any existing equipment from the decommissioned area of the retired lease area. Tassal intends to reuse as much existing infrastructure as possible.

Table 3.2 Approximate costs predicted with the proposed amendment

Item/Infrastructure	Cost
Pens	$800, 000
Nets	$465,000
Bird Net Stands	$91,000
Moorings	$184,000
Feed Barge	$2,000,000
Feed System	$1,700,000
Total	$3,340,000

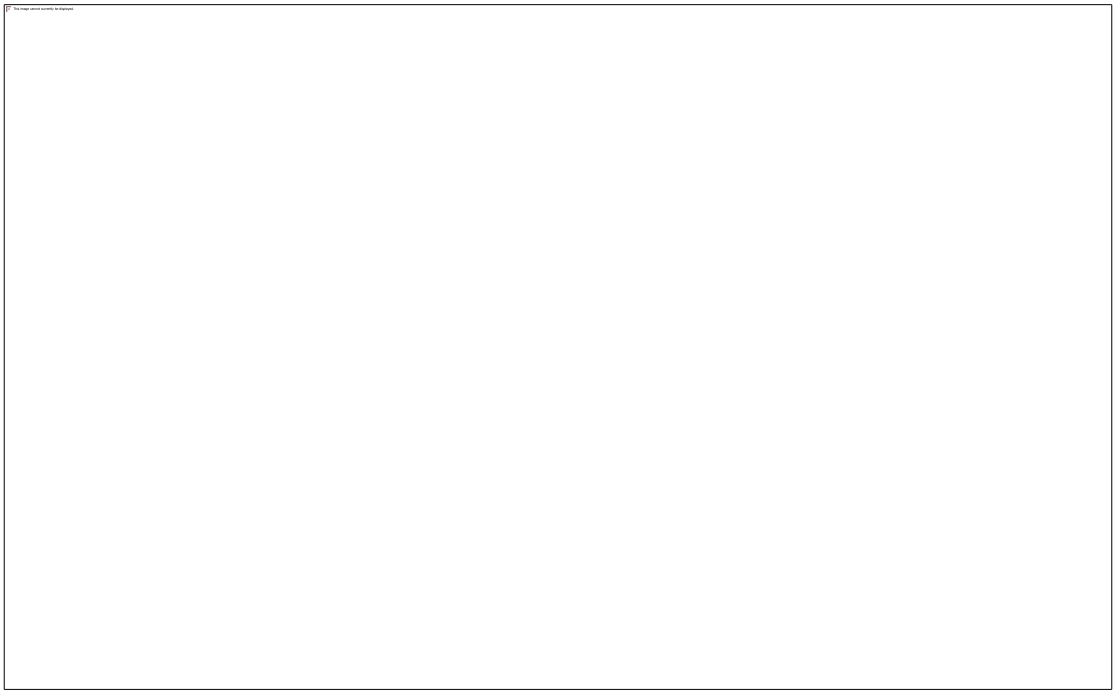
All net and feed infrastructure upgrade costs associated with the proposed Butlers Point amendment and repositioning will be routine upgrades that occur periodically as normal business practice.

3.1.5 Existing and Likely Markets for Product

Demand for seafood and farmed salmon consumption has been growing globally and nationally for over a decade. Tassal has the capacity to supply product domestically and internationally.

The majority of Tassal's product is exported interstate (see Figure 3.1) and this increased demand has encouraged Tassal's desire to further improve production efficiencies.

Figure 3.1 Tassal's annual salmon sales volume ('000 Head on Gutted [HOG] kg)



Tassal Atlantic salmon is available in fresh and frozen whole fish, fillets, sliced hot and cold smoked salmon portions, value added portions and canned. Tassal products can be found in fresh fish shops and Coles and Woolworths supermarkets throughout Australia.

Tassal has an experienced sales and marketing department located in Melbourne and operates two successful, dedicated salmon shops in Hobart and Melbourne. The company employs more than 800 staff, over 90% of whom are based in Tasmania.

Butlers Point lease will continue to be used for the input of smolt to the marine environment; therefore there is no direct market for stock grown at this lease.

3.1.6 Relationship to other Proposals/Developments

The basis of this proposal is to seek greater fallowing options for smolt leases in the Huon Farming Region (see Appendix 4 - MFDA and Nitrogen Cap areas). For more detail, see section 3.1.3.

As stated in section 3.1.2, this amendment links in to Tassal's 'South East Optimisation' process, which seeks to improve fish health and enhance farm performance.

3.2 Proposed Zone and Lease Details

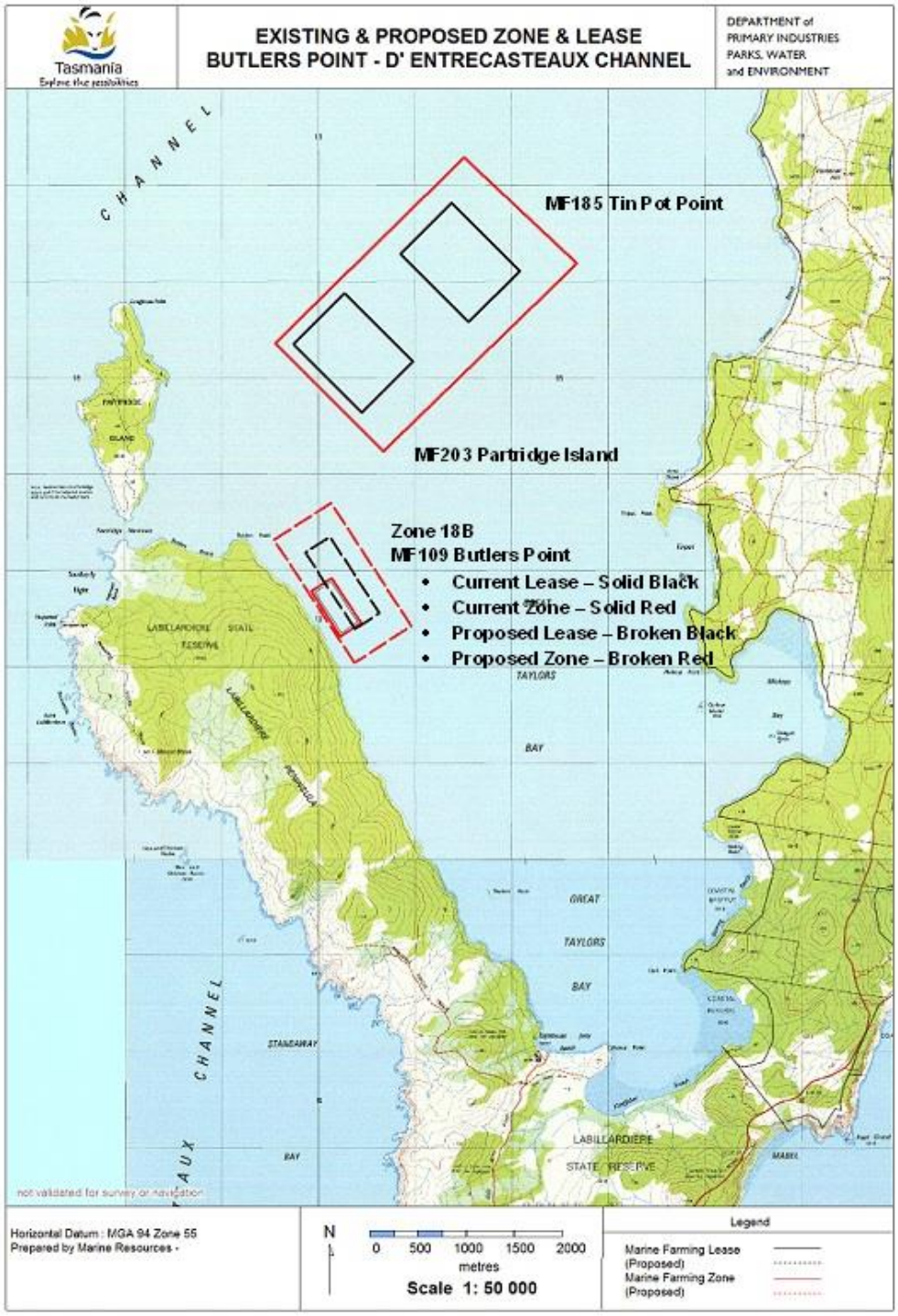
3.2.1 Location of Proposed Zone

Figure 3.2 shows the location of the existing and proposed zones, and the existing and proposed lease areas.

Zone 18B is approximately 120 m from the coastline at its closest point; the proposed amended zone would be approximately 100 m from the coastline. The closest finfish lease is

Partridge Island marine farming lease, in Zone 18A, approximately 1.5 km away (see Figure 3.2). There will be no change to land-based facilities.

Figure 3.2 Existing and Proposed Zone 18B and Lease locations at Butlers Point



3.2.2 Proposed Zone Area

The existing Zone 18B has an area of approximately 14.08 ha with a MLA of 10.01 ha. The amended zone would have an area of 106.7 ha, with a MLA of 28.5 ha. For more detail, see section 3.1.2.

3.2.3 Location of Proposed Lease

The proposed amendment to Butlers Point lease will have the same orientation as the existing lease; approximately north west/south east. It is proposed that a shift of 150 m further offshore occur, allowing greater depth, water flow and greater distance between the shore and the lease (Figure 3.2).

As stated in section 3.1.2, the proposed amendment seeks to extend the Butlers Point lease by approximately 450 m to the north west and 100 m to the north east. This would result in an increase from 10.01 ha to 28.5 ha, an increase of 18.49 ha to the current lease area.

3.3 Infrastructure and Servicing

3.3.1 Mooring and Grid system

The mooring system will be an extension of the existing herringbone mooring system into the proposed new lease area.

Appendix 5 shows the design of the 20 bay herringbone system to be used at this lease.

As previously stated, the proposed zone and lease dimensions will be 1525 m by 700 m, and 950 m by 300 m respectively.

3.3.2 Size and Configuration of Sea Pens/Netting

Tassal uses plastic cages that are 120 m in circumference. The nets have a side wall of 10 m, and the deepest part of the net is approximately 15 m, giving a total volume of approximately 13 400 m^3 per net.

Wildlife exclusion is an important aspect of contemporary marine farming practice in Tasmania. Tassal's exclusion technology of choice includes a combination of seal proof bird nets and Kikko constructed cage nets. In addition, all cage netting is heavily weighted to strengthen the configuration to provide protection against seal predation. The above surface portion of each cage is covered by a bird net with a mesh size of less than 115 mm.

Copper antifoulant will not be used on cage nets deployed in this region.

3.3.3 Construction Aspects

Construction associated with the extension of the existing herringbone mooring system into the proposed new lease area will take up to three weeks depending on production demands and weather conditions.

During installation, buoyed trip lines marking mooring blocks would be deployed in the buffer area between the lease and zone boundaries. A Notice to Mariners would be issued to advise of any hazard that may occur associated with this activity.

Mooring deployment would require the use of a large company workboat with a crane to lift and place mooring blocks into position.

Cages would be constructed by Plastic Fabrications or Mitchell Plastic Welding. Assembly of the cages takes place onshore at a site near the lease area. Once assembled, they would be towed to the marine farm. Biosecurity and introduced marine pest risks will be managed through existing company protocols during the construction phase and movement of cages.

3.3.4 Servicing the Proposed Zone

As the proposed amendment includes the provision for an additional 10 pen bays, it is expected that there will be an increase in vessel activity within the proposed lease area. As a consequence, there will be a corresponding decrease in vessel activity at the Huon Estuary smolt leases. The number of trips and types of vessels to be used are detailed in Table 3.3.

Table 3.3 Vessels to be used by Tassal to service amended lease in Zone 18B

Vessel	Activity	Frequency
Salvation	Feeder Tender	7 days/week
Cascade	Feeder Tender	7 days/week
Stinger	Farm Works	5 days/week
Recovery	Farm Works	5 days/week
Fraid Knot	Farm Works	5 days/week
Hornet	Works	5 days/week
Together Crayz	Dive Vessel	5 days/week
Budah	Dive Vessel	5 days/week
Royal Knight	Farm Works	5 days/week
Ebeneezer	Feed Delivery	1-2 days/week
Stealth	Wildlife Management	1 day/week
Dynamic 3	Net Cleaning	3-4 days/week
Efishent	Heavy Works Vessel	5 days/week
GT	Farm Works	5 days/week
Raadas	Farm Works	5 days/week
Mover	Farm Works	5 days/week

Tassal has undertaken noise level surveys at all their marine operations sites, and has determined that vessels utilised in day to day activities within the lease average L_{eq} (sound pressure level) 66 dB(A) at 30 m. The average level recorded for barges (including bathe barges, venturation barges, feed barges, net washing, and harvesting) is an L_{eq} of 63.1 dB(A) at 30 m (Environmental Dynamics 2013).

The use of sub-surface lighting is dependent on the stage of development of the fish held on the lease at any given time. If sub-surface lighting is used, the standard configuration is nine 1000 W lights in each pen, either metal halide or LED. Typically they are deployed between

June and November. The power source for these lights will continue to be the generator housed on the moored feed barge.

Servicing of the amended lease would follow the same pattern as the existing lease at Butlers Point. Work crews access the site from the land base at Meads Creek in Port Esperance or Killala Bay in the Huon Estuary. On a typical day the site would be accessed by up to five vessels, including work barges, the dive vessel, and general purpose/works crew vessels. The type of vessels accessing the site generally depends on the work activities scheduled on a given day. It is very unlikely that all vessels used at the Huon Farming Region would be at any one site at the same time.

Typical working hours for Tassal marine farming activities in the south east of Tasmania are 0600 to 1900 in the summer and 0700 to 1700 in the winter. As the Butlers Point lease is fully fallowed during summer months, there may be long periods where no vessels visit the site, excluding routine site and infrastructure inspections.

Security patrols may visit the site outside these hours and spotlights are most likely to be utilised during these patrols. Lease boundary markers are mandatory, and will be in place as they are currently at the existing lease; these lights are yellow and flash intermittently and are permanent fixtures attached to the yellow lease corner markers (meeting IALA requirements).

The equipment and infrastructure required to service the amended lease are identical (other than the extra cages) to those in current operation at the lease. There will be an initial increase in bathing and in situ net cleaning activities as stocking of the proposed lease commences. With time, and due to advances in the selective breeding program and the continued rollout of Kikko nets, instances of these activities are predicted to decrease.

The purpose built feed barge used to service the amended lease will be customised to mitigate noise emissions from the generator and the feeding system. The onboard generator will be housed in a specifically designed room within the feed barge, with noise mitigation designed and built in to meet marine farming licence conditions, lessening the level of noise reaching receptors within Great Taylors Bay. With any application for the deployment of a newly constructed feed barge in a marine farming lease, the Marine Farming Branch of DPIPWE has a policy stipulating that noise modelling be carried out prior its deployment.

The barge will be grey in colour, conforming to DPIPWE management controls in the marine farm licence and the D'Entrecasteaux Channel MFDP (see Appendix 3). It will contain the centralised feeding system, feed storage, generators and amenities for the work crew.

A generator will continue to provide power for the feeding system and sub-surface in-pen lighting system; it may be required to run 24 hours during the period July – November and during daylight hours March – June.

Noise generating equipment on the lease has the potential to impact on amenity and detract from visitor value of the South Bruny National Park. To minimise this risk, Tassal will introduce noise mitigation measures into the design of any barge required to house noise generating equipment.

Conservative modelling of activities on the existing lease has been conducted (allowing for the use of a compressor) with an estimated maximum noise level at the South Bruny National Park boundary of 40.4 dB. As a result of the hemispherical isotropic spreading of sound, each doubling of distance (distance over which noise measurement is taken) from a point source will see a 6 dB reduction in noise (pers. comm. Environmental Dynamics 2014). At distances greater than several hundred metres, the entire marine farm can be considered

a point noise source. For example, if the L_{eq} noise level from a net wash operation is 50 dBA at 100 m from the net wash vessel, the L_{eq} will be about 44 dBA at 200 m from the vessel.

The relocation of the lease further offshore, coupled with appropriate design, engineering, and management is expected to result in a decrease in noise impacts to the South Bruny National Park boundary. A more detailed assessment of noise impacts from the proposed amendment is described in section 6.2.6.

Waste from the amenities is pumped to a holding tank on the barge, which is then collected by the service vessel for appropriate disposal onshore.

The salmon stock at the lease will periodically require bathing in freshwater to control Amoebic Gill Disease (AGD). Bathing involves towing cages with freshwater contained in a tarpaulin liner from the adjacent fill station to the lease area. Infrastructure within the zone includes a freshwater pipe terminus on a MAST registered mooring that services Great Taylors Bay, and on average is used to fill one liner per day Monday to Friday.

It is predicted that bathing frequency will decrease over time as a result of the positive outcomes from the Selective Breeding Program (SBP).

Typically each year class of salmon requires freshwater bathing approximately 8-10 times during its seawater growth, this equates to approximately 60 ML of freshwater per annum for the bathing of smolt at Butlers Point.

As the Butlers Point lease is currently utilised as a smolt site, stock are not held on the lease all year round. Fish are grown to approximately 1 – 2 kg, and then transferred to the grow-out leases in Great Taylors Bay between August and November. This allows a full site fallowing period of approximately 2 – 6 months until the new season's stock is fed into Butlers Point lease in March the following year from the hatchery. Additional fallowing is achieved by rotational stocking in conjunction with freshwater bathing regimes and stock biomass splits. A similar fallowing period is expected with the proposed lease amendment.

As Tassal now uses in situ Marine Inspector Cleaner (MIC) technology for washing of nets, much of the pressure has been relieved from the land base used for net maintenance. This technology is also regularly used for net and rigging inspections.

3.3.5 Infrastructure Maintenance

Minor cage and net maintenance is carried out on site, with major work conducted at the Meads Creek and Killala Bay land bases as is routine vessel maintenance, with larger projects normally carried out in Hobart.

Cage nets are inspected by divers at least once a week and during routine in situ net cleaning operations. Bird nets are inspected daily. Moorings are subject to periodic inspection by divers and/or remote operated vehicle (ROV), and additional inspections may be instigated following storm events.

Tassal recently gained third-party certification of their systems and operations; this includes maintenance/storage and disposal of farm supplies, ensuring that the highest standard is met regarding the storage and disposal of farm supplies (fuels and lubricants included). It also requires that waste is disposed of in a responsible manner, including recycling programs and waste reduction plans.

3.3.5.1.1 Disease management and equipment translocation

Tassal has implemented a Farm Disease Management and Biosecurity Protocol covering all aspects of marine operations for the company. The protocol includes two biosecurity statuses: normal and red; red being full damage control in response to a major fish loss due to infectious disease. A red status results in all resources being utilised to produce a coordinated response to reduce fish fatality and control the associated problems of disease spread to naïve stocks or regions. This is characterised by timely mitigation and mortality disposal and encompasses the legislative notifiable requirements as defined in AQUAVETPLAN.

The Tassal Farm Disease Management and Biosecurity Protocol, also includes farm hygiene instructions where all hand and cage nets, cages, feeding barges and harvesting equipment must be disinfected prior to translocating to another biosecurity zone. This disinfection can be through the use of proprietary branded disinfection products or thorough cleaning of all equipment. Cross-contamination in transit and storage must also be managed under these protocols when moving or storing equipment across discrete biosecurity zones.

3.3.5.1.2 Life span of on-site equipment

Moorings	5-6 year replacement
Nets	5-6 year replacement
Cages	8-9 year replacement

3.4 Stock Husbandry Aspects

3.4.1 Fish Size / Stocking Density

The species to be cultivated at the Butlers Point lease will continue to be Atlantic salmon (*Salmo salar*). Stocking activities within the proposed zone/lease will occur within the provisions of the Butlers Point marine farming licence (see Appendix 3) and MFDP management controls.

As stated in Section 3.3.4, Butlers Point currently receives smolt from the hatchery and are grown out to approximately 1 to 2 kg before being transferred to the growout leases in Great Taylors Bay.

The proposed amendment would provide enhanced capacity for fallowing and stock rotation for the Huon Farming Region, allowing adaptive management to optimise fish health and performance, and benthic condition. Tassal will continue to determine the location of smolt inputs based on environmental performance and substrate condition of smolt leases from the results of routine environmental monitoring and compliance surveys. For any given year, the ratio of smolt input numbers between Butlers Point, Brabazon Point, and Killala Bay will be based on these assessments.

The maximum permitted stocking density under the D'Entrecasteaux Channel MFDP is 25 kg/m^3, however Tassal's internal policy is to not exceed 15kg/m^3.

The proposed amendment will allow Tassal to implement a systematic rotational fallowing program in the Huon Farming Region. Stocking numbers of smolt will initially increase at the Butlers Point lease as one or more of the Huon Estuary leases undergo fallow periods. This proposal will not result in more fish being introduced into the Huon Farming Region on an

annual basis. While maximum smolt input numbers for the region peaked in 2013, Tassal projects a 9% decrease in stocking numbers moving forward.

3.4.2 Fish Feeding

The fish will be fed commercially extruded salmon feed(s). Projected monthly feed amounts vary according to water temperature, fish size and fish health. Projected biological Feed Conversion Ratio (FCR) for the smolt grow-out cycle would be 1.35.

Feeding occurs through a centralised feed system, with the operator (located in the feed barge) controlling and monitoring the feeding by camera feedback on multiple displays. This responsive practice limits feed wastage.

The increased fallowing and stock rotation options within the Huon Farming Region will contribute to improved overall benthic health and biosecurity at the farming region.

Fish are fed strictly during daylight hours; the feeding occurs between 0700 and 1700.

3.4.3 Fish Health

In the Huon Farming Region, Amoebic Gill Disease (AGD) is an important fish health challenge. However, it is well managed within Tassal's program of continuous surveillance (AGD scoring), reducing stress on stock, and freshwater bathing frequency. Tassal does not use chemicals or antiparasitics to manage AGD. Tassal began participating in a selective breeding program in 2006 based on the need for preferential selection of more robust fish exhibiting resistance to the attachment of the amoeba to the gills. With each year, there are gains made in reducing the impact of AGD and the necessity for freshwater bathing.

Coupled with the gains from the selective breeding program, the future AGD management strategy is focused on reducing the use of freshwater by the application of new technologies.

Harmful algal blooms (HAB) and jellyfish presence are monitored daily through algal trawls and associated observational on site work. Tassal organises both in-house and external training covering fish health and biosecurity.

Salmon Orthomyxovirus (SOMV) was isolated following a smolt mortality event in the 2012 year class at Killala and in 2013 at Brabazon. Investigations into SOMV and vaccine development in collaboration with DPIPWE are on-going. SOMV has never been detected at the Butlers Point lease.

Butlers Point lease has received two antibiotic treatments in 2013 totalling 20.6 kg.

Date	Treatments	Volume kg	Disease
25/07/2013	Trimethoprim	15.38	Yersiniosis
14/03/2013	Trimethoprim	5.2	Skin lesions

Future use of medication will be in line with Tassal's internal policy - antibiotics are never used prophylactically or for growth promotion. Any salmon that are treated with antibiotics undergo a lengthy withdrawal period of 90-120 days to ensure all residues are cleansed from their system. Prior to harvest, any groups of salmon that have been treated are tested for residue. This complies with the Australia New Zealand Food Standards Code for residue levels (FSANZ 2013).

The use of medication for farmed fish has reduced due to increased focus and knowledge regarding fish health. This reliance is not expected to increase in the Huon Farming Region. Tassal is currently working with DPIPWE and vaccine suppliers towards an improved vaccination strategy against *Yersinia* to prevent outbreaks in future year classes.

Tassal's Farm Disease Management and Biosecurity Protocol is designed to limit the transmission of existing or exotic pathogens between or within control regions as well as develop a proactive 'hygiene culture' (as stated in section 3.3.5). The Protocol is based on a two-tiered system of alert depending on the disease status of individual pens, leases or regions, with changing actions and monitoring processes throughout the steps.

Tassal has also implemented a South East Fish Health Management Plan (FHMP) which is a combination of compliance, best practice, and regulation through management controls and Marine Farming licence conditions. The FHMP addresses detailed, standard operating procedures to prevent disease from entering the region, to prevent the spread and impact of disease in farming regions, and to respond to emergency disease situations. The FHMP is scheduled to be reviewed annually; however this will occur more frequently if required.

Tassal's focus on disease monitoring and early detection places a high priority on incorporating stock inspections into routine farming activities such as mortality collection, weight checks and harvests. Tassal is also actively involved in the Tasmanian Salmonid Health Surveillance Program, which is a joint program between the Tasmanian salmonid industry and the DPIPWE. This program provides passive and active disease surveillance through regular submission of fish diagnostic samples and testing for specific disease agents of concern.

3.4.4 Predator Control

Australian and New Zealand Fur-seals are predators of salmon in marine farms. The primary means of controlling seal predation is through exclusion, using heavily weighted, tensioned and stiffened cage nets. Tassal is investing in new Kikko nets for the region; these nets have been in use in Great Taylors Bay for 12 months at Tin Pot Point and Partridge Island leases with extremely promising results. Only two breaches have occurred over that time period, representing a significant improvement in wildlife management. Net barriers may also be required above the handrails to prevent seals from jumping into the cages.

Tassal is committed to passive seal deterrents and continues to investigate and trial new exclusion and deterrent technologies. Under DPIPWE's seal management protocols, Tassal can apply to the Department to relocate problem seals.

Effective management of seal interactions is a matter of crucial importance for Tassal. Seal interaction with the company's farms has the potential to impact on employee safety, environmental management practices, seal and fish welfare; all combining to impact on company profitability. To this end, Tassal has created a second Wildlife Management Officer position. This increased wildlife surveillance has proven very effective and has led to improved practices on farms, improved exclusion techniques, and an improved understanding of the seal population and behaviour. Tassal is aiming to reduce its number of seal entries into cages and number of relocations significantly in the 2014 season with the continued rollout of Kikko nets and improved exclusion methods.

Marine mammals have been identified as a significant environmental aspect within the Tassal EMS. As a result, numerous operational controls are in place to ensure that seal exclusion measures and wildlife management protocols are followed to limit potential impacts on these species.

Properly designed and supported bird nets also restrict bird access and limits their interaction with the marine farm.

3.5 Waste Management

3.5.1 Solid Waste

There will be no new solid waste streams as a result of the proposed amendment; however some existing waste streams originating from the Butlers Point lease will increase. Each solid waste stream is discussed below.

3.5.1.1 Harvest Waste

There will be no harvest waste resulting from this proposal. Fish are not currently harvested from Butlers Point lease and there are no plans to change the harvesting strategy as a result of the proposed amendment.

3.5.1.2 Fish Mortalities

As with any livestock operation, mortalities do occur, although mortalities at the current lease are generally low. Mortalities from the Huon Farming Region are collected in sealed fish bins and returned to the shore base where they are held in a refrigerated container until they are collected. This occurs at least once a week, for transport to an approved land-based facility for beneficial reuse (composting or rendering/oil extraction). The frequency of mortality removal from the lease will not increase as a result of the proposal. The quantity of this waste stream removed from the Butlers Point lease is expected to increase, however, there is expected to be no net increase in this waste stream from the Huon Farming Region.

3.5.1.3 Feed Waste

As outlined in section 3.4.2, uneaten feed is minimised through the use of video camera feedback systems and additional tools such as pellet catching panels. Any pellets that do fall through the cages are detected in routine video surveys, and the information is used to continuously improve feed management. There is a strong economic imperative to reduce feed waste.

3.5.2 Liquid Waste

Similarly to solid waste, there will be no new liquid waste streams as a result of the proposed amendment, only increases in the volumes of some existing waste streams.

Black and grey water from the barge is typically collected in a 1000 L waste tank which is routinely emptied by the service vessel. This waste is discharged to an appropriate land-based system.

3.5.3 Environmental Monitoring

Non-regulatory water quality monitoring is primarily conducted to benefit fish health; this monitoring includes daily measuring of temperature, dissolved oxygen, salinity and turbidity. Jellyfish and harmful algal monitoring is also conducted at least once daily. Tassal has initiated an Unknown Algae Response Protocol, which includes the implementation of onsite

microscope cameras, allowing unknown algal species to be photographed and emailed on for third party identification. This process allows for a rapid response following harmful algal bloom outbreaks.

Tassal's Quality Control Department also conducts a bimonthly water sampling program testing for thermotolerant coliforms, an accepted indicator of potential faecal contamination, and thus water quality (ANZECC 2000).

The environmental monitoring program in place for the existing lease will continue and be expanded for the new lease area, as described below.

- Annual benthic video monitoring will be required for the proposed lease under Schedule 3V of the Marine Farming Licence.

- In-house video monitoring additional to that required by Schedule 3V is carried out as part of Tassal's lease management strategy.

The Broadscale Environmental Monitoring Program (BEMP) of the D'Entrecasteaux Channel and Huon Estuary that commenced in March 2009 includes a monitoring site within Great Taylors Bay, approximately 2.6 km from the proposed amendment at Butlers Point. The BEMP is funded by the Tasmanian Salmon Growers Association (TSGA) and is included as a schedule to marine farming licences for finfish growing operations located within the D'Entrecasteaux Channel and Huon River & Port Esperance Marine Farming Development Plan areas. Monitoring is undertaken by an independent consultant.

The BEMP is aimed at assessing the broadscale effects of finfish farming and monitors water quality and sediment health at a number of sites neighbouring finfish marine farms in the D'Entrecasteaux Channel and Huon Estuary. The monitoring program was triggered by the recommendations of previous studies undertaken in these waters by the CSIRO which investigated the cumulative effects on the aquatic environment and effects from finfish aquaculture operations.

A total of 15 sites are included in the monitoring program. Monitoring sites 1-9 are located within the D'Entrecasteaux Channel MFDP, Sites 10-14 in the Huon River MFDP and the control site 15 is located in Recherche Bay (see Figure 5.8). The sampling covers the entire extent of the D'Entrecasteaux Channel and Huon Estuary, from North West Bay to south of Partridge Island.

Monitoring occurs bi-monthly (February-April) and monthly (May-January) at each of the 15 sampling sites within the D'Entrecasteaux Channel and Huon Estuary. To date, over 70 sampling events have been conducted, representing the collection of over four consecutive years of environmental data with which to investigate seasonal or yearly trends in water quality and sediment health, and their response to a range of natural (i.e. oceanic) and anthropogenic (i.e. agriculture, sewage, aquaculture) sources of nutrients.

The monitoring program has two components - a water quality component (surface and bottom water) and a sediment component (sediment biology and chemistry).

Water Quality Parameters:

Analyses on samples are undertaken for the following nutrients: total nitrogen, total phosphorous, ammonia, nitrate, phosphate, and silicate.

Integrated depth samples are taken of the water column (top 12 m) to measure: type and abundance of phytoplankton species, chlorophyll a concentrations and pigment levels.

Physical measurements are taken for: salinity, dissolved oxygen, pH and temperature.

Sediment Health:

Sediment samples (grabs) are taken to measure: the abundance and type of benthic invertebrates living in the sediments.

Sediment samples (cores) are taken to measure redox potential, sulphides and stable isotopes, and to carry out visual and particle size analysis.

3.6 Decommissioning and Rehabilitation

The associated costs relating to the decommissioning of the portion of lease space that will be retired are included in section 3.1.4 - Anticipated Establishment Costs. The costing in this section includes the removal of all existing mooring infrastructure and equipment from this retired lease area.

Normal sedimentary processes will allow any organic enrichment existing in the retired lease space to be metabolised by biological processes, any existing impacts from farming would be remediated by these means.

4 Stakeholder Consultation

Tassal has identified social sustainability as a key sustainability pillar for the company. Tassal's interactions with, and support of, the communities within which they operate, their stakeholders, employees and customers, as well as its contribution to the State and National economy, is taken very seriously and built into strategy development and executive planning processes.

In 2013 Tassal was ranked number two in the world's top salmon farming companies by Seafood Intelligence, for corporate, social and environmental responsibility (CSER) reporting. In addition, their 2012 Sustainability Report was identified as one of the top three Sustainability Reports in Australasia for the reporting year.

Underpinning communication and engagement is the transparency of operations, something that Tassal has been steadily improving over the past five years. With the release of their third Sustainability Report in 2014, Tassal will cover the entire scope of their operations from hatchery through to processing. Tassal is also upgrading their web site to improve access to information, current and historical, for interested parties.

Environmental certification is an important tool for the transparency and accountability of operations and the third party audit process ensures that the company is achieving best practice and exhibiting continual improvement (see section 3.1.1). Tassal has certified all of its marine farming regions and primary processing facility to Global Aquaculture Alliance's (GAA) Best Aquaculture Practices (BAP – see Appendix 1). The Aquaculture Stewardship Council (ASC) certification builds on this with a comprehensive social audit component and the facilitation of coordinated stakeholder consultation.

At the local level, Tassal is actively engaged with the communities in which it operates. Tassal has a dedicated Community Engagement Officer, a role that coordinates community activities, partnerships and research collaborations and liaises with non-government organisations and advisory forums. Community and stakeholder engagement is an overarching and ongoing activity within Tassal. Engagement activities occur regularly throughout the year and are not necessarily tied to any specific project or proposal. Through this approach Tassal has contributed to over 30 community organisations within the Dover and Bruny Island areas alone in the past 18 months, including schools, arts groups, sports clubs and festivals.

Of particular relevance to the stakeholder engagement program is Tassal's founding member status and ongoing engagement with the D'Entrecasteaux Channel Project (recently re-named "The D'Entrecasteaux and Huon Collaboration") with Kingborough and Huon Valley Councils and also Tassal's engagement with IMAS's Marine Values project. Both of these initiatives aim to improve community understanding of salmon aquaculture.

For this specific proposal, Tassal has taken a coordinated approach to stakeholder and community engagement aiming to enhance and support communications. Once potential stakeholders were identified, Tassal developed a stakeholder engagement plan (SEP – see page 15, 2013 Sustainability Report, Appendix 6) to interact within the local community and with associated stakeholders to discuss the proposed amendment for the Butlers Point lease. The ongoing program continues to provide a well thought out and coordinated approach to stakeholder engagement and assists in the management of emerging issues, keeping stakeholders informed and maintaining positive relationships and open dialogues. The SEP continues to be a working document, and is updated or modified based on feedback from stakeholders or new information coming to light. It has assisted in building awareness

amongst stakeholders and the community arising from this proposal, by providing an opportunity for individuals and organisations to be notified of the proposed amendment, understand the potential impacts and how it may affect them. All information gathered during stakeholder consultations has been used in the development of this EIS. In response to stakeholder feedback during this consultation, Tassal informs stakeholders of the statutory process associated with the amendment, including timelines (when known) and the opportunity to provide formal representations during the public exhibition and comment periods of the EIS.

The SEP has resulted in the receipt of information that has assisted the development of this proposal, and it is anticipated that the formal submission of this EIS will prompt further public consultation.

Stakeholders that have been identified include, but are not limited to:

- Kingborough Council
- Huon Valley Council
- Marine and Safety Tasmania (MAST)
- TasPorts
- Tasmanian Seafood Industry Council (TSIC)
- Tasmanian Association for Recreational Fishing (TARFish)
- local boating clubs
- residents of Bruny Island
- Aboriginal Heritage Tasmania
- Local Tourism operators
- Parks and Wildlife Service
- interested members of the community.

Specific engagement activities that have been undertaken include:

- mail-out (via Australia Post) to all residents on Bruny Island
- information posters displayed at key locations on Bruny Island providing information about the proposal and contact details of Tassal staff
- tour for key local stakeholders to Butlers Point smolt lease
- briefings with key stakeholders (individuals and organisations)
- identifying and capitalising on opportunities to link with existing networks and provide information through these channels
- provision of project information to ensure accurate information is available and that people understand the nature of the proposed amendment
- establishment of an online information page which will include provision of a phone number, email and postal address for anyone who has a question,

concern or wishes to obtain more information or discuss the project (http://www.tassal.com.au/community-engagement.html)

- meeting with representatives from local yachting, boating and sailing clubs that use the D'Entrecasteaux Channel and Huon Estuary
- tour of lease for Dover community stakeholders (as part of the Dover Information Day 22nd February 2014).

These activities are detailed further below in section 4.1. Stakeholder consultation and engagement activities will be ongoing.

4.1 Stakeholder Engagement Activities

4.1.1 Bruny Island Residents

A mail-out was undertaken to all Bruny Island residents via Australia Post during the second week of December 2013. A brief letter and the document "Butlers Proposal Summary for Stakeholders_Final" was included in the mail-out along with Tassal staff contact details.

A poster was also placed in key locations around the island and Kettering, with similar information to above included. These locations were:

- Bruny Island Ferry terminal (Kettering side)
- Alonnah shop noticeboard
- Adventure Bay shop noticeboard
- Lunawanna shop noticeboard.

All of these documents are included in Appendix 11. No feedback resulting from this mail-out was received directly by Tassal, other than contact made with environmental stakeholders as described below.

4.1.2 Tour to Butlers Point lease

Initial consultation (arising from a Bruny Island wide mail out) with key environmental stakeholders on Bruny Island resulted in a request to view the current and proposed lease areas.

This interactive site visit was conducted on the 19th December 2013 with four key stakeholders.

Tassal employees present on this tour were:

- Fiona Ewing (Community Engagement Officer)
- Matt Barrenger (Senior Environmental Officer).

4.1.3 Consultation with yacht and boating clubs

Yachting and boating clubs operating in the south east were contacted by email and supplied with documentation regarding the proposed amendment ("Why is Tassal Proposing to amend this lease?" and "Butlers Proposal Summary for Stakeholders_Final" (Appendix 11).

Subsequent to this initial contact, a preliminary advisory meeting was held with representatives of the Kingborough Boating Club and the Royal Yacht Club of Tasmania on the 20th December 2013. This meeting provided attendees with the opportunity to ask questions about the proposal with a view to informing their club executive committees.

Following on from this meeting, upon advice from a local yacht club representative, an information session was organised and held at the Derwent Sailing Squadron Club rooms on the 3rd February 2014. Eleven representatives from yachting clubs in the south east region attended and a further two representatives were followed up with email contact. All attendees and email contacts resulting from this meeting were supplied with the following documentation (see Appendix 11):

- Butlers Proposal Summary for Stakeholders_Final
- Why is Tassal Proposing to amend this lease?
- Lippies and Browns Proposal Summary for Stakeholders (not included in appendices as relating to another proposal by Tassal)
- Yacht Club Tassal meeting DSS (PowerPoint presentation).

Attendees who provided email contact addresses were also supplied with minutes of the meeting as well as referral to the DPIPWE Aquaculture web pages.

At this meeting, all attendees were provided with the opportunity to ask questions, voice concerns and opinions regarding salmon aquaculture in general and the Butlers Point proposed amendment in particular. Eight (operational, technical and executive) staff from Tassal and two external consultants attended this meeting in order to answer questions and provide accurate information regarding external environmental monitoring activities. Information from this meeting was used in the development of this Environmental Impact Statement.

4.1.4 Other Consultation

During November and December 2013, meetings were held with the following organisations, both to inform and to receive feedback about the proposal:

- Marine and Safety Tasmania (MAST)
- Tasmanian Seafood Industry Council (TSIC)
- Tasmanian Association for Recreational Fishing (TARFish)
- Pennicott Wilderness Journeys.

Both TARFish and TSIC will undertake further consultation with their constituents and provide feedback to Tassal.

Tassal met with the Tasmanian Abalone Council (TAC) on 18th February 2014, providing information regarding this (and other) proposed amendments. Tassal is providing the

Abalone Council with further information. The Abalone Council advised that they will undertake further consultation with their constituents also and provide feedback to Tassal.

A further meeting was held with MAST in February 2014 to consider movement of the proposed lease and zone area, access and mooring between the lease and shore and lighting options, following the yacht club meeting detailed below and MAST officers conducted a site visit on 14th February 2014.

The Tasmanian Parks and Wildlife Service (DPIPWE) was contacted by phone and email and informed of the proposal and invited to contact Tassal.

Environment Tasmania, Environmental Defenders Office (EDO) and the Tasmanian Aquaculture Reform Alliance (TARA) were alerted at a regular Tasmanian Salmonid Growers Association (TSGA) meeting to the proposal on 12th December 2013 and directed to the Tassal website for further information. These organisations, along with the Tasmanian Conservation Trust were sent the Butlers Proposal Summary for Stakeholders_Final in early March 2014.

A number of organisations have been advised (via email) of the proposed amendment, including:

- Kingborough Council
- Huon Valley Council
- TasPorts
- NRM South
- World Wildlife Fund for Nature (WWF) Australia.

4.2 Major outcomes of Stakeholder Engagement

MAST advised Tassal that the proposed amendment to the Butlers Point lease would not present any navigational concerns. Furthermore, officers from MAST visited the site of the proposed amendment on 14th Feb 2014 to assess available anchorage space between the proposed zone and shoreline.

During this field visit, the officers concluded that adequate space is available for anchoring vessels in between the proposed zone and shoreline, although conceded that anchorage may be 'tight' between the midway point of the edge of the zone and the shoreline. They noted that there appears to be plenty of swing room in the other positions in west to south west conditions. It was considered by MAST that the proposed amendment would have little effect on the ability for other vessels to anchor provided mooring lines did not extend westwards, towards the shore beyond the proposed zone.

Additionally, local cruising guides mention Butlers Beach or Taylors Reef as the "recognised" anchorages for that part of Great Taylors Bay. (Cruising Southern Tasmania: A guide to the waterways of the River Derwent, D'Entrecasteaux Channel, Huon River and their tributaries Author: A collaboration by the members of the Cruising Yacht Club of Tasmania Publisher: TASMAP)

Yachting and boating clubs

Feedback from the yachting and boating clubs was broad-ranging: specifically directed at the proposed amendment, or feedback relating to salmon farming in general.

A summary of the major outcomes of stakeholder engagement relating to the Butlers proposed amendment is provided below.

Points below are summarised to succinctly reflect complex views as expressed by stakeholders. Tassal has addressed questions raised by stakeholders by email and in face to face discussions.

Impacts of salmon farming activities in general on the amenity of recreational boat users as expressed in feedback to Tassal includes:

- noise
- visual impact of farm infrastructure (including lights – particularly at night and including lights from farm security patrols)
- navigation impediment, particularly at night when lights from farms can be confusing
- odour
- restricted access to anchorages and encroachment of farms on popular anchorages
- increased boat traffic, wash and intrusion of privacy, particularly when recreational vessels are closer to farming operations.

Changes in the marine environment over a long period of time perceived to be caused by salmon farming activities include the following.

- Changes in sediments in Great Taylors Bay.
- Changes in algal assemblages, particularly on the rocky shores of Partridge Island and near Butlers Beach.
- Concern regarding numbers of escaped fish in southern waterways (akin to other introduced pests). How are they surviving if not to prey on native species? How has their presence in our waters affected the natural ecosystems?

Specific views expressed regarding the Butlers Point proposal by individuals involved in recreational boating included the following.

- Proximity of the Butlers Lease adjacent to the South Bruny National Park (the Park), whilst outside the Park boundary is not in keeping with the values of the Park and will impact on the enjoyment of visitors to the Park.
- The existing and proposed Butlers Point lease restricts available anchorage sites in the area.
- The existing and proposed Butlers Point lease restricts available snorkelling, diving and fishing sites in the area.
- Noise, odour, visual and lighting impacts from the existing and proposed Butlers Point lease on the amenity of recreational boaters and walkers in the South Bruny National Park.
- The enlargement of the 'farming zone' from a length of 650 m (sic) along the shore to 2000 m (sic) will impede navigation along the Labillardiere Peninsula.

Many boats use the Butlers Beach area as a day anchorage and if the weather is suitable remain overnight. If a north westerly/northerly/ north easterly blows up over night the logical place to move to is Mickeys Bay on the eastern side of Great Taylors Bay. The track for safety is now blocked by the 200 ha marine farm. Without the proposed expansion boats moving to safety could take a direct track to Mickeys Bay. Similarly in strong west, south west, and southerly weather boats move from Partridge Island and Butlers Beach along to the lighthouse jetty beach in Great Taylors Bay. The current lease restricts this passage and an extension of the lease more so. Thus the expansion of the Butlers Point lease will have an adverse impact on the safety of mariners.

- Increased infestation on the adjacent shores, particularly on the rocky shores of Partridge Island and near Butlers Beach, by sea lettuce (*Ulva* spp.), indicating increased nutrients in the waters.

- Concern that Tassal is moving farming operations away from the Huon Estuary because impacts of salmon farming have resulted in the river being no longer suitable for salmon farming. Concern that Tassal will create the same problems in Great Taylors Bay.

- Concern that Butlers Point lease is inherently vulnerable to algal blooms due to the relatively calm waters found there.

- The farming of salmon at Butlers Point on the existing lease has only occurred since March 2013. The impact of farming on this lease should be thoroughly assessed prior to any consideration of a doubling of the size of the lease. This is the basis of the 'precautionary principle' that is at the cornerstone of environmental management.

- The entire zone is an area of 'public land' that is effectively alienated from use by the public. Even though the lease itself will be moved offshore, the zone is still close enough to the shoreline to impact transit and anchoring options.

- A suggestion by some yacht club representatives to move the proposed lease to a previous lease site on the other side of the bay was considered by Tassal, but not achievable.

- Concern over the timing of the proposal being over the Christmas holiday period and that there is an impending state election.

- Doubt was expressed regarding the opportunity for this proposal to be tested in a public hearing process.

Feedback from Bruny Island environmental stakeholders and local residents resulting from tour to Butlers Point lease

Feedback was also received from environmental stakeholders on Bruny Island, including frustration regarding not receiving the mail notification of the upcoming proposal. Generally there was a lack of support for the proposal, however, it was understood that there was an economic benefit to the amendment. In general there was opposition based on environmental and amenity impacts. The issues raised by environmental stakeholders on Bruny Island regarding the proposal are as follows.

- Concern regarding the visual and noise impact of the Butlers Point lease on walkers in the South Bruny National Park (the Park). Users of the Park have the right to expect a 'wilderness' experience in the Park and the lease at Butlers Point will detract from that experience.

- The waterways are a public resource and there should be offsets for the community regarding the use of this resource by salmon aquaculture companies.

- Marine debris should not be let go from marine farms, and when it is it should be cleaned up regularly (monthly in Great Taylors Bay was suggested).

Additionally, there were general views on salmon farming in the D'Entrecasteaux Channel including impacts:

- decreased amenity of residents, shack owners, visitors and boat users in the area

- noise

- visual impact of farm infrastructure (including lights – particularly at night)

- concern about the ongoing expansion of salmon farming in the D'Entrecasteaux Channel and the environmental impact of this

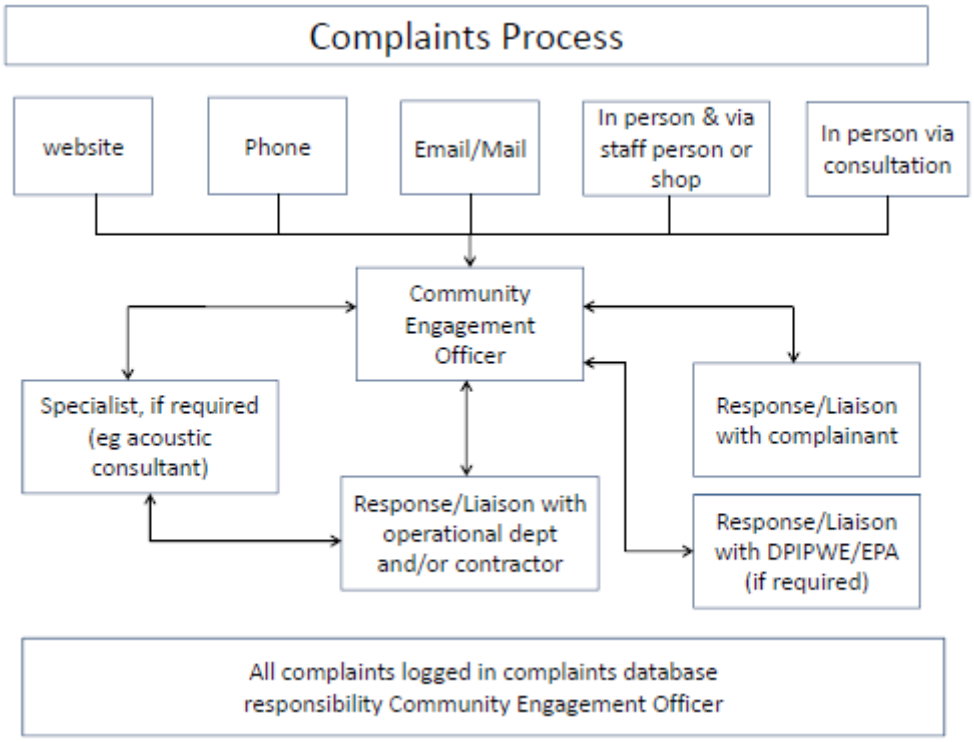
- recreational boating safety concerns regarding larger pieces of marine farming debris (including feed pipe, large buoys, etc.).

General

Consultation with stakeholders has also revealed a desire to know more about how they can have input into the statutory process associated with the amendment to a marine farm development plan.

Meeting with concerned stakeholders as described above has developed a solid foundation for ongoing dialogue with Tassal. Many questions have been addressed and misinformation has been corrected through this process.

The following flowchart outlines the process by which complaints are managed by Tassal's Community Engagement Officer and follow Tassal's internal complaints protocol. It is the responsibility of this position to liaise with relevant government departments, specialist consultants and the complainant in order to mitigate or resolve the issue.



4.3 Further Consultation/Engagement

Initial consultation with environmental stakeholders, community stakeholders and users of the local waterways has highlighted a need for more direct and interactive engagement within the community. To this end, Tassal will establish a communication framework with Bruny Island residents in order to further enhance knowledge transfer between key groups, community members and Tassal.

Tassal staff members are scheduled to meet with the TARFish Board in early April 2014 in order to brief them on the proposed amendment. It is understood by Tassal that the TARFish Board will then inform and consult with their respective recreational fishing interest groups and members of the proposed amendment. Tassal will be available to support this process as required.

The following environmental non-governmental organisations (ENGOs) will be contacted directly and notified when the Butlers Point proposed amendment is open for public consultation:

- Tasmanian Conservation Trust
- Bruny Island Environment Network
- NRM South
- Environment Tasmania
- Tasmanian Aquaculture Reform Alliance (TARA)
- World Wildlife Fund for Nature (WWF) Australia

- Southern Coast Care Association Tasmania.

This is not a definitive list and, as it is brought to Tassal's attention, additional organisations or individuals may be contacted.

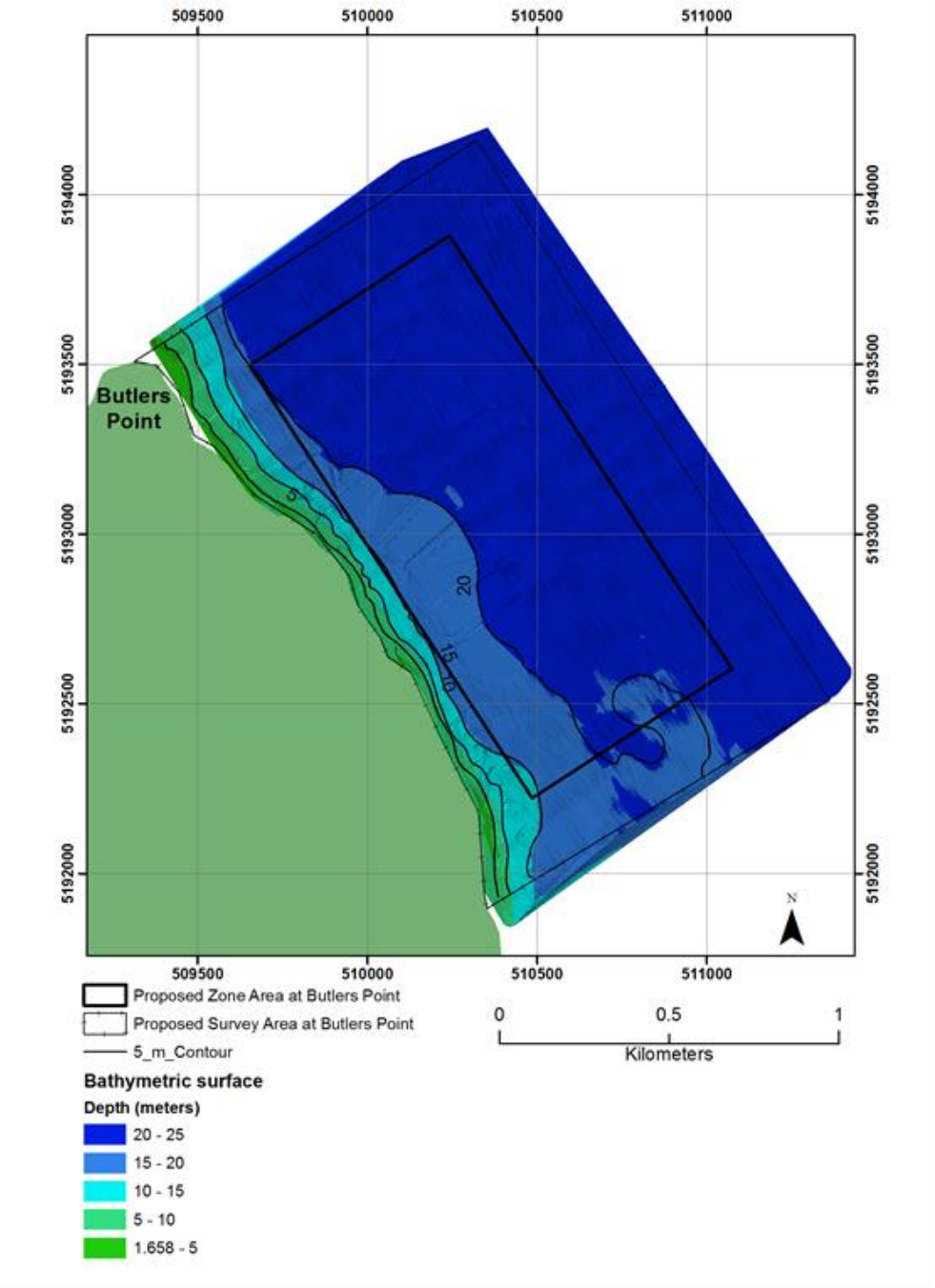
5 Existing Environment

5.1 Environmental Conditions

5.1.1 Bathymetry (IMAS survey and other where available)

The bathymetry for the proposed farming zone can be seen in Figure 5.1 where the bold black rectangle shows the proposed zone within the survey assessment area. There is a gradual increase in depth across the zone moving from the shore area towards the north east (into Great Taylors Bay). The shallowest area of the proposed zone is the <15 m area in the section closest to the shore in the south west corner, this increases out to between 20 and 25 m in the remainder of the area of the proposed zone. The offshore shift of approximately 150 m will provide greater average water depth than the existing lease and zone. The IMAS report including data collection methods is included in Appendix 7.

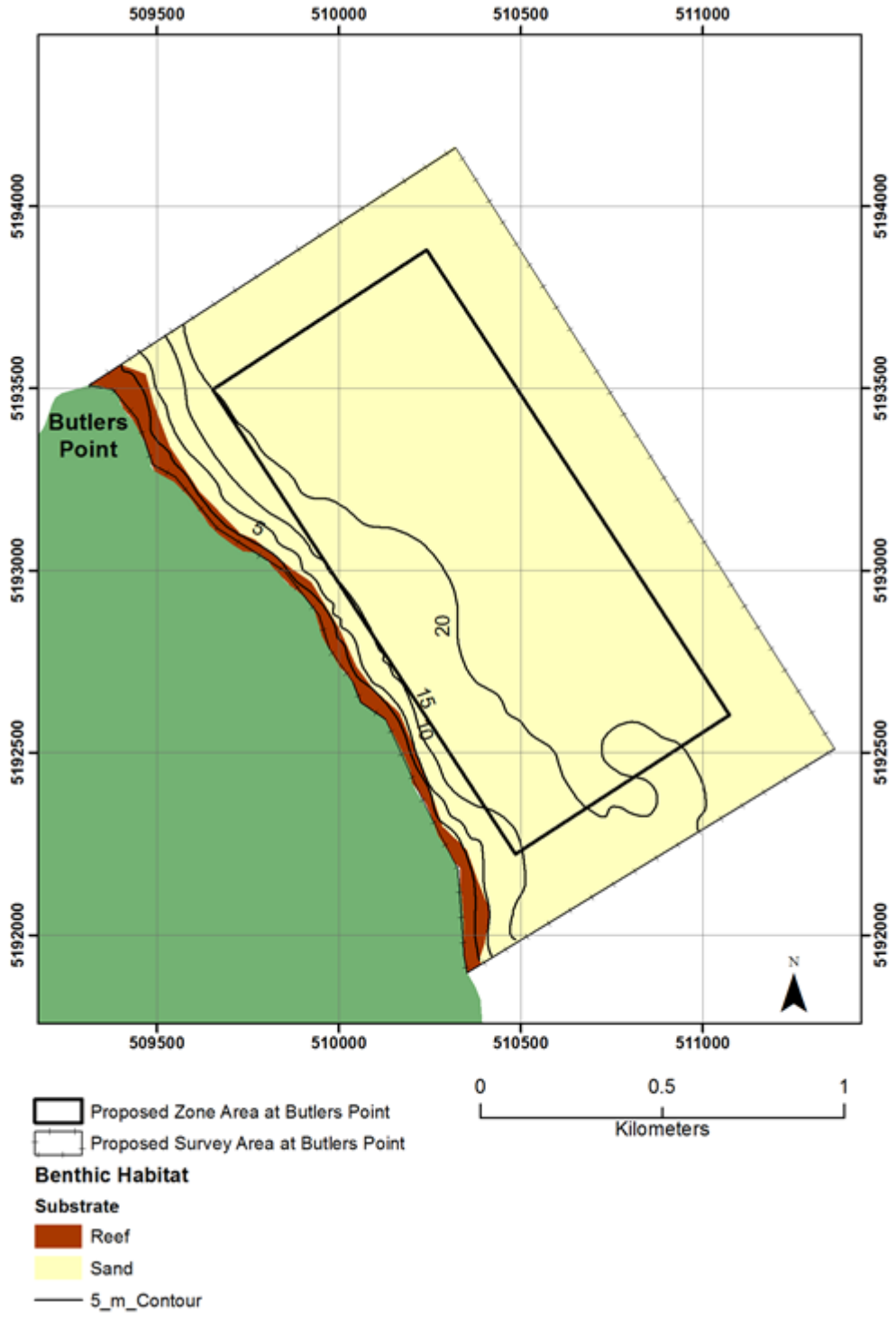
Figure 5.1 Bathymetry of the assessment area at Butlers Point (from Appendix 7)



5.1.2 Substrates (IMAS survey and other where available)

The substrates and benthic habitat for the proposed zone can be seen in Figure 5.2 where the bold black rectangle shows the proposed zone within the survey assessment area. Within the survey assessment area there were small patches of reef and rock substrate along the shoreline; this reef area is located in less than 5 m water depth. There was no reef found within the proposed zone area meaning that all mooring infrastructure will be placed on unvegetated, unconsolidated sand substrate (see Appendix 7 – IMAS site survey report).

Figure 5.2 Benthic habitats within the assessment area at Butlers Point (from Appendix 7)



IMAS also conducted a series of sediment grabs within the proposed zone. These were dominated by fine brown silty sand with no odour. For full results, see Table 2 in Appendix 7.

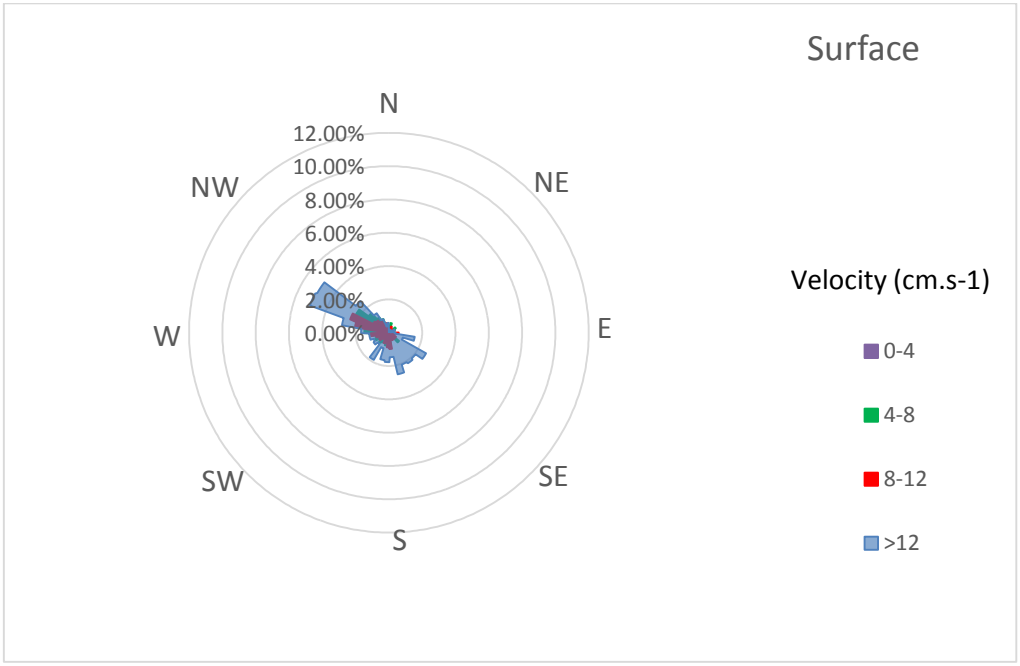
5.1.3 Hydrology

Figure 5.3 shows the deployment location (BP001) of the Acoustic Doppler Current Profiler (ADCP) within the proposed amendment area (outside the existing Butlers Point lease). This deployment was for a six week period to capture a full tidal lunar cycle. Currents at the site are strongly influenced by both prevailing north westerly winds and movement of current up the D'Entrecasteaux Channel from the Southern Ocean. Current plots were determined for surface, mid (10-15 m) and bottom waters for the deployment area.

Figure 5.3 Location of ADCP deployment for amended Butlers Point lease

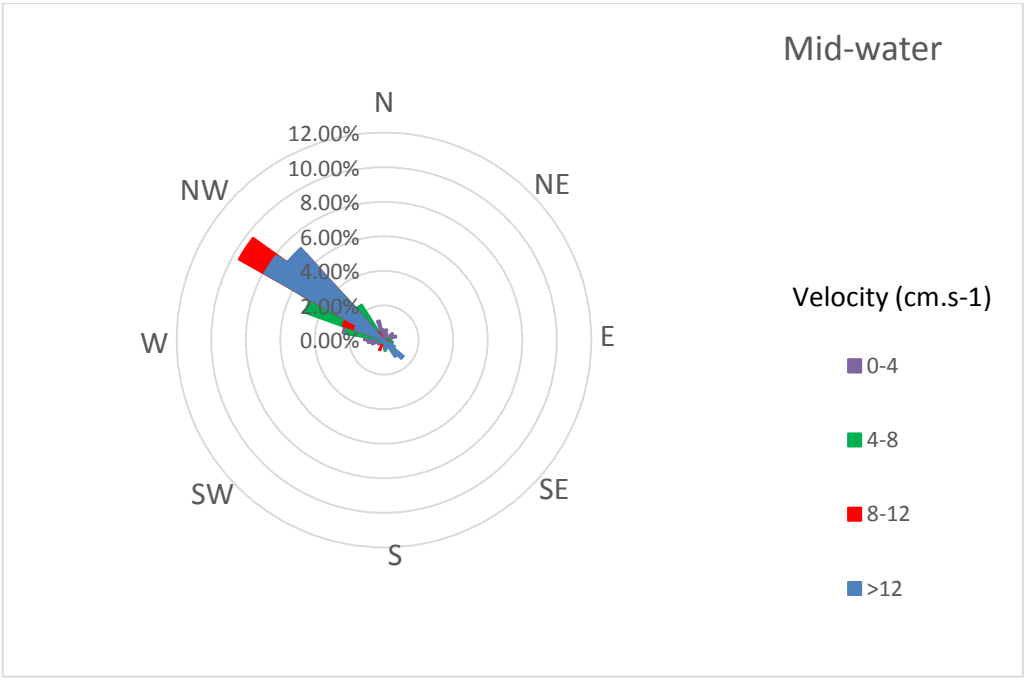
The current plot for surface waters within the proposed Butlers Point lease shows surface water is dominated by the prevailing north westerly and south easterly winds (see Figure 5.4).

Figure 5.4 Surface water velocity from Doppler Flow Meter Data (6 week deployment data collected by Tassal, current plots generated by Marine Solutions)



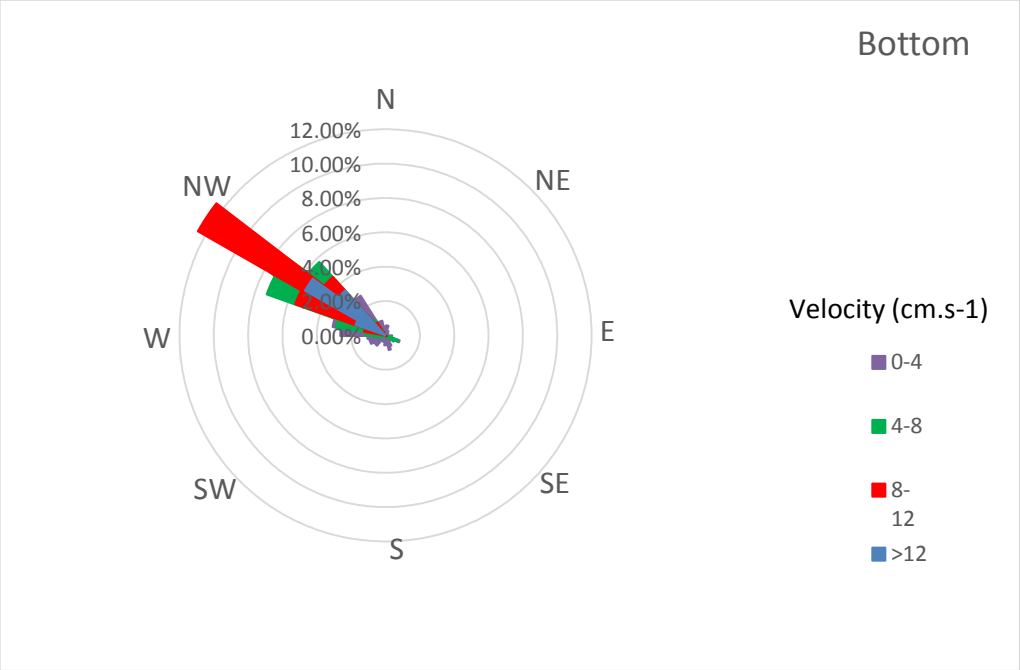
The current plot for midwater column waters is dominated by north westerly current flow, indicating the water flow runs parallel to the proposed lease site to Great Taylors Bay (see Figure 5.5). This current flow is driven by the prevailing north westerly wind coupled with water flow from the Southern Ocean into the D'Entrecasteaux Channel and Great Taylors Bay (refer to Figure 5.7).

Figure 5.5 Middle water velocity from Doppler Flow Meter Data (6 week deployment data collected by Tassal, current plots generated by Marine Solutions)



The current plot for the bottom waters of the proposed amended lease is strongly dominated by north westerly flows (see Figure 5.6). This current flow is driven by water flow from the Southern Ocean into the D'Entrecasteaux Channel and Great Taylors Bay.

Figure 5.6 Bottom water velocity from Doppler Flow Meter Data (6 week deployment data collected by Tassal, current plots generated by Marine Solutions)



The water flow at this location within Great Taylors Bay is driven both by wind and flows from the Southern Ocean. Broadscale Environmental Monitoring Program (BEMP) sampling location W8 is located further up the bay from the current and proposed leases (see section 5.1.4).

5.1.4 Water Quality

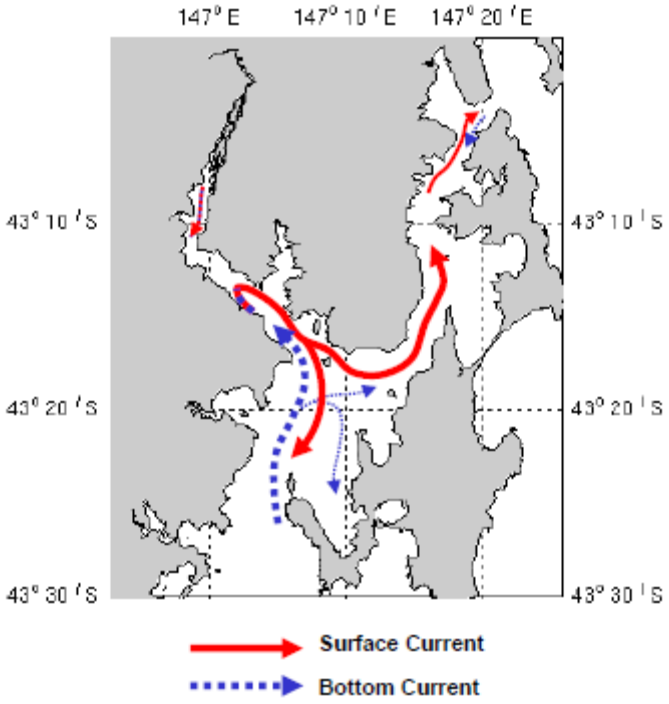
The D'Entrecasteaux Channel and Huon Estuary exhibit contrasting biological, physico-chemical and hydrological processes, and interactions between both water bodies are known to affect water quality characteristics, as well as other nutrient cycling processes. The D'Entrecasteaux Channel is naturally oligotrophic, with strong trophic coupling and nutrient cycling processes, whereas the Huon Estuary is mesotrophic with increased primary production that manifests in a greater propensity for algal bloom events (Thompson et al. 2008). Both water bodies have considerable exchange with offshore derived oceanic waters, including seasonal intrusions of warmer water from the East Australian Current in summer, and colder water from the Zeehan Current in winter.

Herzfeld et al. (2005) provides a conceptual description of the residual flow characteristics of the D'Entrecasteaux Channel-Huon Estuary system (see Figure 5.7) with the following explanation:

1. oceanic water enters the lower D'Entrecasteaux Channel as bottom water moving upstream into the Huon Estuary in the salt wedge (and favouring the southern bank of the river mouth)

2. at the salt wedge (upper Huon Estuary), entrainment occurs into the downstream freshwater flow, most of which moves north entering the D'Entrecasteaux Channel and exits into Storm Bay between Tinderbox and Dennes Point (Bruny Island)
3. a smaller proportion of the Huon flow exits via the southern D'Entrecasteaux Channel

Figure 5.7 Residual circulation in the D'Entrecasteaux Channel and Huon Estuary (From: Herzfeld et al. 2005)

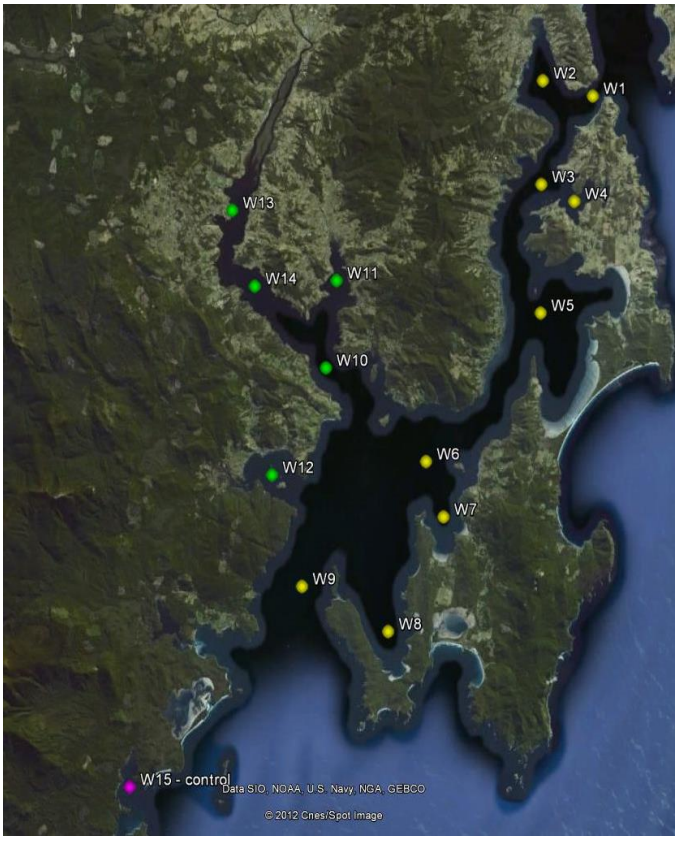


Two key studies, namely the Huon Estuary Study (Butler et al. 2000) and the Whole of Ecosystem Assessment of Environmental Issues for Salmonid Aquaculture in the D'Entrecasteaux Channel and Huon Estuary (Volkman et al. 2009) contributed significantly to the development of monitoring methodologies to determine the ecosystem impacts from salmonid farming in the D'Entrecasteaux Channel and Huon Estuary. In addition, the latter study proposed the application of modelling to focus monitoring programs on those areas most susceptible to the effects from fish farming and eutrophication processes.

The whole of ecosystem approach led to the implementation of the BEMP, as discussed in section 3.5.3, which commenced in March 2009. The BEMP is an industry funded program that undertakes independent monitoring of water quality, sediment chemistry and benthic infauna health at 15 sites (including a control site at Recherche Bay) in the D'Entrecasteaux Channel and Huon Estuary.

BEMP Site 8 is located at Great Taylors Bay, approximately 2.6 km to the east of the Butlers Point lease (Figure 5.8). The water quality data included in this EIS cover 68 sampling events from March 2009 – August 2013 and are assumed to be representative of the water quality characteristics within the area of the proposed amendment.

Figure 5.8 BEMP Monitoring Sites W1-W15



Seasonal averages for salinity, water temperature and dissolved oxygen (for surface and bottom water) for sampling events 1-68 are shown in Table 5.1. The values suggest that the waters of Great Taylors Bay at BEMP Site 8 are typically marine in nature and generally well mixed, with minimal variation between surface and bottom water samples.

Table 5.1 Seasonal average values for salinity, temperature and dissolved oxygen taken at the surface and bottom at BEMP Site 8 from March 2009-August 2013

	Autumn		Winter		Spring		Summer	
Analyte	**Surface**	**Bottom**	**Surface**	**Bottom**	**Surface**	**Bottom**	**Surface**	**Bottom**
Salinity (ppt)	35.0	35.5	34.3	35.3	35.0	35.9	35.3	35.6
Temperature (°C)	15.4	15.2	11.1	11.7	13.4	12.4	17.2	15.3
Dissolved Oxygen (% sat)	101.0	90.2	95.9	91.2	102.4	92.8	102.0	91.9
Dissolved Oxygen (mg/L)	8.1	7.3	8.5	8.8	8.6	7.9	7.9	7.4
No. of observations	24	24	15	15	12	12	15	15

Salinity for both surface and bottom waters (approximately 27 m depth) remains relatively consistent between seasons and there is little variation between surface and bottom waters, suggesting a relatively minor influence from Huon River derived freshwater surface flows.

For surface water, seasonal average values range from 34.3 parts per thousand (ppt) in winter to 35.3 ppt in summer. This range for bottom water is 35.3 ppt (winter)-35.9 ppt (spring). The small variation in salinity between surface water and bottom water samples over the period is consistent with Herzfeld et al.'s (2005) conceptual model of residual circulation in the D'Entrecasteaux Channel-Huon Estuary system, and the predominantly marine nature of waters within the southern D'Entrecasteaux Channel region (Figure 5.7).

Surface water temperatures at BEMP Site 8 ranged from 11.1°C in winter to 17.2°C in summer, whereas a more contracted variation occurred for bottom water temperatures which ranged from 11.7°C in winter to 15.3°C in summer.

Dissolved oxygen values at BEMP Site 8 are generally higher for surface water than bottom water. Seasonal average values for dissolved oxygen in surface water ranged from 102.4% saturation in spring to 95.9% saturation in winter. This range for bottom water is 92.8% saturation (spring) – 90.2% saturation (autumn).

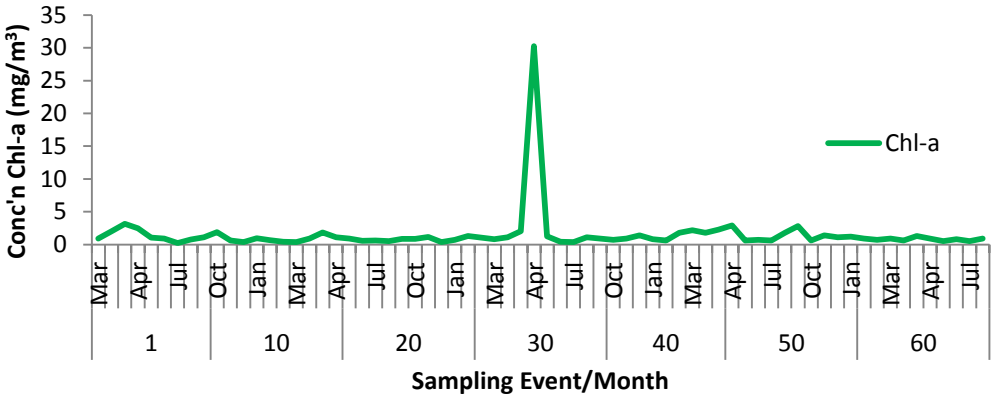
Determinations of dissolved and total nutrients are shown below in Table 5.2. Dissolved nutrient concentrations (ammonium, oxidised nitrogen, phosphate and silicate) display a range of patterns related to seasonal influxes of Southern Ocean-derived nutrient rich water in winter (particularly oxidised nitrogen), biological uptake of nutrients in the photic zone during summer (particularly ammonium), and processes of sediment remineralisation (particularly ammonium and phosphate) that occur throughout the year. This explains the observed differences between surface water and bottom water results. The values shown below are consistent with the range of nutrient concentrations observed at other BEMP sampling sites within the D'Entrecasteaux Channel.

Table 5.2 Nutrient concentrations for BEMP Site 8 (Great Taylors Bay) taken from March 2009-August 2013

Analyte	Mean		Maximum		Minimum	
	Surface	Bottom	Surface	Bottom	Surface	Bottom
Ammonium (mg/L-N) (n=63)	0.002	0.005	0.008	0.023	<0.001	<0.001
Oxidised Nitrogen (mg/L-N) (n=68)	0.020	0.032	0.075	0.072	<0.001	<0.001
Phosphate (mg/L-P) (n=68)	0.008	0.012	0.015	0.018	0.002	0.005
Total Nitrogen (mg/L-N) (n=68)	0.261	0.277	0.420	0.420	0.080	0.140
Total Phosphorous (mg/L-P) (n=68)	0.028	0.033	0.048	0.061	0.013	0.012
Silicate (mg/L-S) (n=68)	0.129	0.121	0.539	0.300	<0.001	<0.001

Chlorophyll a results for BEMP Site 8 are shown separately because the environmental signature of algal bloom events is manifested by chlorophyll a concentrations that are an order of magnitude above background levels. This is shown in Figure 5.9, where a sharp spike in chlorophyll a concentration in April 2011represents a significant algal bloom event in Great Taylors Bay.

Figure 5.9 Chlorophyll a concentrations at BEMP Site 8 (Great Taylors Bay) taken from March 2009-August 2013



Chlorophyll a concentrations are an accepted indicator of phytoplankton biomass and are usually higher in the warmer months, but peaks in spring and autumn are known to occur in the D'Entrecasteaux Channel and Huon Estuary. Furthermore, large differences in chlorophyll a concentrations are known to occur between sites, and in some instances, algal bloom events are restricted spatially to individual bays or regions within the D'Entrecasteaux Channel and Huon Estuary. For example, in April 2011, the algal bloom event at Great Taylors Bay was complemented by larger than usual chlorophyll a concentrations at Sites 7 (Little Taylors Bay), 9 (Southern Boundary) and 6 (Central Channel), and in the Huon Estuary, but remained at baseline levels at the Port Esperance and northern D'Entrecasteaux Channel BEMP sites.

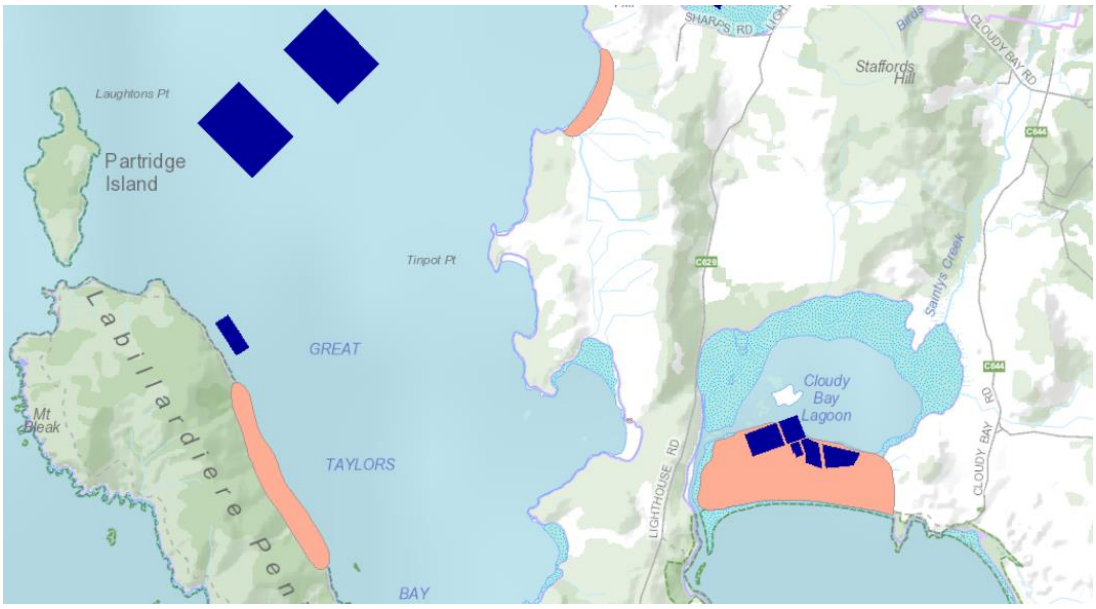
A comprehensive assessment of the BEMP in the D'Entrecasteaux Channel and Huon Estuary, including environmental impacts from marine farming, wastewater treatment and industrial plants, and the effects from oceanic influences is provided in Ross and Macleod (2013).

5.1.5 Geoconservation Sites

A desktop search of LISTMap[1] was undertaken and indicates that there are two listed geoconservation sites located in Great Taylors Bay: Labillardiere Peninsula dolerite and Conleys Beach Pleistocene Dune (see Figure 5.10). It must be noted that the Cloudy Bay mid-bay spit is geographically separated from Great Taylors Bay, and while it is in close proximity on a map, the proposed amendment cannot influence this geoconservation site.

[1] http://maps.thelist.tas.gov.au/listmap/app/list/map - accessed 28-10-2013

Figure 5.10 Geoconservation sites (highlighted in terracotta, with marine farm leases shown in blue) in the vicinity of the Butlers Point lease



These sites are recorded on the Tasmanian Natural Values Atlas with the following descriptions.

Labillardiere Peninsula Dolerite is very coarse grained. There are dolerite exposures along the east coast of the Labillardiere Peninsula Dolerite. It is classified as least concern, but could be degraded by onshore development[2].

The proposed amendment seeks to shift Butlers Point lease further away from the Labillardiere Peninsula Dolerite.

Conleys Beach Pleistocene Dune is the only known location of a reasonably intact last interglacial coastal dune occurring at sea level; this indicates recent tectonic activity in the area. Suggestions that it is most likely a recent interglacial feature include the highly bleached nature of surface sands with a semi-lithified dune core. Only very minor current day beach berms occur in front of the dune. This type of occurrence has not been described from other sites in the State but it appears there may be more subdued features just to the south at Tin Pot Bay.

This landform would be threatened by uncontrolled development of vehicle access points to the beach. Although semi-lithified and more resistant to erosion by wave action, sea level rise poses a longer term threat[3].

[2] Natural Values Atlas https://www.naturalvaluesatlas.tas.gov.au/pls/apex/f?p=200:60:44181648824090 95::NO:RP,60:P60_GEOSITE_ID:2189 accessed 28-10-2013

[3] Natural Values Atlas https://www.naturalvaluesatlas.tas.gov.au/pls/apex/f?p=200:60:44181648824090 95::NO:RP,60:P60_GEOSITE_ID:2206 accessed 28-10-2013

5.1.6 Wind and Wave Conditions

A desktop search of the Bureau of Meteorology (BOM) website provided wind data from 1957 to 2010 for the nearest weather station at Cape Bruny Lighthouse. It showed that the site was dominated by westerly wind patterns at an average of 27.8 km/h[4].

As Butlers Point lease is relatively sheltered, wave height is not expected to exceed 3 m. Scope in the mooring design will take wind and wave conditions at the site into consideration. The majority of wave action comes from the north to north west, and is driven by cool winds draining from elevated mountain ranges behind Dover.

5.2 Flora and Fauna

5.2.1 Marine Vegetation

The substrate within the IMAS survey area included a narrow band of fringing reef along the inshore coastline, typically 30-40 m in width, to a maximum depth of 10 m. The fringing reef habitat was colonised by marine vegetation communities considered typical of sheltered habitats in the D'Entrecasteaux Channel. This area of fringing reef will not be subject to farming infrastructure and operations are proposed to be moved a further 150 m offshore. The IMAS survey showed the vegetation communities to be characterised by *Caulerpa trifaria, Caulerpa longifolia*, red algae, *Macrocystis pyrifera, Sargassum* sp., *Phyllospora comosa and Ecklonia radiata*. *Macrocystis pyrifera* is sparsely distributed along the narrow fringing reef at depths not exceeding 4 m (J. Lane pers. comm., March 2014).

5.2.2 Benthic Fauna (IMAS survey and other where available)

From the 2013 IMAS survey it was found that the sandy area (which included the proposed zone area) had a range of particle sizes correlating with depth. The sand substrates were found to host the New Zealand screw shell *Maoricolpus roseus*, benthic worm tubes, ghost shrimp (*Callianassidae), Corbula gibba, Caulerpa scalpelliformis, Caulerpa trifaria*, hermit (*Paguristes* sp.*)* and other crabs (*Hexapus granuliferus)* and squat lobsters (*Munida haswelli).*

For full details of the IMAS survey, see Table 1 in Appendix 7.

5.2.3 Fish

Parsons (2012) lists 148 native fish species (including sharks and rays) recorded in the D'Entrecasteaux Channel, lower Huon Estuary and adjacent coastal streams.

Waters of the D'Entrecasteaux Channel and lower Huon Estuary are important for many resident species (such as flathead, flounder, wrasses and leatherjackets), migratory pelagic species (such as Australian salmon, jack mackerel and blue warehou) and species that utilise sheltered coastal waters as nursery areas (such as school and gummy sharks).

Table 5.3 below lists species of fish recorded during quantitative surveys undertaken in the lower D'Entrecasteaux Channel (including the Ninepin Point marine reserve area) between 1988-2013 (data provided by Graham Edgar). Many of these fishes are likely to be found in

[4] BOM http://www.bom.gov.au/climate/averages/tables/cw_094010.shtml accessed 28-10-2013

close proximity to Butlers Point, especially along the narrow band of shallow fringing reef adjacent to the coastline. Additional demersal and pelagic species that are more likely to occur in the deeper, less complex habitat off Butlers Point (< 25 m) have also been included to supplement the list of known reef inhabitants. In addition, the list also includes shark species (school shark, gummy shark, elephantfish and the seven gilled shark) that are known to feed, forage and use sheltered waters within the D'Entrecasteaux Channel and lower Huon Estuary as breeding and pupping areas.

Table 5.3 Fish species recorded in lower D'Entrecasteaux Channel (1988-2013)

Scientific Name	Common Name
Acanthaluteres spilomelanurus	Bridled leatherjacket
Ammotretis lituratus*	Spotted flounder
Ammotretis rostratus*	Longsnout flounder
Arnoglossus bassensis*	Bass Strait flounder
Aplodactylus arctidens	Marblefish
Apogon conspersus	Southern cardinalfish
Aracana aurita	Shaw's cowfish
Arripis trutta*	Australian salmon
Bovichtus angustifrons	Dragonet
Caesioperca lepidoptera	Butterfly perch
Caesioperca rasor	Barber perch
Caranx dentex	Silver trevally
Callorhinchus milii*	Elephantfish
Cephaloscyllium laticeps	Draughtboard shark
Cheilodactylus nigripes	Magpie perch
Cheilodactylus spectabilis	Banded morwong
Conger verreauxi	Southern conger eel
Cyttus australis*	Silver dory
Dentiraja lemprieri*	Thornback skate
Dinolestes lewini	Long-finned pike
Diodon nichthemerus	Globe fish
Dipturus whitleyi*	Whitley's skate
Dotalabrus aurantiacus	Castelenau's wrasse
Forsterygion varium	Threefin blenny
Genypterus tigerinus	Rock ling
Gnathanacanthus goetzii	Red velvet fish
Heteroclinus johnstoni	Jonhnston's weedfish
Heteroclinus perspicillatus	Common weedfish
Heteroclinus tristis	Longnose weedfish
Kathetostoma leave*	Common stargazer
Latridopsis forsteri	Bastard trumpeter
Lepidotrigla papilio*	Spiny gurnard
Lepidotrigla Vanessa*	Butterfly gurnard
Lotella rhacinus	Largetooth beardie
Meuschenia australis	Brownstriped leatherjacket
Meuschenia freycineti	Sixspine leatherjacket
Mustelus antarcticus*	Gummy shark
Nemadactylus macropterus	Jackass morwong
Neoodax balteatus	Little weed whiting
Neosebastes scorpaenoides	Common gurnard perch
Norfolkia clarkei	Common threefin
Notalabrus fucicola	Purple wrasse
Notalabrus tetricus	Bluethroat wrasse
Notorynchus cepidianus*	Seven gilled shark

Scientific Name	Common Name
Olisthops cyanomelas	Herring cale
Omegophora armillata	Ringed toadfish
Parablennius tasmanianus	Blenny
Paratrachichthys trailli	Sandpaper fish
Parequula melbournensis	Silverbelly
Parma microlepis	White-ear damselfish
Pempheris multiradiatus	Common bullseye
Penicipelta vittiger	Toothbrush leatherjacket
Pentaceropsis recurvirostris	Long snouted boarfish
Pictilabrus laticlavius	Senator wrasse
Pseudolabrus psittaculus	Rosy wrasse
Platycephalus bassensis*	Sand flathead
Platycephalus richardsoni*	Tiger flathead
Pseudophycis bachus	Red cod
Pseudophycis barbatus	Bearded red cod
Rhombosolea tapirina*	Greenback flounder
Scorpaena papilosa	Southern red scorpioncod
Scorpis lineolatus	Sweep
Seriolella brama*	Blue warehou
Seriolella punctata*	Silver warehou
Siphonognathus beddomei	Pygmy rock whiting
Squalus acanthias*	White spotted dogfish
Thamnaconus degeni	Bluefin leatherjacket
Trachinops caudimaculatus	Blotch-tail trachinops
Trachurus declivis	Jack mackerel
Urolophus cruciatus	Banded stingaree
Urolophus paucimaculatus	Sparsely spotted stingaree

Note: species highlighted with * are additional to those species recorded at Ninepin Point and represent demersal and pelagic species that are likely to inhabit the deeper waters off Butlers Point.

Numerous individuals of two fish species (Blue-throat Wrasse, *Notolabrus tetricus* and Blotch-tail trachinops, *Trachinops caudimaculatus*) were observed in the IMAS survey from drop video camera footage.

For a full description of the locations of these fish, refer to the IMAS report, Appendix 7.

5.2.4 Birds

The southern D'Entrecasteaux Channel supports a diverse range of bird species including waders, waterfowls, seabirds, woodland/forest birds, and raptors. Estuarine and coastal habitats are of particular importance within the D'Entrecasteaux Channel and Huon Estuary, especially for breeding and migratory shorebirds that utilise exposed near shore landforms (such as beaches, dunes and rocky outcrops) and littoral zones (such as mudflats and estuaries) for feeding and roosting (Bryant 2002, Parsons 2012).

Table 5.4 below is a list of species identifications/observations obtained from the BirdLife Tasmania database for species observed within a 5 km radius of the Butlers Point proposed amendment (centroid for query positioned at GDA94 509792, 5193387). This list includes 64 species and is significant in that it represents just over 50% of all bird species recorded in the 2012 State of the D'Entrecasteaux Channel and the lower Huon Estuary Report (Parsons 2012) and includes 9 of Tasmania's 12 endemic bird species.

Table 5.4 Bird observations within 5 km of proposed amendment (from BirdLife Tasmania database)

Scientific Name	Status*	Common Name
Acanthiza chrysorrhoa		Yellow-rumped Thornbill
Acanthiza ewingii	En	Tasmanian Thornbill
Acanthiza pusilla		Brown Thornbill
Acanthorhynchus tenuirostris		Eastern Spinebill
Anthochaera paradoxa	En	Yellow Wattlebird
Artamus cyanopterus		Dusky Woodswallow
Cacomantis flabelliformis		Fan-tailed Cuckoo
Calyptorhynchus funereus		Yellow-tailed Black-Cockatoo
Carduelis carduelis		European Goldfinch
Carduelis chloris		European Greenfinch
Chrysococcyx basalis		Horsfield's Bronze-Cuckoo
Colluricincla harmonica		Grey Shrike-thrush
Coracina novaehollandiae		Black-faced Cuckoo-Shrike
Corvus tasmanicus		Forest Raven
Coturnix ypsilophora		Brown Quail
Cuculus pallidus		Pallid Cuckoo
Cygnus atratus		Black Swan
Egretta novaehollandiae		White-faced Heron
Eudyptula minor	C	Little Penguin
Falco berigora		Brown Falcon
Haematopus fuliginosus	C	Sooty Oystercatcher
Haematopus longirostris	C	Pied Oystercatcher
Haliaeetus leucogaster	T	White-bellied Sea-Eagle
Hirundapus caudacutus		White-throated Needletail
Hirundo neoxena		Welcome Swallow
Hirundo nigricans		Tree Martin
Larus dominicanus		Kelp Gull
Larus novaehollandiae		Silver Gull
Larus pacificus	C	Pacific Gull
Lathamus discolor	T	Swift Parrot
Lichenostomus flavicollis	En	Yellow-throated Honeyeater
Malurus cyaneus		Superb Fairy-wren
Megalurus gramineus		Little Grassbird
Melanodryas vittata	En	Dusky Robin
Melithreptus affinis	En	Black-headed Honeyeater
Melithreptus validirostris	En	Strong-billed Honeyeater
Morus serrator	C	Australasian Gannet
Myiagra cyanoleuca		Satin Flycatcher
Pachycephala olivacea		Olive Whistler
Pachycephala pectoralis		Golden Whistler
Pardalotus punctatus		Spotted Pardalote
Pardalotus quadragintus	En, T	Forty-spotted Pardalote
Pardalotus striatus		Striated Pardalote
Petroica phoenicea		Flame Robin
Petroica rodinogaster		Pink Robin
Phalacrocorax carbo		Great Cormorant
Phalacrocorax fuscescens	C	Black-faced Cormorant
Phalacrocorax melanoleucos		Little Pied Cormorant
Phylidonyris novaehollandiae		New Holland Honeyeater
Phylidonyris pyrrhoptera		Crescent Honeyeater
Platycercus caledonicus	En	Green Rosella

Scientific Name	Status*	Common Name
Puffinus tenuirostris		Short-tailed Shearwater
Rallus pectoralis		Lewin's Rail
Rhipidura fuliginosa		Grey Fantail
Sericornis humilis	En	Tasmanian Scrubwren
Stagonopleura bella		Beautiful Firetail
Stercorarius parasiticus		Arctic Jaeger
Sterna bergii	C	Crested Tern
Sterna caspia	C	Caspian Tern
Sturnus vulgaris		Common Starling
Thalassarche cauta		Shy Albatross
Thinornis rubricollis	C	Hooded Plover
Turdus merula		Common Blackbird
Zosterops lateralis		Silvereye

*Status: En = Endemic, T = Threatened, C = non-threatened high conservation value coastal bird (status category from Parsons 2012).

5.2.5 Marine Mammals

The D'Entrecasteaux Channel and Huon Estuary are known to host a range of marine mammals that reside, feed, forage and migrate within these sheltered waterways both regularly and intermittently. While some marine mammals (such as the Australian and New Zealand Fur-seals) may be considered as resident species, other species (such as the Southern Right and Humpback Whales) are seasonal visitors during their annual migration, and long-range visitors (such as Southern Elephant and Leopard Seals and the Australian Sea-lion) occur on rare occasions[5].

Australian and New Zealand Fur-seals have established haul out and breeding sites around the more remote, exposed locations along Tasmania's coast and offshore islands. There are no established haul out or breeding sites within the D'Entrecasteaux Channel or Huon Estuary, however they commonly inhabit these waters to forage and feed[5].

Southern Elephant Seals, the largest of all seals, are rare visitors to Tasmanian coastal waters – their closest breeding area is Macquarie Island. However, there have been records of females with pups at Dover in 2000 and Bruny Island in 2001. Each year in Tasmania an average of three elephant seals are reported[5].

Leopard Seals breed on the Antarctic pack ice and range from the Antarctic coast to the sub-Antarctic and sub-tropical seas. An average of five Leopard Seals visit the coast of Tasmania each year, but up to 18 have been sighted in one year (1990) [5].

Whilst the Australian Sea-lion has a breeding range which extends from islands off Western Australia to islands east of Kangaroo Island (South Australia), they are known to occur in Tasmanian waters on rare occasions. Documented records of their presence in Tasmanian waters are likely to be an underestimate of actual numbers because they are morphologically similar to local seal species[5].

Bottle-nosed Dolphins and Common Dolphins are the most frequently seen cetaceans in Tasmanian waters and are commonly observed feeding and foraging in the D'Entrecasteaux Channel and Huon Estuary. Southern Right and Humpback Whales are migratory species

[5] DPIPWE 2013, Mammals of Tasmania, http://www.dpiw.tas.gov.au/inter,nsf/ThemeNodes/ LBUN-5362ZN?open - accessed 1 February 2014

that visit Tasmanian coastal waters on their way from the summer subantarctic feeding grounds. While there have been no recorded interactions with either species at the Butlers Point lease, they come sufficiently close to the coast to allow regular sightings from land and because of their large size, interactions with other recreational and commercial marine users require careful management[6].

Table 5.5 below lists the marine mammal species that are known to occur within the proposed amendment at Butlers Point and surrounding areas, or where their preferred habitat also occurs.

Table 5.5 Marine mammals that may be found in the vicinity of Butlers Point

Scientific name	Common name
Eubalaena australis	Southern Right Whale
Megaptera novaeangliau	Humpback Whale
Delphinus delphis	Common Dolphin
Tursiops truncatus	Bottlenose Dolphin
Arctocephalus pusillus	Australian Fur-seal
Arctocephalus forsteri	New Zealand Fur-seal
Hydrurga leptonyx	Leopard Seal
Mirounga leonina	Southern Elephant Seal
Neophoca cinerea	Australian Sea-lion

5.2.6 Threatened Species (IMAS survey and others where available)

Listed threatened and migratory species under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBCA) and TSPA recorded within the area of this proposal or where the species, or species habitat may occur in areas surrounding the area of the proposed amendment are provided below in Table 5.6. These species have been selected on the basis of their inclusion in:

- the Australian Government's online EPBC Protected Matters Report
- the Tasmanian Government's Natural Values Atlas
- the Tasmanian Government's online list of Threatened Species.

For both the EPBC Protected Matters Report (see Appendix 8) and the report generated using the Tasmanian Natural Values Atlas (see Appendix 9), buffers of 5 km from the proposed development at Butlers Point were adopted to ensure adequate coverage across the proposed amendment area and similar habitats where migratory species are likely to occur, breed, or where listed threatened or migratory species are known to forage for food.

[6] DPIPWE 2013, Mammals of Tasmania, http://www.dpiw.tas.gov.au/inter,nsf/ThemeNodes/ LBUN-5362ZN?open - accessed 1 February 2014

Terrestrial plants, reptiles, insects, and mammals have been excluded from this list on the basis that the proposed amendment is restricted to activities below the high water mark and is unlikely to negatively impact on these species.

Table 5.6 Listed Threatened and Migratory species and communities under the EPBCA and TSPA within 5 km of the proposed amendment.

Threatened Ecological Communities				
Name		**EPBC Status**		**Type of Presence**
Giant Kelp Marine Forests of South East Australia		Endangered		Community likely to occur within area
Listed Threatened Species				
Birds				
Species	**Common Name**	**EPBC Status**	**TSPA Status**	**Type of Presence**
Aquila audax fleayi	Wedge-tailed Eagle (Tasmanian)	Endangered	Endangered	Breeding likely to occur within area
Ceyx azureus diemenensis	Tasmanian Azure Kingfisher	Endangered	Endangered	Species or species habitat likely to occur within area
Diomedea epomophora sanfordi	Northern Royal Albatross	Endangered	Endangered	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora epomophora	Southern Royal Albatross	Vulnerable	Not Listed	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans (sensu lato)	Wandering Albatross	Vulnerable	Endangered	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans antipodensis	Antipodean Albatross	Vulnerable	Not Listed	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans exulans	Tristan Albatross	Endangered	Not Listed	Species or species habitat likely to occur within area
Diomedea exulans gibsoni	Gibson's Albatross	Vulnerable	Not Listed	Foraging, feeding or related behaviour likely to occur within area
Fregetta grallaria grallaria	White-bellied Storm-Petrel	Vulnerable	Not Listed	Species or species habitat likely to occur within area
Halobaena caerulea	Blue Petrel	Vulnerable	Vulnerable	Species or species habitat likely to occur within area
Lathamus discolor	Swift Parrot	Endangered	Endangered	Breeding likely to occur within area
Macronectes giganteus	Southern Giant-Petrel	Endangered	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Macronectes halli	Northern Giant-Petrel	Vulnerable	Rare	Species or species habitat likely to occur within area
Pardalotus quadragintus	Forty-spotted Pardalote	Endangered	Endangered	Species or species habitat likely to occur within area
Pterodroma mollis	Soft-plumaged Petrel	Vulnerable	Endangered	Species or species habitat likely to occur within area
Sternula nereis nereis	Australian Fairy Tern	Vulnerable	Vulnerable	Species or species habitat likely to occur within area
Thalassarche bulleri	Buller's Albatross	Vulnerable	Not Listed	Foraging, feeding or related behaviour likely to occur within area

Thalassarche cauta cauta	Shy Albatross, Tasmanian Shy Albatross	Vulnerable	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Species	**Common Name**	**EPBC Status**	**TSPA Status**	**Type of Presence**
Thalassarche cauta salvini	Salvin's Albatross	Vulnerable	Not Listed	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta steadi	White-capped Albatross	Vulnerable	Not Listed	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma	Grey-headed Albatross	Endangered	Endangered	Species or species habitat likely to occur within area
Thalassarche melanophris	Black-browed Albatross	Vulnerable	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris impavida	Campbell Albatross	Vulnerable	Not Listed	Foraging, feeding or related behaviour likely to occur within area
Tyto novaehollandiae castanops **(Tasmanian population)**	Masked Owl (Tasmanian)	Vulnerable	Endangered	Species or species habitat likely to occur within area
Fish				
Species	**Common Name**	**EPBC Status**	**TSPA Status**	**Type of Presence**
Brachionichthys hirsutus	Spotted Handfish, Spotted-hand Fish	Critically Endangered	Endangered	Species or species habitat likely to occur within area
Protroctes maraena	Australian Grayling	Vulnerable	Vulnerable	Species or species habitat likely to occur within area
Thymichthys politus	Red Handfish	Critically Endangered	Not Listed	Species or species habitat may occur within area
Mammals				
Species	**Common Name**	**EPBC Status**	**TSPA Status**	**Type of Presence**
Balaenoptera musculus	Blue Whale	Endangered	Endangered	Species or species habitat may occur within area
Eubalaena australis	Southern Right Whale	Endangered	Endangered	Breeding likely to occur within area
Megaptera novaeangliae	Humpback Whale	Vulnerable	Vulnerable	Species or species habitat may occur within area
Arctocephalus forsteri*	New Zealand Fur Seal	Not Listed	Rare	Not recorded in Natural Values Atlas Report, but likely presence
Other				
Species	**Common Name**	**EPBC Status**	**TSPA Status**	**Type of Presence**
Parvulastra vivipara	Tasmanian Live-bearing Seastar	Vulnerable	Vulnerable	Species or species habitat may occur within area
Gazameda gunnii	Gunn's Screw Shell	Not listed	Vulnerable	Not recorded in Natural Values Atlas Report, species or species habitat may occur within area

Sharks				
Carcharodon carcharias	Great White Shark	Vulnerable	Vulnerable	Species or species habitat may occur within area
Listed Migratory Species				
Marine Birds				
Species	**Common Name**	**EPBC Status**	**TSPA Status**	**Type of Presence**
Apus pacificus	Fork-tailed Swift	Not Listed	Not Listed	Species or species habitat likely to occur within area
Diomedea exulans antipodensis	Antipodean Albatross	Vulnerable	Not Listed	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans exulans	Tristan Albatross	Endangered	Not Listed	Species or species habitat may occur within area
Diomedea epomophora epomophora	Southern Royal Albatross	Vulnerable	Not Listed	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans (sensu lato)	Wandering Albatross	Vulnerable	Endangered	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans gibsoni	Gibson's Albatross	Vulnerable	Not Listed	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora sanfordi	Northern Royal Albatross	Endangered	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes giganteus	Southern Giant-Petrel	Endangered	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Macronectes halli	Northern Giant-Petrel	Vulnerable	Rare	Species or species habitat may occur within area
Puffinus carneipes	Flesh-footed Shearwater	Not Listed	Not Listed	Foraging, feeding or related behaviour likely to occur within area
Thalassarche bulleri	Buller's Albatross	Vulnerable	Not Listed	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta cauta	Shy Albatross, Tasmanian Shy Albatross	Vulnerable	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma	Grey-headed Albatross	Endangered	Endangered	Species or species habitat may occur within area
Thalassarche melanophris	Black-browed Albatross	Vulnerable	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris impavida	Campbell Albatross	Vulnerable	Not Listed	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta salvini	Salvin's Albatross	Vulnerable	Not Listed	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta steadi	White-capped Albatross	Vulnerable	Not Listed	Foraging, feeding or related behaviour likely to occur within area

Listed Migratory Marine Species				
Species	**Common Name**	**EPBC Status**	**TSPA Status**	**Type of Presence**
Balaenoptera musculus	Blue Whale	Endangered	Endangered	Species or species habitat may occur within area
Caperea marginata	Pygmy Right Whale	Not Listed	Not Listed	Species or species habitat may occur within area
Species	**Common Name**	**EPBC Status**	**TSPA Status**	**Type of Presence**
Carcharodon carcharias	Great White Shark	Vulnerable	Vulnerable	Species or species habitat may occur within area
Eubalaena australis	Southern Right Whale	Endangered	Endangered	Breeding likely to occur within area
Lagenorhynchus obscurus	Dusky Dolphin	Not Listed	Not Listed	Species or species habitat may occur within area
Lamna naus	Porbeagle, Mackerel Shark	Not Listed	Not Listed	Species or species habitat likely to occur within area
Megaptera novaeangliae	Humpback Whale	Vulnerable	Not Listed	Species or species habitat may occur within area
Orcinus orca	Killer Whale, Orca	Not Listed	Not Listed	Species or species habitat may occur within area
Listed Migratory Terrestrial Species				
Species	**Common Name**	**EPBC Status**	**TSPA Status**	**Type of Presence**
Haliaeetus leucogaster	White-bellied Sea-Eagle	Not Listed	Vulnerable	Species or species habitat known to occur within area
Hirundapus caudacutus	White-throated Needletail	Not Listed	Not Listed	Species or species habitat likely to occur within area
Myiagra cyanoleuca	Satin Flycatcher	Not Listed	Not Listed	Species or species habitat known to occur within area
Pardalotus quadragintus	Forty-spotted Pardalote	Endangered	Endangered	Species or species habitat likely to occur within area
Listed Migratory Wetland Species				
Species	**Common Name**	**EPBC Status**	**TSPA Status**	**Type of Presence**
Ardea alba	Great Egret, White Egret	Not Listed	Not Listed	Species or species habitat likely to occur within area
Ardea ibis	Cattle Egret	Not Listed	Not Listed	Species or species habitat likely to occur within area
Gallinago hardwickii	Latham's Snipe, Japanese Snipe	Not Listed	Not Listed	Species or species habitat may occur within area

5.2.6.1 Targeted threatened species surveys (as required by DPIPWE)

Gunn's screw shell (*Gazameda gunnii*)

Species description

Gazameda gunnii is a member of the benthic infauna community (i.e. living within sediments rather than occurring visibly on the surface of the seabed). Commonly referred to as Gunn's Screw shell, *Gazameda gunnii* is a turretelid gastropod which is endemic to Australia. Its distribution has been recorded from Cape Moreton (Queensland) southwards to northern and eastern Tasmania. *Gazameda gunnii* is a relatively small gastropod with a size range commonly between 30-40 mm, but has been measured up to 69 mm in length. It has been recorded at depths ranging from 8 to at least 140 m, and lives in muddy and gravelly sand.

Gazameda gunnii is listed as vulnerable in the TSPA, and a field assessment (as specified by the DPIPWE) is required to determine whether this species occurs within benthic infaunal assemblages where development activities are proposed (Aquenal 2012).

Survey results

Individuals of Gunn's screw shell (*Gazameda gunnii*) were not recorded in the IMAS Environmental Zone Assessment (IMAS 2013, see Appendix 7). During the initial environmental baseline survey undertaken in June 2011, no live or dead shells of *Gazameda gunnii* were discovered as part of the threatened species survey (Aquenal 2011).

Spotted Handfish (*Brachionichthys hirsutus*)

Species description

The Spotted Handfish is a small endemic handfish inhabiting inshore demersal zones of coastal embayments and estuaries, with a narrow geographic and depth distribution. It is currently restricted to the lower Derwent Estuary and adjoining bays and channels in southern Tasmania; inhabiting unconsolidated substrata ranging from well sorted coarse sand and shell grit, to areas of fine sand and silt.

Spotted Handfish populations have reduced significantly since its discovery and this species is now critically endangered under the EPBCA and TSPA. Some records of specimens have been taken well beyond the current known geographic range, from Coles Bay on the east coast to the Cygnet Estuary in the south. Specimens reach up to 120 mm in length, and occur at depths from 1 - 60 m, but are more commonly observed between 5 - 15 m by SCUBA divers (Bruce et al. 1998, Last et al. 2007).

Survey details and results

A dedicated Spotted Handfish survey was undertaken over January and February 2014 according to the specific survey guidelines as directed by DPIPWE. Over 20 individual 100 m transects were undertaken using a Seabotix® Little Benthic Vehicle LBV150SE² Remote Operated Vehicle (ROV). Underwater footage at the substrate level is captured using internal video cameras that are relayed to the topside via a fibre optic cable. The machine is fitted with two LED spotlights that can be used when visibility is low. The field positioning of transect dives was made accurate by the use of a DGPS, giving real time differentially corrected GPS positions that are correct to less than 1 m.

Video footage was compiled into DVD format and provided for independent analysis by an approved third party consultancy with previous experience in undertaking Spotted Handfish surveys and research.

Previous surveys of the current Butlers Point lease and surrounding area (e.g. environmental baseline and IMAS zone assessment surveys) have not detected this species. The dedicated survey undertaken as part of the DPIPWE threatened species requirements did not confirm the presence of Spotted Handfish within the survey area (see Appendix 12).

5.3 Reservations

5.3.1 World Heritage Areas

There are no World Heritage Areas within the proposed zone or surrounding area.

5.3.2 Ramsar sites

There are no Ramsar Sites within the proposed zone or surrounding area.

5.3.3 Marine Reserves

There are no Marine Reserves within the proposed zone or surrounding area.

5.3.4 National Parks

South Bruny National Park

The proposed zone lies offshore to the east of the Labillardiere Peninsula which is part of the South Bruny National Park.

The South Bruny National Park is a popular tourist destination with an abundance of bird life and a scenic landscape containing a varied coastline of beach, cliffs, headlands and coastal heathland. It has prominence in Tasmanian Aboriginal and European history, and provides key habitat for threatened species.

As stated in the *South Bruny National Park, Waterfall Creek State Reserve, and Green Island Nature Reserve - Management Plan 2000*, the South Bruny National Park contains high historic, cultural and natural values that include the following.

- Threatened and priority flora, plant communities with Comprehensive, Adequate and Representative (CAR) values and communities of conservation significance, National Estate flora values, and natural flora diversity.
- Threatened and priority fauna species, habitats of conservation significance, National Estate fauna values, natural fauna diversity. The South Bruny National Park contains one of the largest colonies of the Forty-spotted Pardalote.
- Natural landscapes, vistas and sites of geoconservation.
- Sites, objects and places of Aboriginal Heritage significance.
- National Estate significance sites such as Cape Bruny Light station.

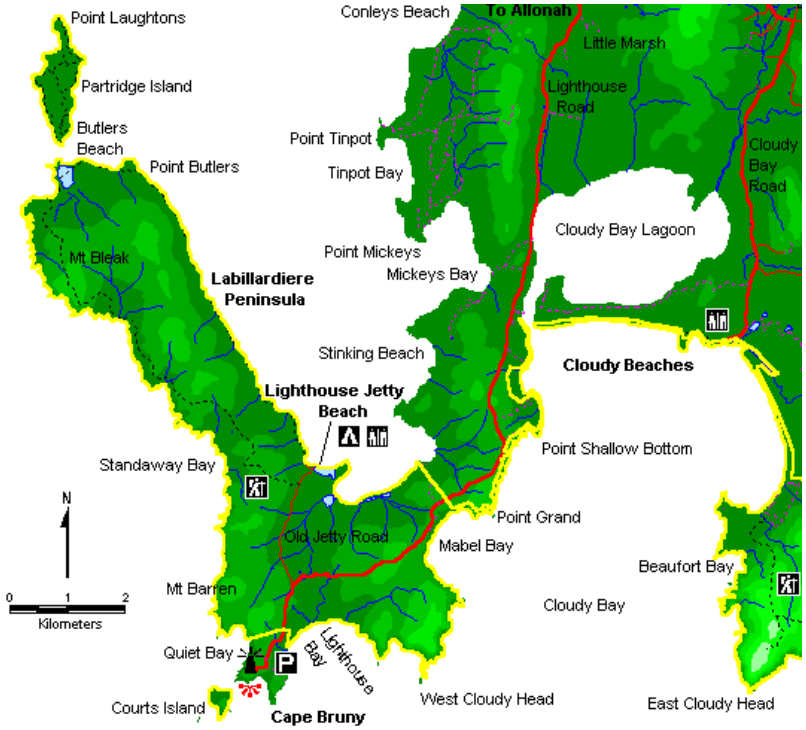
- Evidence of early European exploration and early whaling activities (Jetty Beach).

In addition to these values, the management plan seeks to uphold an atmosphere of quietness and relaxation, particularly in relation to tourism.

The coastal fringes of the South Bruny National Park on the Labillardiere Peninsula in direct view of the proposed zone are designated 'Recreational Zone' in the *South Bruny National Park, Waterfall Creek State Reserve, and Green Island Nature Reserve - Management Plan 2000,* under which the South Bruny National Park is managed. Several bushwalking tracks circumnavigate the South Bruny National Park and a coastal track for bushwalkers lies along the eastern side of the Labillardiere Peninsula (Butlers Beach track) from which the proposed amendment is likely to be viewed.

There are public recreational facilities including toilets and camping areas approximately 4.5 km to the south at Lighthouse Jetty Beach, and at Cloudy Bay (the Pines and Cloudy Corner, see Figure 5.11).

Figure 5.11 Map indicating public recreational facilities, walking tracks,



5.3.5 Other Conservation Areas

There are no other designated conservations areas within the proposed zone or surrounding area.

5.4 Land Planning Aspects

5.4.1 Land Tenure

The land adjacent to the proposed amendment, including Partridge Island, is Crown Land and forms part of the South Bruny National Park.

The majority of land surrounding Great Taylors Bay outside the South Bruny National Park is private freehold.

5.4.2 Land Zoning

All the land surrounding the proposed amendment area and the greater region of Great Taylors Bay is zoned 'Environmental Management' under the *Kingborough Planning Scheme 2000*.

5.4.3 Land Use

The private freehold land to the east of the proposed amendment is used for residential and tourist accommodation purposes. There are a number of residences approximately 3 km to 4.5 km from the proposed amendment area. Ten dwellings have been identified on the eastern shore of Great Taylors Bay, and of these dwellings, four properties have been granted planning approval for a change of use to tourist accommodation.

An application for a proposed dwelling to be built on a property between Mickeys Point and Tin Pot Bay is also current. There are no other proposed sensitive uses identified in proximity to the proposed amendment area for which planning approval is being sought.

Informal coastal reserves with public access lie along the Great Taylors Bay eastern shoreline, and Crown licences have been granted for land in the coastal reserve at Stinking Beach (PID 1656642 – Agreement ID 5215) and another at Mickeys Bay (PID1934171 – Agreement ID 10256).

Tourist and recreation facilities, routes, and camping areas are located within the South Bruny National Park, and are detailed in section 5.3.4.

North of Conleys Beach is not considered within the potential impact zone as the nearest dwellings are significantly north, near Ventenat Point.

5.5 Maritime Aspects

5.5.1 Commercial Shipping

TasPorts advise that there will be no impact to commercial shipping in the area due to the proposed amendment (C. Black, General Manager, Marine Services. Tasmanian Ports Corporation, *pers. comm.*).

5.5.2 Recreational Boating

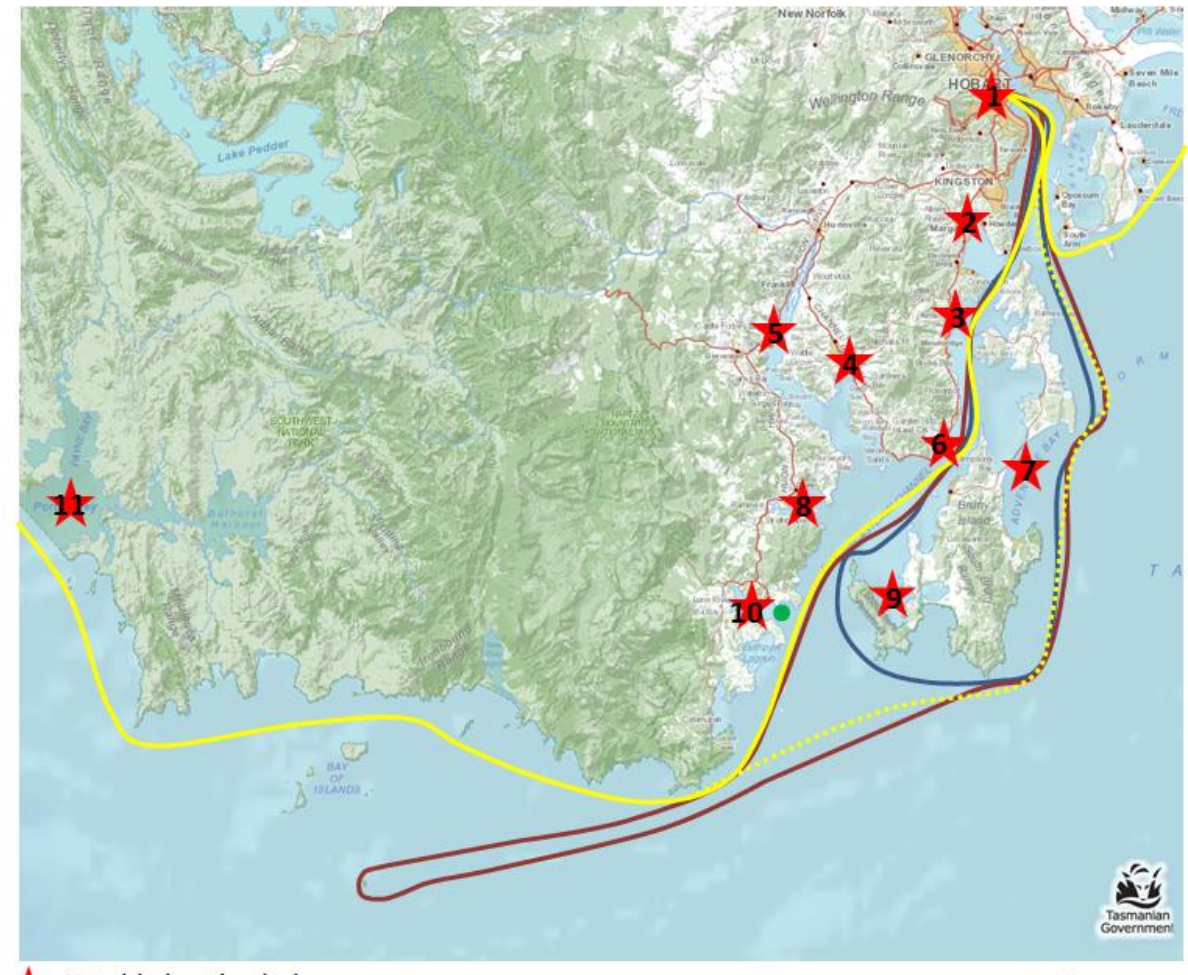
Coastal scenery and the presence of anchorages in adjacent waterways make Great Taylors Bay a popular area for recreational boaters. Recreational vessels utilising the area range from small run-abouts to sailing and motor vessels, and occasionally luxury yachts. The frequency of people using recreational boats in the area is increasing, corresponding with local population expansion and improved marine facilities.

Organised boating events that occur in the area, or attract vessels to transit through the area, include:

- Bruny Island Race (February)
- Mewstone Race
- Southport Regatta (February)
- Van Diemen Circumnavigation Cruise.

All of these are run annually, with the exception of the Van Diemen Circumnavigation Cruise which is run biennially. Figure 5.12 below shows the approximate routes taken for these events, and the locations of boating hubs in the D'Entrecasteaux Channel and further afield. Boating transit lines interconnect these hubs.

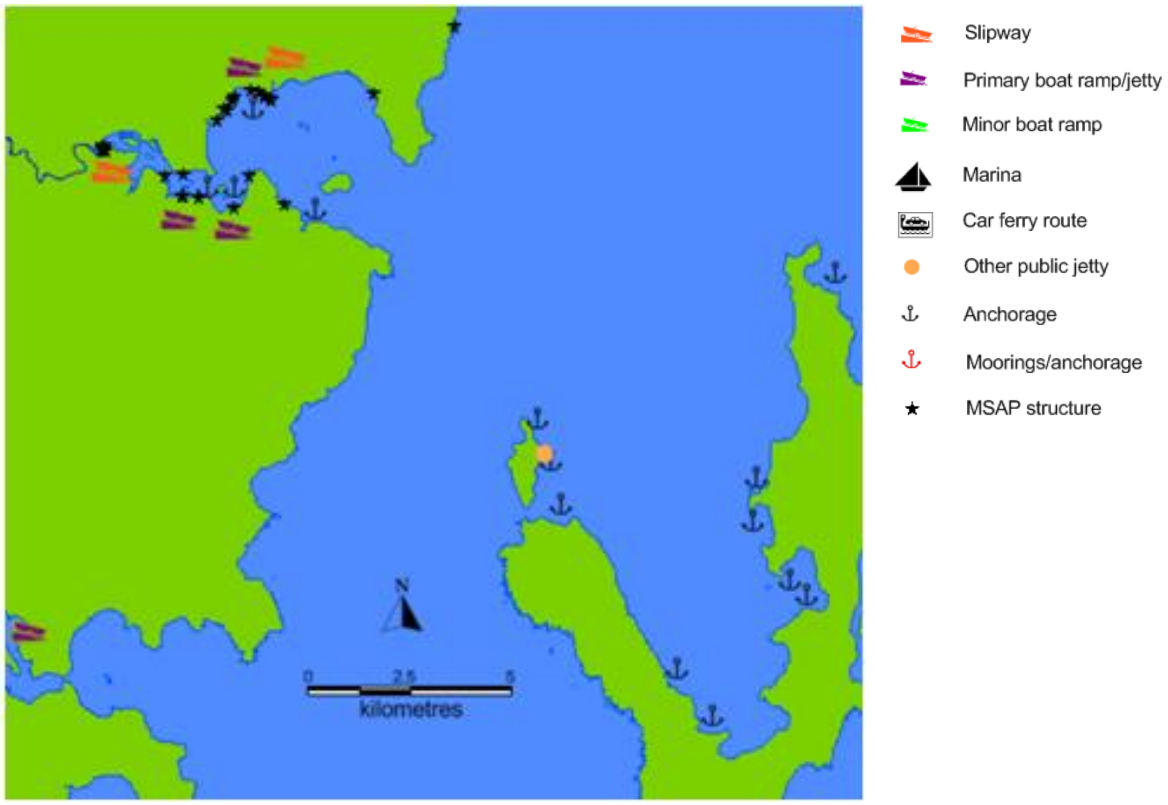
Figure 5.12 Approximate locations/routes of organised boating events in south east Tasmania



Popular anchorages within the immediate vicinity of the proposed amendment are Butlers Beach and Taylor's Reef and along the eastern side of Partridge Island. The nearest boat

ramps are at Lunawanna and Jetty Beach. There is a public jetty located on the eastern side of Partridge Island (Figure 5.13).

Figure 5.13 Marine facilities in the southern D'Entrecasteaux Channel (modified from Parsons 2012)



5.5.3 Commercial Fishing

The D'Entrecasteaux Channel is closed to the commercial taking of scalefish, scallops and rock lobster. Commercial abalone fishing does occasionally occur near the proposed amendment (Partridge Island) with the main target species being blacklip abalone *(Haliotis rubra)*.

5.5.4 Recreational Fishing

Recreational fishing provides social and economic benefit to communities throughout south east Tasmania (Department of Primary Industries, Parks, Water and Environment [DPIPWE] 2010). A survey of over 130 residents of the D'Entrecasteaux Channel/Huon region identified recreational fishing as a key value, with a high number of respondents specifically identifying the regions of Great Taylors Bay as a valued fishing ground (Ogier and Macleod 2013). Popular fishing methods include line fishing, diving and restricted gill-netting.

By number of specimens caught, the key species targeted by recreational fishers in south east Tasmania (inclusive of the D'Entrecasteaux Channel) include flathead, scallops and rock lobster (DPIWE 2010). Other species taken include squid, abalone, gurnard, cod, flounder and wrasse.

5.5.5 Recreational Activities

Recreational activities known to take place in the Butlers Point area, including Great Taylors Bay, are:

- fishing
- camping
- boating
- diving
- kayaking
- walking
- bird watching, and
- swimming.

As stated in section 5.3.4, the South Bruny National Park provides a range of facilities that support various recreational activities within proximity of the proposed amendment.

5.6 Heritage

5.6.1 Aboriginal Heritage

Aboriginal heritage is protected under the *Aboriginal Relics Act 1975*, which states that if at any time during works, suspected Aboriginal heritage is uncovered, works must be ceased and Aboriginal Heritage Tasmania notified.

Aboriginal Heritage Tasmania (AHT) conducted a desktop search of the Tasmanian Aboriginal Site Index regarding the proposed amendment of Zone 18B in Great Taylors Bay, and has advised that there are no Aboriginal heritage sites recorded within Great Taylors Bay. Due to the proposal having no land based infrastructure it is believed that the area has a very low probability of Aboriginal heritage being present.

Accordingly there is no requirement for an Aboriginal heritage investigation and Aboriginal Heritage Tasmania has no objection to the project proceeding.

5.6.2 European and Other Heritage

5.6.2.1 Places listed on the Tasmanian Heritage Register (maintained by the Tasmanian Heritage Council), including consideration of cultural landscapes

Tassal conducted a search of the Tasmanian Heritage Register[7]. The Tasmanian Heritage Register lists those places that are recognised as being of historic cultural heritage significance to the whole of Tasmania. The Register is maintained by the Heritage Council under the *Historic Cultural Heritage Act 1995*.

There are no registered places located within or in close proximity to the proposed amended lease area; however, listed sites in the South Bruny National Park area are noted in the following section.

5.6.2.2 Places on the Tasmanian Historic Places Inventory (maintained by the Tasmanian Heritage Office)

Tassal conducted a search of the Tasmanian Historic Places Inventory, under the Australian Heritage Places Inventory. There are no historic places within or in close proximity to the proposed amended lease area. However the closest, the Light Station and associated buildings on Lighthouse Road Cape Bruny as identified on Figure 5.11, are listed on:

- Register of the National Estate – Federal heritage significance
- Tasmanian Heritage Council listing – State heritage significance, and
- Register of National Trust – Classified – State heritage significance.

5.6.2.3 Local government planning scheme heritage schedules

Schedule 2 of the Kingborough Planning Scheme 2000 lists:

- the Light Station and associated buildings, Lighthouse Road, Cape Bruny, as
    - Registered National Estate – Federal heritage significance
    - Tasmanian Heritage Council listing – State heritage significance, and
    - Register of National Trust – Classified – State heritage significance
- South Bruny National Park and Bay of Islands Mount Bruny as
    - Registered National Estate – Federal heritage significance
- Cape Bruny Lighthouse Jetty Lunawanna as
    - Kingborough Council listing of National significance.

None of the above are in or in the near vicinity of the proposed amendment. However the closest is the Light Station and associated buildings on Lighthouse Road, Cape Bruny as identified on Figure 5.11.

[7] http://www.heritage.tas.gov.au/thr.html

5.6.2.4 Other places of heritage significance

There are no other places of heritage significance within the proposed amended lease area or surrounds.

5.7 Social and Economic Description

The Tasmanian economy has been subject to recent and significant structural change, and this has become more evident as the lag effects from the 2007-2008 global financial crisis have presented key sectoral challenges to Tasmanian businesses over the past two years.

Rising real incomes, changing patterns of consumer spending, and growth in exports from Tasmania's primary industries have resulted in strengthening Tasmania's salmonid aquaculture industry. Other traditionally important sectors of Tasmania's economy, such as forestry and some parts of the manufacturing sector, have been subject to rapid declines in recent years[7].

In recognition of the important role that the salmonid aquaculture industry will play in providing a range of economic, investment and employment opportunities in this state, the Tasmanian Government is supportive of the need to investigate the potential for new marine farming areas for possible further aquaculture expansion in the medium term[7]. This is an approach that is consistent with Tassal's 'South East Optimisation Program'.

The value of farmed salmonids to Tasmania has increased from $362 M in 2009-10 to $506 M in 2011-12, and represents 48% of the total annual value of aquaculture production in Australia (Australian Bureau of Agricultural and Resource Economics and Sciences [ABARES] 2013).

In Tasmania alone, salmonid aquaculture production now accounts for 73% of the total annual fisheries production (including both wild capture and farmed products), whereas in 1988-89 this same level of contribution was sourced from Tasmania's wild capture fisheries (rock lobster, abalone and finfish; ABARES 2013).

Tasmania employs the largest number of people in the aquaculture sector nationally (1 152 people), two-thirds of whom are based in southern Tasmania for their employment[8]. Tassal employs over 800 people in Tasmania which equates to approximately 70% of Tasmania's aquaculture sector.

5.7.1 Population

It must be noted that the primary land base for Butlers Point lease is Meads Creek within Port Esperance. The following population analysis and economic impact therefore focusses on Dover and Adventure Bay and its immediate environs.

The area adjacent to the current and proposed zone areas is unpopulated as it is within the South Bruny National Park. The closest township to the lease is Lunawanna, a small gazetted locality on the western side of Bruny Island and is approximately 15 km by sea from the proposed lease area. Lunawanna has a community hall, a shop, a public toilet, a jetty and a post box. The Australian Bureau of Statistics (ABS) does not release data for gazetted localities, however population data from the ABS has been accessed to describe the suburb of Adventure Bay which includes Lunawanna and incorporates all of South Bruny Island.

[8] in http://www.development.tas.gov.au/economic/economic_development_plan/Printable_documents

Adventure Bay, Bruny Island

Total Population	534
Male	283
Female	251
Median Age	55

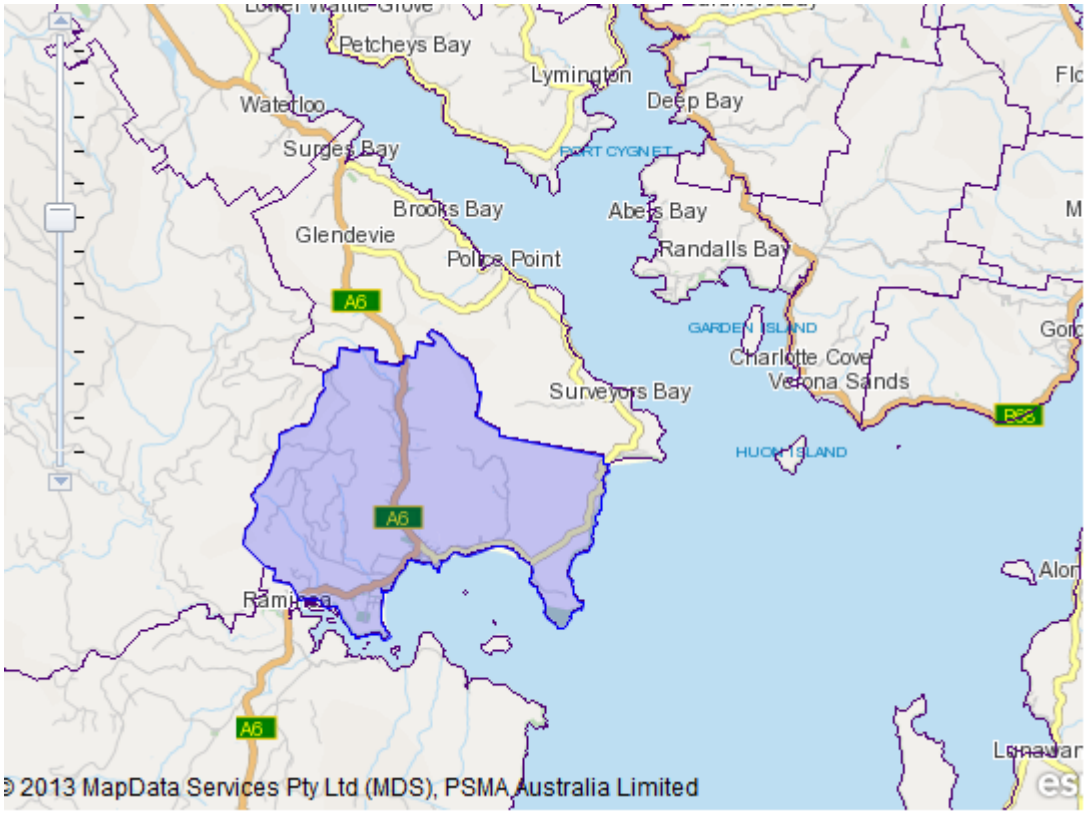
Of the employed people aged 15 years and over, 4.7% of the population in Adventure Bay are employed in the aquaculture industry.

As previously stated, the land base for the Huon Farming Region that would be used to service this lease is located near Dover. Killala Bay also services the Huon Farming Region, but this is for the smolt leases in the Huon Estuary and has therefore not been included in this analysis. Population data from the ABS has been accessed to describe the suburb of Dover (see Figure 5.14).

Dover, Tasmania

Total Population	763
Male	387
Female	376
Median Age	51

Figure 5.14 State Suburb (SSC) of Dover



Of the employed people aged 15 years and over, 24% of the population in Dover work in the aquaculture industry.

5.7.2 Economic Description

5.7.2.1 Tourism

The *State of the D'Entrecasteaux Channel and the lower Huon Estuary 2012 Report* (Parsons 2012) stated that the number of tourists visiting the area has declined in the past five years with a decrease of 9.5% recorded between 2010/11 and 2011/12, but noted that visitors are choosing to spend more time in the area, with an increase in overnight stays. This finding was based on tourism data collected by Tourism Tasmania.

The current and proposed zone and lease areas fall within the 'Huon Trail' tourism area. The Huon Trail incorporates touring routes south of Hobart and is made up of four regions – the Huon Valley, Far South, D'Entrecasteaux Channel and Bruny Island and covers 56 registered attractions[9].

Land-based tourism

Accommodation in the Lunawanna area on Bruny Island include:

- Bruny Island Villas, Lunawanna
- Aquarius Retreat, Lunawanna
- All Angels Church House, Lunawanna
- St Clairs Cottage, Lunawanna
- Bruny Island Explorer Cottages, Lunawanna
- Inala Country Accommodation, Lunawanna
- Daniel's Bay Retreat, Lunawanna
- Hotel Bruny, Alonnah
- The Bruny Island Long Weekend, South Bruny

  The Bruny Island Long Weekend offers a luxury three-day guided food, wine and walking tour. The tour highlights opportunities for bird and wildlife spotting and includes a Bruny Island Cruse and seaplane flight.

Restaurants, cafes, bars and other food outlets in the Lunawanna area on Bruny Island include:

- Bruny Island Premium Wines – Vineyard and Cellar Door, Lunawanna
- Hotel Bruny, Alonnah
- Lunawanna Store, Lunawanna.

Accommodation in the Dover area include:

[9] http://www.huontrail.org.au/

- Far South Wilderness Lodge, Strathblane
- Chapel Lane Hall, Dover
- Dover Beachside Tourist Park, Dover
- Driftwood Cottages, Dover
- Smugglers Rest, Dover.

Restaurants, cafes, bars and other food outlets in the Dover area include:

- Post Office 6985, Dover
- Wombats of Dover Takeaway, Dover
- Thelma Retreat Teahouse, Dover
- Dover Café and Takeaway, Dover
- Dover RSL, Dover
- St Imre Vineyard and Cellar Door, Dover.

Walks and treks

Walking tracks on South Bruny Island include:

- Labillardiere Peninsula Walk / Butlers Beach track
- East Cloudy Head
- Luggaboine Circuit
- Mavista Nature Walk
- Mt Mangana
- Slide Track
- Fluted Cape
- Grass Point
- Alonnah Sheepwash Track.

The Huon Trail touring guide does not list any walking tracks within the Dover area, however the Dover foreshore allows for activities such as walking and bike riding.

The Dover public nine hole golf course is Australia's most southerly golf course.

Marine-based tourism

The waterways are of high importance to the local areas with growth in cruises and other forms of marine-based tourism. The D'Entrecasteaux Channel and lower Huon Estuary region is the state's most popular area for boating, fishing and yachting as well as SCUBA diving, surfing, kayaking and swimming (Parsons 2012).

Wildlife spotting

Several species of marine mammals including whales, dolphins and seals visit the D'Entrecasteaux Channel and lower Huon Estuary. Penguins and shearwaters can also be seen on Bruny Island.

Boat cruises

Boat cruise operators in the southern D'Entrecasteaux Channel area include:

- Hobart Yachts – Tasmanian Yachting Adventures, Hobart
- Channel Cruise and Charters, Hobart
- Moonshine Charters, Southport (May – August)
- Pennicott Wilderness Journeys – Bruny Island Cruises, Hobart.

Pennicott Wilderness Journeys are working with Tassal and host their Tasmanian Seafood Seduction tour which includes a stop at a Tassal marine farm within the Bruny Farming Region and view below the surface with an underwater camera.

Seaplane flights

Tasmanian Air Adventures offers tours that include the Huon Estuary and D'Entrecasteaux Channel. These tours depart from the Hobart waterfront.

SCUBA diving

SCUBA diving activities are frequently associated with recreational fishing of rock lobster and abalone. The Marine Life Network lists 31 recommended dive sites in the D'Entrecasteaux Channel, Bruny Island and Far South area.

Sea kayaking

Sea kayaking is a popular recreational activity in the D'Entrecasteaux Channel area. Operators offering sea kayak charters and equipment hire in the area include:

- Roaring 40's Ocean Kayaking (day tours and equipment hire), Kettering
- Alonnah Paddleboats and Kayaks, Alonnah (Bruny Island).

5.7.2.1.1 Industry

In addition to aquaculture (finfish and shellfish farming), the region supports a number of industries including commercial fishing, boat building, gourmet food production and tourism, all of which provide valuable employment for the region (Parsons 2012).

6 Potential Effects and their Management

6.1 Impacts on the Natural Environment

6.1.1 Water Quality

6.1.1.1 Recognised effects of farming emissions on water quality

A key component of marine finfish farming, both in terms of fish performance and developing an ecologically responsible industry involves understanding the environmental effects of farming on water quality.

Marine farming has the potential to impact negatively on water quality, the severity of which depends on the type and intensity of the farming activity and the capacity of the receiving environment to buffer any impact (Black 2001). However, there have been significant improvements over the last twenty years in the management of marine cage aquaculture operations, resulting in improved water quality. This has been observed through improvements in feeding practices, feed formulation and understanding fish behaviour (Price and Morris 2013).

Farm site characteristics, such as bathymetry, current and tidal flows are significant drivers in nutrient dispersion in and around farms. Establishing farm sites in waters of suitable depth, with sufficient flushing rates are known to lessen impacts on water quality. In addition, the combination of physical (hydrodynamic) and ecological (trophic relationships) processes is also known to influence the assimilative capacity of the receiving environment through:

- nutrient uptake by phytoplankton, and the associated trophic transfers through higher trophic levels, and
- dilution of nutrients and planktonic organisms, primarily driven by the prevailing hydrodynamic forces and movement of water masses – these occurrences may reflect patterns of large scale oceanic circulation or individual wind mixing events, or a combination of both (Buschmann et al. 2007).

Reviews of the existing literature on the impacts of aquaculture (see Munday et al. 1992, Gowen and Rosenthal 1993, Wu 1995, Black 2001) essentially report similar conclusions.

Nutrient emissions associated with finfish farming are known to affect water quality at both fine and broadscale levels. The release of nutrients into the environment from finfish farming is largely associated with the exogenous feed input (De Pauw and Joyce 1991, Handy and Poxton 1993, Pillay 1995), and the extent to which water quality is affected by farming emissions can be attributed to the assimilative capacity of the environment, fish stocking densities and levels of feed input (Ackefors and Enell 1990, Black 2001).

Soluble wastes associated with finfish culture include ammonia, phosphorus and dissolved organic carbon emissions. The CSIRO Huon Estuary Study (HES) (2000) assessed the sources, distribution and cycling of nutrients (including those from finfish farming) in the Huon Estuary (Butler et al. 2000). These studies and further analysis of the broadscale impacts to the ecosystem were subsequently updated through the Aquafin CRC biogeochemical modelling of the D'Entrecasteaux Channel and Huon Estuary (Volkman et al. 2009).

The results of the HES demonstrated the importance of flow and flushing rates of a system in relation to nutrient cycling and confirmed that problems associated with nutrient emissions are minimised where flushing rates are sufficient enough to dilute nutrient loads.

One of the environmental concerns relating to fish farming in Tasmania is eutrophication of the water column, since the combination of high stocking densities and feed inputs could potentially lead to imbalanced levels of nitrogen and phosphorous in the water column. In marine systems, nitrogen is typically the limiting nutrient, so its availability will dictate the amount of primary production.

Approximately 5% of the total feed input from salmon farming is released into the receiving environment as a form of nitrogen (Wild-Allen 2005), of which 85% is released as dissolved nitrogen (predominantly ammonium) and 15% in particulate form. The phosphorus component released into the environment is considered to be divided between particulate labile detritus (at a fixed Redfield ratio of 16N:1P) and dissolved inorganic phosphorus. However, because nitrogen is the limiting nutrient in this marine system, the environmental impacts of salmon farming in the D'Entrecasteaux Channel and Huon Estuary are managed by regulating the total permissible dissolved nitrogen output (TPDNO) that enters the receiving environment as emissions from feed input.

Previous studies in Scotland have found that at most farm sites, enrichment levels are low and that primary production attributable to fish farm nutrients is small relative to that generated by other marine and terrestrial nutrient inputs. Research in Scotland also failed to conclusively establish a link between perceived increases in Harmful Algal Blooms (HABs) and expansion of the fish farming industry (The Scottish Association for Marine Science and Napier University 2002).

Assessment of water quality is typically based on measuring physico-chemical parameters including temperature, pH, light, dissolved oxygen, salinity and nutrients. All of these vary on a temporal basis and are subject to the movement of water masses and the site specific characteristics of the surrounding environment (e.g. currents, depth, tidal flow and weather conditions). The Broadscale Environmental Monitoring Program (BEMP) in the D'Entrecasteaux Channel and Huon Estuary (2009-ongoing) provides a whole of ecosystem approach to understanding how water quality and biological assemblages respond to nutrient loads from both natural and anthropogenic sources.

A report by GESAMP (1996) stated that the acceptable level of change in any water quality parameter is generally unknown and the definition of impact level threshold is usually only achieved after data have been collected over a considerable period of time. This report suggested measuring chlorophyll concentrations to assess nutrient enrichment because:

- nutrient enrichment is not a problem in itself; and
- nutrient enrichment will only stimulate phytoplankton growth when that particular nutrient is the limiting factor.

In most studies there is usually insufficient data to link nutrient availability to algal growth. The succession of algal species may be of significance, since species have different responses to different nutrient levels. The particular species present may be the most important factor in determining the nutritional value of the food, or impact of the algal bloom. Microscopic analysis of the species composition of the communities may be needed, or specific phytoplankton pigments may be measured as an indirect assessment of the community present. Phytoplankton assessment forms a key component of the BEMP and on-site daily water quality monitoring undertaken by Tassal field staff.

In addition, Thompson et al. (2008) suggested that low dissolved oxygen is a high risk contributor to changes in trophic structure and should be regarded as a high priority for broadscale ecological monitoring programs in the D'Entrecasteaux Channel and Huon Estuary. Dissolved oxygen monitoring is also a key monitoring parameter of the BEMP.

6.1.1.2 Current levels of farming emissions

6.1.1.2.1 Soluble nutrient emissions from stock/feed/faeces

Current feed inputs to Butlers Point lease are approximately 1 517 T/yr (A in Table 6.1). This represents a release to the receiving environment of approximately 64 T (B in Table 6.1) of dissolved nitrogen made available for primary production annually.

This calculation is based on the premise that approximately 5% of the feed input is released to the receiving environment as a form of nitrogen. Of this amount, 85% is nitrogen in dissolved form.

6.1.1.2.2 Soluble effluent stream from in situ net cleaning

Approximately 10% of in situ net cleaning effluent is released into the water column in a suspended form (90% consists of the solid fraction) (DHI 2012). This currently represents approximately 1.1 T of suspended effluent to the receiving environment and 9.6 T of related solid effluent per year (Figure 6.2). These calculations were based on 10 net cleans per cage, per production cycle, for each of 10 cages at this site and the maximum average net cleaning effluent volume as described in DHI 2012. Please note, for the purpose of this EIS, the fraction <100 µm as reported in DHI 2012 is considered to represent the soluble component, as it is suspended within the water column for an indeterminate period. Those fractions above 100 µm are considered solid, settling within close proximity of the net wash outlet.

6.1.1.3 Expected levels of farming emissions

6.1.1.3.1 Soluble nutrient emissions from stock/feed/faeces

The current level of feed input to Butlers Point lease is expected to increase to 2 481 T/yr (C in Table 6.1). This represents105 T (D in Table 6.1) of dissolved nitrogen released into the receiving environment as soluble emissions annually.

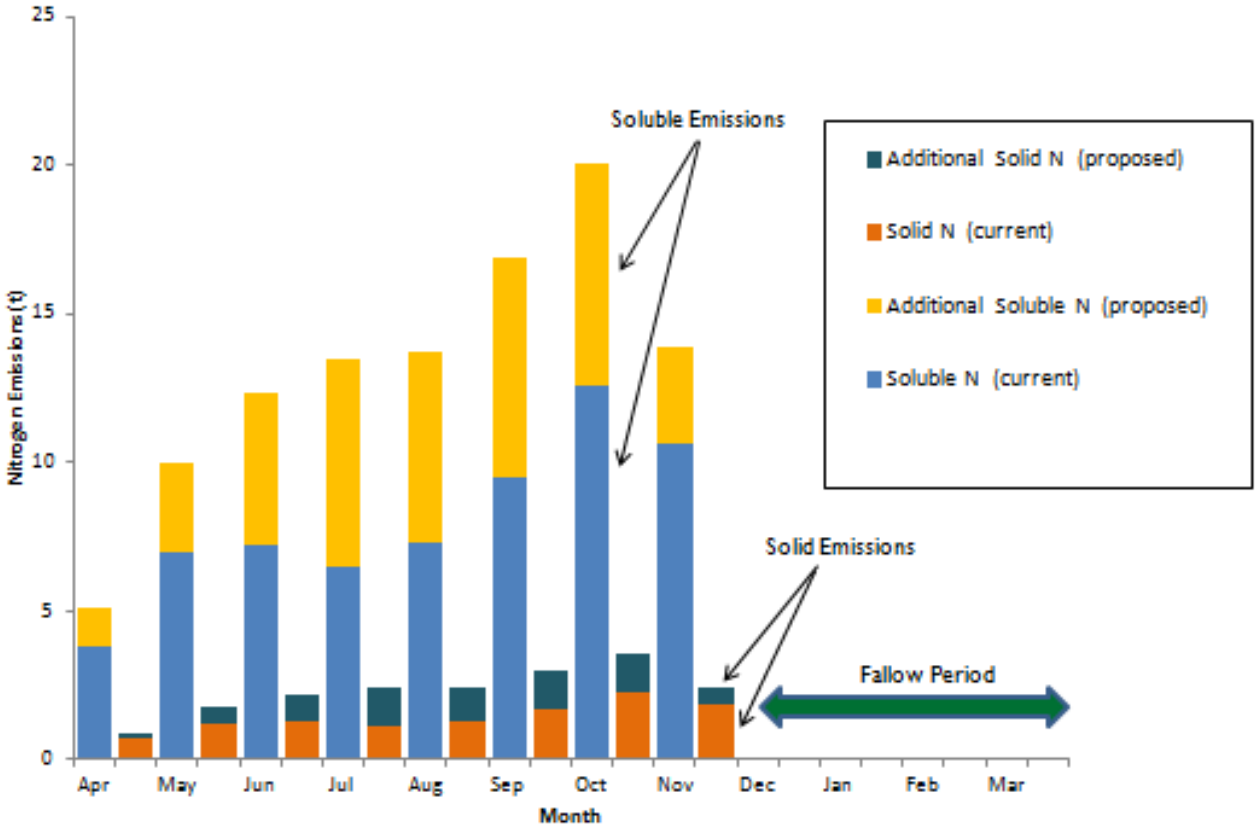
Because the Butlers Point lease will be used as a smolt lease, it will only be stocked for approximately eight months of the year, at which time the smolt are transferred to one of the grow-out leases in the area. The period during which the proposed lease area is vacant represents a whole of lease fallowing and recovery period.

The proposed amendment to the Butlers Point lease will not compromise the TPDNO (from feed input) for the D'Entrecasteaux Channel MFDP Area. For more information on the total permissible dissolved nitrogen output limit, see section 6.1.1.4.1 below.

Table 6.1 **Current (and expected) annual nitrogen emissions to the surrounding environment for Great Taylors Bay and Huon smolt lease areas.**

Smolt Feed Management (Annual)	Total Feed Input (T)	Total N released to environment (T)	Soluble N released to environment (T)	Particulate N released to environment (T)
Current - Butlers Point	**1 517[A]**	**75**	**64[B]**	**11[J]**
Current Total- Huon River (Killala and Brabazon)	1 293	65	55	10
Current Total (Huon Farming Region)	2 810	140	119	21
Proposed - Butlers Point	**2 481[C]**	**124**	**105[D]**	**19[K]**
Proposed - Huon River (Killala and Brabazon)	Nil	Nil	Nil	Nil
Proposed Total ()	2 481	124	105	19
Net Effect of the Proposed Amendment at Butlers Point	**+964[E]**	**+49[F]**	**+41[G]**	**+8[H]**

Figure 6.1 Soluble and solid nutrient (nitrogen) emissions for the Butlers Point lease based on monthly feed inputs.

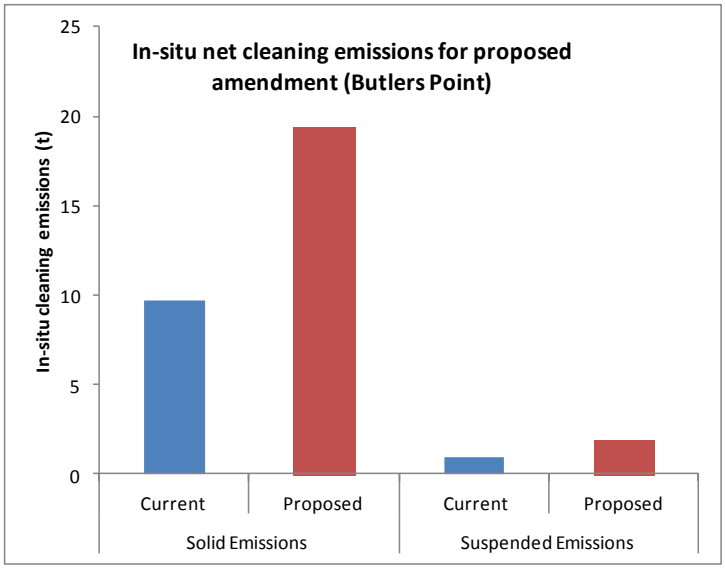


* This figure is based on the predicted input of 1.6 million smolt per year - the scenario of all smolt stocked to proposed Butlers Point lease only (i.e. not to Huon Estuary smolt leases)

6.1.1.3.2 Soluble effluent stream from in situ net cleaning

An additional 10 cages would require cleaning under the proposed amendment. This would result in an additional 1.1 T/yr (i.e. a total of 2.2 T/yr) of suspended effluent from the additional cleaning activities in the amended lease area (Figure 6.2). These calculations are based on 10 net cleans per cage, per year for each using the maximum value for net cleaning effluent in the D'Entrecasteaux Channel as determined by DHI 2012.

Figure 6.2 Current and predicted emissions from in situ net cleaning



However, stocking will be staggered over the production cycle to maintain appropriate stocking densities, e.g. initial input to 5 sea cages, from 5 into 10 cages, 10 into 20 cages as stock biomass splits occur. Thus the estimated emissions from net cleaning are an overestimate.

6.1.1.3.3 The effects of the above expected emission levels relative to current emission levels on a local and regional scale

The proposed amendment involves the relocation of some smolt growout activities that have predominately been undertaken in the Huon Estuary (i.e. at Killala Bay and Brabazon Point leases) to the proposed Butlers Point lease.

It is possible that the effects of an increase in soluble nitrogen emissions (41 T/yr) could lead to short term changes to ammonia/nitrate concentrations in close proximity to the proposed lease and that possible impacts could manifest in increased primary production within a localised area. However, it is considered that this additional loading would result in only minor environmental impacts to the receiving environment.

The range and complexity of possible responses to nutrient loading are extremely difficult to predict and measure, particularly at the broadscale level, and where water bodies (such as the D'Entrecasteaux Channel and Huon Estuary) exhibit contrasting biological, physico-chemical and hydrological processes. Studies undertaken by Volkman et al. (2009) using particle traces suggest that it is possible for an emissions plume having a concentration of 10% (i.e. 10:1 dilution) of the source concentration to exist up to 0.5 km from the cage at

times. Other studies suggest that nutrient plumes can be detected at similar distances from the source (i.e. sea cages) (Sanderson et al. 2008, Oh 2009).

The proposed lease is situated further offshore in deeper water than the existing site at Butlers Point, and more mixing and dilution of soluble emissions is an expectation of moving to this more exposed location.

Overall, it is considered that the proposed amendment would not result in any significant environmental impact to the broader ecosystem of the southern D'Entrecasteaux Channel.

6.1.1.4 Mitigation measures

6.1.1.4.1 Monitoring and management response

As the Huon Farming Region operates under two separate MFDPs, the management of nitrogen emissions (calculated based on feed input) in the Huon Farming Region is regulated by two separate TPDNOs. It should be noted that these areas are consistent with the MFDP areas (see Appendix 4).

For the purpose of assessing the quantities of dissolved nitrogen output covered under the MFDP areas, pursuant to Management Control 3.2.2.2 of the Plans, the methodology of Wild-Allen et al. (2005) delivers a measure of total dissolved nitrogen output for salmon farming operations.

Tassal adopts a conservative approach to feed input volumes, maintaining them below both the TPDNOs for the MFDP areas. The movement of some smolt from the Huon Estuary to the D'Entrecasteaux Channel will result in a small increase in nitrogen emissions for this MFDP area, however, emissions will remain below the D'Entrecasteaux Channel MFDP area TPDNO. Therefore, under the proposed amendment, TPDNOs for both MFDP areas will not be exceeded by relocating smolt from the Huon Estuary to the proposed Butlers Point lease.

As described in section 5.1.4, the BEMP commenced in March 2009 with the aim of assessing water and sediment quality and benthic infauna health at a number of sites in the D'Entrecasteaux Channel and Huon Estuary. One of these sites is located in Great Taylors Bay. To date, 74 sampling events have occurred (between March 2009 and February 2014), representing a significant baseline with which to measure any broadscale environmental and biological change, should these impacts occur as a result of the proposed amendment. A recent IMAS Review of the BEMP undertaken in 2013 showed that while there had been a change in some nutrient levels at some sites, particularly in the Huon Estuary, they did not translate into significant or adverse effects to water quality or sediments.

The following Management Controls contained within the D'Entrecasteaux Channel MFDP apply to the proposed amendment at Butlers Point and include:

- **Management Control 3.1.1 (MFDP)** There must be no unacceptable environmental impact, to the satisfaction of the Secretary, 35 metres outside the boundary of the marine farming lease area. Relevant environmental parameters must be monitored in the lease area, 35 metres from the boundary of the marine farming lease area and at any control site(s) in accordance with the requirements specified in the relevant marine farming licence.

- **Management Control 3.2.1 (MFDP)** The Secretary may, from time to time, determine the total permissible dissolved nitrogen output, within specified

periods, attributable to marine farming operations within a specified area covered by this Plan.

- **Management Control 3.2.2 (MFDP)** For the purposes of assessing quantities of dissolved nitrogen output attributable to marine farming operations the Secretary may use:
    - **Management Control 3.2.2.1 (MFDP)** the proportion of expected dissolved nitrogen output from a unit of feed as used in Butler et al. (2000) at section 10.2.5; or
    - **Management Control 3.2.2.2 (MFDP)** any other method that the Secretary is satisfied delivers a measure of total dissolved nitrogen output from marine farming operations equal to or better than that used by Butler et al.(2000).
- **Management Control 3.2.3 (MFDP)** If the Secretary makes a determination under clause 3.2.1, the Secretary is to apportion the total permissible dissolved nitrogen output between those leaseholders within the specified area.
- **Management Control 3.2.4 (MFDP)** The Secretary is to give notice in writing to leaseholders within the area specified in 3.2.1 of any determination the Secretary makes under 3.2.1 and 3.2.3.
- **Management Control 3.2.5 (MFDP)** Lessees must comply with any written notice given by the Secretary under 3.2.4.
- **Management Control 3.3.1 (MFDP)** The maximum permissible stocking density of salmonid fish is 25 kg/m^3 of caged volume unless otherwise specified in the marine farming licence.
- **Management Control 3.3.2 (MFDP)** Maximum permissible stocking densities for other finfish species may be specified in licence conditions.
- **Management Control 3.3.3 (MFDP)** Lessees must ensure that farmed areas are fallowed as soon as practicable after bubbles of hydrogen sulphide and/or methane gasses form in the sediment and rise to the surface without physical disturbance of the seabed.
- **Management Control 3.3.4 (MFDP)** Finfish cage nets must be at least 1 metre clear of the seabed at low tide under normal growing conditions unless otherwise specified in the relevant marine farming licence.
- **Management Control 3.4.2 (MFDP)** Lessees must comply with the environmental monitoring requirements for collection, analysis and reporting as specified in the relevant marine farming licence;
- **Management Control 3.4.3 (MFDP)** Lessees must provide to the Director, Marine Resources of the Department of Primary Industries, Water and Environment in each calendar year the following information for the immediately preceding calendar year.
    - **Management Control 3.4.3.1 (MFDP)** The quantity and type of fish feed placed into each lease area each month for which they hold a marine farming licence.

- **Management Control 3.4.3.2 (MFDP)** A list specifying the names and quantities of therapeutic treatments, pesticides, anaesthetics, antibiotics, hormones, pigments, antifoulants, disinfectants, cleansers, sedatives and any other potentially harmful materials which have been used in each lease area for which they hold a marine farming licence.
- **Management Control 3.4.3.3 (MFDP)** Location, size and stocking rates of cages on each lease area for which they hold a marine farming licence and the areas being fallowed as specified in the relevant marine farming licence.

- **Management Control 3.4.4 (MFDP)** Environmental data is to be collected at each finfish lease area and analysed, by persons approved by the Secretary for that purpose, to specific standards and in accordance with the requirements for collection, reporting and analysis as specified in the relevant marine farming licence.

- **Management Control 3.4.5 (MFDP)** Lessees are to ensure that underwater surveys are conducted as specified in the relevant marine farming licence to assess the extent of marine farming-derived organic sedimentation and the degree of impact on the benthic community.

Further, marine farming licence conditions detail the specific requirements for monitoring and reporting (see Schedule 3V, Appendix 3).

In situ net cleaning protocols

Measures are in place to mitigate the amount of soluble net wash released into the water column from net cleaning activities and these measures are included in the '*Environmental Best Management Practice for In situ Net Cleaning*' (see Appendix 10). The best way to mitigate potential net wash effluent issues is through good house-keeping, where nets are cleaned frequently to prevent the accumulation of excessive biofouling on nets.

With the company implementation of Kikko design nets across some farming regions in the past two years, Tassal has observed a decline in the frequency of net cleaning by two thirds. This is due to the plastic makeup of the Kikko mesh design inhibiting organism attachment, compared with the fibrous nature of the monofilament designed mesh, thus making net cleaning practices more efficient. The Butlers Point lease net cleaning frequency is expected to show a similar decrease in cleaning frequency and related soluble and insoluble waste streams derived from this activity with the rollout of Kikko nets to the lease.

The more exposed and deeper aspect of the proposed zone relative to the existing zone provides a more suitable location for dispersal of net cleaning effluent within the lease area.

Tassal undertakes regular ROV surveys beneath the cages within the current lease and around lease boundaries to monitor for organic deposition from farming practices. This visual record along with feed, stocking and net wash data are all used to manage the fallowing and stocking rotations for all Tassal leases. This will continue to occur for the amended lease area. Information relating to emissions and localised impacts is also independently audited as part of Tassal's third party certification processes.

6.1.1.5 Overall effect following implementation of mitigation measures

An increase (of approximately 964 T/yr – E in Table 6.1) in feed input is anticipated at the proposed Butlers Point lease. This equates to an increase of approximately 49 T/ yr of

nitrogen as farm emissions (F in Table 6.1), of which approximately 41 T/yr is in the dissolved form (G in Table 6.1) and 8 T in the solid particulate form (H in Table 6.1).

The impact of increased feed input at this location is expected to result in minor environmental impacts to water quality, restricted to localised areas within and around the lease boundary. These impacts are not anticipated to result in significant or adverse effects to the water quality characteristics of the D'Entrecasteaux Channel or Great Taylors Bay. Increased feed inputs into the proposed Butlers Point lease will remain within Tassal's regulatory TPDNO for the D'Entrecasteaux Channel MFDP Area.

6.1.2 Substrates and Fauna

6.1.2.1 Recognised effects of farming emissions on substrates and benthic fauna

Benthic impacts from aquaculture are primarily associated with the settlement of solid waste products originating from marine farming operations where cultured stock is fed. Many studies have been conducted on the impact of marine farming on the benthic environment around fish farms with known effects reasonably well established and understood (Black et al. 1997, Hargrave et al. 1997, Crawford et al. 2002, Macleod et al. 2002).

The majority of exogenous feed is ingested and metabolised by the target culture species, a small percentage is uneaten and some may be deposited in particulate form on sediments under stocked pens (NPI 2001).

Visible impacts of solid waste deposition tend to be confined to directly under stocked pens, evident as distinct "footprint" zones (Crawford et al. 2001). Benthic monitoring and research conducted at various sites throughout Tasmania has shown that physico-chemical and biological impacts extend beyond this footprint zone, but are generally not discernible more than 35 m from the edge of the pen (Woodward et al. 1992, Macleod et al. 2002). Physical disturbances of substrates from mooring systems also occur within farm lease areas, however, these impacts are localised and restricted to sediments directly beneath fixed mooring block positions.

Essentially the impacts from solid waste follow the patterns of impact described for other organic pollutant sources (Pearson and Rosenberg 1978), but on a more reduced spatial scale. Recorded effects include reducing sediments, bacterial build up, marked changes in benthic faunal and meiofaunal assemblages in terms of species number, diversity, abundance and biomass, hypoxia in the water overlying the sediment, increased sulphate reduction and the build-up and release of methane and hydrogen sulphide gas (Duplisea and Hargrave 1996, Crawford et al. 2002, Macleod et al. 2002).

Fish farms release particulate organic matter from two main sources, uneaten feed and faecal material. Salmon farming is known to cause localised benthic impacts. Effects on the substrate and benthic community assemblages have been well studied and the results confirm the successional community patterns associated with organic enrichment gradients (Black et al. 2008).

In a Tasmanian context, impacts from organic enrichment of sediments manifest in a variety of forms (biological and chemical), and the level of impact can be categorised using a range of assessment techniques, including:

- key faunal indicators (species, abundance and biodiversity)

- visual assessment using underwater video
- sediment chemistry – determinations of sulphide concentration and redox potential.

The methods for determining the level of impact described by Macleod and Forbes (2004) are widely used both by industry and regulatory authorities.

Studies by Edgar et al. (2009) determined that salmonid aquaculture in Tasmanian waters had effects on benthic infaunal communities and sediment properties near farm leases. The study utilised two forms of sediment monitoring data collected by the Tasmanian salmonid industry, namely physico-chemical and benthic infauna between 1997 and 2003. Effects detected by the study on sediments near farm leases included a decline in redox potential of sediments, an increased faunal dominance pattern and an increased proportional abundance of capitellids.

The degree of impact to sediments is influenced largely by the rate of water exchange at particular sites, water depth, sediment characteristics, feed management systems, the physical characteristics of feed (e.g. settlement rate), pen size and pen separation distance (Holmer 1992, ICES 1995).

Benthic impacts are reversible and an impacted site can recover to background conditions; however the time taken for this recovery is dependent on a range of factors including previous stocking practices, husbandry techniques and environmental conditions in the region (Black 2001).

While these changes in sediment condition are localised, the time required for sediment recovery is variable and dependent on abiotic and biotic factors (Lumb 1989, Chang and Thonney 1992, Lam et al. 1994). It is widely accepted that the variation in observed benthic recovery is dependent on the physical, chemical and biological characteristics of the system together with the duration and intensity of past production at a site and the level of impact at the time that site is fallowed (Gowen and Rosenthal 1993, Wu 1995, British Columbia Environmental Assessment Office 1997, Black 2001).

If sites are not managed properly, the cumulative effect of prolonged marine farming operations over the same area within a lease can lead to what is commonly referred to as "site souring". Partially fallowed, impacted sediments also deteriorate at a faster rate. In addition, sites tend to take longer to recover to transitional and background conditions if they are restocked with fish prematurely. For these reasons a robust site fallowing strategy is an important environmental and farm management tool. The development of effective and systematic fallowing regimes is a key driver of this proposed amendment.

6.1.2.2 Current levels of farming emissions

6.1.2.2.1 Fish faeces and feed

Current feed inputs to Butlers Point are approximately 1 517 T/yr (see A in Table 6.1). This represents a release to the receiving environment of approximately 11 T/yr of particulate nitrogen potentially deposited to the substrate, based on the method of Wild-Allen et al. (2005) (J in Table 6.1). See section 6.1.1.2.1 for current levels of dissolved/suspended nitrogen.

6.1.2.2.2 Solid effluent stream from in situ net cleaning

Approximately 90% of in situ net cleaning effluent is released into the water column in a solid form (DHI 2012). Based on the number of nets cleaned using this method annually at the Butlers Point lease (10 cages cleaned approximately 10 times per year) this represents the addition of approximately 9.6 T of solid waste to the receiving environment (as well as 1.1 T of related suspended effluent - see section 6.1.1.2.2) per year.

6.1.2.3 Expected levels of farming emissions

6.1.2.3.1 Fish faeces and feed

The current level of feed input to Butlers Point is expected to increase to 2 481 T/yr (C in Table 6.1), this represents a total of 19 T/yr of particulate nitrogen emissions from fish faeces and uneaten feed at this site (K in Table 6.1). Current and proposed feed inputs for Butlers Point are presented in Table 6.1

Because the Butlers Point lease will be used as a smolt lease, it will only be stocked for approximately eight months of the year, at which time the smolt are transferred to one of the grow-out leases in the area. The period during which the proposed lease area is vacant represents a whole of lease fallowing and recovery period.

The proposed amendment at Butlers Point will not compromise the TPDNO to the D'Entrecasteaux Channel MFDP Area (section 6.1.1.4.1).

6.1.2.3.2 Solid effluent stream from in situ net cleaning

As stated in section 6.1.2.2.2, approximately 90% of in situ net cleaning effluent is released into the water column in a solid form. Based on the number of nets cleaned using this method annually at Butlers Point (20 sea cages cleaned approximately 10 times per year) this represents the addition of approximately 9.6 T/yr (19.2 T/yr in total) of solid waste to the receiving environment at Butlers Point lease; there will be no overall increase in net cleaning to the Huon Farming Region.

6.1.2.3.3 The effects of the above expected emission levels relative to current emission levels on a local and regional scale

As detailed in section 6.1.1.3.3, the proposed amendment involves the relocation of some smolt rearing activities that have historically been undertaken in the Huon Estuary (i.e. at Killala Bay and Brabazon Point leases) to Butlers Point.

An increase (of approximately 964 T/yr - E in Table 6.1) in feed input is anticipated at Butlers Point. This equates to an increase in approximately 49 T/yr of additional nitrogen as farm emissions (F in Table 6.1), of which approximately 8 T/yr is in the solid particulate form (H in Table 6.1).

The increase in feed inputs into the proposed Butlers Point lease will be met with a corresponding decrease in feed input into the Huon Estuary. Feed inputs into the Huon Farming Region will not increase as a result of the proposed amendment. Rather, they are instead anticipated to decrease by 329 T/yr due to a 9% decrease in stocking numbers to the Huon Farming Region.

It is considered that the proposed amendment area is situated in a more exposed location (hence improved mixing, dilution and dispersion of emissions). Overall, it is considered that

the proposed amendment will not result in any significant environmental impacts to the broader ecosystem of the southern D'Entrecasteaux Channel.

6.1.2.4 Other effects of farming operations

6.1.2.4.1 Physical/structural disturbance of substrates and fauna

Current moorings:

The current 10 pen bay herringbone mooring system at Butlers Point has:

- 20 x 5 tonne concrete blocks
- 8 x 3 tonne 'H' concrete blocks
- 24 x 3.5 tonne concrete blocks

Proposed moorings:

The proposed 20 pen bay herringbone mooring system at Butlers Point will require:

- 20 x 5 tonne concrete blocks
- 18 x 3 tonne 'H' concrete blocks
- 37 x 3.5 tonne concrete blocks

6.1.2.5 Mitigation Measures

The range of mitigation measures to ensure that impacts to the substrate are maintained at acceptable levels include:

- compliance with annual benthic video surveys as required by the state government regulator (Schedule 3V of the Licence Conditions, salmonid finfish annual video surveys; see Appendix 3)
- internal feed management practices to minimise feed wastage
- fallowing principles (see below in Section 6.1.2.5.3)
- specific regulatory management controls (see below in Section 6.1.2.5.4).

6.1.2.5.1 Fish feeding regimes/feed wastage minimisation

Feed control is constantly being improved by Tassal and remains a focus for the company. Surface and underwater cameras are used to monitor feeding rates at all marine leases. This form of visual monitoring assists with minimising feed wastage and unnecessary nutrient loads to the substrate. Pellet catching devices are also periodically used to assess effectiveness of camera depth and angle. Routine ROV surveys also look for any presence of feed wastage. Net cleaning activity and divers report the presence of any uneaten feed within cages. Tassal's feed management performance and its effect on the environment is also subject to third party audit through BAP and ASC certification.

Routine ROV inspections beneath cages within leases and around lease boundaries are an important monitoring tool for determining environmental impacts and depositional patterns

on the substrate. This visual data along with feed, stocking and net wash data will be used in combination to manage the fallowing and stocking rotations for the Huon Farming Region. This reporting requirement is outlined in Schedule 3V and is included as Appendix 3.

6.1.2.5.2 In situ net cleaning protocols

Refer to section 6.1.1.4.

6.1.2.5.3 Fallowing principles

As Butlers Point lease will be utilised as a smolt lease, it will only be stocked for eight months of the year. Following this period, smolt will be transferred to grow-out leases in the area. The four month window where the proposed lease area is vacant represents a whole of lease fallowing and recovery period.

Fallowing of pen bay positions is undertaken regularly to allow sediments to recover and for the level of organic enrichment caused by farming (i.e. faeces, net washing) to be metabolised by natural benthic processes. Tassal conducts internal ROV surveys to determine optimal fallowing regimes and to adjust stocking schedules based on the environmental characteristics and recovery capacity of individual farm sites.

Excess build-up of farm detritus beneath leases has the potential to affect not only benthic and environmental health, but also fish health and farm performance. This is a major factor driving Tassal to proactively manage benthic impacts responsibly and sustainably for the long term. Tassal manages farm sites on an individual basis to maintain the best conditions possible within its lease areas. The proposed amendment would allow greater flexibility to manage benthic impacts at both Butlers Point and Tassal's Huon Estuary smolt leases. This would be achieved through the enhanced capacity for fallowing and stock rotation opportunities within the Huon Farming Region.

6.1.2.5.4 Monitoring and management response

Management Controls contained within the D'Entrecasteaux Channel MFDP include requirements for monitoring and reporting of environmental aspects. Management Controls include:

- **Management Control 3.1.1 (MFDP)** There must be no unacceptable environmental impact, to the satisfaction of the Secretary, 35 metres outside the boundary of the marine farming lease area. Relevant environmental parameters must be monitored in the lease area, 35 metres from the boundary of the marine farming lease area and at any control site(s) in accordance with the requirements specified in the relevant marine farming licence.
- **Management Control 3.2.1 (MFDP)** The Secretary may, from time to time, determine the total permissible dissolved nitrogen output, within specified periods, attributable to marine farming operations within a specified area covered by this Plan.
- **Management Control 3.2.2 (MFDP)** For the purposes of assessing quantities of dissolved nitrogen output attributable to marine farming operations the Secretary may use:

- **Management Control 3.2.2.1 (MFDP)** the proportion of expected dissolved nitrogen output from a unit of feed as used in Butler et al. (2000) at section 10.2.5; or
- **Management Control 3.2.2.2 (MFDP)** any other method that the Secretary is satisfied delivers a measure of total dissolved nitrogen output from marine farming operations equal to or better than that used by Butler et al.(2000).

- **Management Control 3.2.3 (MFDP)** If the Secretary makes a determination under clause 3.2.1, the Secretary is to apportion the total permissible dissolved nitrogen output between those leaseholders within the specified area.
- **Management Control 3.2.4 (MFDP)** The Secretary is to give notice in writing to leaseholders within the area specified in 3.2.1 of any determination the Secretary makes under 3.2.1 and 3.2.3.
- **Management Control 3.2.5 (MFDP)** Lessees must comply with any written notice given by the Secretary under 3.2.4.
- **Management Control 3.3.1 (MFDP)** The maximum permissible stocking density of salmonid fish is 25 kg/m3 of caged volume unless otherwise specified in the marine farming licence.
- **Management Control 3.3.2 (MFDP)** Maximum permissible stocking densities for other finfish species may be specified in licence conditions.
- **Management Control 3.3.3 (MFDP)** Lessees must ensure that farmed areas are fallowed as soon as practicable after bubbles of hydrogen sulphide and/or methane gasses form in the sediment and rise to the surface without physical disturbance of the seabed.
- **Management Control 3.3.4 (MFDP)** Finfish cage nets must be at least 1 metre clear of the seabed at low tide under normal growing conditions unless otherwise specified in the relevant marine farming licence.
- **Management Control 3.4.2 (MFDP)** Lessees must comply with the environmental monitoring requirements for collection, analysis and reporting as specified in the relevant marine farming licence;
- **Management Control 3.4.3 (MFDP)** Lessees must provide to the Director, Marine Resources of the Department of Primary Industries, Water and Environment in each calendar year the following information for the immediately preceding calendar year.
  - **Management Control 3.4.3.1 (MFDP)** The quantity and type of fish feed placed into each lease area each month for which they hold a marine farming licence.
  - **Management Control 3.4.3.2 (MFDP)** A list specifying the names and quantities of therapeutic treatments, pesticides, anaesthetics, antibiotics, hormones, pigments, antifoulants, disinfectants, cleansers, sedatives and any other potentially harmful materials which have been used in each lease area for which they hold a marine farming licence.

- **Management Control 3.4.3.3 (MFDP)** Location, size and stocking rates of cages on each lease area for which they hold a marine farming licence and the areas being fallowed as specified in the relevant marine farming licence.

- **Management Control 3.4.4 (MFDP)** Environmental data is to be collected at each finfish lease area and analysed, by persons approved by the Secretary for that purpose, to specific standards and in accordance with the requirements for collection, reporting and analysis as specified in the relevant marine farming licence.

- **Management Control 3.4.5 (MFDP)** Lessees are to ensure that underwater surveys are conducted as specified in the relevant marine farming licence to assess the extent of marine farming-derived organic sedimentation and the degree of impact on the benthic community. Further, marine farming licence conditions specify the specific requirements for monitoring and reporting (see Schedule 3V, Appendix 3).

6.1.2.5.5 Other Mitigation

A custom designed mooring system will be used that will be sufficiently weighted and anchored to prevent dragging of mooring blocks in the proposed zone (see Appendix 5).

6.1.2.6 Overall effect following implementation of mitigation measures

As stated in 6.1.1.5, an increase (of approximately 964 T/yr - E in Table 6.1) in feed input is anticipated at the proposed Butlers Point lease. This equates to an increase of approximately 49 T/yr of nitrogen as farm emissions (F in Table 6.1), of which approximately 41 T/yr (G in Table 6.1) is in the dissolved form and 8 T/yr (H in Table 6.1) in the solid particulate form.

The proposed amendment will have a localised impact on a greater area of seabed under the proposed Butlers Point lease due to the proposed increase in the maximum leasable area to cater for an additional 10 cages. These impacts are not anticipated to result in unacceptable or adverse effects to the sediment condition beneath cages and within the proposed lease area. Impacts will continue to be managed through the management controls listed above in section 6.1.2.5.4 and through Tassal's program of regular fallowing. Tassal is required to undertake annual video surveys of the benthic environment within and outside of marine farming leases. As part of Tassal's licence conditions, there must be no significant visual, physico-chemical or biological impacts at or extending beyond 35 m from the boundary of the lease area. Internal visual assessments are undertaken routinely to assess sediment condition and to determine optimal fallowing strategies for the Huon Farming Region.

6.1.3 Marine Vegetation

6.1.3.1 Recognised effects of farming emissions on marine vegetation

Marine farming operations have the potential to impact on marine vegetation if those operations are sited over or adjacent to marine flora.

Physical damage may be caused by the placement of marine farming structures directly on top of vegetation; such structures include moorings.

Shading from marine farming structures may reduce light to an extent where the growth or survival of marine vegetation is impacted. Deposition of fish feed and excretory products may occur to an extent where vegetation is smothered.

In marine coastal waters, the two most important elements promoting algal growth are nitrogen and phosphorous in their dissolved forms, both of which are released into the receiving environment from feed inputs, however it is assumed that nitrogen is more likely to be limiting for growth in marine conditions than phosphorous (Sanderson et al. 2008, Mente et al. 2006).

Overall, approximately 5% of the total feed input is released into the environment as a form of nitrogen, of which 85% is released as dissolved nitrogen, and 15% in its particulate form (Ross and Macleod 2013). Most of the dissolved nitrogen is excreted by fish as ammonium, which is a preferred source of nitrogen for phytoplankton and other marine plant species.

Nutrient loading can also increase the abundance of algal epiphytes which has the potential to smother marine vegetation.

The studies of Sanderson et al. (2008) showed that the distribution of ammonium plumes from salmon cages at farm sites in north west Scotland is consistent with current flow patterns, and concentrations above background levels could extend for distances of at least 200-300 m from cages. However, these studies did not indicate that the higher concentrations of ammonium attributable to salmon farming were likely to be toxic, but rather provided an additional source of nutrients for uptake by marine algae. Whilst a number of studies suggest that nutrients loads enhance the growth of marine plant communities, increased sedimentation rates are also known to suppress marine plant growth.

More recently, an honours project used macroalgae as a bioindicator of nutrient level changes in southern Tasmanian waters to determine whether aquaculture leases are impacting on nutrient levels in adjacent waters (Oh 2009). This study found that aquaculture farms could potentially have some impact on macroalgal assemblages up to several hundred metres away. It also found that several other factors could possibly contribute to the changes measured including natural variations in nutrient levels, changing ocean conditions and seasonal variation. Additional research in this area is required to determine broadscale effects from soluble nutrient emissions on the ecological structure and function of natural marine macroalgal assemblages.

The impact from soluble nutrient emissions on macroalgal assemblages from marine farming is not restricted to negative impacts alone; there are known instances where increased macroalgal growth can occur as a result of increased nutrient supply from point source nutrient additions. For instance, Giant kelp has been shown to respond favourably to the supply of nutrients from sewage outfalls and other nutrient sources (Eddyvane 2003, Parsons 2012). In addition, there are known instances where increased cover of opportunistic species (filamentous and other opportunistic green algae) has occurred within 100-400 m of marine finfish farms in the D'Entrecasteaux Channel, and this has been attributed to increased nutrient supply from farming emissions (Oh 2009).

Previous studies suggest that the complex nature of the structure and function of macroalgal assemblages makes it difficult to discern any direct influence of aquaculture (Crawford et al. 2006). However, there is increasing interest in developing a monitoring program in Tasmania to assess macroalgal biodiversity and examine how patterns of distribution and community structure are affected at the broadscale level by external nutrient influences, as opposed to the need to infer direct relationships with marine farming practices. Research to assess potential nutrient response criteria for sub-tidal macroalgal communities in south east Tasmania has been proposed pending funding approval.

6.1.3.2 Current levels of farming emissions

6.1.3.2.1 Soluble nutrient emissions from stock/feed/faeces

See Section 6.1.1.2.1.

6.1.3.2.2 Soluble effluent stream from in-situ net cleaning

See Section 6.1.1.2.2.

6.1.3.3 Expected levels of farming emissions

6.1.3.3.1 Soluble nutrient emissions from stock/feed/faeces

See Section 6.1.1.3.1.

6.1.3.3.2 Soluble effluent stream from in-situ net cleaning

See Section 6.1.1.3.2.

6.1.3.3.3 The effects of the above expected emission levels relative to current emission levels on a local and regional scale

See Section 6.1.1.3.3.

6.1.3.4 Mitigation Measures

6.1.3.4.1 Monitoring and management response

An initial survey of the proposed zone was undertaken by IMAS at Butlers Point (IMAS 2013, see Appendix 7). The survey did not detect any reef substrate within the proposed zone. Unvegetated, unconsolidated sandy substrate occurs throughout the entire proposed zone. Marine vegetation communities described from the adjacent fringing reef are considered typical of sheltered water habitats in the southern D'Entrecasteaux Channel.

Management Controls listed in section 6.1.1.4, particularly in respect of limits placed on soluble nitrogen emissions in the D'Entrecasteaux Channel, stocking densities and requirements for benthic monitoring, are considered to be relevant mitigation measures for potential impacts on marine vegetation.

6.1.3.4.2 In situ net cleaning protocols

See section 6.1.1.4.1.

6.1.3.5 Overall effect following implementation of mitigation measures

An increase (of approximately 964 T/yr - E in Table 6.1) in feed input is anticipated at the proposed Butlers Point lease. This equates to an increase of approximately 49 T/yr of nitrogen as farm emissions (F in Table 6.1), of which approximately 41 T/yr (G in Table 6.1) is in the dissolved form and 8 T/yr (H in Table 6.1) in the solid particulate form.

With increased feed input at the proposed Butlers Point lease, additional soluble emissions (i.e. an additional 41 T/yr of soluble nitrogen) at concentrations above background levels may have an effect on macroalgal assemblages at the fine spatial level (i.e. between 100 m to 400 m from the lease boundary) but are unlikely to affect macroalgal assemblages beyond this distance from the farm. As the proposed amendment involves relocating the current lease 150 m into Great Taylors Bay, nutrient concentrations are considered low enough that only minor changes to macroalgal species compositions would be anticipated (if any) as a result of the increase in feed input and related emissions.

The proposed amendment area is situated in a more exposed location (hence improved dilution and dispersion of emissions). Overall, it is considered that there is minimal risk that the proposed amendment will result in any significant environmental effects on marine vegetation communities within the southern D'Entrecasteaux Channel and Great Taylors Bay.

6.1.4 Birds

6.1.4.1 History of bird entanglements/predation issues at proposed sites

Tassal maintains bird monitoring data sheets at each of their regions, and publicly reports this information annually in its Sustainability Report (Appendix 6). Over the last 12 months there have been a total of 58 individual bird interactions at the Butlers Point lease. All birds were released alive with none becoming tangled in netting.

6.1.4.2 Migratory bird species listed under international agreements (e.g. JAMBA/CAMBA/ROKAMBA)

There are a number of migratory birds that can be found within the area during the year that are listed under international agreements (Japan-Australia Migratory Bird Agreement - JAMBA, China-Australia Migratory Bird Agreement -CAMBA, and Republic of Korea-Australia Migratory Bird Agreement - ROKAMBA). Being the most southerly point of the East Asian-Australasian Flyway, Tasmania is an important destination for many migratory species that spend their winter months in the Southern Hemisphere (see Table 6.2).

Table 6.2 Birds protected under bilateral agreements (JAMBA, CAMBA and ROKAMBA) through the Federal EPBC Act 1999

Scientific Name	Common Name	CAMBA	JAMBA	ROKAMBA
Diomedea exulans	Wandering Albatross		X	
Oceanites oceanicus	Wilson's storm petrel		X	
Puffinus carneipes	Fleshy-footed Shearwater		X	X
Puffinus griseus	Sooty Shearwater	X	X	
Puffinus tenuirostris	Short-tailed Shearwater		X	X
Stercorarius parasiticus	Arctic Jaeger		X	X
Sterna albifrons sinensis	Little Tern	X	X	X
Sterna caspia	Caspian Tern	X	X	
Actitis hypoleucos	Common Sandpiper	X	X	X
Arenaria interpres	Ruddy Turnstone	X	X	X

Scientific Name	Common Name	CAMBA	JAMBA	ROKAMBA
Calidris acuminata	Sharp-tailed Sandpiper	X	X	X
Calidris alba	Sanderling	X	X	X
Calidris canutus	Red Knot	X	X	X
Calidris ferruginea	Curlew Sandpiper	X	X	X
Calidris melanotos	Pectoral Sandpiper		X	X
Calidris minuta	Little Stint			X
Calidris ruficollis	Red-necked Stint	X	X	X
Calidris tenuirostris	Great Knot	X	X	X
Charadrius leschenaultii	Greater Sand Plover	X	X	X
Charadrius mongolus	Lesser Sand Plover, Mongolian	X	X	X
Charadrius veredus	Oriental Plover, Oriental Dotterel		X	X
Gallinago hardwickii	Latham's Snipe	X	X	X
Gallinago megala	Swinhoe's Snipe	X	X	X
Gallinago stenura	Pin-tailed Snipe	X	X	X
Heteroscelus brevipes	Grey-tailed Tattler	X	X	X
Limnodromus semipalmatus	Asian Dowitcher	X	X	X
Limosa lapponica	Bar-tailed Godwit	X	X	X
Limosa limosa	Black-tailed Godwit	X	X	X
Numenius madagascariensis	Eastern Curlew	X	X	X
Numenius minutus	Little Curlew, Little Whimbrel	X	X	X
Numenius phaeopus	Whimbrel	X	X	X
Pluvialis dominica	Lesser Golden Plover	X	X	
Pluvialis fulva	Pacific Golden Plover	X	X	X
Pluvialis squatarola	Grey Plover	X	X	X
Tringa nebularia	Common Greenshank	X	X	X
Tringa stagnatilis	Marsh Sandpiper, Little Greenshank	X	X	X
Xenus cinereus	Terek Sandpiper	X	X	X
Ardea ibis	Cattle Egret	X	X	
Haliaeetus leucogaster	White-bellied Sea-Eagle	X		
Hirundapus caudacutus	White-throated Needletail	X	X	X
Ardea alba	Great Egret	X	X	

6.1.4.3 Roosting, nesting and feeding sites

Tasmania's coastal fauna includes significant populations of birds that are dependent on the beach and cliffs for breeding and the littoral zones, mudflats and estuaries for feeding and roosting. Butlers Point and the surrounding area offers a range of different habitats and a variety of bird species may be found within these areas (see Table 5.4 in section 5.2.4). Some of these species are known to inhabit this area based on recorded observations whilst others may be present based on the presence of suitable habitat within the area.

6.1.4.4 Potential Impacts

6.1.4.4.1 Impacts on marine farms

Predation by birds can be a significant problem for finfish culture, particularly when smolt are first introduced into the marine environment. Similar problems may also exist with the consumption of feed pellets by birds. If neither of these situations is managed effectively they can have the potential to impact on activities within the proposed zone over time.

6.1.4.4.2 Impacts on birds

Potential general impacts on birds from salmon farming activities include:

- habitat loss - marine farming activities and related debris may restrict access to inter-tidal feeding and shoreline habitat or feeding, roosting and nesting sites
- behavioural change - home ranges may alter with an increased reliance on marine farms for foraging activity
- entanglement and bird strike - birds may be killed or injured by entanglement in bird netting or by striking farm infrastructure.

Consultation with BirdLife Tasmania identified a number of specific potential impacts on birds within Great Taylors Bay from the proposed zone amendment including the following.

- Birds such as cormorants, gulls and eagles may view the proposed amendment as a potential food source, including opportunistic scavenging. It is expected that some bird species (gulls) would congregate at the farms.
- The proposed zone may be seen as a convenient staging point for bush birds that fly across the bay (e.g. Swift parrot and Forty-spotted pardalote) and they may become entangled in the equipment, nets, etc.
- Any increase in marine debris from these fish farms on foreshores may potentially reduce available habitat and/or habitat quality to birds in these foreshore areas.
- Marine debris poses additional risks to birds from entanglement and ingestion, again, resulting in increased mortalities. BirdLife Tasmania has been working collaboratively with Tassal to advise and assist in the coordination of regular clean-up activities by, and supporting/facilitating community groups who wish to remove debris from foreshore areas as a means of mitigating or removing the threat to birds posed by marine debris.

6.1.4.5 Mitigation Measures

Tassal imposes upon all staff a range of stringent bird protocols to mitigate potential interactions with birds around their marine farms. These protocols seek to provide guidance to Tassal's marine operations staff to assist with the passive exclusions of birds from sea cages, removal of birds that may be trapped in pens, and reporting of any entanglements of birds in exclusion nets.

6.1.4.5.1 Bird netting and other exclusion mechanisms

Taking away the potential for scavenging reduces the attraction to aquaculture farms for bird species. In order to prevent bird predation on smaller farmed fish and the opportunity to scavenge feed pellets, Tassal currently use bird nets over all pens containing fish. Birds could potentially gain access to stocked fish and feed through holes in netting and in places where the netting has not been securely fastened to the cage handrail. Birds can become entangled in the netting whilst attempting to enter or exit the cage. Tassal has a detailed Wildlife Interaction Plan that covers bird management and exclusion mechanisms.

In the Huon Farming Region, Tassal currently uses, and will continue to use, black netting of less than115 mm covering the entire pen, fastened to the handrail and supported by buoyant 'mouse wheel' bird stands in the centre of the pen.

This netting configuration has proven to be very effective at denying birds' access to stocked fish and feed. As previously stated in section 6.1.4.1, there has not been a single bird entanglement at Butlers Point since stocking commenced.

Bird netting will continue to be routinely inspected by Tassal staff and repairs undertaken immediately upon identification of damage. This practice restricts the number of birds that are able to enter a cage and become entangled whilst attempting to exit a cage through the aerial bird netting.

6.1.4.5.2 Protocols for managing bird entanglements

Tassal continues to strive to reduce interactions with birds across all of their farming operations as production impacts can include reduced feed consumption, increased stress to fish, increased mortality and reduced inventory control. Tassal has expended considerable cost and effort with an aim of reducing interactions with birds, and has developed a Code of Best Practice (COBP) for Bird Interactions (Tassal Bird Protocols). This document was developed in conjunction with the Royal Society for Protection of Cruelty to Animals (RSPCA), BirdLife Tasmania and World Wildlife Fund for Nature (WWF). It covers exclusion measures, entanglements, birds trapped in pens, removal procedures, record keeping and bird identification.

Tassal staff must take all reasonable and practical measures to minimise adverse interactions with any waterbirds and birds of prey encountered.

6.1.4.5.3 Maintenance regime for inspection and repair of bird nets and other exclusion devices

Tassal bird nets are maintained in as good condition as practically possible; small holes are repaired by Tassal operational staff in situ. If this is not possible, the net is removed, replaced and repaired on land.

Tassal's Wildlife Management Officer conducts quarterly audits of the monitoring at farm sites for:

- bird netting – particularly holes (points of ingress for birds)
- number of birds in pen
- number of birds released
- bird species
- number of entanglements/bird deaths.

All of this monitoring data feeds into the Tassal annual sustainability reporting framework.

6.1.4.5.4 Marine debris clean-ups

Tassal conducts regular marine debris clean-ups of the shorelines surrounding their operations as a part of their Shoreline Clean-up Program. This is done with the advice of BirdLife Tasmania to ensure that nesting shorebirds are protected (see Figure 6.3).

Figure 6.3 Tassal shoreline clean-up schedule

Region	January	February	March	April	May	June	July	August	September	October	November	December
Bruny												
Dover												
Huon												
MH												
NW Bay												
Tasman												

Marine Operations
Wildlife Management Team
Shorebird breeding season (no clean ups)

Management Controls within the D'Entrecasteaux Channel MFDP include the following.

- **Management Control 3.12.6 (MFDP)** Lessees must ensure any predator control of protected species is conducted with the approval of the Parks and Wildlife Service of the Department of Primary Industries, Water & Environment.

6.1.4.6 Overall effect following implementation of mitigation measures

The proposed amendment would provide for an extra 10 cages within the proposed zone and it is anticipated that this will result in greater interactions with birds at this site. The current wildlife control measures employed by Tassal at the Butlers Point lease have resulted in no bird entanglements since stocking commenced in March 2013. Tassal proposes to continue to use these mitigation measures to alleviate negative interactions with birds.

Following implementation of the bird mitigation measures, it is considered that the proposed amendment will have a minimal impact on birds.

6.1.5 Marine Mammals

6.1.5.1 History of marine mammal interactions at existing sites

There have been no recorded negative interactions with marine mammals at the current Butlers Point lease, i.e. no breached sea cages, entanglements in netting, or interactions with staff.

Fur seals (Australian and New Zealand) commonly occur within lease areas at all marine finfish farms in southern Tasmania, including the existing Butlers Point lease area. Other marine mammals are commonly observed around the Tasmanian coastline, but generally do not interact with marine finfish farms.

6.1.5.2 Potential Impacts

6.1.5.2.1 Impacts on marine farms

Seal interactions are a significant issue for the finfish farming industry causing a range of negative effects including:

- predation of farmed stock - seals damage and kill fish by biting fish through netting
- causing stress in fish - ongoing attacks on fish within pens causes stress to fish and a reduction in feeding rates
- increases in the cost of production - seal defence systems such as predator netting and seal trapping/removal and damage to nets caused by seals – this currently equates to millions of dollars per year for the company
- workplace health and safety issues - aggressive seals may cause injury to personnel employed on marine farms.

6.1.5.2.2 Impacts on marine mammals

Potential impacts on marine mammals may include:

- behavioural management, trapping and relocation of seals from marine farming areas may cause animals to experience stress
- modification of behaviour in seals that habituate to marine farms, which may alter, for example, foraging behaviours
- potential for dolphins and seals to become entangled in netting or farm infrastructure resulting in injury or death. These metrics are reported annually in Tassal's Sustainability Report (see Appendix 6).
- potential for marine mammals such as whales to have higher survival rates where there are stranding events due to rescue response support from aquaculture staff and their equipment – similar to assistance given by Tassal to Parks and Wildlife in saving eleven animals during a stranding in the south east of Tasmania in March 2011.

6.1.5.3 Mitigation Measures

6.1.5.3.1 Details of any marine mammal interaction plan

As part of Tassal's commitment to operating in an environmentally sustainable manner there has recently been the development of a Wildlife Interaction Plan (WIP). This document covers bird and marine mammal management strategy for all Tassal operations. Tassal has taken a proactive approach to managing key environmental issues as they arise.

6.1.5.3.2 Seal netting – tensioning and stiffening

Removing the potential for scavenging by seals reduces their attraction to aquaculture farms. The primary means of controlling seal predation is through exclusion. Seal 'jump fences' extending above the cage handrail and aerial seal netting may also be used to exclude seals from entering fish cages. The routine collection of mortalities from fish cages also removes the attraction for seals.

Tassal currently uses heavily weighted and tensioned cage netting at their farming regions to restrict access by seals to stocked fish below the waterline. The continued introduction of the Kikko net systems to the Huon Farming Region within the next year will also provide additional control against seals.

Tassal is committed to the use of passive seal deterrents and exclusion infrastructure, and employs a dedicated Wildlife Management Officer who regularly consults with researchers, experts and government authorities to manage seal exclusion responsibly and effectively. All Tassal marine cages are rigged in accordance with DPIPWE seal management protocols and will be continually improved as new methods are developed.

Tassal has worked closely with Plastic Fabrications Pty Ltd to develop a new aerial seal net that it believes will easily cope with loadings placed on the net by seals trying to enter the pens. These are currently used at Butlers Point. Nets are inspected weekly by divers for holes and to ensure that they are correctly tensioned by the weighting system. Tassal is not proposing to use predator nets on its cages in the proposed lease area.

6.1.5.3.3 DPIPWE seal management protocols

The Wildlife Management Branch of DPIPWE, in consultation with sections of the marine industry and other interest groups, developed a set of specific protocols to manage the risk posed to both seal and human interests. These protocols address circumstances and procedures under which it would be appropriate to apply negative conditioning (methods to scare or deter seals from sites) to persistent seals, to trap and relocate individual seals or to destroy seals that have been determined as posing a significant threat to human safety.

The proposed lease will have staff on-site trained in these seal management protocols. Individual seals that repeatedly enter a secure pen pose WH&S risks to staff and would be trapped and relocated to Devonport in accordance with DPIPWE protocols. The main WH&S risks are disease transfer, infection of wounds and crush injuries.

Regulatory Controls

The following regulatory controls are contained in the D'Entrecasteaux Channel MFDP.

- **Management Control 3.12.6 (MFDP)** Lessees must ensure any predator control of protected species is conducted with the approval of the Parks and

Wildlife Service of the Department of Primary Industries, Parks, Water & Environment.

- **Management Control 3.12.9 (MFDP)** Lessees must notify the Nature Conservation Branch of the Department of Primary Industries, Parks, Water & Environment in the event that any marine mammals are found entangled in marine farming equipment.

6.1.5.4 Overall effect following implementation of mitigation measures

The proposed amendment would provide for an extra 10 cages within the proposed zone and it is expected that interactions with marine mammals (particularly Fur seals) will continue at the Butlers Point lease. However, due to Tassal's internal policies for wildlife management, the proposed amendment is not expected to result in negative impacts to marine mammals.

6.1.6 Threatened Species

6.1.6.1 History of threatened species interactions at existing sites

There is no history of threatened species interactions at this site.

A number of listed threatened and migratory species under the EPBCA and TSPA that may be found within the Huon Farming Region and surrounding areas (i.e. within 5 km of the proposed amendment) have been identified in this EIS and are shown in Table 5.6 (see section 5.2.6). Some of these species have been recorded within and around the proposed amendment area (e.g. BirdLife Tasmania unpublished data), whilst others may be present based on suitable habitat being found within the area for breeding, foraging or feeding. For some species, the areas surrounding the proposed amendment may represent part of a migratory route.

6.1.6.2 Potential impacts on threatened species, communities and habitats listed under the EPBCA and the TSPA

General potential impacts on threatened species within Huon Farming Region may include the following.

- Entanglement - marine farming equipment such as predator nets, bird netting and mooring lines have the potential to entangle birds and marine mammals resulting in injury or death.

- Habitat loss - the deployment of marine farming equipment within a lease area may degrade suitable habitat for some marine species. Some examples of direct impact on habitat may include the deployment of mooring blocks (benthic species), rows of pens restricting access (pelagic species), or smothering from solid waste (benthic species).

- Behavioural change - the presence of marine farms may cause some threatened species to alter their behaviour, particularly foraging behaviour in species such as seals and birds.

- Predation – potential predation of threatened species and/or threatened species prey by escaped salmonids.

- Alteration of breeding behaviour – the presence and intensity of marine farming activities may interrupt breeding and reduce breeding success

- Reduction in ecological integrity of an ecological community – assisting invasive species that are harmful to listed ecological communities to become established or causing the mobilisation of pollution into an ecological community that kills or inhibits the growth of species within the community.

- Other effects - noise, lighting, waste and vessel movements all have the potential to impact on threatened species through potential interactions or by the physical presence of artificial structures and associated infrastructure.

There are a number of threatened species that may potentially be subject to specific impacts from the proposed amendment.

For the purpose of this assessment, *Macrocystis pyrifera*, a listed threatened community under the EPBCA, was not included for further risk analysis. This decision was based on current distribution patterns of *Macrocystis pyrifera* in the vicinity of the proposed amendment, which do not satisfy the criteria for a threatened *Macrocystis pyrifera* ecological community, as defined in the relevant Commonwealth Listing Statement (DSEWPaC 2012).The *Macrocystis pyrifera* plants in the Butlers Point area are generally isolated plants that do not form a surface or sub-surface canopy, and typically occur in waters shallower than 5 m.

Listed threatened plant, reptile, terrestrial mammal, frog and insect species have not been assessed for potential impacts because the proposed amendment does not involve any land-based development activities or the erection of artificial structures on land. The species included below have been selected on the basis that they are known to occur within the proposed amendment and surrounding areas (within 5 km) and/or have been recorded in the Tasmanian Natural Values Atlas within the extent of this area. These are:

- White-bellied Sea Eagle

- Wedge-tailed Eagle

- Swift Parrot

- Forty-spotted pardalote

- Southern Right Whale

- Humpback Whale

- New Zealand Fur Seal.

White-bellied Sea-Eagle (*Haliaeetus leucogaster*)

The White-bellied Sea-Eagle occurs in Tasmania as a single population containing fewer than 1000 individuals and has a restricted distribution, usually occurring and nesting within 5 km of the coast, estuaries or large inland lakes (Threatened Species Section [TSS] 2006). They are present on most of the islands of Bass Strait and are believed to possess the ability to island-hop between Tasmania and the mainland. Large estuaries and convoluted coastlines are the favoured sites for both nesting and foraging as these provide a greater interface between land and water. Population density is lower on the west and south coasts, possibly due to the lack of suitable forest habitat sheltered from high winds. This species is commonly observed within marine coastal waters of south east Tasmania, and nests for this species have been recorded based on four observations (Tasmanian Natural Values Report)

within 5 km of the proposed amendment area between 1977-1981. There have been no recorded negative interactions between White-bellied Sea Eagles and current marine farming operations at Butlers Point.

Key potential threats to the species from activities associated with the proposed amendment may include:

- nest disturbance
- marine debris
- modification of foraging behaviour
- reduction in habitat quality and quantity.

Nest Disturbance

Disturbance to nests can impact on White-bellied Sea Eagles. A management practice recommended in the recovery plan includes buffers of 500 m and 1000 m line of sight to protect nests from disturbance arising from human activities during the breeding season. Nesting sites near Butlers Point have been recorded in forests fringing the coastline south of Great Taylors Bay, Port Esperance and Southport.

Marine Debris

White-bellied Sea-Eagles may potentially be affected by marine farming-derived debris located within the water column or on shorelines around Great Taylors Bay. White-bellied Sea-Eagles may become entangled in marine debris resulting in injury or death. It is possible that an increased number of cages at Butlers Point may result in an increase in marine debris in surrounding waters and along the foreshore. However, the potential scale of any increase in marine debris is not expected to pose any significant risks to White-bellied Sea-Eagle populations within the Huon Farming Region and surrounding areas.

Foraging

White-bellied Sea-Eagles are attracted to fish farms and will extend their foraging range to include fish farms, although they rarely exploit fish directly due to the large size of the fish and the aerial netting deployed on all sea cages (Wiersma and Richardson 2009). Whilst the proposed amendment includes an expansion in area at Butlers Point (18.5 ha), this reduction in foraging habitat is not expected to significantly impact on the foraging behaviour or capacity of White-bellied Sea-Eagles to source an adequate supply of marine prey.

Depletion of habitat

Residential, tourist and industrial developments and recreational pursuits pose a potentially significant threat to White-bellied Sea-Eagles through the reduction of available habitat (TSS 2006) and significant reduction in habitat quality. It is unlikely that the proposed increase in area at Butlers Point would result in a significant loss of habitat for the White-bellied Sea-Eagles located near the Huon Farming Region.

Wedge-tailed Eagle (*Aquila audax fleayi*)

The Tasmanian Wedge-tailed Eagle (*Aquila audax fleayi*) is an endemic subspecies and is listed as endangered under the TSPA and the EPBCA. The Wedge-tailed Eagle occurs as a single population of fewer than 1000 individuals (TSS 2006). Wedge-tailed Eagles are landscape hunters with a wide distribution throughout Tasmania but prefer to nest in tall open forests.

Nesting sites for this species have not been recorded in the Tasmanian Natural Values Report within 5 km of the proposed amendment, but are known to occur on Mt Cook (18 km to the east), and between Port Esperance and Southport (approximately 8-10 km from Butlers Point). The Tasmanian Wedge-tailed Eagle has been subject to Recovery Plans since 1992. Actions have included increasing public awareness of the Wedge-tailed Eagle's conservation value, educating the public about the eagle's importance and consulting with farmers to protect nest sites and reduce disturbances near nests during breeding. There have been no recorded negative interactions between Wedge-tailed Eagles and current marine farming operations at Butlers Point.

Key potential threats to the species from activities associated with the proposed amendment may include:

- nest disturbance
- marine debris
- modification of foraging behaviour
- depletion of habitat.

Nest Disturbance

Nesting habitat includes a range of old-growth native forests (TSS 2006). This habitat occurs on Bruny Island and along the coast between Port Esperance and Southport. Medium and high levels of disturbance during nesting, such as forest harvesting and road building have been known to adversely affect the success of breeding birds (Bell and Mooney 1999). The proposed amendment does not include shore based operations or disturbance within forests and is unlikely to adversely affect the breeding success of Wedge-tailed Eagles within the Huon Farming Region and surrounding areas.

Marine Debris

Wedge-tailed Eagles may potentially be affected by marine farming-derived debris located on the shorelines around Great Taylors Bay. Wedge-tailed Eagles may become entangled in marine debris resulting in injury or death. It is possible that an increased number of cages at Butlers Point may result in an increase in marine debris in surrounding waters and along the foreshore. However, the potential scale of any increase in marine debris is not expected to pose any significant risks to Wedge-tailed Eagle populations within the Huon Farming Region and surrounding areas.

Foraging

Wedge-tailed Eagles may be attracted to fish farms, however they are generally known to favour hunting in open areas and have been recorded hunting over most terrestrial Tasmanian habitat types (Bell and Mooney 1999). Whilst the proposed amendment includes an expansion in area at Butlers Point (18.5 ha), this reduction in available marine habitat is unlikely to impact on the foraging behaviour or capacity of Wedge-tailed Eagles to forage and obtain adequate levels of prey.

Depletion of habitat

Residential, tourist and industrial developments and recreational pursuits pose a potentially significant threat to Wedge-tailed Eagles through depletion of available habitat (TSS 2006) and significant reduction in habitat quality. It is unlikely that the proposed increase in area at

Butlers Point would result in a significant loss of foraging and nesting habitats for Wedge-tailed Eagles located near the Huon Farming Region and surrounding areas.

Swift Parrot (*Lathamus discolor*)

The swift parrot is a small fast-flying, nectivorous parrot which inhabits eucalypt forests in south eastern Australia and is listed as endangered on the EPBCA and TSPA. Within the parrot's breeding range the area of occupancy is less than 500 km^2 and the population has a severely fragmented distribution. A continuing decline in the number of mature individuals and in habitat extent and quality is projected unless action is taken to address the threats to the species. The swift parrot breeds only in Tasmania and migrates to mainland Australia in autumn. In Tasmania, the breeding range of the swift parrot is largely restricted to the east coast within the range of the Tasmanian blue gum. The breeding season of the swift parrot coincides with the flowering of blue gum and the nectar of this eucalypt is the main source of food for the parrots during breeding (Swift Parrot Recovery Team 2001). The breeding distribution varies interannually, reflecting food availability and quality of flowering gums.

Whilst habitat loss through land clearance for agriculture and urban and coastal developments are known to impact on the population status of this species, the swift parrot also suffers from high mortality during the breeding season through collisions with man-made structures such as windows, wire-mesh fences and vehicles. Numerous swift parrot sightings have been recorded in the Tasmanian Natural Values Atlas within 5 km of the proposed zone amendment. There have been no recorded negative interactions between Swift Parrots and current marine farming operations at Butlers Point.

Key potential threats to the species from activities associated with the proposed amendment may include:

Collisions with man-made structures

There are a number of man-made structures associated with marine farming operations, such as sea cages, feed barges and large vessels. As Swift Parrot sightings have previously been recorded within the Huon Farming Region and surrounding areas, there is the possibility of interactions with these structures. To date, no interactions have been recorded causing direct mortality or injury during the Swift Parrot's breeding season. It is presently considered unlikely that these mortality events would occur within the waters of the proposed expanded area at Butlers Point, however ongoing consultation with BirdLife Tasmania will continue to evaluate any residual risks associated with the proposed amendment, and additional mitigation measures may be adopted to remove these risks.

Forty-Spotted Pardalote (*Pardalotus quadragintus*)

The Forty-spotted Pardalote (*Pardalotus quadragintus*) is an endemic species and is listed as endangered under the TSPA and the EPBCA. The Forty-spotted Pardalote occurs as a number of discrete breeding populations of fewer than 1200 individuals (TSS 2006). Forty-spotted Pardalotes have a restricted breeding distribution in Tasmania. Nesting sites for this species have been recorded in the Tasmanian Natural Values Report within 5 km of the proposed amendment. The Forty-spotted Pardalote has been subject to Recovery Plans since 1991. Actions have included increasing public awareness of the Forty-spotted pardalote's conservation value, establishing nesting boxes in known breeding sites and restoring woodland areas for nesting and foraging habitat. There have been no recorded negative interactions between Forty-spotted pardalotes and current marine farming operations at Butlers Point.

Key potential threats to the species from activities associated with the proposed amendment may arise from collisions with man-made structures.

Collisions with man-made structures

There are a number of man-made structures associated with marine farming operations, such as sea cages, feed barges and large vessels. As Forty-spotted pardalotes sightings have previously been recorded within the Huon Farming Region and surrounding areas, there is the possibility of interactions with these structures. To date, no interactions have been recorded causing direct mortality or injury during the Forty-spotted pardalote's breeding season. It is presently considered unlikely that these mortality events would occur within the waters of the proposed expanded area at Butlers Point. Ongoing consultation with BirdLife Tasmania will continue to evaluate any residual risks associated with the proposed amendment, and additional mitigation measures may be adopted to remove these risks.

Southern Right Whale (*Eubalaena australis*)

The Southern Right Whale is currently listed as endangered under both the EPBCA and TSPA because they have undergone a severe reduction in numbers as a result of commercial whaling activities in the 19th and 20th centuries. There has been recent evidence of some population increase in southern Australian waters, however current abundance is well below the estimated historic abundance. Southern Right Whales have a circumpolar distribution between latitudes of 16°S and 65°S. Southern right whales from Australian populations probably forage between about 40°S and 65°S, generally south of Australia. In the region of the sub-tropical front (41–44°S) they mainly consume copepods, while at higher latitudes (south of 50°S) krill is the main prey item. The migratory paths between calving and feeding areas are not well understood.

Calving usually takes place in sheltered coastal waters of southern Australia in winter months. Nursery grounds are occupied from May to October in shallow coastal waters, and there is an increasing incidence of female whales giving birth and nursing calves in southern Tasmanian waters in recent years. Female Southern Right Whales exhibit strong calving site fidelity, generally returning to the same location to give birth and nurse offspring (Department of Sustainability, Environment, Water, Population and Communities [DSEWPC] 2012). While Southern Right Whales have been sighted in Great Taylors Bay, there have been no recorded negative interactions between Southern Right Whales and current marine farming operations at Butlers Point.

Key potential threats to the species from activities associated with the proposed amendment may include:

- entanglement
- vessel disturbance
- habitat modification.

Entanglement (ropes and marine debris)

Entanglement can harm or kill individual whales, and can reduce the fitness of an individual whale by restricting mobility and impairing breathing, swimming or feeding ability. Entanglement causes physical damage (e.g. nets and lines cutting through the skin and blubber thus exposing the animal to infection and amputation or death). Entanglements in Australian waters primarily come from commercial fishery equipment and marine debris. In the Protected Matters Report that describes listed EPBC threatened and migratory species

within 5 km of the proposed amendment, Southern Right Whales are the only cetacean where breeding is likely to occur within 5 km of the proposed amendment. Despite the increased presence of this species in recent years in southern Tasmanian coastal waters, Southern Right Whales are excellent inshore navigators. It is considered unlikely that this species will be affected in any way by the proposal. Interactions between Southern Right Whales and marine farming activities have not been recorded in the Huon Farming Region, despite their known presence in surrounding waters from time to time. It is considered unlikely that the proposed development will result in an increased risk of entanglement of Southern Right Whales.

Vessel disturbance

Vessel disturbance can occur in the form of collisions or by disrupting the behaviour of animals. Southern Right Whales appear to be the primary whale species involved in vessel collisions in the southern hemisphere. Vessel collision can lead to mortality or significant injury. Southern Right Whales are naturally conspicuous by virtue of their size. Marine farming operations involve significant movement of vessels ranging in size from outboard powered dinghies to large feed barges. The nature of the waters around the proposed development are considered to be somewhat exposed, yet sheltered enough to allow Southern Right Whales to be observed in nearby waters should they be present. There are no recorded interactions between Southern Right Whales and marine farming activities in the Huon Farming Region, hence it is considered highly unlikely that the proposed development will result in any collisions with or disturbance of Southern Right Whales that may inhabit waters surrounding the proposed development.

Habitat modification

Habitat modification through the development of infrastructure such as ports, marinas, aquaculture facilities, and ocean/marine energy production facilities could lead to the physical displacement of Southern Right Whales from their preferred (breeding) habitats or disruption to normal behaviour. Animals may also encounter chemical pollution in the form of sewage and industrial discharges, run off from onshore activities, and accidental spills. In their feeding grounds they are most at risk from bioaccumulation of human-made chemicals such as organochlorines. The proposed development includes an expanded area to the existing Butlers Point lease of 18.5 ha. It is highly unlikely that this increase in area within the waters of Great Taylors Bay will impact upon the status of Southern Right Whale populations.

Humpback Whale (*Megaptera novaeangliae)*

The humpback whale is listed as vulnerable under the EPBCA and endangered under the TSPA. It is a moderately large baleen whale found virtually worldwide, but with apparent geographical segregation. Each year Australian humpback whales migrate from the Southern Ocean summer feeding grounds to sub-tropical winter calving grounds. The northern and southern hemisphere populations appear to be distinct given temporal migration separation (Department of the Environment and Heritage [DEH] 2005).

Humpback Whales utilising Australian waters currently have tropical calving grounds along the mid and northern parts of the east and west coasts of Australia, and feeding grounds in the Southern Ocean. The majority of Humpback Whales in Australian waters migrate north to tropical calving grounds from June to August, and south to the Southern Ocean feeding areas from September to November. The exact timing of the migration period can change from year to year and may be influenced by water-temperature, the extent of sea-ice, predation risk, prey abundance and location of feeding ground (DEH 2005).

Feeding is likely to be related to krill density and primarily occurs in Southern Ocean waters south of 55°S. However, several opportunistic feeding areas have also been found off the coast of Australia. The available information suggests that a portion of the east coast population disperses into the South Pacific including New Caledonia, Tonga and probably other western South Pacific Islands.

It is not currently possible to define habitat critical to the survival of humpback whales. The flexibility and adaptability of the species' habitat requirements are not known, and it is not clear if all the currently used areas are critical to survival or whether the loss of one of these areas could be sustained. Habitat important (and potentially critical) to the survival of humpback whales is defined as those areas known to seasonally support significant aggregations of whales, and those ecosystem processes on which humpback whales rely - in particular known calving, resting and feeding areas, and certain sections of the migratory pathways (Department of Environment, Water, Heritage and the Arts [DEWHA] 2009).

Whilst Humpback Whale sightings have occurred within 5 km of the proposed amendment, there have been no recorded negative interactions between Humpback Whales and current marine farming operations at Butlers Point.

Key potential threats to the species from activities associated with the proposed amendment may include:

- entanglement
- vessel disturbance
- habitat modification.

Entanglement (ropes and marine debris)

Observations for Southern Right and Humpback Whales have been recorded in the Tasmanian Natural Values Atlas Report within 5 km of the proposed amendment area, therefore the proposed amendment area is considered to provide suitable habitat for these species. As described above for Southern Right Whales, entanglement in mooring lines or as a direct result of marine debris can harm or kill individual whales, and can reduce the fitness of an individual whale by restricting mobility and impairing breathing, swimming or feeding ability. Entanglement causes physical damage (e.g. nets and lines cutting through the skin and blubber thus exposing the animal to infection and amputation or death). It is considered unlikely that this species will be affected in any way by the proposal. Interactions between Humpback Whales and marine farming activities have not been recorded in the Huon Farming Region, despite their known presence in surrounding waters. It is considered unlikely that the proposed development will result in an increased risk of entanglement of Humpback Whales.

Vessel disturbance

Humpback Whales are likely to be affected in a manner similar to the vessel disturbance impacts identified for the Southern Right Whales above. However, high levels of boating traffic have been found to cause lactating female humpback whales and calves to leave traditional inshore resting areas in favour of offshore waters (DEH 2005). Whilst there are no recorded interactions between Humpback Whales and marine farming activities in the Huon Farming Region, it is considered unlikely that the proposed development will result in any disturbance to or collisions with Humpback Whales that may temporarily reside in waters surrounding the proposed amendment.

Habitat modification

Habitat modification through the development of infrastructure such as ports, marinas, aquaculture facilities, and ocean/marine energy production facilities could lead to the physical displacement of Humpback Whales from their preferred habitats or disruption to normal behaviour. The annual migration of Humpback Whales covers a distance up to 10 000 km from their summer feeding grounds to their sub-tropical winter breeding grounds. It is unlikely that the addition of 18.5 h to the Butlers Point lease from this proposed amendment will significantly impact on the habitat requirements for Humpback Whale populations, or affect their patterns of migration.

New Zealand Fur-seal (*Arctocephalus forsteri*)

The New Zealand Fur-seal is listed as rare under the TSPA and is found in West Australia, South Australia and New Zealand. In Tasmanian waters, it mainly occurs on the west and south coasts. Only a small number of New Zealand fur seals breed on remote islands off the south coast. The total population in Tasmania may be as low as only several thousand and they have not re-populated traditional areas such as Bass Strait. About 100 pups are born annually. Australia-wide, the population is estimated to be 58 000.

It is very difficult to distinguish between the Australian Fur-seal and the New Zealand Fur-seal in the field. The New Zealand Fur-seal is slightly smaller than the Australian fur seal and are best distinguished from this species by their much darker colouration. For more positive identification, a suite of other morphological and behavioural characteristics are used as diagnostic features.

The New Zealand Fur-seal's main prey includes Redbait and Jack Mackerel and myctophid species. Unlike the Australian Fur-seal, it also consumes seabirds such as Little Penguins and Shearwaters.

Seal interactions (Australian and New Zealand Fur-seals) are a significant issue for the Tasmanian finfish farming industry, and will continue to be so while seals are attracted to marine farms to source food. Tassal manages this issue by excluding seals from entering the cages through the use of specifically designed nets and weighting systems. The transition to Kikko net mesh technology will further reduce the potential for seals to enter salmon cages, and this may assist in mitigating against habituate behaviour and the attraction of seals to marine farms.

Potential threats to the species from activities associated with the proposed amendment may include:

- entanglement and entrapment
- marine debris
- modified foraging behaviour.

Entanglement and entrapment

By the very nature of finfish aquaculture techniques, equipment and infrastructure deployed in marine waters, netting and ropes can potentially cause entanglement and entrapment of seals, resulting in injury or death. Ropes and nets that are poorly maintained provide points of potential entanglement and entrapment. Seal mortalities (including mortalities to New Zealand Fur-seals) have historically occurred as a result of entanglement and entrapment during the development of the Tasmanian Salmon farming industry.

Marine debris

Commercial fishing and aquaculture activities are known to cause injury and death to seals from marine debris, predominantly through net material that may become entangled around seals. New Zealand Fur-seals may potentially be affected by marine farming-derived debris located within the water column or on shorelines around Great Taylors Bay.

Modified foraging behaviour

New Zealand Fur-seals are attracted to fish farms and will extend their foraging range to include fish farms. This issue continues to be managed using predator exclusion devices and the use of approved seal deterrents.

6.1.6.3 Mitigation Measures

White-bellied Sea-Eagle

Marine Debris

Tassal currently participates in a program involving the collection of marine debris from shorelines around the Huon Farming Region. To reduce the potential for disturbance, marine debris collections are only undertaken during the non-breeding season to avoid disturbing nesting birds.

Foraging

No additional mitigation measures are deemed necessary for the proposed amendment.

Nest disturbance

No additional mitigation measures are deemed necessary for the proposed amendment.

Reduction in habitat quality and quantity

No additional mitigation measures are deemed necessary for the proposed amendment.

Wedge-tailed Eagle

Marine Debris

The mitigation response addressing the potential impacts to Wedge-tailed Eagles from marine debris as a result of the proposed amendment is identical to the mitigation response described above for White-bellied Sea-Eagles. The proposed amendment will not involve any change to existing operations apart from the transfer of smolt to an expanded lease area at Butlers Point and there should be no additional impacts to Wedge-tailed Eagle populations from marine debris within the Huon Farming Region.

To reduce the residual risk for disturbance, marine debris collections (Shoreline Clean-up program) are only undertaken during the non-breeding season to avoid disturbing nesting birds.

Nest disturbance

No additional mitigation measures are deemed necessary for the proposed amendment.

Modification of foraging behaviour

No additional mitigation measures are deemed necessary for the proposed amendment.

Reduction in habitat quality and quantity

No additional mitigation measures are deemed necessary for the proposed amendment.

Swift Parrot and Forty-spotted Pardalote

Collisions with man-made structures

Should any collision events be recorded through farming operations within the Huon Farming Region for either of these species, Tassal will continue to liaise with BirdLife Tasmania to ameliorate any residual risks or negative impacts and develop solutions to prevent further interactions.

New Zealand Fur-seal

Refer to section 6.1.5.3 for general mitigation measures. No specific additional mitigation measures are proposed for this species.

Southern Right Whale

Refer to section 6.1.5.3 for general mitigation measures. No specific mitigation measures are proposed for this species.

Humpback Whale

Refer to section 6.1.5.3 for general mitigation measures. No specific mitigation measures are proposed for this species.

6.1.6.4 Overall effect following implementation of mitigation measures

White-bellied Sea-Eagle

Following mitigation the risk to this species from the proposed development is considered low. The proposed amendment is unlikely to contribute to the decrease in White-bellied Sea-Eagle populations.

Wedge-tailed Eagle

Following mitigation the risk to this species from the proposed development is considered low. The proposed amendment is unlikely to contribute to the decrease in the Wedge-tailed Eagle population.

Swift Parrot and Forty-spotted Pardalote

Following mitigation the risk this proposal poses to these species is considered low. The proposed amendment is unlikely to contribute to decrease in Swift Parrot or Forty-spotted Pardalote populations as a result of collisions with marine farming infrastructure.

New Zealand Fur-seal

Seals continue to be an ongoing challenge to marine farming operations with daily interactions recorded throughout the south-east of the state. Large investments are made to exclude and deter seals from affecting marine operations and stock. In addition, deterrents reduce negative seal interactions and their positive associations with fish farms. Despite the range of efforts employed to reduce these interactions, the number of seals that interact with fish farms means that the risk of injury or mortality is a distinct possibility, but should be considered low due to the mitigation measures employed and recent improvements to predator-proof fish netting (i.e. use of Kikko design nets) used to prevent and exclude seals from entering cages.

Southern Right Whale

The proposal poses negligible threat to this species.

Humpback Whale

The proposal poses negligible threat to this species.

Summary

The overall effect following implementation of mitigation measures to listed threatened and migratory species under the EPBCA and TSPA is that no significant change to the current level of threat is anticipated. Tassal adopts a range of standard practice protocols to mitigate any negative interactions with listed species. The species identified above were chosen on the basis that the waters in close proximity to the proposed amendment *may* provide suitable habitat, or these species may occur or forage in these waters (or areas) from time to time as part of their migratory routes. Only the New Zealand Fur seal is known to interact with marine finfish farms on a regular basis.

6.1.7 Geoconservation

6.1.7.1 Potential impacts on sites of geoconservation significance listed on the Tasmanian Geoconservation Database

As stated in section 5.1.5, a desktop search of the LISTMap website was undertaken and indicates that there are two listed geoconservation sites located in the surrounding area; Labillardiere Peninsula Dolerite and Conleys Beach Pleistocene Dune.

6.1.7.2 Mitigation Measures

Land base servicing the proposed amended Butlers Point lease will not be moved from its current location, so there will be no land based construction work conducted in the area. All marine debris (including marine farm debris) is collected and removed from shorelines adjacent to Tassal's active marine farming leases as a component of the Shoreline Clean-up program (see Figure 6.3).

There are a number of factors that reduce the potential impacts of the proposed amendment:

- Labillardiere Peninsula Dolerite

- the nature of the geoconservation site,
- the proposal moves the lease further away from the geoconservation site

- Conleys Beach Pleistocene Dune
  - this geoconservation site is sufficient distance from the proposed development that is it not expected to be impacted.

6.1.7.3 Overall effect following implementation of mitigation measures

The amendment to Zone 18B and Butlers Point lease is not expected to impact on either neighbouring sites of geoconservation significance.

6.1.8 Chemicals

6.1.8.1 History of usage at the site and details on specific activities in relation to chemical usage

Therapeutants

Tassal has records of antibiotic use in the Huon Farming Region dating back to 2006.

As part of Tassal's Fish Health Management Plan, 100% of smolt are vaccinated against the main bacterial diseases. This practice has dramatically reduced Tassal's total antibiotic use. In FY2012 Tassal's company-wide antibiotic use was less than 2% of the total use in 2009. Any salmon that are treated with antibiotics must go through a lengthy withdrawal period of between 90 – 120 days to ensure the antibiotic is cleansed from their system. Prior to harvest, any group of fish that may have had antibiotics is tested for residues. Tassal complies with the Australian New Zealand Food Standards Code for residue levels.

Disinfectants

Disinfectants are used in aquaculture to control spread of potential disease organisms. Disinfectants can potentially harm local flora and fauna if released in large amounts to waterways. Disinfectant footbaths are located at land-based facilities, but only contain a few millilitres of disinfectant diluted in several litres of water. Disinfectants are also used to disinfect farm equipment before transfer between sites. The disinfectant is diluted in water and sprayed sparingly in a controlled manner. The majority of disinfectant use by Tassal takes place at its land base operations with proper wash down facilities.

6.1.8.2 Proposed usage of chemicals including antifoulants, therapeutants (such as antibiotics) and disinfectants

Antibiotics will only be prescribed as required to address illness and fish welfare issues. It is not possible to forecast antibiotic use, but it is expected that use will remain low if not absent, due to improved husbandry practices and effective vaccines. Should a significant new bacterial disease emerge, antibiotics may be required to control stock losses and welfare issues while a vaccine is developed.

6.1.8.3 Recognised localised and system-wide effects of chemical usage on water quality, the benthic environment and other fauna

Generally the effects of disinfectants on the marine environment are poorly studied (Burridge et al. 2010); however the disinfectants and cleaning agents used by Tassal are water soluble and low toxicity when used according to label instructions. Virkon is the primary disinfectant used by Tassal and is oxygen based, containing simple organic salts and organic acids. The active ingredient decomposes in the environment, breaking down to form harmless compounds, potassium salts and oxygen. Three quarters of the ingredients of Virkon are inorganic which decompose to naturally occurring simple inorganic salts. The remaining organic compounds are classified as readily biodegradable by OECD and EU standards.

6.1.8.4 Public health risks

There are no anticipated public health risks from the use of chemicals.

In order to address the issue of risks to human health associated with the consumption of medicated escapee Atlantic salmon or wild fish containing antibiotic residues, the Tasmanian Public and Environmental Health Service (Department of Health and Human Services) engaged Food Standards Australia and New Zealand (FSANZ) in 2007 to undertake a risk assessment for Oxytetracycline (OTC) levels in both wild fish and farmed medicated Atlantic salmon (FSANZ 2013). OTC is a prescribed antibiotic used in salmon farming. The study examined the OTC residue levels from the flesh of several fish species 10, 15 and 70 days post treatment, and related the highest found residue levels in these samples to the acceptable daily intake (ADI) for OTC in humans (0.03 milligrams per kilogram of body weight per day). The report by FSANZ concluded that, based on the residual levels observed in the fish tested, there was no public health risk for any Australian population group associated with the consumption of farmed salmon or wild fish caught near salmonid farming areas.

6.1.8.5 Mitigation Measures

6.1.8.5.1 Proponent management plan specific to the management of chemicals and environmental consequences of usage and chemical waste management

Tassal has a detailed Dangerous Goods and Hazardous Substances Procedure and Waste Management Plan created specifically for the management of chemicals and environmental consequences of usage and chemical waste management. This procedure has been validated by a third party auditor through the Best Aquaculture Practices (BAP) certification process. The BAP Standard includes a comprehensive section focused on the safe storage and disposal of farm supplies.

Tassal keeps Dangerous Goods and Hazardous Substances registers for all of its Marine Farming, Hatchery and Processing sites. Each substance listed has a current Material Safety Data Sheet kept in hard copy on site and electronically on Tassal's intranet.

Spill kits are located on all vessels and barges, at all chemical storage areas and areas where chemicals are used. All Tassal employees are appropriately trained in the use of spill kits. Tasmania also has a State Emergency Plan that includes resources that can be deployed to contain and clean up large spills if required. Some chemicals used in aquaculture are classified under the *Environmental Management and Pollution Control Act 1994* as controlled wastes which require disposal by an appropriate licensed contractor. Commercial arrangements

exist with approved waste service providers for all waste materials ensuring disposal in accordance with the appropriate regulations.

All chemicals used in the Huon Farming Region are stored in bunded areas with the capacity to hold 110% of the volume of the largest container. This ensures that any spill that occurs is appropriately contained and the risk of spill to the environment is minimised.

All boats and equipment are serviced regularly and inspected daily with thorough "start-up" and "shut down" procedures completed to ensure that any issues are identified early and remedial action can be taken.

No antibiotics are stored on site. Should antibiotics be required, medicated feed would be prepared at the feed mill and transported to the region in fully contained and clearly identified plastic bags.

Tassal will continue to comply with the regulatory controls outlined below.

6.1.8.5.2 Regulatory Controls

Tassal complies with management controls as stipulated in the D'Entrecasteaux Channel MFDP and Schedule 3 of Marine Farming Licence Conditions Relating to Environmental Management of a Finfish Farm. Relevant controls are:

- **Management Control 3.4.3 (MFDP)** Lessees must provide to the Director, Marine Resources of the Department of Primary Industries, Water and Environment in each calendar year the following information for the immediately preceding year:
    - **Management Control 3.4.3.2 (MFDP)** A list specifying the names and quantities of therapeutic treatments, pesticides, anaesthetics, antibiotics, hormones, pigments, antifoulants, disinfectants, cleansers, sedatives and any other potentially harmful materials which have been used in each lease area for which they hold a marine farming licence.
- **Management Control 3.6.1 (MFDP)** All chemicals use must comply with the requirements of the Agriculture and Veterinary Chemicals (Control of Use) Act 1995.
- **Condition 1.6 (MF Licence)** Levels of antibiotics, or chemical residues derived from farm therapeutic use, present in sediments within or outside the Lease Area, are not to exceed levels specified to the licence holder by prior notice in writing by either the Director or the Chief Veterinary Officer, Tasmania.
- **Condition 1.7 (MF Licence)** Prior to any stock being treated with therapeutants, the licence holder must advise the Director, and provide a copy of any medication authority specific to stock treatment that has been issued. The licence holder must comply with requirements to undertake any reasonable residue testing prescribed by the Director.

6.1.8.6 Overall effect following implementation of mitigation measures

The proposed amendment is not expected to result in a significant increase in the quantities of chemicals used and stored on the lease, therefore the resulting impact is considered to be minimal.

As detailed above (section 6.1.8.5), management controls and marine farming licence conditions are designed to mitigate risk and any potential impacts from chemical use, spillage, or waste on fish farms. While there is an increase in vessel movements associated with the proposed amendment, the management controls in place will ensure that the net impact from the chemicals on vessels and those used on the farm would be negligible.

6.1.9 Species Escapes

6.1.9.1 History of escape events within MFDP area

Tassal has records of escape events for all of their Marine Farming Regions dating back to January 2000. Over this 14 year period there has been no significant escape event within the Great Taylors Bay region of the D'Entrecasteaux Channel MFDP Area.

6.1.9.2 Recognised ecological effects of escaped stock

There are no wild salmon populations in Tasmania and the farmed populations of salmon are composed of all females, thus making reproduction in the wild impossible. Research also indicates that escaped Atlantic salmon do not successfully forage outside of the pens and do not thrive in the wild (Steer and Lyle 2003).

Thorstad et al. (2008) have documented the incidence and impacts of escaped farmed Atlantic salmon in nature, and the review covers all of the major commercial salmon farming regions of the world. Major topics covered in the review of relevance to Tasmanian salmon farming include:

- geographic and temporal trends in numbers and proportions of escaped farmed salmon in nature
- effects of escaped farmed salmon in regions where the Atlantic salmon is an exotic species
- technologies and other efforts for escape prevention
- technologies and efforts to reduce impacts of escapes.

The report also summarises the knowledge gaps in each of these areas and suggests areas of research to better understand the issue.

Marine farming practices, farm designs and equipment specifications are designed to avoid the release of fish. However, despite the best of intentions and practices, the occasional escape of salmonids is an unavoidable impact of finfish marine farming operations.

There are a number of potential concerns associated with the escape of farmed salmonids into the marine environment. These include:

- establishment of feral populations
- impact on native fish populations through predation or competition for resources
- disease/parasite transfer from farmed fish to native fish populations.

The major concern for northern hemisphere farming countries – genetic pollution of wild stocks of Atlantic salmon – is not relevant in Tasmania. Although numbers of escaped fish in these countries are relatively small compared to the number stocked, they are highly significant in the context of low numbers of genetically distinct wild populations in small river systems.

Sea cage farming of salmonids (rainbow trout) in Tasmania commenced in the 1970s but did not become a significant industry until late in the 1980s with the focus moving to Atlantic salmon. To date there has been no documented evidence of the establishment of feral populations of Atlantic salmon in Tasmania. Commencing in 1865 and continuing until the 1930s, numerous attempts were made to establish self-supporting populations of both Atlantic salmon and Pacific salmon; hundreds of thousands of juveniles were released in river systems all over the state but the goal of establishing self-supporting populations for recreational purposes was never achieved (Clements 1988). In fact there is no documented evidence to suggest that Atlantic salmon have established successful breeding populations outside their normal home range in the northern hemisphere (Thorstad et al. 2008).

In 2003 researchers from the Tasmanian Aquaculture and Fisheries Institute in conjunction with the Tasmanian Salmonid Growers Association conducted preliminary research into salmonid escapees from marine farming operations in Macquarie Harbour located on the west coast of Tasmania. The study primarily focused on aspects of post-escape feeding activity and involved examination of stomach contents and condition of escaped fish. Results indicated that escapees did not appear to successfully forage outside of the farm nets and lost condition, supporting the contention that escaped fish do not appear to thrive in the wild (Steer and Lyle 2003). Some of the fish examined however, did have prey items in their stomachs that indicated they were feeding on native species. This suggested that more work was required to achieve a greater understanding of the fate of escaped salmonids in the marine environment in Tasmania.

Abrantes et al. (2010) used lab analysis techniques to determine if escaped salmonids in Macquarie Harbour feed on native fauna. They established that one Atlantic salmon (13 sampled) and one rainbow trout (38 sampled) had successfully fed on native fauna post escape. It was concluded that in general, escaped salmonids do not switch to feed on native fauna but because of the limited sample size results were not conclusive and there was still no definitive answer regarding the fate of salmonid escapees in Tasmania.

In an international context, Tasmanian farmed salmonid species are free of all the major infectious bacterial and viral diseases that cause significant management issues in other salmon farming regions. In addition, there is as yet no record of the presence of salmon lice on Tasmanian salmonids. There has been no evidence to date that farmed Tasmanian salmon are responsible for transmission of diseases to either native species or wild salmonid populations.

Tassal has recently engaged the University of Tasmania to perform an evaluation of practices on salmon farms in Tasmania to mitigate escapes and ecological impacts. The assessment includes:

- an overview of current state and international policies and regulations around salmonid escapes from sea cage culture;
- identification of potential ecological impacts posed by escaped Atlantic salmon; and
- an assessment on the risk of escapes based on Tassal's current practices

While there is the potential for disease transfer from escaped fish, the low level of disease in farmed salmonids combined with relatively low loss rates from recent years means such a risk is very low. Furthermore, the poor adaptation of escaped fish to natural conditions in Tasmania suggests that most Atlantic salmon do not survive for long in the wild, effectively reducing the time period for potential disease transfer (Lyle & Frijlink 2013).

A number of social and economic impacts both negative and positive may also be associated with escaped salmonids, but to date there has been little work undertaken to estimate these issues. The aquaculture sector bears the direct losses in foregone revenue, loss of capital in the stock and poor public perceptions (Naylor et al. 2005). Escapes can be seen as a bonus for local recreational fishing interests and the tourism industry, providing extra revenue from new target species. This was particularly apparent in Dover in March 2000 when the loss of a significant number of salmon provided the businesses in the town with a major economic boost for several days.

Jensen et al. (2010) provide further detail on the causes, consequences and prevention of escapes in a Norwegian context. The Norwegian web site Bellona[10] also has a comprehensive review of the topic.

6.1.9.3 Spread of disease from escaped fish

As stated above, there have been no significant escape events within the Great Taylors Bay region of the D'Entrecasteaux Channel MFDP Area in the last 14 years. The rarity of escape events combined with the fact that there are no major diseases present in Tassal's salmon, means there is a low risk associated with the spread of disease from escaped fish.

6.1.9.4 Mitigation Measures

6.1.9.4.1 Risk minimisation strategies

Tassal aims to eliminate stock escapes from their marine farms wherever possible.

6.1.9.4.2 Protocols for managing escape events

Tassal has developed and implemented an Escape Prevention and Response Protocol company wide. This plan incorporates escape prevention, net inventory, weighting systems, smolt input and harvest operations as well as inventory management and incidental losses.

This process also included the development of Tassal's Escape Response Kits. These kits contain equipment for containment or attempted recapture and include a written procedure for their use. They have been successfully used in the marine farming environment, with positive feedback from operational staff.

Tassal complies with management controls as stipulated in the D'Entrecasteaux Channel MFDP and Schedule 3 of Marine Farming Licence Conditions Relating to Environmental Management of a Finfish Farm. Relevant controls are:

- **Management Control 3.8.2 (MFDP)** Lessees must not intentionally release into State waters fish of the species authorised in the relevant marine farming licence.

[10] http://www.bellona.org/ aquaculture /tema_aquaculture/Escapes

- **Management Control 2.4 (MF Licence)** the licence holder must report to the Director any significant incident of fish escapes within 24 hours of becoming aware of the escape. A significant escape is defined as any loss of licensed species to the marine environment in excess of 500 individuals at any one time.

6.1.9.5 Overall effect following implementation of mitigation measures

The implementation of Tassal's escape prevention measures has resulted in a significant decrease in escape events. This process has been validated by third party audit through the Best Aquaculture Practices (BAP) certification process which has an entire component dedicated to the management of escapes. Impact from species escapes is not expected to increase as a result of the proposed amendment.

6.1.10 Disease

Issues to be considered must include, but are not limited to;

6.1.10.1 History of disease within MFDP area and bioregion

Amoebic Gill Disease (AGD) is the main fish health issue in the Huon Farming Region. However, it is well managed by Tassal through their proactive program of continuous surveillance and freshwater bathing.

Bacterial infections in smolt after transfer caused some mortality in 2012, *Tenacibaculum maritimum* and 2013, Yersiniosis. Other pathogens found in the Huon Farming Region prior to 2010 were Enteric Vibriosis (SGS), and Rickettsiosis. They are not currently an issue at Butlers Point lease.

Harmful algal blooms (HAB) and jellyfish presence is monitored daily through algal trawls and associated observational on ground work. These are monitored as they may predispose fish stock to infection or disease (i.e. AGD, etc.).

Salmon Orthomyxovirus (SOMV) was isolated following a smolt mortality event in the 2012 year class at Killala and in 2013 at Brabazon. Investigations into SOMV and vaccine development in collaboration with DPIPWE are on-going.

6.1.10.2 Recognised ecological effects of disease

There have been no reported fish kills in wild fish populations within the Huon Farming Region attributed to disease agents from farmed salmon. Therefore, it is highly unlikely that the presence of any disease agents in farmed salmon in the Huon Farming Region will have the capacity to manifest in natural marine ecosystems.

6.1.10.3 Mitigation Measures

6.1.10.3.1 Fish health strategies

Tassal's focus on disease monitoring and early detection places a high importance on incorporating stock inspections into routine farming activities such as mortality collection, weight checks and harvests.

Tassal is actively involved in the Tasmanian Salmonid Health Surveillance Program, which is a joint program between the Tasmanian Salmonid Industry and the Tasmanian Government.

This program provides passive and active disease surveillance through regular submission of fish diagnostic samples and testing for specific disease agents of concern.

Tassal's Farm Disease Management and Biosecurity Protocol is designed to limit the transmission of existing or exotic pathogens between or within control regions as well as develop a proactive 'hygiene culture'. The Protocol is based on a two-tiered system of alert depending on the disease status of individual pens, leases or regions, with changing actions and monitoring processes throughout the steps.

Tassal has also implemented a South East Fish Health Management Plan (FHMP) which consists of a combination of compliance, best practice, and regulation through management controls and Marine Farming licence conditions. The FHMP addresses detailed, standard operating procedures to prevent disease from entering the region, to prevent the spread and impact of disease in farming regions and to respond to emergency disease situations. The FHMP is scheduled to be reviewed annually; however this will occur more frequently if required.

Tassal complies with management controls as stipulated in the D'Entrecasteaux Channel MFDP Relating to Environmental Management of a Finfish Farm. Relevant control is:

- **Management Control 3.8.1 (MFDP)** Lessees must notify the Secretary of any suspected disease in accordance with the Animal Health Act 1995.

6.1.10.4 Overall effect following implementation of mitigation measures

Tassal's use of medication has decreased markedly over the last five years.

This is due to a greater focus and knowledge towards fish health, and is not expected to change due to this amendment, therefore the resulting potential impact is considered to be minimal.

6.1.11 Waste Streams Disposed on Land

6.1.11.1 History of mortalities including effect of mass mortality events

Mortalities are collected from pens and transported in bins to an external processing plant under contract. This plant produces fish protein (typically 185 g protein/kg fish) as a liquid protein hydrosylate for export as aquafeed and use as fertiliser, and fish oil for export as an animal and aquafeed. Severely decomposed mortalities (10 – 20%) are segregated at the processing plant and taken to an approved composting facility as a valued additive.

In the unlikely occurrence of mass mortalities, these will be removed from pens as soon as possible and treated likewise.

6.1.11.2 Dilapidated or broken equipment

Clean unserviceable nets are given away for reuse where possible or suitable sections reused for repair of other nets. Antifoulant treated nets (presently being permanently removed from service as they become unserviceable) are cleaned and stored off site awaiting a suitable disposal option. Farm cages, which are constructed predominantly of polypropylene and steel, and general equipment has traditionally been disposed of at the local landfill. A recycling avenue is now available for all polypropylene materials which will be used where practicably possible.

- Steel recycling is available to all Tassal farming regions.
- Cage and feed pipe is often sold or given away as drainage pipe and is fully recyclable.
- Kikko nets are made of plastic and are fully recyclable.

6.1.11.3 Soluble and solid waste streams from land-based maintenance of antifouled nets

The solid material from the cleaning of nets containing antifoulant is currently being stored awaiting an EPA approved disposal solution. It is planned to supply this material for the recovery of copper and zinc or as calcium based feedstock for cement manufacture. There are a variety of other disposal options being investigated as well.

There will not be any copper antifouled nets used at the farming region as Tassal has phased out the use of this treatment on nets for all of its farming operations.

6.1.11.4 Bloodwater

Bloodwater, a by-product of the harvesting process, is treated at the processing factory at Dover in the effluent treatment system. This system is an EPA authorised waste water treatment facility that has a marine discharge permit for treated effluent. Bloodwater from the harvest vessel is stored on board and pumped to the wastewater treatment plant when docked at the Dover factory.

Fish will not be grown out to harvest on the Butlers Point lease, so there will be no bloodwater resulting from farming practices at this lease.

6.1.11.5 Black and grey water from on-site barges and other installations

The black and grey water from the feed barge is pumped out on a routine basis by the feed delivery vessel. This waste is discharged to an approved disposal point on-shore.

6.1.11.6 Potential Impacts

Fish Mortalities

If mortalities are not removed from the cage on a regular basis there is the potential for some impact on the environment and the populations of stock within the cage and adjacent cages.

Potential impacts on the natural and human environment include:

- organic enrichment of the water column and the seabed from putrefying fish
- spread of disease to wild fish
- changes in water quality
- odour issues affecting public amenity.

Potential impacts on stock populations within a cage and on adjacent cages include:

- spread of disease and parasites

- lowering of DO (and impact on other water quality physico-chemical parameters) due to microbial degradation of putrefying fish
- stress on existing populations and potential health impacts.

Waste from General Operations

Marine debris

There is potential that some forms of rubbish may be found within the water column or on the shorelines of Great Taylors Bay.

Potential impacts on the natural and human environment include:

- entanglement or other physical impact on local fauna, e.g. birds and marine mammals
- public amenity and aesthetics
- hazards to navigation, e.g. propeller entanglement.

Black and Grey Water

The inappropriate discharge of black and grey water directly into the marine environment has the potential to cause environmental and human health issues including:

- impacts on physico-chemical properties leading to undesirable impacts on water quality
- contamination of seawater with faecal coliforms
- health related impacts for fish.

Other General Waste

The inappropriate disposal of other general wastes has the potential to become marine debris which can then impact on marine wildlife and wash up on the shorelines as rubbish.

Harvesting Operations

Bloodwater from fish harvesting events has the potential to organically enrich surrounding waters and potentially spread disease amongst fish stocks if released into the marine environment.

6.1.11.7 Mitigation Measures

The MFDP under which the lease operates specifies waste management control requirements that must be met:

- **Management Control 3.7.1** Lessees must dispose of wastes from:
    - harvesting;
    - processing of produce;
    - removal of fouling organisms; and
    - production,

in a manner that the Secretary is satisfied will not cause an unacceptable effect on the ecology of the marine environment or nearby shorelines.

- **Management Control 3.7.4** Lessees must fallow or comply with limits upon the use of a lease imposed by the Secretary under the *Living Marine Resources Management Act* 1995 if impacts unacceptable to the Secretary from solid or dissolved waste emanating from marine farming in the leased area in the marine environment.

Tassal's fish farm operations have been developed to ensure that the above is complied with fully.

Over the last two years Tassal has developed a comprehensive Marine Operations Waste Management Plan and Waste Management Policy. These have been developed to support Tassal's Environmental Policy and recognise that Tassal has a legal responsibility to ensure that waste does not enter the marine environment.

The Marine Operations Waste Management Plan and Waste Management Policy are reviewed annually. This review process is done to assess the efficacy prior to being audited as part of third party audit regimes undertaken by Tassal.

The management plan was written to address the following objectives:

- Target zero waste entering the marine environment
- Establish procedures and operating mechanisms that focus on managing the loss of farm materials into the marine environment
- Establish chains of responsibility at the farm level
- Establish monitoring procedures

The target waste types that this plan is based around are:

- Rope – primary concern
- Feed pipe – primary concern
- Cigarette butts
- Domestic waste
- Netting off cuts
- Cardboard and paper
- Used Personal Protective Equipment (PPE)

The plan ensures that all Tassal vessels are fitted with a secure and sealed rubbish bin and this is serviced as part of the daily boat start up protocol. As with all Tassal Management Plans this is monitored and reviewed to assess the efficacy and audited as part of third party audit regimes undertaken by Tassal.

Mortalities are removed from the cages promptly on a regular basis, collected in lidded sealed bins for off-site transport.

The black and grey water from the feed barge is pumped out routinely by the feed delivery vessel.

6.1.11.7.1 Proponent management plan to manage mass mortality events

An industry wide mass mortality contingency plan is currently being developed. Mortality retrieval by divers and airlift systems are currently used in the unlikely event of high mortality events. Disposal of mortalities is carried out as described in section 6.1.11.1.

6.1.11.8 Overall effect following implementation of mitigation measures

With proper management of wastes as detailed above in section 6.1.11.7, including staff education, collection, containment and prompt and efficient removal of wastes from the proposed amendment lease, the net impacts of waste streams from farming activities as a result of the proposed amendment is negligible and will not increase on the lease or surrounding environment.

6.1.12 Introduced Marine Pests

6.1.12.1 History of marine pest species within MFDP area

Parsons (2012) identified 49 known introduced and cryptogenic (= potentially introduced) species that have been recorded in the D'Entrecasteaux Channel and Huon Estuary (see Table 6.3). This includes six 'target' introduced pest species, as categorised by the Australian Marine Pest Monitoring Manual (Department of Agriculture, Fisheries and Forestry [DAFF] 2010), and a further 43 identified species. The European fan worm *Sabella spallanzanii*, was recorded on a moored vessel in Kettering in 2008 (Aquenal 2008). Follow up surveys around this area did not detect the species and no sightings have been reported since 2009, suggesting that it may not have established in the Channel (Hamilton 2011).

Table 6.3 Introduced and cryptogenic marine species of the D'Entrecasteaux Channel and lower Huon Estuary (From Parsons 2012)

Scientific Name	Common Name
Target Species	
Asterias amurensis	Northern Pacific seastar
Codium fragile tomentosoides	Dead man's fingers
Crassostrea gigas	Pacific oyster
Gymnodium catenatum	toxic dinoflagellate
Undaria pinnatifida	Japanese seaweed
Varicorbula gibba	European clam
Other Introduced and Cryptogenic Species	
Salmo salar	Fish
Forsterygion varium	
Chiton glaucus	Mollusc
Maoricolpus roseus	
Raeta pulchella	
Theora lubrica	
Venerupis largillierti	

Scientific Name	Common Name
Bugula flabellata	Bryozoans
Bugula neretina	
Cryptosula pallasiana	
Tricellaria inopinata	
Watersipora subtorquata	
Bougainvillia muscus	Cnidarians
Clytia hemispherica	
Clytia paulensis	
Halecium delicatulum	
Obelia dichotoma	
Ascidiella aspersa	Ascidians
Botrylloides leachii	
Botryllus schlosseri	
Ciona intestinalis	
Patiriella regularis	Seastars
Euchone limnicola	Polychaete worms
Carprella acanthogaster	Crustaceans
Chelura terebrans	
Elminius modestus	
Halicarcinus innominatus	
Petrolisthes elongatus	
Callithamnion byssoides	Algae
Cladophora lehmanniana	
Cladophora sericea	
Colaconema caespitosum	
Cutleria multifida	
Ectocarpus siliculosus	
Enteromorpha compressa	
Enteromorpha intestinalis	
Grateloupia turuturu	
Hincksia sandriana	
Polysiphonia brodiei	
Polysiphonia subtilissima	
Pterosiphonia pennata	
Ulva lactuca	

6.1.12.2 Assessment of the likelihood for introduced marine pest translocation by activities associated with the proposed zones

There is evidence that introduced marine species are increasing in numbers. Benthic monitoring during 1998-2003 at Tasmanian marine farm sites, a large portion of which occur in the D'Entrecasteaux Channel and Huon Estuary, found that the proportional abundance of introduced species to the total benthic community increased by 2-3% per annum (Edgar et al. 2009). The most common and widespread introduced species include the bivalves *Theora lubrica* and *Corbula gibba*, and *M. roseus*. In addition, the adjacent Derwent Estuary is known to harbour at least 70 introduced and cryptogenic species (Aquenal 2002), and hence the likelihood of additional introduced species being identified, and the risk of further introductions occurring, is high.

An EIS compiled by the DPIPWE in 2007 suggests several issues regarding potential translocation vectors for introduced marine pests in the aquaculture industry, namely:

- inappropriate disposal of marine farming debris from aquaculture leases
- fouling on farm boats and ballast water discharge transferred between sites, and
- translocation of fish pens around the state that may be fouled.

Tassal will continue to adhere to biosecurity protocols as a result of the proposed amendment, it is expected that there will be minimal additional risks associated with the potential for translocation or spread of introduced marine pests in the Huon Farming Region.

6.1.12.3 Potential Impacts

Potential adverse impacts of introduced species include habitat alteration, changes in trophic dynamics and community composition, fishery declines, fouling of marine structures and loss of aesthetic and amenity values (Aquenal 2002). Introduced marine pests not only have the potential to harm aquaculture fish stocks through the creation of toxic and harmful algal blooms, but the potential also exists that impacts could affect natural ecosystems, including wild fisheries.

6.1.12.4 Mitigation Measures

Tassal has strict and documented internal biosecurity protocols in place for all their marine farming areas and adheres to state regulations and management controls mitigating the risks associated with the potential for IMP incursions. These processes and systems remain current and are independently verified through Tassal's third party BAP certification audit process.

Restricting the translocation and spread of IMPs is a priority for Tassal. Internal biosecurity protocols have been implemented that require full disinfection and decontamination of all equipment and boats between designated sites and stock year classes. Similar procedures will be adopted within the amended lease to prevent the spread of IMPs and to maintain the biosecurity status within the southern D'Entrecasteaux Channel.

The following measures are employed by Tassal to minimise the risk of IMP translocation.

- The use of an on-site harvest vessel. This eliminates pen movements to and from processing sites and reduces the risk of fish pens acting as a vector for IMP translocation.

- Antifouling paint is used on all farm boats. This inhibits potential IMP growth on hulls and hence decreases the likelihood of translocation by this means.

- Biosecurity protocols separate the use of most equipment between regions and any equipment that is passed between regions is thoroughly disinfected prior to transportation.

- All farming debris and broken machinery is collected and suitably disposed of on land which reduces the risk of IMP translocation.

At National and State levels, there are also various legislative controls and initiatives aimed at reducing the risks of marine species introductions and spread, focussing most recently on biofouling management requirements (Department of Agriculture, Fisheries and Forestry [DAFF] 2011).

With the above mitigation measures continuing to be employed company wide, the proposed amendment is not anticipated to lead to an increase in the risk of IMP translocation.

Annual ROV compliance survey databases record the presence of IMPs in and around lease areas as part of the annual video surveys. The DPIPWE compiles annual databases as part of their marine lease compliance audit system.

Regulatory Controls contained within Marine Farming Licence Conditions for Butlers Point lease (MF 109) include environmental records and reporting requirements (Section2). Applicable conditions include:

- **Licence Condition 2.2** The Licence Holder must notify the Director in writing of the presence of any unusual or uncharacteristic marine flora or fauna found within the Lease Area (including any introduced marine pests). (email: mfarming.environment@dpipwe.tas.gov.au).

- **Licence Condition 2.5** The Licence Holder must give prior written notice to the Director and Chief Veterinary Officer of any proposal to move or re-deploy marine farming equipment from a Marine Farming Development Plan (MFDP) area located in one geographic region to a MFDP located in another geographic region. Geographic regions include the south-east, north and west of the state (email: mfarming.environment@dpipwe.tas.gov.au).

6.1.12.5 Overall effect following implementation of mitigation measures

In concert with existing biosecurity practices and implementation of the above mitigation measures, the potential for the spread or translocation of IMPs as a result of the proposed amendment is considered low.

6.1.13 Marine and Coastal

6.1.13.1 Effects of structures on sediment dynamics regarding channels and sand bars in proximity to the proposed zone

The site depth ranges from 20 to 25 m and is subject to wind chop predominately generated by north west to north easterly winds. Current movements from the Southern Ocean and D'Entrecasteaux Channel generally enter Great Taylors Bay from a northerly direction (see figure 5.5).

There is a sandbar approximately 2.1 km from the proposed lease, between Butlers Beach and Partridge Island. Due to its geographical separation from the proposed lease, and strong tidal flow through this narrow channel, impacts resulting from the proposal are expected to be negligible.

6.1.13.2 Mitigation Measures

As there is no expected effect of structures on sediment dynamics regarding channels and sandbars in proximity to the proposed zone, no mitigation measures are planned and no overall effects are anticipated.

6.1.13.3 Overall effect following implementation of mitigation measures

As stated above, there is no anticipated effect of the proposed amendment on sediment dynamics regarding channels and sandbars in proximity to Butlers Point and Partridge Island.

6.1.14 Climate Change

6.1.14.1 Sea level rise

The range of possible sea level rise is unlikely to have any effect on salmon growing operations in the Huon Farming Region. Sea level rises are more likely to affect coastal infrastructure and coastal landforms that are not associated with salmon operations.

While Tassal is aware of predictions regarding global and local sea level rises; due to the negligible effect sea level rise is expected to have on salmon growing operations, a detailed assessment of the potential effects associated with sea level rise has not been taken into account nor is it considered necessary by Tassal.

6.1.14.2 Changes in weather patterns (rainfall and wind)

Winter wind speeds increasing by up to 5% and summer rainfall decreasing by 5% (Battaglene et al. 2008) are noted by the General Circulation Models for Tasmania's three salmon growing regions. Wind and rainfall changes of this magnitude are not expected to have any effect on salmon growing operational responses in the Huon Farming Region; therefore no consequent environmental effects on the environment by the industry are expected in response to this issue.

6.1.14.3 Water temperature and chemistry

A report by the Tasmanian Aquaculture and Fisheries Institute and CSIRO Climate Adaptation Flagship (Battaglene et al. 2008) predicts that average temperatures in southern Tasmanian waters could increase by 1 to 3°C by 2030. The probability of this temperature increase has been considered by the industry and due to its limited predicted range current management prescriptions or procedures will not change with any significance.

To put the predicted sea temperature rise in perspective, the industry already works with an annual fluctuation in temperature of over 10°C. In addition there are daily fluctuations in temperatures as well as different temperatures in different regions and at different depths.

Venturation (pumping cooler water from moderate depths – 5 to 8 m) with upwelling pumps is a mitigation measure for warmer water periods that the industry in Tasmania already employs when necessary.

While it is recognised that in ocean systems 'climate change can strongly influence the distribution and abundance of marine species through changes in growth, survival, reproduction, or response to changes at other trophic levels' (Doubleday et al. 2009), the salmonid industry is already well adapted to responding to dynamic systems.

Salmonids are grown all over the world in varying ranges of temperature and sunlight. Managing performance in different environmental conditions is an ongoing husbandry focus for all salmonid farmers. Therefore the potential effects of climate change on ocean temperatures is only one of many factors that Tasmanian salmonid growers already factor into their on-going business and environmental planning strategies.

Increased water temperature is expected to 'impact on salmonid growth and nutrition directly through the influence of temperature on growth and indirectly via specific nutritional and physiological process that affect growth' (Battaglene et al. 2008).

While it is clear that rising water temperatures associated with global climate change will increase thermal stress and disease outbreaks (Battaglene et al. 2008), there is a general lack of knowledge about the effects of higher water temperatures and other environmental changes related to global climate change on farmed salmonids. An increased research effort is required to address this knowledge gap (Battaglene et al. 2008).

6.1.14.4 Mitigation Measures

It is difficult to predict how a changing climate will modify ocean systems; most evidence suggests that the net effect will be negative (André et al. 2009). The Tasmanian salmonid industry is thus acutely aware of the possible effects of climate change on its future sustainability and consequently is working closely with the local research community on a variety of issues aimed at supporting the sustainability of farmed Tasmanian salmonids.

Any challenges that may arise, for example, effects on such things as fish health and nutrition, can be offset and improved through selective breeding. Selective breeding for increased tolerance to higher water temperatures is now possible with the establishment of an industry breeding program.

Breeding salmonids to tolerate higher temperatures will become integral to the general selection strategy for maintaining the excellent growth rates and fish wellbeing currently achieved.

Genetically modified organisms and the use of transgenic salmonids have been completely ruled out by industry as potential solutions to climate change challenges (Battaglene et al. 2008).

Venturation (as discussed above) is already employed as a management tool and could be employed further as a mitigation activity if necessary.

Modern mooring systems are designed to withstand a 1:100 year storm event. This means that strengthening winds resulting from climate change are not expected to impact on mooring infrastructure.

6.1.14.5 Overall effect following implementation of mitigation measures

As noted above, Tassal already manages significant annual ranges in temperature fluctuations throughout the year and has the capacity to manage further minor fluctuations in temperature due to climate change. Climate change mitigation measures are not expected to contribute to any negative effects on the environment in the Huon Farming Region.

6.1.15 Greenhouse gases and ozone depleting substances

Food producers are under increasing pressure to provide for a growing population that is demanding good quality, nutritious foods that have a minimal environmental footprint. At the same time, they face significant supply-side constraints as the costs of inputs required to produce food reach record highs.

Tassal has undertaken a detailed 'cradle to grave' Life Cycle Assessment (LCA) of Tassal's supply chain to gain a better understanding of the environmental impacts of producing Tassal products and to highlight areas of improvement. The LCA incorporated upstream and downstream impacts associated with the production of Tassal product and included greenhouse gas emissions, fuel use, water use and eutrophication potential. Tassal intends to perform an LCA every two reporting years.

LCA is an environmental accounting tool that quantifies the cumulative environmental impacts and natural resources embodied in a particular product or service from 'cradle-to-grave'. It provides an evidence-based approach to assist businesses in making the transition to more sustainable ways of managing their operations.

6.1.16 Environmental Management

Tassal has a robust integrated management system (TIMS) in place incorporating environment, quality assurance and workplace health and safety. Under this system Tassal has implemented environmental policies and procedures relevant to all aspects of the business.

Tassal has recently gained Global Aquaculture Alliances (GAA) BAP certification across all six of its Marine Farming Regions, including its Primary Processing Facility. This includes the Huon Farming Region which incorporates the proposed amended Butlers Point lease. Gaining independent third party certification has allowed Tassal to validate its integrated management system across these areas and annual recertification ensures continuous improvement.

Tassal is entering into their third year of partnership with WWF Australia. This partnership underpins Tassal's mission to improve environmental practices. Through this partnership Tassal aims to be the leader in responsible aquaculture production in Australia.

Tassal is demonstrating its commitment to environmental and social sustainability through the development and growth of its Environmental and Sustainability department. This department is led by the Head of Sustainability and covers wildlife management, marine and land based environmental compliance, environmental certification and community engagement.

Tassal has also introduced a System Team Leader role into all of six of their Marine Farming Regions. This role acts as a TIMS representative on each site and is responsible for providing a link between Quality Assurance, WH&S and Environmental and Sustainability departments within Marine Operations. System Team Leaders are also responsible for all internal

compliance with TIMS requirements, including monthly WH&S inspections and environmental checklists.

All Tassal employees are required to sign off on relevant environmental policies and procedures to demonstrate their understanding.

The Tassal induction process includes a detailed presentation which explains its systems and environmental commitments and responsibilities. This is given to all new employees.

Tassal has a detailed Contractor Management Procedure. This procedure details the process that must be adhered to at Tassal to ensure that contractor work is controlled and coordinated. Correct application of this procedure ensures that good coordination, cooperation, communication and alignment with facility operations exist between contractors and Tassal employees. This procedure will also ensure that only contractors that display the highest level of safety, quality and environmental management work at Tassal.

The marine farming industry in Tasmania is regulated by the Department of Primary Industries, Parks, Water and Environment (DPIPWE) under the *Marine Farming Planning Act 1995* (MFPA) and the *Living Marine Resources Management Act 1995* (LMRMA).

Prior to commencing marine farming operations on lease areas, leaseholders are required to collect baseline environmental data on sediment biology, chemistry, current flow and habitat characteristics within and outside lease areas at various compliance and control sites.

Management controls within the D'Entrecasteaux Channel Marine Farm Development Plan (MFDP) February 2002 require all marine farming leaseholders to comply with an environmental monitoring program as prescribed in marine farming licence conditions.

Marine Farming licences are issued to lease holders on an annual basis. Licence conditions specify environmental standards, recording and reporting requirements that are dependent on the species being licensed. For finfish licence holders, production data must either be reported or made available for audit on request. Production data can include information on feed, smolt inputs, production planning and food conversion ratios and this can be used in conjunction with other environmental monitoring data to assist in site specific or regional management of sustainability issues across the MFDP area.

In addition to production related reporting, licence holders must also undertake underwater video surveys to assess sediment health either 12 monthly or in accordance with their stocking and fallowing regimes.

Farms have been required to participate in this benthic monitoring program since 1997 in order to monitor compliance against licence conditions and management controls specific to benthic impacts.

The program has led to the compilation of a comprehensive, area-specific dataset, providing information on environmental conditions within marine farming lease areas, at 35 m compliance sites and control sites. This information has been used to assist in the adaptive management of regulatory monitoring.

The results of monitoring in finfish lease areas around the State have confirmed that pen positioning, stocking duration and intensity are the major factors affecting detectable impacts on the benthos. Current flow is typically low and survey assessments have revealed that visible benthic impacts are localised, with solid particulate waste settlement forming distinct footprint zones directly under pens.

Unacceptable impacts when detected through monitoring can be broken down into two main categories; any visible farm derived impact at a compliance site 35 m outside the lease boundary, or any significant visual impact within the lease area. These impacts are largely due to either or both of the following occurring within a lease:

- Detectable impact at a 35 m compliance point – poor pen positioning leading to the presence of a pen footprint at a compliance point.
- Significant impact within the lease area – the cumulative impact of overfeeding stock and or stocking a single pen bay for an extended period of time. This leads to excessive feed and faecal deposition, deterioration of sediment health and eventual spontaneous gas bubbling from sediments.

In cases where a breach of licence conditions is detected by DPIPWE as a result of these surveys, immediate action can be taken as required to ascertain the level and extent of the breach and the cause of the specific problem. DPIPWE can then require changes to the management of the lease and where relevant, stipulate an increased frequency and intensity of monitoring to assess the rate of recovery of an impacted site. This regulatory program employs adaptive management principles, enabling performance based monitoring for individual lease areas, with the frequency and intensity of monitoring surveys being adjusted according to the level of compliance and monitoring history of individual farm sites.

6.2 Impacts on the Human Environment

6.2.1 Visual

6.2.1.1 Specific visual impact assessment for proposed zone

Existing visual setting

Views towards the proposed zone are currently available from permanent residences, shacks, properties, campsites and anchorages in and around Great Taylors Bay. The surrounding landscape is predominantly wooded with native open to medium density bushland on the Labillardiere Peninsula, and native bushland interspersed with *Pinus radiata* on the north eastern shoreline from approximately Tin Pot Point to Mickeys Bay.

There are existing aquaculture leases (Tassal leases Butlers Point, Partridge Island, and Tin Pot Point, and the Huon Aquaculture lease Zuidpool MF141) with no associated land base in the immediate vicinity. The invaginated nature of the coastline and the generally vegetated landscapes common in the area are such that the leases are not visible from all vantage points. The closest landscape to the Butlers Point lease is entirely wooded; obscuring it from view as there is no horizon to provide contrast.

This visual impact assessment has followed the *Guide to Best Practice in Seascape Assessment* (Countryside Council for Wales/Brady Shipman Martin/University College Dublin 2001) for landscape and seascape visual impact assessment. This assessment describes the land and seascapes surrounding the proposed amendment and estimates the visual impact on the various observer groups existing in the area.

A report compiled by Moir Landscape Architecture was used as a reference guide for the practical approach of this visual assessment (Moir Landscape Architecture 2012). This report outlines how people interact with the landscape, and how they perceive developments from differing angles, aspects, and distances; it infers human line of sight in relation to altitude and goes on to quantify landscapes, water bodies and vegetation.

6.2.1.1.1 Proposed infrastructure

The proposed infrastructure amendments associated with this proposal are an additional ten fish pens and the north east movement of the existing barge. No infrastructure changes to either shore base at Meads Creek in Port Esperance or Killala Bay in the Huon Estuary are planned as part of this proposal. It is noted that a 150 m offshore shift is also proposed.

Fish pens, by regulation, are black in colour (see Figure 6.4). Furthermore, all floating infrastructure associated with the farming operations are to be grey to black in colour. From sea level, the birdnet and associated stands are the most visible portion of the entire cage; these are approximately 4.2 m at their highest point. Other visible infrastructure includes the handrails (approximately 1.2 m in height), feedpipe, and the collar of the cage itself. The visibility of these structures is largely dependent on elevation, as they are very low lying when compared with the birdnet stands. The collar and feedpipe float on the water's surface.

Figure 6.4 Fish cages at Butlers Point lease showing bird netting and birdnet stand in centre of cages (Photo taken from Butlers Point)

6.2.1.1.2 Sensitive receptors having direct view lines to the proposed zone

Potential sensitive visual receptors are illustrated in Figure 6.5.

1. Partridge Island Jetty
2. Butlers Point / 2a Butlers Beach Walking Track
3. Jetty Beach Point
4. Oak Point
5. Stinking Beach Point
6. Mickeys Point
7. Tin Pot Point
8. Taylors Reef

Figure 6.5 Potential sensitive visual receptors

6.2.1.1.3 Likely visual impact

Visual impacts relate to changes in available views of the landscape and the effect of these changes on people. The visual impact of the proposed changes has been assessed by considering the sensitivity of an observer and the scale of the visual impact.

Table 6.4 and Table 6.5 set out the criteria used to quantify these two factors.

Table 6.4 Observer Sensitivity Criteria

Low	People at their place of work, whose attention may be focused on their work or activity, and who may be less susceptible to appreciating changes in the view. People who believe that commercial activity in the southern D'Entrecasteaux Channel is acceptable and are supportive of the aquaculture industry.
Medium	People engaged in outdoor recreation activities involving the Labillardiere Peninsula, but are not focused on the bay itself. Perhaps visiting a shack, or passing across the bay to go fishing. People who are ambivalent about commercial activity in the southern D'Entrecasteaux Channel, and about the aquaculture industry.
High	People in residential properties for whom the view is part of their lives. Also, some people engaged in outdoor activities around the southern D'Entrecasteaux Channel, whose activity involves prolonged proximity to the proposed changes. People who believe that the waters around the Labillardiere Peninsula should not be used for salmon farming. People who are not supportive of the aquaculture industry.

Table 6.5 Scale of Impact Criteria

Low	Few people affected Minor changes in the view Changes only observable infrequently
Medium	Many people affected Moderate changes in the view Changes observable fairly often
High	Majority of people affected Major changes in the view Changes almost always observable

Overall assessment

The impact of proposed changes can be positive, resulting in an enhanced visual experience; or negative, resulted in a degraded viewing experience. The two input factors, observer sensitivity and the scale of impact, are considered in both cases. Table 6.6 is a matrix combining these two input factors into an overall visual impact assessment, and Table 6.7 summarises the results of applying this assessment to the observer groups that together account for residents and visitors to the area.

Table 6.6 Visual Impact Criteria - this table can be applied to positive and negative impacts

		Scale Of Impact		
		Low	**Medium**	**High**
Observer Sensitivity	**High**	Medium	High	Extreme
	Medium	Low	Medium	High
	Low	Negligible	Low	Medium

Table 6.7 Visual Impact Assessment for the principle and sensitive observer groups associated with Butlers Point amendment

Observer Location	Sensitivity	Scale of Impact Rating Pre Amendment	Scale of Impact Rating Post Amendment	Impact
1. Partridge Island Jetty	Medium	Low - Medium	Medium	Medium
2/2a. Butlers Point/Butlers Beach Walking Track	High	Medium	Medium	High
3. Jetty Beach Point	High	Low	Low	Medium
4. Oak Point	Low	Low	Low	Negligible
5. Stinking Beach Point	Medium	Low	Low	Low
6. Mickeys Point	Medium	Low	Low	Low
7. Tin Pot Point	Low	Low	Low	Negligible
8. Taylors Reef	Medium	Low	Low - Medium	Low - Medium

1. Partridge Island Jetty (medium impact)
The jetty at Partridge Island is a popular day use area for recreational vessels operating in the Great Taylors Bay. The proposed offshore shift of the lease will result in a more pronounced view of the proposed lease area. Due to the proximity to the proposed lease, observer sensitivity is deemed to be medium.

2. Butlers Point/Butlers Beach Walking Track (high impact)
This site is in close proximity (350 m at the closest point) to the proposed amended lease. The track is elevated (approximately 5 m above sea level) with views over the current and proposed lease area broken by vegetation.

3. Jetty Beach Point (medium impact)
This point lies between two popular beaches, one of which has an adjoining camp site. Observers in this area are most likely to be transiting the southern end of Great Taylors Bay; therefore they are not expected to be highly impacted by the proposed amendment.

4. Oak Point (negligible impact), 5. Stinking Beach Point (low impact), 6. Mickeys Point (low impact), 7. Tin Pot Point (negligible impact)
These points lie on the south eastern end of Great Taylors Bay; the proposed lease remains in front of the heavily vegetated Labillardiere Peninsula, and hence is obscured from view at these four locations. There are a number of dwellings on the eastern side of Great Taylors Bay. Due to their distance from the proposed amended lease, and the nature of the background of the lease, impact on these dwellings is expected to be negligible.

8. Taylors Reef (low-medium impact)

This point is a popular anchorage for recreational vessels and commercial fishing vessels. This location is approximately 3.5 km from the proposed amended lease, and due to this, observer sensitivity is deemed to be low-medium.

Great Taylors Bay is popular with recreational boaters and fishers, and commercial fishing vessels. Vessels that may be stationary or very slow moving (e.g. recreational fishers) will experience a greater visual impact depending on time spent in the area. However, given that there is an existing visual impact from the current lease, and that there are no permanent vessel moorings/wharf features in the immediate vicinity of the lease, the scale of visual impact will increase as a result of the proposed amendment and is considered to be medium for this incidental observer group.

Key vantage points

Figure 6.5 outlines the locations of photos taken from key vantage points. It was not possible to take photos from all 'potential sensitive receptor sites' (Figure 6.5) due to tree cover or access through private land. Please note, due to the distance of some vantage points to the current and proposed lease, printed versions of this document may not show either lease configuration. They can however, be observed in the electronic form of this document.

Photos taken from locations 1, 2, 2a, 3, and 8 are shown in Figure 6.6, Figure 6.7, Figure 6.8, Figure 6.9 and Figure 6.10, respectively. The photo from location 6 is shown in Figure 6.11 illustrating low visual impact for observers at Mickeys Point.

For each of the four key vantage points, two photos are illustrated:

- the first photo shows the current visual impact of the Butlers Point lease from that point
- the second photo is a photomontage where the lease has been shifted offshore and the extra 10 proposed cages superimposed.

Figure 6.6 **Top: View south east from Partridge Island Jetty (vantage point 1 in Figure 6.5) towards the lease before proposed amendment**

Bottom: View south east from Partridge Island Jetty towards the lease after proposed amendment (10 cages superimposed and lease shifted offshore)

Figure 6.7 **Top: View east-south-east from Butlers Point (vantage point 2 in Figure 6.5) towards the lease before proposed amendment**

Bottom: View east-south-east from Butlers Point towards the lease after proposed amendment (10 cages superimposed and lease shifted offshore)

Figure 6.8 **Top: View east from Butlers Beach Walking Track (vantage point 2a in Figure 6.5) towards the lease before proposed amendment**

Bottom: View east from Butlers Beach Walking Track towards the lease after proposed amendment (10 cages superimposed and lease shifted offshore)

Figure 6.9 **Top: View north west from Jetty Beach Point (vantage point 3 in Figure 6.5) towards the lease before proposed amendment**

Bottom: View north west from Jetty Beach Point towards the lease after proposed amendment (10 cages superimposed and lease shifted offshore)

Figure 6.10 Top: View north west from Taylors Reef (vantage point 8 in Figure 6.5) towards the lease before proposed amendment

Bottom: View north west from Taylors Reef towards the lease after proposed amendment (10 cages superimposed and lease shifted offshore)

Figure 6.11 View west from Mickeys Point (vantage point 6 in Figure 6.5) towards the lease before proposed amendment illustrating negligible visual impact for observers on the eastern side of Great Taylors Bay. This photo was taken at 5 m elevation.

6.2.1.2 Mitigation Measures

Given the location of the current and proposed lease, impacts to permanent residences are low. Incidental recreational users of the area are rated as being medium to high impact. Whilst land-based structures can be coloured to blend in with the background, the colour of the water can vary substantially from deep blue to silver grey dependent on sun, cloud and wind conditions.

The D'Entrecasteaux Channel Marine Farm Development Plan February 2002 places the following regulatory controls on licence holders (controls listed are those relevant to salmonid farms):

- **Management Control 3.9 Visual Controls**
    - **Management Control 3.9.1** Lessees must ensure that all marine farming structures and equipment on marine farming lease areas conform to the following controls:
        - **Management Control 3.9.1.1** All fish cages, buoys, netting and other floating marine structures and equipment on State Waters, other than that specified for navigational requirements, must be grey to black in colour, or be any other colour that is specified in the relevant marine farming licence

- **Management Control 3.9.1.2** Marine farming structures and equipment must be low in profile and be of a uniform size and shape to the satisfaction of the Secretary.
- **Management Control 3.9.1.5** The lease area must be kept neat and tidy to a standard acceptable to the Secretary

- **Management Control 3.9.2** Lessees are to ensure that light generated from marine farming operations does not cause a nuisance. The Secretary will determine what constitutes a nuisance.

6.2.1.3 Overall effect following implementation of mitigation measures

Direct visual impact resulting from the proposed amendment will be from the placement of an additional 10 pen bay positions and a 150 m offshore shift of the entire lease. The barge will be centrally located within the amended lease. As the current Butlers Point lease is stocked, this amendment will be viewed as an extension, not an entirely new landscape element.

The distance to the nearest potential sensitive visual receptor (2/2a Butlers Point/Butlers Beach Walking Track – both of which are located in the South Bruny National Park) is approximately 350 m from the proposed lease, and the visual impact has been assessed as high. For the majority of the users of the Great Taylors Bay area, the Labillardiere Peninsula forms the background to the lease, tending to obscure the visual impact of the cages on the lease.

The current and proposed lease areas form a major component of the landscape from the Butlers Point/Butlers Beach walking track location. However, dense vegetation cover and woodland obscures the lease from the view of Great Taylors Bay for sections of the walking track. However, for small sections of the walking track, particularly in close proximity the proposed lease area, visual impact is deemed to be high.

For Partridge Island and Taylors Reef, distance and Marine Farming management controls limit the visual impact to the observer group. Both these observer groups are at least 3 km from the current and proposed lease.

While there are some residential dwellings on the eastern side of Great Taylors Bay, the visual impact on these observers is deemed to be negligible or low. The nearest resident is approximately 3 km from the current and proposed leases, is surrounded by heavily vegetated land, and the Labillardiere Peninsula forms a natural background, making the lease less conspicuous from these locations.

6.2.2 Navigation

6.2.2.1 Results of consultation with maritime stakeholders – TasPorts, MAST and local boating clubs.

TasPorts advised Tassal that the proposed amendment will not interfere with commercial shipping in the D'Entrecasteaux Channel or Great Taylors Bay.

Marine and Safety Tasmania (MAST) advised Tassal that the proposed amendment to the Butlers Point lease will not present any navigational concerns.

Local yachting and boating clubs advised Tassal that for mariners anchoring between the proposed zone and shoreline, navigation between these and other anchorages in Great Taylors Bay will be hindered.

Consultation with yachting and boating clubs (section 4.2) revealed that some mariners have navigation concerns directly related to the proposal to be the following:

- impedance of navigation along the shoreline between the proposed zone and the shore
- impedance of direct navigation from Butlers Beach to Mickeys Bay to shelter from north-westerly, north-easterly or northerly winds.

6.2.2.2 Potential Impacts

Some mariners will be inconvenienced by the proposed amendment.

6.2.2.3 Mitigation Measures

As MAST foresees no negative impacts to navigation in the area, no mitigation measures are proposed other than continuing consultation with regulatory and boating organisations to ensure smooth transition to the proposed lease arrangement.

Lighting on corner markers conforms with IALA requirements, as well as those of MAST and DPIPWE.

The offshore shift of the proposed lease will make sheltered close-shore navigation easier, and safer than with the lease in its current position.

6.2.2.4 Overall effect following implementation of mitigation measures

The proposed offshore shift will allow safer and easier navigation of the sheltered shoreline of the Labillardiere Peninsula in Great Taylors Bay.

6.2.3 European and Other Heritage

As stated in section 5.6.2.2, Tassal conducted a search of the Tasmanian Heritage Places Inventory and it was determined that there were no registered places of historical cultural heritage significance located within close proximity to the proposed amendment area.

6.2.3.1 Potential Impacts

There will be no impacts on places of heritage significance as a result of the proposed amendment area.

6.2.3.2 Mitigation Measures

No mitigation measures are proposed.

6.2.3.3 Overall effect following implementation of mitigation measures

It is considered that the proposed amendment would not impact on any sites/features of historic cultural and natural heritage significance.

6.2.4 Aboriginal Heritage

6.2.4.1 Impacts on places within the area listed on the Tasmanian Aboriginal Site Index (maintained by Aboriginal Heritage Tasmania) including consideration of cultural landscapes

Aboriginal Heritage Tasmania (AHT) has advised that the proposed amendment would not have an impact on any areas of Aboriginal significance.

6.2.4.2 Mitigation Measures

Given the advice from AHT, no mitigation measures are proposed.

6.2.4.3 Overall effect following implementation of mitigation measures

It is expected that there will be no impacts on areas of Aboriginal heritage as a result of the proposed amendment area.

6.2.5 Reservations

6.2.5.1 World Heritage Area properties and values

There are no World Heritage Areas in or near the proposed amendment area.

6.2.5.2 Ramsar site properties and values

There are no Ramsar sites in or near the proposed amendment area.

6.2.5.3 Marine Reserve properties and values

There are no marine reserves in or near the proposed amendment area.

6.2.5.4 Conservation Area properties and values

There are no conservation areas in or near the proposed amendment area.

6.2.5.5 National Park properties and values.

The South Bruny National Park is the only reservation that may be impacted by the proposed amendment area.

The potential impacts include:

- noise
- visual amenity

- farm debris on-shore.

As discussed in section 5.3.4, the South Bruny National Park contains sites of high historic, cultural and natural values. Several bushwalking tracks circumnavigate the South Bruny National Park and a coastal track for bushwalkers lies along the eastern side of the Labillardiere Peninsula from which the proposed amendment is likely to be viewed.

6.2.5.6 Mitigation Measures

As discussed in section 6.1.11, Tassal has a comprehensive Marine Operations Waste Management Plan and Waste Management Policy outlining on site practices and procedures to minimise farm debris, included in this is Tassal's Shoreline Clean-up Program (section 6.1.4.5.4).

Noise mitigation and minimising noise impact on the amenity of the South Bruny National Park from the proposed amendment, will be undertaken as discussed in section 6.2.6 below.

As stated in section 6.2.1.3, the distance to the nearest potential sensitive visual receptor (2/2a Butlers Point/Butlers Beach walking Track) is approximately 350 m from the proposed lease. For the majority of the users of the Great Taylors Bay area, the Labillardiere Peninsula forms the background to the lease. This tends to obscure the visual impact of the infrastructure on the lease.

6.2.5.7 Overall effect following implementation of mitigation measures

It is considered that the proposed amendment will have an unavoidable high impact on the visual amenity of sections of the bushwalking track on the north east section of the Labillardiere Peninsula.

Other impacts resulting from the proposal are considered to have an overall minor effect on the natural biodiversity and values associated with the South Bruny National Park.

6.2.6 Noise

Potential nuisance noise can result from changes in noise frequencies and tonal components, changes in ambient noise levels, the time varying nature of emissions (e.g. modulation, impulsive or intermittent noise) and the temporal span of the noise emissions.

The main issues considered are the nature of the nuisance noise and the proximity of sensitive receptors to the noise source. Noise nuisance is subjective and depends on the duration and other variables such as intensity, source, and type.

The potential sensitive receptors in the area have been chosen on the basis of proximity to the proposed zone. Section 6.2.1.1.2 details potential sensitive visual receptors. The most vulnerable and potentially sensitive noise receptors are within the South Bruny National Park (Receptors 1, 2, and 2A in particular, refer Figure 6.5). Sufficient distance to other receptors mitigates any potential noise impacts.

There are numerous sources of noise associated with the marine farming of finfish. Details of noise sources relevant to the current and proposed Butlers Point marine farm are described below.

6.2.6.1 All sources of noise should be identified and described

Barges and Vessels on Lease

Tassal has undertaken noise level surveys at their marine operations sites and has found that vessels utilised in day to day activities within a lease have an average L_{eq} of 66 dBA at 30 m. The average level recorded for barges and large vessels (including bathe barges, venturation barges, feed barges, net washing, and harvesting) is an L_{eq} of 63.1 dBA at 30 m (Environmental Dynamics 2013).

Before any noise producing equipment is deployed on site, noise ratings are determined to ensure compliance with legislative requirements. If they do not comply, mitigation measures are implemented to ensure that noise output does not exceed these requirements.

Support vessels

Tassal operates support vessels associated with marine farming to access the farming zones. There are noise emissions associated with these vessels and they typically produce no more than 74 dB(A) at a distance of 25 m (Environmental Dynamics 2013). This is consistent with the legislative framework outlined in *Environmental Management and Pollution Control (Miscellaneous Noise) Regulations 2004*. This noise source is mainly generated during the day time period.

Pen lighting

The subsurface lighting of fish cages encourages growth at the smolt stage of development and reduces the incidence of precocious maturation. Lights are powered by generators on the farm barge located within the lease; these may be required to operate 24 hours per day depending on environmental conditions. The lighting is usually deployed during winter months around the shortest days, and before any such lighting is deployed the generator will be evaluated for noise output.

The standard configuration of these lights is nine 1000 Watt Metal Halide or LED lights in each pen.

Venturation and Air Lift

Venturation is the process of raising dissolved oxygen (DO) levels in the water for fish health management purposes during the warmer summer months, potentially 24 hours per day. This is done by forcing air into the water using a compressor, which typically produces an L_{eq} (sound pressure level) of 70 dB(A) at 28 m.

Recovery of fish from the pens using compressed air lift systems may be used during emergencies where large numbers of mortalities occur and need to be removed from pens quickly.

Fish feeding

Fish are fed according to a strict regime during daylight hours each day, during the lease stocking period (see sections 3.3.4 and 3.4.2). Feed pellets from the feed barge are blown by a compressor along high density polyethylene (HDPE) pipes that run to individual pens. Typically, the noise associated in close proximity to the feed blower can reach an L_{eq} of 90 dB(A) at a frequency of around 1.5 kHz. This is strongly attenuated over distances greater than a few hundred metres; fish feeding noise is quite localised and only generated during the day time period during feeding times.

Net washing

Unless removed for cleaning onshore, nets are cleaned in situ to remove biofouling and maintain the water flow through the cages for fish health. In situ net washing is generally a quiet operation, typically producing an L_{eq} of approximately 78 dB(A) at 2 m. This noise generating activity is only undertaken during the day when the lease is stocked.

Harvesting

There will be no fish harvesting from the proposed amended lease.

Shore facility

There will be no new shore facility associated with this lease. However, the marine traffic associated with this lease will be based at Tassal's shore facility at Meads Creek, Strathblane, and related marine traffic noise may increase to and from this facility.

6.2.6.2 Foreseeable variations in noise generated during the start-up phase should be identified and any temporary mitigation requirements specified.

All noise producing equipment introduced to the proposed amended lease will undergo a thorough noise evaluation, with mitigation measures taken if the equipment exceeds legislative requirements. Refer to section 6.2.6.3.

6.2.6.3 Potential for noise emissions (during both the construction and operational phases) to cause nuisance for nearby sensitive receptors.

As stated in section 3.3.4, there will be an initial increase in bathing and in situ net cleaning activities as stocking of the proposed lease commences. With time, and due to advances in the selective breeding program and the continued roll-out of Kikko nets, instances of these activities are predicted to decrease.

The equipment and infrastructure required to service the amended lease are identical to those that are currently operating (other than the extra cages). The feed barge moored on the lease will continue to service the expanded lease. This is a 27 m concrete barge of a relatively low profile. The barge is grey in colour and conforms to DPIPWE Management Controls, and contains the centralised feeding system, feed storage, a generator and amenities for the work crew. With the increase in feed demand associated with the proposed amended lease, it is likely that the barge will require to be upgraded accordingly.

A generator will continue to provide power for the feeding system and sub-surface in-pen lighting system; it may be required to run 24 hours a day during the period July to November.

The introduction of additional noise generating equipment on the lease has the potential to elevate the noise levels at the South Bruny National Park and impact on amenity and detract from visitor value of the South Bruny National Park.

To lessen this risk, Tassal will introduce noise mitigation measures into the design of any barge required to house noise generating equipment.

Conservative modelling of activities on the existing lease has been conducted (allowing for the use of a compressor) with an estimated maximum noise level at the South Bruny National Park boundary of 40.4 dB. As a result of the hemispherical isotropic spreading of sound, each doubling of distance (distance over which noise measurement is taken) from a point source will see a 6 dB reduction in noise (pers. com. Environmental Dynamics 2014).

The relocation of the lease further off shore coupled with appropriate design (especially acoustic), engineering, and management, the proposed amendment is expected generate a decrease in noise impacts to the South Bruny National Park boundary.

There will be no major construction undertaken within the proposed lease area. The existing farming infrastructure will be used with additional moorings being added to the existing system.

Installation of farm infrastructure such as feedpipe, moorings, and navigation markers will take place during daytime hours. This work is much the same as regular farm work and is not expected to be unduly noisy. Deployment of moorings would require the use of a large company workboat with a crane to lift and deploy mooring blocks.

As noted above, Tassal has undertaken noise level surveys at their marine operations sites, and has found that vessels utilised in day to day activities within the lease have an average L_{eq} of 66 dBA at 30 m. The average level recorded for barges (including bathe barges, venturation barges, feed barges, net washing, and harvesting) is an L_{eq} of 63.1 dBA at 30 m (Environmental Dynamics 2013).

6.2.6.4 Mitigation Measures

Noise levels are not expected to increase as a result of the proposed lease amendment for the following reasons.

- An offshore shift of farming operations approximately 150 m further out into Great Taylors Bay will lessen impacts on Receptors 1, 2, and 2A in the South Bruny National Park (see Section 6.2.1.1.2).
- As discussed in section 3.3.4, the feed barge constructed to service the amended lease will be customised to mitigate noise emissions from the generator and the feeding system. The onboard generator will be housed in a specifically designed room within the feed barge, with noise mitigation designed and built in to meet marine farming licence conditions, lessening the level of noise reaching the adjacent Labillardiere Peninsula.
- With any application for the deployment of a newly constructed feed barge in a marine farming lease, Marine Farming have a policy stipulating noise modelling is to be carried out prior its deployment.
- The nearest residential potential sensitive receptor is approximately 3 km from the proposed lease boundary and is unlikely to be significantly impacted.
- A decline in the frequency of net cleaning by two thirds with the introduction of Kikko design nets. The proposed lease net cleaning frequency is expected to show a similar decrease with the rollout of Kikko nets to the lease. This translates to a relative reduction in the noise associated with this equipment.
- Due to advances in the selective breeding program, the necessity to bathe fish and operate fish bathing equipment is decreasing.
- The lease is not to be used for the grow out cycle, therefore harvesting will not occur on the lease.

If pen lighting is employed the power source for these lights would be the generator housed on the farm feed barge. Before any such lighting is deployed, the generator will be evaluated for noise levels and the appropriate mitigation measures are to be employed if necessary.

The configuration of existing noise producing equipment housed at the lease will not change due to the proposed amendment, other than the movement of the barge to the central location within the amended lease area 150 m further offshore.

Tassal's Community Engagement Officer proactively works with community members should any noise issues arise, Tassal has an excellent reputation in this regard. All noise complaints are managed by Tassal's Community Engagement Officer and follows Tassal's internal complaints protocol. It is the responsibility of this role to liaise with relevant government departments, specialist consultants and the complainant in order to mitigate or resolve the issue. Tassal employs an acoustic specialist to assist with noise mitigation across all sites as required.

Tassal is also required to comply with guidelines on noise emission made under the *Environmental Management and Pollution Control Act 1994* for marine farming operations.

6.2.6.5 Overall effect following implementation of mitigation measures

Given the location of the current and proposed lease along with the distance to potential sensitive receptors outside the South Bruny National Park, noise impacts on these receptors are considered very low. Impacts on visitors to the South Bruny National Park using the eastern track can be appropriately managed and minimised to prevent undue loss of amenity for South Bruny National Park visitors using the track.

The relocation of the lease further offshore will be coupled with appropriate design, engineering, and management activities. The proposed amendment is therefore not expected to increase noise impacts for users of the South Bruny National Park.

6.2.7 Odour

6.2.7.1 Potential sources of odour emissions

Salmon farming activities have the potential to be a concentrated source of odour due to the large volume of organic matter associated with these activities. Potential sources of odour from salmon farming operations within the proposed amendment include:

- storage of dead and decaying fish
- spilled or incorrectly stored feed
- organic fouling on equipment
- chemicals including petroleum products
- engine exhausts from vessels and other machinery.

6.2.7.2 Potential for emissions to cause environmental and health effects

There are no anticipated issues associated with odour in the region. Notwithstanding this, potential odour impacts from salmon farms can vary in nature depending on the type and intensity of individual farming operations and odour impacts may result from land- and marine-based farming activities.

6.2.7.2.1 Land-based

The primary land base associated with this lease is at Meads Creek. There is a secondary land base at Killala Bay; access to Butlers Point lease is not usually gained from this site.

Loss of amenity may occur due to odour associated with land based storage of dead stock and storage of used farm equipment.

6.2.7.2.2 Marine-based

There are generally no odour issues associated with marine-based operations. In order to experience loss of amenity due to odour, the sensitive receptor would have to be very close to the source (i.e. feed storage), and this loss of amenity would be unlikely to occur for receptors that are outside the lease boundary.

6.2.7.3 Mitigation Measures

Tassal currently operates in accordance with specific strategies on a company-wide basis to mitigate potential odour impacts. The specific strategies include:

- timely removal of dead stock from farm cages – dive teams currently collect dead stock from cages twice per week and they are placed in sealed plastic bins for transport to shore
- appropriate transport of stock mortalities
- delivery of feed directly to the farm feed barge where it is stored in a sealed hopper from which the feed is directly dispersed to the fish pens
- management of equipment to ensure it is kept clean and in good working order
- secure and appropriate storage of chemicals including petroleum products.

Land based odour source is considered to be of low impact due to the remote nature of the primary facilities used to service the Butlers Point lease.

6.2.7.3.1 Regulatory Controls

The following regulatory control is contained in the D'Entrecasteaux Channel Marine Farming Development Plan February 2002.

- **Management Control Section 3.11.1** Lessees are to ensure that odour generated from marine farming operations does not create an odour nuisance as defined by the Secretary

6.2.7.4 Overall effect following implementation of mitigation measures

There will be no increase in odour related impacts from the proposed amendment.

6.2.8 Commercial Fishing

6.2.8.1 Effects on commercial fishing activities

The Tasmanian Seafood Industry Council has been consulted during the preparation of this EIS and advises that there are no negative impacts expected in regard to the commercial fishing sector due to the proposed amendment.

As outlined in 5.5.3, the D'Entrecasteaux Channel is closed to the commercial taking of scalefish, scallops and rock lobster. Tassal also liaised with the Tasmanian Abalone Council in regards to this proposal; commercial abalone fishing does occasionally occur near the proposed amendment (Partridge Island) with the main target species being blacklip abalone (*Haliotis rubra*).

Due to the geographical and hydrological separation of the proposed lease from Partridge Island (approximately 2 km), there is negligible impact predicted to occur from this amendment.

6.2.8.2 Mitigation Measures

No mitigation measures are proposed.

6.2.8.3 Overall effect following implementation of mitigation measures

Impacts are predicted to be negligible from the proposed amendment.

6.2.9 Recreational Fishing

6.2.9.1 Effects on recreational fishing activities

Tassal is mindful that fishing grounds and waterways are a public resource for recreational users and access will be unavoidably reduced due to the proposed amendment.

Recreational line fishing is popular in the southern D'Entrecasteaux Channel, with species caught including flathead, squid, gurnard, cod, and wrasse. In particular, the waters of Great Taylors Bay and around Partridge Island are popular recreational fishing areas in close proximity to the proposed amendment. Other recreational fishing pursuits around the proposed zone include recreational diving for lobsters and abalone as well as restricted net fishing.

6.2.9.2 Mitigation Measures

No mitigation measures are proposed.

6.2.9.3 Overall effect following implementation of mitigation measures

Although restricting access to some fishing which currently may occur in this area of Great Taylors Bay, impacts are predicted to be negligible due to the proposed amendment.

6.2.10 Recreational Activities

6.2.10.1 Effects on recreational activities

The proposed amendment will have an effect on visual amenity with the approximate doubling of the lease size. The movement of farming activities further offshore should reduce noise impacts of farm activities at the South Bruny National Park. However, visual impact is considered to be high for bushwalkers using Butlers Beach Walking Track.

There are no significant impacts on recreational fishing as discussed in section 6.2.9 and there is no impact predicted for diving activities as the proposed amendment occurs over sand and is not a desirable dive site. There will be some restriction of access to areas of waterways where the proposed lease will be; this will have the potential to impact waterway users. The increased area between the shoreline and the lease will provide a sheltered path for safe navigation in northerly weather.

6.2.10.2 Mitigation Measures

As previously discussed in this document, visual, navigation, noise, and recreational fishing impacts that may arise from this proposal will be treated with the specific mitigation measures outlined with each section.

For the majority of the users of Great Taylors Bay, the Labillardiere Peninsula forms a natural background, obscuring the visual impact of farming infrastructure from locations around the bay.

6.2.10.3 Overall effect following implementation of mitigation measures

For a detailed explanation of effects on recreational activities resulting from this proposal, see sections 6.2.1, 6.2.2, 6.2.6, and 6.2.9.

6.2.11 Tourism

Section 5.7.2.1 highlights both marine and land based tourism operations in the southern D'Entrecasteaux Channel and Bruny Island area.

6.2.11.1 Results of stakeholder consultation undertaken

As stated in Section 4, tourism provider Pennicott Wilderness Journeys advised Tassal that they have no objections to the proposed amendment. Pennicott Wilderness Journeys conducts frequent marine debris clean-ups around the Labillardiere Peninsula with school groups. Tassal currently provides support for these shoreline clean-ups and will continue to work with the tourism provider.

6.2.11.2 Effects on tourism activities

Tassal does not anticipate any negative effects on tourism activities in the area as a result of the proposed amendment. The proposed offshore movement of the lease results in a wider passage for Pennicott Wilderness Journey's Seafood Seduction tour which currently transits between the existing Butlers Point lease and the shoreline.

6.2.11.3 Mitigation Measures

As a result of feedback received, no mitigation measures are proposed.

6.2.11.4 Overall effect following implementation of mitigation measures

It is considered that the proposed amendment would not impact on tourism operations within the southern D'Entrecasteaux Channel and Great Taylors Bay, Labillardiere Peninsula or South Bruny National Park.

As addressed in section 6.2.1 there will be some loss of visual amenity as a result of the proposed amendment.

6.2.12 Land Use and Development

6.2.12.1 Effects on existing or proposed tourist or recreation activities, such as camping areas, picnic areas, walking tracks, horse riding tracks, heritage trails

The proposed amendment area is within relative close proximity to the Butlers Beach Walking Track on the Labillardiere Peninsula in the South Bruny National Park, which will give bushwalkers a view of the lease area (as it currently does).

For details on visual and noise impacts arising from this proposal, please see sections 6.2.1 and 6.2.6 respectively.

6.2.12.2 Effects on residential activities

As residences are approximately 3 km from the proposed amended lease area it is considered very unlikely that significant impacts from noise would occur, nor would there be a clear observable impact on visual amenity given the distance.

6.2.12.3 Effects on industrial activities

There are no industrial activities relevant to this proposal.

6.2.12.4 Effects on other commercial activities

The commercial activities relevant to this proposal are tourist accommodation and tour business operators that may frequent the area.

The tourist accommodation businesses east of Great Taylors Bay are unlikely to be impacted by the proposed amendment to any significant degree due to the distance between the proposed amendment and the accommodation (being 4.5 km or more away). It is also very unlikely that the proposal would impact on the further development of tourist and accommodation businesses in the area.

6.2.12.5 Mitigation Measures

Mitigation measures for noise are provided in sections 6.2.1 and 6.2.6. It is considered very unlikely that significant impacts from noise on residences and tourist accommodation would occur, nor would there be significant impact on visual amenity.

6.2.12.6 Overall effect following implementation of mitigation measures

The proposed amendment is not expected to significantly impact on these activities.

6.2.13 Socio-Economic Aspects

As this proposal is for an amended lease and zone, economic modelling and social return on investment analysis have not been commissioned by Tassal. However, the following information is provided:

- the Huon Farming Region currently employs 53 full time and 1 casual staff, resulting in approximately $3.1 million in wages and benefits annually in this region alone
- in 2012, Tassal was awarded the 'Employer of Choice' Award in recognition of people based initiatives and programs that demonstrate the company is committed to its employees and recognises their significant contribution to the organisation's success
- the Huon Farming Region produces between 5500 - 6000 HOG tonnes of biomass which equates to between 30.2 and 33.4 million dollars
- the Huon Farming Region has $21.3 million in overheads (including $14.1 million in feed costs, which is sourced from a Tasmanian based supplier)

6.2.13.1 Estimate of total capital investment for the proposal

The total capital invested for this proposal will be in excess of $3 million, supporting Tasmanian businesses and local suppliers.

6.2.13.2 Effects on local and state labour markets

There is not expected to be an increase in employment in the region as a result of this proposal. This amendment will however, support the sustainability of Tassal's operations which in turn protects jobs and socio-economic value in the region.

6.2.13.3 Effects on upstream/downstream industries, both locally and for the state

This proposal will ensure upstream/downstream industries continue to be supported in the area, and there will be a positive employment impact during the construction phase and associated with the maintenance and natural turnover of farming related equipment.

6.2.13.4 Extent to which raw materials and services will be sourced locally

Infrastructure for the proposed amendment is specialised equipment and is not available for purchase in the Dover area. All raw materials and services will be sourced locally (within Tasmania where possible).

Installation will be carried out by farm and contracted staff.

6.2.13.5 Effects on land values, and demand for land and housing

This proposal has the potential to increase land values and demand for land or housing in the region by providing jobs to residents and supporting local businesses.

6.2.13.6 Effects on the local, regional, state and national economies

This proposal is not large enough to impact the Regional, State or National economies. This proposal does support the sustainability of Tassal's operations which in turn protects jobs and economic values in the region. The salmon industry is one of Tasmania's growth industries, and continues to provide employment opportunities for the State.

Optimisation of fish performance ensures the future viability of the farming region, sustaining regional employment opportunities and enhancing economic growth in the Huon Farming Region and also supports future offshore expansion of aquaculture operations within the state.

6.2.13.7 Mitigation Measures

No mitigation measures are proposed as this proposal's potential effects are positive. Currently Tassal supports a number of community based organisations within the D'Entrecasteaux Channel, Bruny Island and Huon Valley regions and will continue to support these and other local community based organisations through our Community Engagement Strategy. In addition, Tassal supports local and Tasmanian businesses through purchasing strategies which prioritise local expertise and products where available. This includes, but is not limited to, vessels, sea cages, mooring infrastructure, fuel, outboard motors, accommodation, food, protective and safety equipment suppliers.

6.2.13.8 Overall effect following implementation of mitigation measures

No mitigation measures are proposed as this proposed amendment's potential effects are positive.

7 Summary of Effects and their Management

Table 7.1 Summary of potential effects and their management

SECTION	POTENTIAL THREAT/EFFECT	AVOIDANCE & MITIGATION	OVERALL EFFECT
6.1.1	**Water Quality**		
	Increased nutrient release into surrounding waters, localised at Butlers Point, from additional feed input into proposed lease area Deterioration in water quality from nutrient emissions - eutrophication of the water column and impacts on the ecology of native flora and fauna	Optimal siting of leases in areas of increased flow and exposure Feed inputs to the Huon Farming Region are governed by the D'Entrecasteaux Channel and Huon River TPDNO Feeding procedures and company policies to minimise feed wastage Management controls from D'Entrecasteaux Channel Marine Farming Development Plan February 2002 and marine farming licence conditions Stocking density maintained at levels below those prescribed in the D'Entrecasteaux Channel Marine Farming Development Plan February 2002 BEMP– ongoing independent monitoring of Butlers Point lease and Great Taylors Bay area (Site 8). The detection of broadscale changes through the BEMP may trigger a management response On-site daily monitoring of DO, temperature, salinity, turbidity and phytoplankton. Application of *"Environmental Best Practice for In situ Net Cleaning"* Protocols Anticipated decreased cleaning frequency due to implementation of Kikko design mesh nets	Due to the addition of pens and associated stock, there is expected to be a minor localised impact from increased nutrient emissions – however, these impacts are not expected to translate into adverse broadscale effects to water quality Proposed lease amendment will result in improved dispersion and dilution of nutrients Ongoing adherence to the TPDNO will not result in an unacceptable impact Reduced net wash effluent released to marine environment as Kikko design mesh nets phased in, and implementation of *"Environmental Best Practice for In situ Net Cleaning"*

SECTION	POTENTIAL THREAT/EFFECT	AVOIDANCE & MITIGATION	OVERALL EFFECT
		Continued BAP standard certification and associated third party audit	
6.1.2	**Substrates and Fauna**		
	Organic enrichment of sediments directly beneath cages from feed, faeces and net wash effluent Reduction in oxygen component of sediments directly beneath cages Bacterial matting build up directly beneath cages Changes in species number, diversity, abundance and biomass of benthic faunal and meiofaunal assemblages directly beneath cages Hypoxia in the water overlying the sediment Increased sulphate reduction Build up and release of methane and hydrogen sulphide gas from sediments	Greater fallowing options for amended site and Huon Farming Region Feed inputs to the Huon Farming Region are governed by the D'Entrecasteaux Channel and Huon River TPDNO Internal ROV surveys and management controls from D'Entrecasteaux Channel Marine Farming Development Plan February 2002 and marine farming licence conditions Appropriate management responses will continue to be adopted if unacceptable changes are observed from annual ROV monitoring surveys (i.e. 35 m from lease boundary) Feeding procedures and company policies to minimise feed wastage Continued BAP standard certification and associated third party audit Application of *"Environmental Best Practice for In situ Net Cleaning"* Protocols Anticipated decreased cleaning frequency due to implementation of Kikko design mesh nets	Increased benthic health from greater fallowing options – rotational fallowing and extended remediation periods Ongoing adherence to the TPDNO will not result in an unacceptable impact Proposed lease amendment will result in improved dispersion and dilution of feed, faeces and net wash effluent Reduced net wash effluent released to marine environment as Kikko design mesh nets phased in, and implementation of *"Environmental Best Practice for In situ Net Cleaning"* It is expected that the implementation of the mitigation measures will minimise the likelihood of unacceptable impacts occurring to the substrate from the fish farm organics and nutrients Tassal does not anticipate any adverse effects beyond 35 m from lease boundary

SECTION	POTENTIAL THREAT/EFFECT	AVOIDANCE & MITIGATION	OVERALL EFFECT
6.1.3	**Marine Vegetation**		
	Physical damage caused by the placement of marine farm structures and moorings Shading from marine farming structures causing reduced growth Suppression of marine plant assemblages through sedimentation from marine farm emissions Localised effects on intertidal and subtidal macroalgal assemblages from marine farm emissions (i.e. nutrient loads) resulting in changes in community structure and function Net wash effluent related nutrients can potentially impact on surrounding marine vegetation	Feed inputs to the Huon Farming Region are governed by the D'Entrecasteaux Channel and Huon River TPDNO Management controls from D'Entrecasteaux Channel Marine Farming Development Plan February 2002 and marine farming licence conditions Marine farming zone and lease placement over predominantly sandy unvegetated substrates - all mooring infrastructure to be housed within marine farming zone Anticipated decreased cleaning frequency due to implementation of Kikko design mesh nets Continued BAP standard certification and associated third party audit Application of *"Environmental Best Practice for In situ Net Cleaning"* Protocols Continued monitoring of marine vegetation assemblages in Huon Farming Region and surrounding waters	Adherence to TPDNO maintained, however there is the potential for an increase in available dissolved nutrients that may impact on localised (<0.5 km) macroalgae populations. This impact could potentially result in increased localised growth of macroalgae, particularly filamentous green algae (e.g. *Ulva* spp.). Due to the limited extent of fringing reef around the coastline, any change is only expected to affect a relatively small area of reef habitat Reduced net wash effluent released to marine environment as Kikko design mesh nets phased in, and implementation of *"Environmental Best Practice for In situ Net Cleaning"*
6.1.4	**Birds**		
	Habitat loss – prevents normal feeding, breeding, foraging or roosting behaviour and activities Behavioural changes – birds may be attracted by fish and feed resulting in changes to home ranges or	Bird exclusion control through sea cage aerial netting On site (enclosed) feed storage and management	Despite the potential for increased interactions with birds and farming infrastructure, it is considered that the proposed amendment will have a minimal impact on birds.

SECTION	POTENTIAL THREAT/EFFECT	AVOIDANCE & MITIGATION	OVERALL EFFECT
	increased potential for interactions (e.g. entanglement) with marine farming operations Entanglements – birds may be injured or killed in bird netting Bird strike and collision – birds may be injured or killed if they strike farming infrastructure (including night time strikes due to artificial lighting) Marine debris impacting on nesting and roosting sites on adjacent shorelines Predation of stocked fish	Company-wide adherence to Tassal's internal Wildlife Interaction Plan, including SOPs to minimise bird interactions Ongoing consultation with Birdlife Tasmania ensures continual improvement of systems and minimise negative bird interactions Shoreline clean-up of marine debris (undertaken outside of breeding season to prevent nest disturbance). Kikko net roll-out reduces rope used to configure pens, therefore reducing the potential onshore impacts of farm debris Limit night lights deployed onsite – low impact lighting for those that are required to be used at night Provide information to staff on how to treat and release birds found on farming infrastructure and vessels Staff training / operational practices to decrease marine debris Management controls from D'Entrecasteaux Channel Marine Farming Development Plan February 2002 and marine farming licence conditions Continued BAP standard certification and associated third party audit	

SECTION	POTENTIAL THREAT/EFFECT	AVOIDANCE & MITIGATION	OVERALL EFFECT
6.1.5	**Marine Mammals**		
	Entanglement of marine mammals in netting, ropes or mooring lines resulting in injury or death Marine debris causing entanglement or ingestion by marine mammals Modification of seal behaviour through translocation practices – negative welfare issues for seals and modification of behaviour in seals (e.g. habituation to marine farms) Predation of farmed fish Negative impacts on fish performance Risk of fish escapes from damaged nets WH&S risk to farm staff	Tassal's strategy for seal interactions is to implement technology (e.g. Kikko nets) for total exclusion Seal exclusion – sea cage netting/net tensioning Seal proof bird nets Implementation of Kikko net technology (and associated decrease in potential for nets/ropes to be damaged or compromised by seals) Company-wide implementation and adherence to procedures contained in the Tassal Wildlife Interaction Plan DPIPWE seal management protocols Staff training and compliance with wildlife management procedures Management controls from D'Entrecasteaux Channel Marine Farming Development Plan February 2002 and marine farming licence conditions WWF partnership protocols Continued BAP standard certification and associated third party audit	The level of interactions between seals and marine farming operations may increase, however Tassal's seal management strategy of total exclusion and non-lethal deterrents will mitigate negative interactions There will be no significant effect from the proposed amendment on marine mammals in the Huon Farming Region
6.1.6	**Threatened Species**		
	Entanglement - marine farming equipment, ropes, marine debris, netting and mooring lines have the	Shoreline clean-up of marine debris in accordance with BirdLife Tasmania to	No significant effect from the proposed amendment on the following Listed

SECTION	POTENTIAL THREAT/EFFECT	AVOIDANCE & MITIGATION	OVERALL EFFECT
	potential to entangle birds and marine mammals resulting in injury or death Bird collisions with marine farming infrastructure Habitat loss – the deployment of additional marine farming equipment at Butlers Point lease (i.e. additional ten cages) may impact on habitat requirements and habitat quality for a range of listed threatened and migratory species. Additional impacts affecting habitat include effects from sedimentation below cages from farming emissions and deployment of mooring blocks affecting infaunal and demersal marine species Behavioural change – the addition of ten cages to the Butlers Point lease may cause some listed threatened species to alter their behaviour, particularly foraging behaviour of seals and birds Predation – potential predation of threatened species and/or threatened species prey by escaped salmonids Alteration of breeding behaviour – marine farming operations may interrupt breeding or diminish breeding success (e.g. nest disturbance)	protect nesting shorebirds (always undertaken outside of breeding season) Feed inputs to the Huon Farming Region are governed by the D'Entrecasteaux Channel and Huon River TPDNO Use of internal feeding management protocols to minimise feed wastage and emissions Use of fallowing and rotational stocking practices to promote habitat recovery (i.e. sediment recovery) Regular monitoring of seabed characteristics (annual ROV surveys) and water quality monitoring Discourage positive association with marine farms (e.g. birds and seals) Fish escape prevention, particularly during handling procedures, as a result of predator attacks, or equipment failure, through the establishment of emergency procedures Regular net inspections and routine maintenance by divers, MIC and marine operations personnel Prevent the introduction of diseases and marine pests through best practice farm hygiene and biosecurity protocols Minimise discharge of waste and emissions into the marine environment No disposal of dead fish to the marine environment, only land-based disposal and	Threatened or Migratory Species (identified as potentially being impacted by the proposed development) White-bellied Sea-Eagle – Low risk Wedge-Tailed Eagle – Low risk Swift Parrot – Low risk Forty-spotted pardalote – Low risk New Zealand Fur seal – Low risk Southern Right Whale – No threat posed Humpback Whale – No threat posed

SECTION	POTENTIAL THREAT/EFFECT	AVOIDANCE & MITIGATION	OVERALL EFFECT
		reuse Continual improvement in the design and installation of mooring systems and transition towards the use of Kikko net technology Tassal employs a dedicated Wildlife Management Team to continue to reduce negative interactions with wildlife, and train other staff with best practice wildlife management skills.	
6.1.7	**Geoconservation**		
	Disturbance to significant geological features	No mitigation proposed Avoidance due to: location of proposed marine farming zone continued BAP standard certification and associated third party audit routine shoreline clean-up of marine debris no land-based developments or activities	No impacts are expected on recorded geoconservation sites
6.1.8	**Chemicals**		
	Chemicals such as fuel, disinfectants, therapeutants can potentially harm local flora and fauna if mishandled or spilled	Any chemicals that are classified under the *Environmental Management and Pollution Control Act 1994* as controlled wastes require disposal by an appropriate licensed contractor - approved waste service providers dispose of chemicals in	The proposed amendment is not expected to result in an increase in the quantities of chemicals used and stored in the Huon Farming Region It is expected that existing mitigation measures implemented would restrict the likelihood of

SECTION	POTENTIAL THREAT/EFFECT	AVOIDANCE & MITIGATION	OVERALL EFFECT
		accordance with the appropriate regulations All chemicals used on marine farming sites are stored in bunded areas with the capacity to hold 110% of the volume of the largest container Spill kits and training – Tassal's policy is to have a spill kit on every company vessel and barge and at all fuel-fill stations Regular servicing of all boats and equipment; daily inspection and appropriate start up and shut down procedures ensuring early identification of issues and appropriate remedial action WH&S and Environmental policies and procedures in place for correct storage and handling, and onsite MSDS cataloguing Management controls from D'Entrecasteaux Channel Marine Farming Development Plan February 2002 and marine farming licence conditions Continued BAP standard certification and associated third party audit	impacts occurring from these chemicals
6.1.9	**Species Escapes**		
	Establishment of wild populations of Atlantic salmon Impact on native fish populations through predation or competition for resources	Comprehensive diving regime to routinely monitor net integrity Transition to stronger net construction	Tassal implemented protocols to manage the associated risks, which has significantly reduced the likelihood of escapes. Tassal remains committed to continually improving these

SECTION	POTENTIAL THREAT/EFFECT	AVOIDANCE & MITIGATION	OVERALL EFFECT
	Disease/parasite transfer from farmed fish to native fish populations	material – i.e. Kikko net technology Regular net tension testing conducted Newly deployed nets to be dived prior to fish stocking All stock transactions conducted in weather conditions that do not present an unacceptable risk of fish escape All cages, nets and mooring systems appropriate for the prevailing weather conditions, currents, water depths and seabed characteristics at each site Installation of a custom designed mooring system tailored to proposed site characteristics and prevailing weather conditions Integrity of all farm systems checked and repaired after severe weather events Appropriate procedures, staff training and educational programs are implemented regarding key processes that pose a higher risk of an escape event if not performed correctly Continued third party certification audit process verifies Tassal escape mitigation procedures Company Wide Escape Prevention and Response Protocols in place, and Escape Response Kits on all work and feed barges MIC Net Cleaner conducts regular net	practices The risk of populations becoming established in the wild is very low due to 100% female stock and inability to successfully forage for feed

SECTION	POTENTIAL THREAT/EFFECT	AVOIDANCE & MITIGATION	OVERALL EFFECT
		inspections while cleaning Management controls from D'Entrecasteaux Channel Marine Farming Development Plan February 2002 and marine farming licence conditions Tassal has engaged the University of Tasmania to perform an evaluation of practices on salmon farms to mitigate escapes and ecological impacts	
6.1.10	**Disease**		
	Antibiotic use Mass mortality event Transmission of an existing salmonid disease to wild fish	Strategies to mitigate against the threat of disease in farmed fish are employed at all stages of fish production from the freshwater hatchery through to marine production (see Fish Health Management Plan – South East) Measures aimed at minimising the spread of pathogens include disinfection procedures, effective control of mortalities and bloodwater, optimal nutrition and husbandry procedures Adherence to Tasmania's strict biosecurity and quarantine regulations Active involvement and significant R&D investment in the Tasmanian Biosecurity and Surveillance Program Collaborative partnerships aimed at further reducing farmed Atlantic salmon stocks vulnerability to harmful diseases.	There is a low risk that the presence of existing disease causing agents to farmed salmon in the Huon Farming Region will have any effect on the natural environment

SECTION	POTENTIAL THREAT/EFFECT	AVOIDANCE & MITIGATION	OVERALL EFFECT
		With advances in fish health, increased survivorship has beneficial effects to the marine environment Management controls from D'Entrecasteaux Channel Marine Farming Development Plan February 2002 and marine farming licence conditions Low history of escapes at region as a result of the implementation of escape prevention measures There is a major effort to prevent the introduction of new diseases both at the Tasmanian border and other Tasmanian sites	
6.1.11	**Waste Streams Disposed on Land**		
	Farmed fish mortalities – impacts on natural and human environment: spread of disease to wild fish; organic enrichment of water column and seabed from decaying fish; odour issues (public amenity and aesthetics) Farmed fish mortalities – impacts on other farmed fish: spread of disease and parasites; lowering of DO (and impact on other water quality physio-chemical parameters) due to microbial degradation of decaying fish; stress on existing populations and potential health impacts Farm generated debris – entanglement of fauna; public amenity and aesthetics; hazards to navigation Inappropriate discharge of black and grey water –	Fish mortalities – avoidance through best practice husbandry, biosecurity measures, utilisation of only the best available stock identified through the industry's Selective Breeding Program (SBP), seal exclusion, vaccination, increased company focus on fish health, appropriate disposal of mortalities Farm generated debris - clean-up of existing debris through Shoreline Clean-up program; staff training and operational practices to decrease marine debris Black and grey water discharge - is collected by service vessel and discharged to sewer Organic material from in situ net cleaning –	It is not expected that the proposed amendment would result in an increase in the quantity of marine farming-derived marine debris – shoreline clean-up program to assess through monitoring and data collation and interpretation Implementation of mitigation measures would restrict likelihood of impacts occurring from grey and black water from feed barge, from vessel to vessel transfer, and bloodwater from harvesting operations, and other waste streams. No expected significant increase in the production of farm-derived waste

SECTION	POTENTIAL THREAT/EFFECT	AVOIDANCE & MITIGATION	OVERALL EFFECT
	physico-chemical effects on water quality; increased faecal coliforms; fish health impacts Dispersion of organic material from in situ net cleaning into the receiving environment	research has quantified MIC removal and dispersal of fouling Marine operations Waste Management Plan and Waste Management Policy Continued BAP standard certification and associated third party audit Application of *"Environmental Best Practice for In situ Net Cleaning"* Protocols and anticipated decreased cleaning frequency due to implementation of Kikko nets Management controls from D'Entrecasteaux Channel Marine Farming Development Plan February 2002 and marine farming licence conditions Draft Industry Mass Kill Contingency Plan	
6.1.12	**Introduced Marine Species**		
	Potential for marine farming activities to translocate marine pest species or extend their known range Potential for translocation of introduced marine pests from marine farming operations to alter ecological structure and function of native marine communities	Use of antifouling paint on vessel hulls – prevents fouling growth on marine hulls (potential source of marine pests) Company-wide adherence to biosecurity protocols and disinfection procedures at all farming and processing sites Collection of marine debris and appropriate disposal on land Continued BAP standard certification and associated third party audit Monitoring for marine pest species through annual underwater ROV video surveys - regulatory annual ROV compliance	The proposed amendment is not expected to increase the risk of introducing marine pest species to the Huon Farming Region , and the southern D'Entrecasteaux Channel or Huon Estuary

SECTION	POTENTIAL THREAT/EFFECT	AVOIDANCE & MITIGATION	OVERALL EFFECT
		species database records the presence of any IMPs in and around lease area	
6.1.13	**Marine and Coastal**		
	Changing sediment dynamics to nearby channels and sand bars	No mitigation required – nearby sand bar is geographically separate from the proposed lease	No negative overall effect expected
6.1.14	**Climate Change**		
	Sea level rise Changes in weather patterns – decreased summer rainfall and increased winter wind Increased water temperature and changes to water chemistry More extreme weather events predicted for the south eastern area of Australia Predicted increase in HAB events Increased mortality of fish stocks	Selective breeding for increased tolerance to higher water temperatures Venturation of pens through susceptible periods Continual water quality monitoring Appropriate change to health and nutrition requirements Industry supplied with temperature trends and long range forecasts through CSIRO Company plans 10 years in advance and maintains a comprehensive risk register system Purpose built mooring systems are designed to withstand severe weather events	The salmonid industry currently manages significant annual ranges in temperature fluctuations throughout the year and has the capacity to manage further minor fluctuations in temperature due to climate change Climate change mitigation measures are not expected to contribute to any significant negative effects on the proposed Butlers Point lease and the Huon Farming Region
6.2.1	**Visual**		
	Loss of amenity of sensitive receptors	Management controls from D'Entrecasteaux Channel Marine Farming Development Plan February 2002 and marine farming licence conditions Within Great Taylors Bay area, the	Two visual receptor groups were deemed to have medium visual impact resulting from the proposed amendment; users of the Partridge Island Jetty and those of the Jetty Beach Point area

SECTION	POTENTIAL THREAT/EFFECT	AVOIDANCE & MITIGATION	OVERALL EFFECT
		Labillardiere Peninsula forms a natural background to the lease, obscuring the visual impact of farming infrastructure	Users of the Butlers Beach walking track and the Butlers Point area are deemed to have high visual impact resulting from the proposed amendment
6.2.2	**Navigation**		
	Some mariners will be inconvenienced by the proposed amendment.	Navigational lighting/lease markers compliant with MAST and DPIPWE requirements Ongoing consultation with marine, regulatory and recreational boating organisations	There is expected to be no increase in impact to safe navigation The proposed offshore shift will allow safer and easier navigation of the sheltered shoreline of the Labillardiere Peninsula in Great Taylors Bay
6.2.4	**Aboriginal Heritage**		
	Aboriginal Heritage Tasmania advised that there are no recorded sites of Aboriginal heritage value	No mitigation measures are proposed	As there are no recorded Aboriginal heritage sites within the immediate vicinity of Butlers Point, there will be no overall effect from the proposed amendment
6.2.5	**Reservations**		
	There are no reservations in the area of the proposed amendment	No specific mitigation measures are proposed (but refer sections 6.1.4.5.4, 6.1.11, 6.2.1.3, 6.2.6,)	As there are no reservations in the area of the Butlers Point lease, there will be no overall effect to reserves from the proposed amendment
6.2.6	**Noise**		
	Loss of amenity of sensitive receptors Barge generator power source for: • Sea cage lighting • Venturation	Compliance with guidelines on noise emission under the *Environmental Management and Pollution Control Act 1994* for marine farming operations Tassal staff adhere to noise protocols	Given the location of the current and proposed lease to potential sensitive receptors located at a distance away, noise impacts on these receptors is considered very low. Mitigation measures are expected to ensure that

SECTION	POTENTIAL THREAT/EFFECT	AVOIDANCE & MITIGATION	OVERALL EFFECT
	• Fish feeding • Net washing • Support vessels • Harvesting	Implementation of Kikko net technology will reduce noise associated with net washing Noise producing construction work will be limited to day time hours Noise associated with harvesting will not occur at Butlers Point Community Engagement Officer to proactively liaise with stakeholders as required Offshore shift of lease area is expected to dissipate noise of marine farming operations. Design, engineering and management of all noise generating plant and equipment to mitigate noise and minimise impacts off the lease.	general amenity and values of the South Bruny National Park are maintained. For 2 – 6 months the lease is completely fallowed, with relatively no noise producing equipment used on site
6.2.7	**Odour**		
	Loss of amenity to sensitive receptors Dead and decaying stock Spilled or incorrectly stored feed Organic fouling on equipment Harvesting wastes Chemicals including petroleum products Engine exhausts	Timely removal of mortalities from farm cages – dive teams currently collect mortalities from cages approximately twice per week and they are placed in sealed plastic bins for transport to shore Appropriate removal and disposal of stock mortalities Feed stored in sealed hopper on the feed barge Management of equipment to ensure it is kept clean and in good working order Secure and appropriate storage of chemicals including petroleum products Management controls from D'Entrecasteaux	It is expected that there will be no increase in odour related impacts from the proposed amendment

SECTION	POTENTIAL THREAT/EFFECT	AVOIDANCE & MITIGATION	OVERALL EFFECT
		Channel Marine Farming Development Plan February 2002 and marine farming licence conditions	
6.2.8	**Commercial Fishing**		
	No negative impacts are expected due to the proposed amendment		No negative impact is predicted.
6.2.9	**Recreational Fishing**		
	Access limited to some fishing grounds as a result of the proposed amendment	No mitigation measures are proposed	Restriction of access by 18.5 ha of currently accessible recreational fishing grounds
6.2.10	**Recreational Activities**		
	Increased visual and auditory impact of marine farming activities Access limited to some recreational areas as a result of the proposed amendment	Mitigation measures are addressed previously in the following sections; • Visual, • Noise, • Recreational Fishing, and • Navigation	The proposed amendment is a modification to the existing lease – it is not an entirely new landscape element Overall effects are addressed previously, for the aforementioned sections
6.2.11	**Tourism**		
	Increased visual impact of marine farming activities Increased noise impact from marine farming activities Management of lease boundary markers, pens and on-water infrastructure Marine debris in the water and along the foreshore	Marine debris clean-up program Compliance with guidelines on noise emission under the *Environmental Management and Pollution Control Act 1994* for marine farming operations Boundary markers clearly mark marine farm lease areas Management controls from D'Entrecasteaux	The proposed amendment will result in the loss of some visual amenity to tourism operations in the area

SECTION	POTENTIAL THREAT/EFFECT	AVOIDANCE & MITIGATION	OVERALL EFFECT
		Channel Marine Farming Development Plan February 2002 and marine farming licence conditions Implementation of Kikko net technology will reduce noise associated with net washing No increase in noise making equipment with proposed amendment No increase in marine operation working hours (e.g. 0700 to 1900)	
6.2.12	**Land use and development**		
	As this is a marine based development there are no potential effects or threats to land use and development Positive effect on development with potential for continued employment in the region	No mitigation measures are proposed	No negative effects are predicted as there will be no land based development directly associated with the proposed amendment
6.2.13	**Socio-Economic Aspects**		
	There are no potential negative effects to socio-economic aspects directly resulting from the proposal	No mitigation measures are proposed	Optimisation of site performance ensures the viability of the farming region This amendment will support the sustainability of Tassal's operations which in turn protects jobs and socio-economic values into the future Continual economic benefit and support to upstream/downstream supply chains and local service providers The salmon industry is one of Tasmania's only growth industries, and continues to provide employment opportunities for the State

8 Conclusion

The proposed marine lease and zone amendment are driven by Tassal's preventative management protocols and aim to achieve optimisation of the Huon Farming Region. The optimisation derives from the improved water quality and depth, increased fallowing and stocking rotations, and the ability to rest the more sensitive Huon Estuary lease areas.

The lease amendment is likely to lead to better benthic quality than that which currently exists in the Huon Farming Region. The potential increase in fish numbers at the amended Butlers Point lease would be offset by the corresponding reduction at the Huon Estuary leases. There is not to be any increase in fish stocking numbers to the Huon Farming Region, rather the outcome will be better overall management of the current allotment and growing conditions.

There are some potential impacts that have been discussed within this document. Tassal has successfully demonstrated an ability to manage these issues through years of farming within the south east and west coast of Tasmania. All current monitoring requirements and management practices will continue to be applied to the proposed amendment. Tassal will continue to actively engage in research and seek constant improvement in the management of their marine operations and impacts on the marine environment.

Furthermore, this amendment supports the sustainability of Tassal's operations for the Huon Farming Region which in turn protects jobs and economic value within the state.

9 References

Abrantes, K. G., Semmens, J. M., Lyle, J. M. and Nichols, P. D. (2010). *Can biochemical methods determine if salmonids feed and thrive after escaping from aquaculture cages? A Pilot Study*.

Ackefors, H. and Enell, M. (1990). Discharge of nutrients from Swedish fish farming to adjacent sea areas. *Ambio*: 28-35.

André, J., Pecl, G. and Hobday, A. (2009). Ecosystem responses to climate change in the ocean. National Climate Change Adaptation Research Facility, IMAS.

ANZECC (2000). *Australian Water Quality Guidelines for Fresh and Marine Waters*. Australian and New Zealand Environment and Conservation Council. Canberra.

Aquenal (2002). *Exotic marine pests survey, Port of Hobart, Tasmania*. Report for Hobart Ports Corporation Pty Ltd.

Aquenal (2008). *National Control Plan for the Northern Pacific seastar Asterias amurensis*. Australian Government.

Aquenal (2011). *Baseline Environmental Assessment – Marine Farming Lease No. 109*.

Aquenal (2012). *Desktop Assessment – Gunn's Screwshell (Gazameda gunnii). Installation of Freshwater Pipeline to Service Marine Farming Sites in the D'Entrecasteaux Channel*.

Australian Bureau of Agricultural and Resource Economics and Sciences (2013). *Australian fisheries statistics 2012*.

Battaglene, S. C., Hobday, A., Carter, C., Lyne, V. and Nowak, B. F. (2008). *Scoping study into adaptation of the Tasmanian salmonid aquaculture industry to potential impacts of climate change*. TAFI. National Agriculture & Climate Change Action Plan: Implementation Programme Report. Hobart.

Bell, P. and Mooney, N. J. (1999). *Wedge-tailed Eagle Recovery Plan, 1998-2003*. Tasmania, Department of Primary Industries, Water, and Environment.

Black, E., Gowen, R., Rosenthal, H., Roth, E., Stechy, D. and Taylor, F. (1997). The costs of eutrophication from salmon farming: implications for policy—a comment. *Journal of Environmental Management* 50(1): 105-109.

Black, K., Hansen, P. K. and Holmer, M. (2008). *Salmon aquaculture dialogue: Working group report on benthic impacts and farm siting*. WWF. pp 54.

Black, K. D. (2001). *Environmental effects of aquaculture*. Sheffield Academic Press, UK.

British Columbia Environmental Assessment Office (1997). Salmon Aquaculture Review.

Bruce, B. D., Green, M. A. and Last, P. R. (1998). Threatened fishes of the world: *Brachionichthys hirsutus* (Lacépède, 1804) (Brachionichthyidae). *Environmental Biology of Fishes* 52: 416–417.

Bryant, S. (2002). *Conservation assessment of beach nesting and migratory shorebirds in Tasmania*. Nature Conservation Branch, Department of Primary Industries, Water and Environment, Tasmania.

Burridge, L., Weis, J., Cabello, F. and Pizarro, J. (2010). Chemical use in salmon aquaculture: A review of current practices and possible environmental effects. *Aquaculture* 306(8): 7-23.

Buschmann, A., Costa-Pierce, B. A., Cross, S., Iriarte, J. L., Olsen, Y. and Reid, G. (2007). *Nutrient impacts of farmed Atlantic salmon (Salmo salar) on pelagic ecosystems and implications for carrying capacity*. Report of the Technical Working Group (TWG) on Nutrients and Carrying Capacity of the Salmon Aquaculture Dialogue.

Butler, E., Parslow, J., Volkman, J., Blackburn, S., Morgan, P., Hunter, J., Clementson, L., Parker, N., Bailey, R., Berry, K., Bonham, P., Featherstone, A., Griffin, D., Higgins, H., Holdsworth, D., Latham, V., Leeming, R., McGhie, T., McKenzie, D., Plaschke, R., Revill, A., Sherlock, M., Trenerry, L., Turnbull, A., Watson, R. and Wilkes, L. (2000). *CSIRO, Huon Estuary Study, Environmental Research for Integrated Catchment Management and Aquaculture*. Project Number 96/284.

Chang, B. D. and Thonney, J. P. (1992). Overview and environmental status of the New Brunswick salmon culture industry. *Bulletin of the Aquaculture Association of Canada* 92-93: 61-63.

Clements, J. (1988). *Salmon at the antipodes: a history and review of trout, salmon and char and introduced coarse fish in Australasia*. John Clements.

Countryside Council for Wales/Brady Shipman Martin/University College Dublin (2001). *Guide to Best Practice in Seascape Assessment*. INTERREG Perport No. 5. The Marine Institute.

Crawford, C., MacLeod, C. and Mitchell, I. (2002). *Evaluation of techniques for environmental monitoring of salmon farms in Tasmania*. Tasmanian Aquaculture and Fisheries Institute and University of Tasmania. TAFI Technical Report Series No. 8. Hobart, 140 pp.

Crawford, C., Mitchell, I. and MacLeod, C. (2001). Video assessment of environmental impacts of salmon farms. *Journal of Marine Science* 58(2): 445-452 pp.

Crawford, C., Thompson, P., Jordan, A., Foster, S., Mitchell, I., Bonham, P. and Willcox, S. (2006). *Development of broad scale environmental monitoring and baseline surveys in relation to sustainable salmon aquaculture in the D'Entrecasteaux Channel region.* Aquafin Cooperative Research Centre, Fisheries Research and Development Corporation, Commonwealth Scientific and Industrial Research Organisation. Aquafin CRC Project 4.4. Tasmanian Aquaculture and Fisheries Institute, University of Tasmania.

De Pauw, N. and Joyce, J. (1991). Aquaculture and the Environment. *Spec. Publ. Eur. Aquacult. Soc* 14: 332.

Department of Agriculture, Fisheries and Forestry (2010). *Australian Marine Pest Monitoring Manual Version 2.0*. Department of Agriculture, Fisheries and Forestry, Commonwealth of Australia.

Department of Agriculture, Fisheries and Forestry (2011). *Proposed Australian Biofouling Management Requirements. Consultation Regulation Impact Statement*. Department of Agriculture, Fisheries and Forestry, Commonwealth of Australia.

Department of Primary Industries, Parks, Water and Environment (2010). *What's the Catch? Fishing Facts and Figures. A survey of Tasmanian recreational fishing*. Wild Fisheries Management Branch, DPIPWE.

Department of Sustainability, Environment, Water, Population and Communities (2012). *Conservation Management Plan for the Southern Right Whale: A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999 2011–2021*. Commonwealth of Australia.

Department of the Environment, Water, Heritage and the Arts (2009). *East Marine Bioregional Plan: Bioregional Profile: A Description of the Ecosystems, Conservation Values and Uses of the East Marine Region*.

Department of the Environment and Heritage (2005). *Humpback Whale Recovery Plan 2005 - 2010*. Department of the Environment and Heritage. Canberra, Commonwealth of Australia.

DHI (2012). *Caring for Our Country Project R&D: Modelling the dispersal of in-situ net cleaning products*. Prepared for Tassal and Huon Aquaculture.

Doubleday, Z., Pecl, G. and Hobday, A. (2009). *Climate change impacts on Tasmania's marine life, Information sheet 3*. Adaption Research Network for Marine Biodiversity & Resources, School of Geography and Environmental Studies, University of Tasmania. 2 pp.

DSEWPaC (2012) *Advice to the Minister for Environment Protection, Heritage and the Arts from the Threatened Species Scientific Committee (the Committee) on an Amendment to the List of Threatened Ecological Communities under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) 1. Name of Ecological Community Giant Kelp Marine Forests of South East Australia*, 41 pp.

Duplisea, D. and Hargrave, B. (1996). Response of meiobenthic size-structure, biomass and respiration to sediment organic enrichment. *Hydrobiologia* 339(1-3): 161-170 pp.

Eddyvane, K. S. (2003). *Conservation, monitoring and recovery of threatened giant kelp (Macrocystis pyrifera) beds in Tasmania*. Department of Primary Industries, Water and Environment, Hobart.

Edgar, G. J., Davey, A. and Shepherd, C. (2009). Broadscale effects of marine salmonid aquaculture and introduced pests on macrobenthos and the sediment environment in Tasmania between 1998 and 2003.

Environmental Dynamics (2013). *Tassal Operations Pty Ltd, North West Bay Fish Farm, Noise Level Survey 2012/13*. Internal report for Tassal.

Lyle, J. M. & Frijlink, S. (2013). *Evaluation of Practices on Salmon Farms to Mitigate Escapes and Ecological Impacts*. Internal report for Tassal Operations Pty Ltd. Institute for Marine and Antarctic Studies, University of Tasmania.

FSANZ (2013). Australia New Zealand Food Standards Code - Standard 1.4.2 - Maximum Residue Limits (Australia Only). http://www.comlaw.gov.au/Details/F2013C00733

GESAMP (1996). *(IMO/FAO/UNESCO- IOC/WHO/OMS/IEAE/UN/UNEP Joint Group of experts on the Scientific Aspects of Marine Environmental Protection.) Monitoring the ecological effects of coastal aquaculture wastes*. 38.

Gowen, R. and Rosenthal, H. (1993). The environmental consequences of intensive coastal marine farming in developed countries: what lessons can be learnt, p 102-115. *Environment and Marine Farming in Developing Countries*.

Hamilton, C. (2011). *Change in introduced species distributions and habitat condition in the D'Entrecasteaux Channel 1999-2011*. University of Tasmania. Report for Kingborough Council.

Handy, R. D. and Poxton, M. G. (1993). Nitrogen pollution in mariculture: toxicity and excretion of nitrogenous compounds by marine fish. *Reviews in Fish Biology and Fisheries* 3: 205-241.

Hargrave, B. T., Phillips, G. A., Doucette, L. I., White, M. J., Milligan, T. G., Wildish, D. J. and Cranston, R. E. (1997). Assessing benthic impacts of organic enrichment from marine aquaculture. In: *7th International Symposium on the Interactions between Sediments and Water*. Baveno, Italy, 22-25 September 1996, pp 641-650.

Herzfeld, M., Parslow, J., Sakov, P. and Andrewartha, J. (2005). *Numerical hydrodynamic modelling of the D'Entrecasteaux Channel and Huon Estuary*. CSIRO Marine and Atmospheric Research. Aquafin CRC Project 4.2, FRDC Report No. 2001/097. Hobart, 101 pp.

Holmer, M. (1992). Impacts of aquaculture on surrounding sediments: generation of organic-rich sediments. In: De Pauw, N.; Joyce, J. *Aquaculture and the Environment: reviews of the International Conference Aquaculture Europe '91, Dublin, Ireland, June 10-12, 1991. EAS Special Publication 16*. pp 155-176.

ICES (1995). *Report of the working group on environmental impacts of mariculture*. Ad hoc study.

Jensen, Ø., Dempster, T., Thorstad, E. B., Uglem, I. and Fredheim, A. (2010). Escapes of fishes from Norwegian sea-cage aquaculture: causes, consequences and prevention. *Aquaculture Environment Interactions* 1: 71-83.

Lam, K., MacKay, D., Lau, T. and Yam, V. (1994). Impact of marine fish farming on water quality and bottom sediment: a case study in the sub-tropical environment. *Marine Environmental Research* 38(2): 115-145.

Last, P. R., Gledhill, D. C. and Holmes, B. H. (2007). A new handfish, *Brachionichthys australis* sp. nov. (Lophiiformes: Brachionichthyidae), with a redescription of the critically endangered spotted handfish, *B. hirsutus* (Lacepède). *Zootaxa* 1666: 53–68.

Lumb, C. (1989). Self-pollution by Scottish salmon farms? *Marine Pollution Bulletin* 20(8): 375-379.

Macleod, C. and Forbes, S. (2004). *Guide to the assessment of sediment condition at marine finfish farms in Tasmania*. Tasmanian Aquaculture and Fisheries Institute. Aquafin CRC Project 4.1. Hobart, 73 pp.

Macleod, C., Mitchell, I., Crawford, C. and Connell, R. (2002). *Evaluation of sediment recovery after removal of finfish cages from marine farm lease No. 76 (Gunpowder Jetty), North West Bay*. Tasmanian Aquaculture and Fisheries Institute. Hobart, 45 pp.

Mente, E., Pierce, G. J., Santos, M. B. and Neofitou, C. (2006). Effect of feed and feeding in the culture of salmonids on the marine aquatic environment: a synthesis for European aquaculture. *Aquaculture International* 14(5): 499-522.

Moir Landscape Architecture (2012). *Landscape & Visual Impact Assessment: Proposed Cherry Tree Wind Farm Project.*

Munday, B., Eleftheriou, A., Kentouri, M. and Divanach, P. (1992). The interactions of aquaculture and the environment. A bibliographical review. A report prepared for the Commission of European Communities, Directorate General for Fisheries

Naylor, R., Hindar, K., Fleming, I., Goldburg, R., Williams, S., Volpe, J., Whoriskey, F., Eagle, J., Kelso, D. and Mangel, M. (2005). Fugitive salmon: assessing the risks of escaped fish from net-pen aquaculture. *BioScience* 55(5): 427-437.

NPI (2001). *Emission estimation technique manual for aggregated emissions from temperate water aquaculture: National Pollutant Inventory manual.* Environment Australia.

Ogier, E. and Macleod, C. (2013). *Your Marine Values: Public Report 2013*. IMAS Technical Report.

Oh, E. (2009). *Macroalgal assemblages as indicators of the broad-scale impacts of fish farms on temperate reef habitats*. PhD Thesis, University of Tasmania, 102 pp.

Parsons, K. E. (2012). *State of the D'Entrecasteaux Channel and the lower Huon Estuary 2012.* Report for the D'Entrecasteaux Channel Project, prepared by Ecomarine Consulting. 222 pp.

Pearson, T. H. and Rosenberg, R. (1978). Macrobenthic succession in relation to organic enrichment and pollution of the marine environment. *Oceanography and marine biology: an annual review* 16: 229-311.

Pillay, T. V. R. (1995). *Aquaculture principles and practices*. Fishing News Books.

Price, C. S. and Morris, J. A., Jr. (2013). *Marine Cage Culture and the Environment: Twenty-first Century Science Informing a Sustainable Industry*. NOAA Technical Memorandum NOS NCCOS 164. 158.

Ross, J. and Macleod, C. (2013). *Evaluation of Broadscale Environmental Monitoring Program (BEMP) data from 2009-2012*. Institute for Marine and Antarctic Studies (IMAS). Technical report. Tasmania, 140 pp.

Sanderson, J., Cromey, C., Dring, M. and Kelly, M. (2008). Distribution of nutrients for seaweed cultivation around salmon cages at farm sites in north–west Scotland. *Aquaculture* 278(1): 60-68.

Steer, M. and Lyle, J. (2003). *Monitoring escapees in Macquarie Harbour: a collaborative study between the salmon industry (TSGA) and the Tasmanian Aquaculture and Fisheries Institute*.

Swift Parrot Recovery Team (2001). *Swift Parrot Recovery Plan*. Department of Primary Industries, Water and Environment, Hobart.

The Scottish Association for Marine Science and Napier University (2002). *Review and synthesis of the environmental impacts of aquaculture*. Scottish Executive Central Research Unit. Edinburgh, Scotland.

Thompson, P., Wild-Allen, K., Macleod, C., Swadling, K., Blackburn, S. I., Skerratt, J. and Volkman, J. (2008). *Monitoring the Huon Estuary and D'Entrecasteaux Channel for the effects of finfish aquaculture*. CSIRO Marine and Atmospheric Research. Aquafin CRC Project 4.2(2), FRDC Report No. 2004/074. Hobart.

Thorstad, E. B., Fleming, I. A., McGinnity, P., Soto, D., Wennevik, V. and Whoriskey, F. (2008). *Incidence and impacts of escaped farmed Atlantic salmon Salmo salar in nature*. NINA Special Report 36. 110 pp.

Threatened Species Section (2006). *Threatened Tasmanian Eagles Recovery Plan 2006-2010*. Hobart.

Volkman, J., Thompson, P., Herzfeld, M., Wild-Allen, K., Blackburn, S., Macleod, C., Swadling, K., Foster, S., Bonham, P., Holdsworth, D., Clementson, L., Skerratt, J., Rosebrock, U., Andrewartha, J. and Revill, A. (2009). *A whole-of-ecosystem assessment of environmental issues for salmonid aquaculture*. CSIRO Marine and Atmospheric Research. FRDC Report No. 2004/074, Aquafin CRC Project 4.2(2). Hobart, 206 pp.

Wiersma, J. and Richardson, A. (2009). Foraging of White-bellied Sea Eagles *Haliaeetus leucogaster* in relation to marine fish farms in Tasmania. *Corella* 33(3): 71-79.

Wild-Allen, K., Parslow, J., Herzfeld, M., Sakov, P., Andrewartha, J. and Rosebrock, U. (2005). *Biogeochemical Modelling of the D'Entrecasteaux Channel and Huon Estuary*. Technical Report, CSIRO Marine & Atmospheric Research, pp113. Aquafin CRC Project 4.2.

Woodward, I. O., Gallagher, J. B., Rushton, M. J., Machin, P. J. and Mihalenko, S. (1992). *Salmon farming and the environment of the Huon Estuary, Tasmania*. Technical Report No. 45. Division of Sea Fisheries, Tasmania.

Wu, R. S. S. (1995). The environmental impact of marine fish culture: towards a sustainable future. *Marine Pollution Bulletin* 31: 159-166.